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**Please note: Due to the amount of materials received for the Energy Storage System report, some of these background materials may have inadvertently been placed in the incorrect section of this file.**

**As errors are noted, the file will be updated and reposted on the CSLB website.**

# **APRIL 25-26, 2018 PUBLIC HEARING TRANSCRIPTS**

TRANSCRIPTION OF RECORDED MEETING  
OF  
CSLB PUBLIC PARTICIPATION HEARING

APRIL 25 & 26, 2018  
SACRAMENTO, CALIFORNIA

Moderator: Rick Lopes, CSLB Chief of Public Affairs

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May 8, 2018  
Elk Grove, California

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**Rick Lopes:** Good morning. It is now 9 o'clock. We will give you a few more minutes here just to settle in. We do have a number of people still signing in. So we'll get started in just a couple of moments. Hello and good morning. We're going to go ahead and get started. It's about five after 9:00 right now. I know some people are still coming in. We were just going to get going so we can kind of stay on track. We have a number of speakers who are already signed up. So thank you, all, for being here.

And welcome to the Contractors' State License Board Headquarters in Sacramento for today's public participation hearing on energy storage systems. My name is Rick Lopes. I'm the Board's Chief of Public Affairs. This morning, we will be taking your testimony to help us review our current determination on the appropriate CSLB license classification or classifications to install an energy storage system either in a stand-alone contract or when included in the installation of the solar voltaic system.

You can find the current determinations on the back of the handout we gave you when you signed in this morning, along with the list of general issues that we hope to learn more about during the hearing. And this is that handout. We appreciate the time you've taken to be

here with us today, and we welcome the insight and the perspective that you're going to be offering us.

It's important to note that no decisions will be made at this hearing, and Board staff are not able to address any questions you might have about CSLB's current determination. The speakers will be allowed to address this two-day hearing once, and the comments will be limited to five minutes. You see we already have 45 people signed up. So chances are we'll be here past our noontime hour if everybody has five minutes apiece. So please work with us on that.

We do have a clock here to help try to keep us on order so you can monitor your time. Please be aware, though, if after you've presented your testimony someone else makes a point that you disagree with, we're not going to be able to give you time to make additional comments. Instead, we would ask that you send us your comments on that point in writing, and we'll give you those details also on your handout.

Your cooperation on this point will really help us moving this hearing along and give every speaker the same ability to present their testimony to us in an uninterrupted manner. We'll trust that you'll offer the same level of respect and attention to other speakers as will be afforded to you.

Also, please note that if any elected officials or representatives from another government agency joins us, we'll allow them to present their testimony immediately.

We are recording this hearing, and all the testimony will be transcribed and included as part of a staff report that is being prepared for the Board. Prior to the Board taking any action on this issue at a public meeting, the entire report will be made public.

I also want to note that, again, all written comments that we are taking will be included in that report, as well. The deadline for you to get the written comments to us is Friday, May the 18<sup>th</sup>, again, look to the handout for those details on how to get those to us.

So I think that covers everything. On behalf of the Board, our Board members and staff thank you again for your presence and participation. And my apologies in advance if I mispronounce names. I'm doing my best. It's all up to you. If you wrote it clearly, chances are I'm going to be able to stumble through it, but if not, please forgive me in advance if I mispronounce your name.

We're going to get going here, and our first speaker this morning is Chuck Vella. And, Chuck, please go ahead and just hit the microphone on. There's a button on there, and the red light will be on. Thank you.

**Chuck Vella:** All right. Good morning. My name is

Chuck Vella, and I thank the Board for the opportunity to speak. I am speaking on public safety concerns related to energy storage systems. I am a California State-certified voice in a video and life fire safety electrician and have been an instructor for the electrical trades for over eight years and hold the title of master instructor.

I've been in the electrical trades for over 29 years and considered a subject matter expert in my field by the State of California. I've helped with the development of the California Electrician certification examination. In all my years performing electrical trade work for C-10 contractors, I've never installed an electrical storage system because I am not qualified to do so.

But because of my training, experience, and knowledge, I know that C-10 contractors and state certified general electricians are qualified to safely and effectively install and maintain energy storage systems.

It would be a mistake for the CSLB to treat energy storage systems as merely a subsystem of a solar voltaic energy system. While these systems can be paired together, they are separate systems, subject to their own code, installation, and fire safety standards. Moreover, they pose very different fire and life safety risks.

These risks include electrical shock, fire, flash burns, explosion, or exposures to hazardous chemicals and released gases. California State certified general electricians who work for C-10 contractors meet or exceed the NEC definition of a qualified person.

It would be highly risky and technically improper for the CSLB to treat energy storage systems as a subsystem of a solar voltaic energy system. While these systems can and will be increasingly paired together, they are highly distinctive and separate systems, subject to their own inherent risk, technical specification, codes, installation, and fire safety standards.

Most energy storage systems are battery-based and pose very different fire and life safety risks such as fire, arc blasts, thermal runaway, explosion, and/or exposure to released gases and hazardous chemicals. I recommend that all aspects of energy storage system installation should be undertaken with the involvement of a properly licensed professional electrical contractor and plenty trained and qualified electrical workers for a number of reasons, including electrical expertise.

The workers for C-10 contractors have a great deal of electrical expertise. They take a very tough exam and can only work as certified general electricians if they pass. Let's compare that expertise to the requirements

for the workers employed by a C-46 contractor. Some customers and business often confuse contractor with an installer.

For example, some think that because a C-46 contractor has to be licensed that their workers are also licensed. That is not the case, and that is a very important distinction. There is no minimum California State requirement for education, training, skills, or certification of the workers who install photo voltaic systems for C-46 contractors. That means if a C-46 contractors are permitted to install energy storage systems, those same workers with no minimum requirements for education, training, skills, or certification would be installing and maintaining these high-powered systems and putting worker and public safety at risk.

Considering the dangers related to energy storage systems and the critical importance of proper and safe installation of maintenance, allowing C-46 contractors and their workers to install energy storage systems is a worker and public safety risk that should not be taken.

I trust that the CSLB will make the right determination and award C-10 contractors with energy storage systems for the protection of life and property for its residents of California. Thank you.

**Rick Lobes:** Great, Chuck. Thank you very much.

Our next speaker is one I'm going to mess up. So Kasitalea Abe Talakai? Welcome.

**Kasitalea Abe Talakai:** Good morning. My name is Kasitalea Abraham Talakai, and I've been a state-certified electrician as of 2011. I completed a five-year electrical apprenticeship that covered many electrical aspects -- AC theory, DC theory, troubleshooting, voltage, safety. Safety is the main priority that I've learned in my trade. It's the difference between life and death and between helping your fellow coworker.

I've been trained to test before you touch waters, to label wires properly so that if you are assigned to a different task, someone else behind you can come and pick up where you left off. I've been trained to lock out and tag out when working on energy systems. Dealing with anything in the electrical industry is dangerous. If conditions are perfect and someone is shocked, they can die.

Not only can unqualified and unskilled workers in the electrical industry be injured, but so can property be damaged. It is better to have state certified electricians working for C-10 contractors that are trained and skilled to install electrical energy storage systems. Thank you.

**Rick Lopes:** Great. Thank you very much. Our next speaker this morning is Taylor Hughes.

**Taylor Hughes:** Hi, my name is Taylor Hughes. I'm an apprentice. And I just want to share some past experiences that I have as far as working under C-46 and the lack of training that I was provided and from now I'm moving forward and being a part of the apprenticeship program and the difference of training with safety and working with energized systems and, you know, coming from C-46 and not getting any type of formal training, being thrown out in the field, and learning as you go. From now actually being a part of an apprenticeship program, where you go to school and you learn safety and you're working under somebody, and you're getting formal training. I feel it's very important as far as, you know, not necessarily working with the PV systems but with working with the ESS systems is now you're dealing with a lot more voltage, and you're dealing with a lot more power and danger when it comes to working with those sort of things. So, you know, I just wanted to share my experience with how much training I've been getting now compared to working under C-46 before. So thank you for letting me speak.

**Rick Lopes:** Great. Taylor, thanks very much. Our next speaker -- Julius Cherry.

**Julius Cherry:** Good morning. You did get my name right. My name is Julius Cherry. I'm here this morning -- I served 30 years with the Sacramento Fire Department, Sacramento City Fire Department, rising through the ranks to become the City's Fire Chief. I retired from that position in 2007.

During my time in the fire department, I held a position of Fire Marshall, which is principally responsible for enforcement of the fire code, working very closely with the building -- with the chief building official who is principally responsible for enforcing the building code. Those two codes -- the building code and fire code -- work very closely together, including working with the Chief Electrical Inspector in the city.

Since I retired about ten years ago, I've done a significant amount of consulting work, mostly in the area of fire and life safety. And to show you how I've really failed retirement, I'm also engaged in the private practice of law. I was able to go to law school at night while I was a firefighter, and I teach as an adjunct professor at one of the local community colleges. So I've really flunked retirement.

But my point of being here this morning is to give you some perspective regarding this issue from a former public safety official and a former first responder for

more than 35 years. I would just tell you that having non-trained, non-C-10 contractors or non-certified electricians working on these energy storage system is a recipe for disaster.

Every firefighter knows and learns from the very first day on the job, the very first day in the Academy that electrical hazards is something that you want to recognize, avoid, and mitigate whenever you're responding to any kind of emergency. There isn't a fire department in the land does not have standing orders to first -- one of the first things you do on the scene is to secure utilities to include electrical hazards.

These kinds of systems are varied, they're massive, and they take a lot of take technical expertise to manage. No one installing, inspecting, maintaining, or repairing these systems should not have a C-10 contractors license and be a certified electrician. I can just tell you that there is a significant risk to both the worker, the first responder, and members of the public.

Now, I know that this Board intends to make decisions based on what's in the best interest of public safety and I would implore them, at this point, to make such a decision that would include requiring C-10 contractors as well as certified electricians work on

these systems whether they are connected to PV or not.

During my time as a member of the International Association of Fire Chief as well as National Fire Protection Association, I've gone to a number of workshops and demonstrations regarding these systems, and obviously, they're growing in proliferation in our community. And I can tell you that the kind of technical expertise that it takes to work on the systems is at a high level, and that only a certified electrician can handle those things.

These are the people that we, as first responders, rely on for both advice and technical expertise regarding how to manage the systems in the event of an emergency. I would only rely on a certified electrician in that situation, and in many cases we keep a list of people that, you know, I'm not sit here and tell you that every time we respond to an emergency involving one of these energy storage systems that we would have somebody available, but we certainly have people that we can contact and get on the phone to get advice and counsel on how to manage these systems in the event of emergency.

So again, I would implore the Board to make a decision that's in the best interest of public safety and require C-10 contractors and state-certified electricians work, install, troubleshoot, and repair these systems,

regardless of whether connected to PV or not. Thank you.

**Rick Lopes:** Thank you very much. Our next speaker this morning is Bob Ward.

**Bob Ward:** Good morning. Thank you for giving us the time to hear our concerns here. My name is Bob Ward, and I'm the, actually, the current business manager of IBEW Local 340. I've been an electrician here in Sacramento for 21 years, completing my electrical apprenticeship in 2001, held the state certification -- California state certification that is current since the early 2000s.

Throughout my career in the industry, I've installed renewables and backup storages throughout my career, all the way -- all around the country. I was brought on as a national construction manager for a solar company out of Chicago called UPC solar. In that time, I was actually the RME for the C-10 in California, so I'm aware of the process.

One thing I wanted to touch on is a term that's loosely thrown around as plug-and-play. I just want it to be known please make no mistake, there is no plug-and-play on an interconnection of an electrical panel. It consists of drilling a hole in a live panel, installing a conduit, pulling wire, and landing on a breaker on a live busbar. This is quite a daunting task to think that a

roofer would perform this. Again, it's something we take to heart here, and we just want to ensure the fact that these are done by certified electricians. Again, thank you for hearing our concerns.

**Rick Lopes:** Thank you very much. Our next speaker is Pete Gregson.

**Pete Gregson:** Thank you very much. Pete Gregson. I was asked to give little dissertation on who I am. I've been installing battery and solar systems for over 40 years, started my business in 1978 with a store in Stockton run by a C-10. We have a store in Redding run by a B. I run the store in Redwood Valley on the C-10 and a C-46. Not only do we install systems, we troubleshoot, maintenance. We also do manufacturing.

I sell more interstate batteries than anybody else in Northern California. I sell so many of them, I private label them under my API label. I have offices in Asia. We manufacture (inaudible) batteries. We've been manufacturing them for over 10 years using. These are industrial grade battery banks. We have been manufacturing lithium-ion LiPo 4 systems for over five years. I have a container of the last generation, eighth generation, of LiPo systems we physically manufacture and design.

The issues of -- and as you see, I'm not writing

notes. I'm just going off of my head here. So I apologize if I have any delays and things. So the issues of a C-46 not been qualified I think are kind of crazy. I'm here basically to advocate that there is a committee set up to look into this further. I don't think there's enough information out there. I think one of the main issues is volatility. Like I would hear here. LiPo systems are actually -- once you understand them -- are one of the safest energy storage systems out. I can give you numerous -- I could talk to you for hours in terms of volatility of other energy storage systems.

And energy storage systems encompass not just batteries, but they also encompass hydrogen. They also encompass water storage. There's many, many different ways of doing energy storage. All of them potentially fall under C-46. We have solar powered electrizers which produce hydrogen. We have solar pumps. We pump water for energy storage.

My house is a perfect example. I live off grid. I've been off grid for 40 years. I have reservoirs that produce power of hydro. I'm totally independent. I have a LiPo storage system that runs off grid heating and storage systems. Unheard of. When you start talking about energy storage sizes, limitations, let me give you a little example. It's what we call a Martin effect.

Martin's the one who -- and he'll be here tomorrow. He discovered this. A gallon of gasoline is equivalent to over 33 KW hour of power. Let that sink in a little bit. So you're going to limit energy storage systems to a gallon of gasoline? Five gallons of flag gasoline?

Let's look at voltage of systems. I don't want to put names out, but there was a 40 KVA system installed in California, 48-volt battery bank, LiPo system, very simple calculations, over a thousand amps 40 KVA at 48 volts. I did the same thing up in Alaska powering an island. I used two 40-volt LiPo system, manufactured system by us. Maximum current is around 160 amps. So look at the volatility difference there. So when you want to start limiting us in terms of voltages, 48 volt, in my mind is only good to 20 KW. At that point, you're out to lunch, too high volatility in terms of current.

We have inverters nowadays that are 30 to 50 KW thousand volt DC with multiple MPPD circuit inputs. So why should we be limited to 48 volt? Why should we be limited to 2 to 5 KW storage?

And I still -- the main reason I'm here, I want to advocate that you, as the CSLB, need to set up a committee to look into this further. People like me who've been in this industry for our entire life, this is our life. And if you start regulating us into doing

things that we don't necessarily accept, that isn't necessarily going to stop us. You're just going to make us criminals.

Where I live, the majority of people live off grid. What I do, I set up islands. I set up systems all over the world. Looks like my time's up. Thank you very much.

**Rick Lopes:** Thank you, thank you for your testimony. Our next speaker this morning is Ben Souza. Ben.

**Ben Souza:** I'd like to thank you for your time and letting me speak here today. I'm Ben Souza. I've been a state-certified general electrician for eight years. Before this I was in the infantry in the Marine Corps. So my training, a five-year apprenticeship, taught me a lot -- taught me a lot about safety, and it taught me a lot about the hazards presented with working with something that can't be seen, but can only be sensed.

When you get to energy storage systems from my training from the amount of classroom work I've done and understanding through AC theory, DC theory, how electricity works -- when you try and contain energy into a small point, a storage system, naturally it wants to escape. And it can escape by two ways -- either slow useful, regulated, trickling it out, or it can basically

create a thermal runaway, as they call it. And a thermal runaway is just a catastrophic event where the battery itself breaks down, and when it breaks down, it can cascade into a cascading failure where it melts everything around it. These hazards presented cannot be taken lightly.

I, myself, am from Petaluma, California. I mean, recently, last fall I think we all know what happened to the area on Front. Fire risks are something that cannot be taken lightly at all. Through my training and basically my experience, I've installed over 10 mega watts of solar systems. I've installed a biogas recovery systems at wastewater plants which take dirty methane, condition it into a usable natural gas, and is able to turn it into a electrical source through micro turbine motor generators. None of that is taken very lightly. When you get to that the storage systems of it, if you do not understand the hazards presented with electricity when you cross over the 48-volt threshold and the danger it creates to your body, that's why there is, you know, a threshold of voltage because once you step over a certain point, it takes less amount of time for it to damage you and kill you.

Through my training in my eight year career, one of the people I went to school with is no longer on this

earth because, you know, an accident. And that's really all I have to say. This is something that cannot be taken very lightly. This is something that needs to have a thorough thought process in the understanding the person installing the system, the person maintaining the system, the person who is going to sign off on this with their name needs to understand the hazards that electricity creates. And that's all I got to say.

**Rick Lopes:** And thank you and keep your service for us, as well. Our next speaker this morning is Matt Turner.

**Matt Turner:** Good morning. My name is Matt Turner, and I come to you before you today as a consumer, as an owner-operator of large central energy plants, including batteries. Just a little bit on my background. I've completed a five-year -- you know, graduated from a five-year apprenticeship program and graduated from college, electrical degree. I also am part of IEEE, and I currently work for a Fortune 15 company and manage large enterprise class data centers that have significant power systems in then from 69,000-volt down to the battery level, 48-volt.

Pretty much -- you know, part of my experience, too, has part been part of a team where the implementation of over a hundred million dollars worth of solar systems

across the nation. So I have a significant amount of interaction with the solar community from the design, specifications, installation, commissioning, and the ongoing care and feeding of it -- maintenance and operations of it.

Also on the battery topic, pretty much my day-to-day responsibilities are here locally. I have about 10-megawatt energy storage system or battery system, and I have various types from control systems to big, robust UPS systems, as well. I've been to -- over the last 14 years, which I've been doing this in a direct, ongoing maintenance of battery systems. I've been to the battery factories for factory witness testing on batteries. I've been to the battery factories for specialized training on them. I've also been for failure analysis. I've been involved with catastrophic events on battery systems for major leakage, thermal runaway events, and hence time I've had to go to the battery factories such as Intersys C and D, GMB, go to factories for hazardous analysis on batteries.

So pretty much as, you know, my team, my local team that I have, and bar none, if you were to come into a large central energy plant, if you asked what the most dangerous room in the house is, it's bar none the battery room. The battery room -- it not only takes -- it's a

very specialized discipline and the bare minimum is have a very robust background in electrical theory and the basis for even beginning work on batteries starts with being a certified electrician.

It's its own specialty thing, and as I communicate this up to my stakeholders and whatnot, they say, oh, it's just a battery. It's very specialized, and it's also very volatile. To the gentleman's point that spoke earlier, I work -- I have two-day inspections with the fire department. One day is for just inspections on the facility, and generally the second day as they rotate battalions in because our battery room is bar none if we have an emergency event, and we have to do some mitigation things, my team of in-house electricians work with them to mitigate that, but getting familiarization with all that.

I'm also part of IEEE and also some other various boards over the last couple years looking on all these various battery technologies that are being rolled out. You know, there's a lot of simplification to this. Batteries are very, very -- they provide a very, very important role, but they are also very extremely dangerous. And as time goes on with these batteries, it's kind of the failure mode for a lot of these batteries. That's one thing -- kind of a good example of

it is you see a e-cigarette or these skateboards. There's a lot of studies going on by a lot of very large corporations now onto these batteries and the volatility of them, and most importantly, the failure mode of the batteries.

In short, I currently have probably one the largest solar companies around under contract under performance agreements, generation agreements, and various things, and I've done solar systems all across and I have people under contract across the nation. And frankly, they have a hard time just fulfilling their normal requirements and obligations just as part of the solar installation. To layer on some additional stuff, it just doesn't make any sense.

But in conclusion, you know, pretty much being the owner-operator of a large industrial battery systems, the bare bare minimum should be a certified electrician, a C-10 contractor with some additional specialized training specific to batteries. Thank you.

**Rick Lopes:** Thank you, Matt. Now, I actually have two cards in a row that have a Matt Turner. So do we have another Matt Turner, or I just happened to get two cards from the same -- from Matt? Okay. Then we're going to move past the second Matt Turner, and we're going to move on to Dan Cohee as our next speaker.

**Dan Cohee:** Good morning and thank you for your time and listening to my story as a C-10 contractor here in California and a topic I'm very passionate about. I've been installing energy storage systems for the last 19 years, collectively, over 60-megawatt hours, and I want to talk about three projects our firm has completed here in California that are recent, relevant, and verifiable.

The first project is at the Twentynine Palms Marine Corps Air Reserve Station in Twentynine Palms. Obviously it's a 10-megawatt microgrid using a 700°F battery. The battery operates at over 700°F and operates at over 1100 Volts DC. It's coupled to a 15,000-volt inverter and directly connected to a 10-megawatt microgrid at the base. So it's much more than just a battery. It's more of communications, relay settings. It's the system as a whole that has to be thought through. It's very, very complicated, and more than just the installation of the battery.

There's a -- I heard this story one time. A guy said if you've done one energy storage project, you've done one energy storage project. They're all very, very unique that takes extreme competencies in more than one electrical discipline. The second project is the Las Positas here in Livermore, California microgrid that we're performing right now, and it involves flow

batteries, which has over 10,000 gallons of acidic electrolyte in it. And in addition to understanding how to interconnect that, we also have -- it interconnects with -- it works with the grid, and it works when the grid is not available. So it includes relay studies, overcurrent protection, et cetera. So again you're looking to resources of controls of DC voltage and AC voltage.

The last project we're working on right now that we just finished is for NAVFAC, it's the military microgrid testbed located at Port Hueneme in Southern California, Central California. To give you an idea of how complicated and how complex and how technologies are emerging, the Navy built this project to specifically test batteries, battery technologies, and the differing, constantly evolving recipes, chemistries that manufacturers are coming up with.

So as part of that project in our contract, the awareness of the dangers was so obvious that we were required to have an electrically competent NFPA 70-E licensed electrician do nothing but supervise our electricians and make sure they are working safe, perform methods of procedures prior to any work being done that was reviewed and approved by NAVFAC. So you can see -- you're seeing very, very progressive industry-leading

Department of Defense projects that are very, very focused in on the on the safety and the complexities of these projects.

There is nothing more important, and it's nothing more important than the women and men that work for you and their safety and ensuring that they have the proper training, the proper safety, the constant reoccurring training to make sure that they can go home at night and be with their families. Nothing. And that is -- requires a very competent, engaged electrician who is not doing just a job but is invested in learning and being safe. So that's my story. That's my experience here in California, and thank you for your time.

**Rick Lopes:** Dan, thank you very much. Our next speaker this morning Eric Fehrs.

**Eric Fehrs:** Good morning and thank you for giving me the opportunity to present my thoughts on the subject. My name is Eric Fehrs. I'm currently a fourth-year apprentice through a state-certified apprenticeship to become a state-licensed electrician. That is something that I take very seriously. It's been a tough road so far, and I'm still not completed it. So I still have a lot to learn. Through the apprenticeship, I've had numerous classes on energy storage systems as well as voltaic systems. We have our own intellectual code that

goes along with the systems because it's not just batteries. It's tied into the electrical grid and then actually engaging on the loads that need to be met. Once again, you know, we've had to go through classes on NFPA safety, national electric code, and then actually present what we have learned, and taken numerous classes, as well as tests to prove that we know that we know what we're talking about and that we know what we're doing, and we're doing it in a safe and professional manner.

Being a professional electrician, you think about not only your safety, your customers' safety, but also the people you work with. You want to trust that they are doing the right job, and they're doing a good job. I currently am working on a battery storage system. It's at the utility level. So that becomes an even more complex, more demanding burden in itself. You have large capacities of batteries, higher voltages and is tied into the grid and the utility, which we want to make sure we have a stabilized grid, we're not not meeting demands, and we're not going to fail when we're called upon.

Once again, I was mentioning the training that most electricians and everyone in this room have received. I think as far as the consumer, we want to make sure that we have people that are over-trained. Training is definitely, you know, one of the biggest things that

electricians have to meet, not only on the job, in the classroom, and then go before a testing procedure and make sure that they can prove that they've met all these requirements through on-the-job training, in the classroom, as well as any other additional training they've received prior to becoming an electrician.

There's not a whole lot more to say other than, you know, I think it'd be a failure to the consumer to have people that aren't meeting the requirements to be working with electrical connections, whether it's photovoltaic or any other type storage or to power generation. You want to make sure that you have the best trained, most qualified, and people that are invested in their career and making sure they can perform the jobs that they've been asked to do and will always be the ones that are performing that work. I'd like to thank you and give the mic to the next person.

**Rick Lopes:** Eric, thanks very much. Steve Powers is our next speaker.

**Steve Powers:** My name is Steve Powers, and I'd to thank you for allowing me to speak today. I'm a retired inside wiring from San Francisco. My career is 41 years in the electrical industry, and it has included a few things. My four-year apprenticeship program, which is now a five-year apprenticeship program, California state

certified general electrician, and fire life safety, C-10 electrical contractor, IAEI certified electrical inspector for the City of San Francisco, California certified teacher for apprentices and journeymen, main director at the SFJTC OSHA 30 certified teacher.

I've been around for a while and seen a lot of things. These new things coming out nowadays are coming out faster than the codes can actually address them. Article 706, energy storage systems, is not in the current code that's in the 2017. That's how fast things are advancing.

At this -- what we're looking at nowadays is just not battery and solar system. We're looking at the utility systems we're putting in. So training is very important in this. With the apprenticeship programs and with journeymen training, we talk about things, how to do them properly and safely and follow the code. When apprentices first get in the trade, the first year they learn AC/DC theory. Theory means we don't really know how it works. We got a pretty good idea. So our training has to be the top line. Safety has to be there.

OSHA is taught, the code of requirements are taught, solar (inaudible) installations taught, emergency storage systems are taught, and other things, too. But nowadays just letting somebody out there and saying I'm qualified

to do this, they have no certifications usually behind their name. To work for a C-10 contractor in the State of California, you have to be a licensed journeymen. You've got to take continuing education classes. You have to renew your license every three years.

So the industry is on top with C-10 contractors training, training, training because we need safety out there. Our common goal out there is to go onto a jobsite, no matter what it is, is to be able to walk in to that job and walk out of that job. If we don't know what we're doing, if we are in flyby at night doing these jobs, someone's going to get hurt.

But 706 addressed a lot of things. The code panels that put this together, had to get into it a lot, and they had a lot of new sections in there for safety because it's never been in place before. The other sections that covered battery storage, you know, they just addressed that article 4A. All they addressed, basically, was the batteries, the racks, and the types of (inaudible) methods. The rest of the code took over for it. Now, it's all coming into place. This is a very important situation we're getting into, and my feeling is it's got to be trained.

Lot of stuff, too, on these tests or these jobs we do is called a short-circuit coordination study. That

talks about the flow of electricity, and always in that study, I always looked at when I was an inspector, there's a section in there that I used to call what if. That's where the electrical engineers are describing how system is going to work, but this might be a problem. They're not sure, and these are qualified people. There's always that what-if situation that can happen in there. A lot of these things we put in nowadays because of the technology and the explosiveness that are involved in it. Fire life safety is very important. Ventilation in these systems. Batteries have gained ground. They don't emit as much gas anymore, but when there is gas, it's got to be vented directly to the outside of the building, not tied into the system in the building so the people in there don't breathe this.

So one of the things about OSHA 30 in the electrical code, they talk pretty much about the same thing about all the electrical installations, but they also have one thing in common. They always talk about qualified people. Qualified people is one who has the skill and knowledge related to construction, operation of electrical equipment and installation, received safety training to recognize and avoid the hazards involved.

How is training place for these installers who never graduate from the state and federal approved

apprenticeship program (inaudible) journeyman and state-certified electricians? How much have they been trained? Are they qualified?

And apprentice required to do a five-year program, 8,000 hours on-the--job training, around 900 hours in the classroom. Then they can come out and become a certified trained -- excuse me -- certified journeyman/wire man after they take the state-certified test. They're always going to be taking classes. They're always going to be taking educational classes and safety classes to maintain this level. So the codes are going to change all the time. After the 2017 code, when 2020 comes out, there will probably be more additional requirements in this section there because right now we're doing utility work. Before we headed up to the service of the utility, and we took it from there. It's called line load. Now, we're putting in the line. And a lot of times there, you have to be trained in safety aspects. We don't want to see anybody getting burned or hurt or killed. Thank you for your time.

**Rick Lopes:** All right, Steve. Thank you very much. Our next speaker this morning Doug Mausegione.

**Doug Mangione:** Almost got it.

**Rick Lopes:** I got the Doug right, though.

**Doug Mangione:** You were close.

**Rick Lopes:** Okay.

**Doug Mangione:** I'll take it.

**Rick Lopes:** Welcome, Doug.

**Doug Mangione:** Thank you. Good morning. My name is Doug Mangione, and I am a state-certified general electrician, license number 105151. I have over 40 years in the industry. I've worked on myriad systems over the years. You know, the national electric code, NFPA 70 in the first section 90.1, it states the purpose of this code is the practical safeguarding of persons and property from hazards arising arising from the use of electricity.

When the certification law came into effect, the company I worked for sent all the foreman to training to take -- you know, to take the test. We all had many years of experience in the trade, didn't think this test would be a problem. On our first test prep quiz, we all failed. We had been doing the installation so long that we had not kept up with newer code revisions. We never bothered looking in the code because we knew everything, and unless an inspector brought it to our attention and they typically don't have a whole lot of time to catch all the mistakes that are made out there, there were new rules. New rules on derating the ampacity of wire for the amount of conduit fill. Or when computers became

prevalent, we had to upsize the size of neutrals because of the harmonic wave that these systems put on the sinewave, increasing the ampacity of the neutral coming back on a multi-wire circuit.

So some of us would take it upon ourselves to keep up with changes, but not everybody did that. With the certification rules that has to happen now. We have to have 32 hours of education in our trade, and most take code upgrade classes. The law makes that a requirement for keeping our license. We have to be up to date. It takes 8,000 hours of practical experience to be just to be eligible to take the test, and it is very code-heavy.

All workers that work for C-10 contractors are required to do this. There is no such requirement for other licenses. The NEC is our Bible. It's there to protect life and property. Others seem to want to take excerpts from this code and say that's all they want to do and that's all we need to know, but the systems that are being installed are all-encompassing. If you install batteries, is it okay to install electrical systems in the building that houses that rack? If new switchgear is required is that out of the certified electrical scope? The venting and lighting systems. The disconnects and controls, the underground, the feeders, where does it stop?

Many C-46 contractor or C-47 contractors also have a C-10 license so that they can install these systems using certified state certified electricians. So rather than weakening the certification rule by exempting storage systems from those requirements, we should be strengthening of the requirement that C-10 license holders with certified electricians are used to install these potentially dangerous systems. People die and buildings burn when electrical systems go awry. Thank you for your consideration. Thank you for allowing me to comment.

**Rick Lopes:** Doug, thank you, and I'm going to blame this on your writing here.

**Doug Mangione:** I would take that, too. My penmanship is not very good.

**Rick Lopes:** Thank you for joining us, and our next speaker this morning is Matt Paiss. Hope I got that one right. Matt.

**Matt Paiss:** Close.

**Rick Lopes:** Close.

**Matt Paiss:** That's okay.

**Rick Lopes:** Thank you. Welcome.

**Matt Paiss:** Thank you, thank you very much. So my name is Matt Paiss. I am with the San Jose Fire Department. I am the International Association of

Firefighters primary representative to the National Electric Code and the new NFPA 855, which is the new energy storage standard.

I studied solar technology in college. I have a system on my home. I'm a proponent of PV and storage. And in fact, resiliency is a critical part of our mission. Speaking today, I'm here to express the concerns over who is qualified to install energy storage systems. The safety of installers, building occupants, and firefighters is our concern.

As we heard pretty eloquently from Chief Cherry earlier this morning, firefighters are trained for the conditions that they respond to. If you fall into a trench, a firefighter certified in trench rescue will get you out. If you're stuck in floods, a firefighter certified in swift water rescue will help you. Specific training for the task is what we provide and require.

It's clear that the C-46 installers have a long history of safety in low-voltage flooded cell energy storage installations. However, introduction of new chemistries and technologies requires a re-look at the requirements for them. The lithium-ion chemistries present new hazards that are not yet fully understood. The variety of technologies and chemistries create a challenge for installers and code officials such as

myself.

As an example, fire behavior of lithium ion ESS is not yet quantified to be able to provide fire protection engineers the data they need to design fire protection systems. So in the fire code we're requiring fire protection systems, but the data that the engineers need -- how to design it -- is not yet there. It's very new. Currently, all lithium-ion chemistries have flammable electrolyte of various energy densities and volatilities, but they are all still flammable, some more than others.

My work in ESS safety regulation is the basis of my position that there is a need for expanded criteria in both education and licensing requirements of installers. As in any C panel member who participated in the development of the new article 706 on energy storage systems, it's clear that ESS is separate from PV systems. It's a separate article.

The current scope of the C-46 does not include installation of electrical equipment outside of PV systems. There is evidence that ESS products coming to the market will be more integrated with PV systems on the low end of the market for residential, but there are still many systems requiring significant electrical engineering and field listing as we heard from one of the previous inspectors. High temperature sodium batteries,

flow batteries. There are some very complex batteries that are in the family of energy storage systems which are way outside the lane of what is required of a C-46.

The safe installation, operation, and maintenance of ESS is a critical issue to our society. I do believe that what we we've heard here from many of the other speakers that the training requirements of those installing the systems is a big gap in the C-46 right now. I appreciate the Board encouraging broad stakeholder input to this critical issue. Thank you.

**Rick Lopes:** Great. Thank you, Matt. Dan Rodriguez is our next speaker.

**Dan Rodriguez:** Good morning my name is Dan Rodriguez, and first let me thank the Board for letting me speak today. I've been at work in the electrical industry for over 35 years. I have done anything from being an apprentice to an electrician, to foreman, a general foreman, instructor, and inspector. I have been around electricity pretty much all my life, and I've been working around workers who understand the hazards that arise from the use of electricity.

One of the things that I've done is as an inspector is gone out and checked out jobs where people who didn't understand the electrical codes, didn't understand the installation procedures and processes and install things.

And there's no way I could've explained to them what their mistakes were because they didn't understand anything about code. They could put it in. You can always teach somebody to put something in, but you can't tell them why if they don't have the basic concept of how things work. You can't tell them why this is this way and why this is that way because all you can do is say put in like this. If anything ever changes they don't understand how to change with it because they don't understand the codes. They don't understand when they're doing something right or doing something wrong. They don't have -- they just don't have the basic background for that.

As far as battery storage goes or energy storage goes, everybody believes batteries are safe, and they are inherently safe. They're made to be safe. But a lot of people picture a battery as a D-cell battery that you put in a flashlight. These batteries that we're talking about here, these storage systems are not simple, little storage systems where you light up a lightbulb. And if you don't think batteries are dangerous, you can take a 12-volt battery out of your car, put a wrench across it, and see what happens. It's going to blow that thing up, and basically you better off borrowing your neighbor's wrench because you're not going to use that again.

So again -- and we're talking that on a bigger scale, not a small scale. These things are dangerous, and we don't want to protect -- we don't want people putting them in that aren't going to understand what's going on. The national electrical code, the code that the C-10 contractors use, is designed to protect the end-user. The people who are going to be working around the stuff after it's been installed, not during the installation. During the installation you're talking NFPA 70 E, which I'm sure people here will talk about that. That's -- that's the safety for the installer, for the people who are putting it in.

But if you're talking about once this thing's done, complete, and you have the layman out there who's just parking their car in the garage, who's working around these things, or just walking around it, it has to be safe for them because they do not understand what the hazards are. They have not been trained in the hazards, and if the installer hasn't been trained and the personnel hasn't been trained in the installation and the hazard that could arise from this type of process, then you're putting people's lives in danger, and I'm asking you please don't do that. Hire C-10 contract -- or use -- only allow C-10 contractors to put this kind of system in. It's -- they've been trained all their lives to do

this. It's in their codebook, the National Electric Code, and it's -- that's the whole reason for its existence for the hazards that could arise from the use of electricity, as was stated earlier. Thank you for your time. Thank you for listening to me. I appreciate it.

**Rick Lopes:** All right. Thank you Dan. Thanks for being here. Robert Chon is our next speaker.

**Robert Chon:** Good morning. My name is Robert Chon. I want to thank the Board for giving us an audience this morning to discuss this matter. I've been an electrician for about 20 years, spent five years doing residential work, 15 commercial work. I got my state certification as a general electrician in 2007. I recently had an opportunity to meet with a C-46 contractor. I was going to install photovoltaics on my own home. I was pretty sure I was going to do it myself, but I wanted to speak with a contractor to weigh the pros and cons.

I spoke in depth with this person, and it became clear that he didn't know basic terminology such as the difference between a grounded conductor and a grounding conductor. He did not know the difference between an equipment grounding conductor and a grounding electrode conductor. So I don't mean to say that he is representative of all C-46 contractors, but this was very

alarming to me,

As was stated before, the purpose of the NEC is the practical safeguarding of people and property from hazards arising from the use of electricity. And I think that it's a very, very bad road to go down to -- to go down to allow people who are not qualified to work on electricity to work on systems in which electricity is stored.

I can talk about qualified people. That was already brought up. These people are not qualified from the definition of the National Electrical Code. So, in summation, I just want to echo the sentiments of all those who spoke before me and strongly urge that energy storage system work is performed by qualified people, licensed certified electricians, and C-10 contractors. Thank you very much.

**Rick Lopes:** All right. Robert, thank you. Thank you for being here. Our next speaker this morning is Mike Mendoza.

**Mike Mendoza:** Good morning my name is Mike Mendoza, 14 years in electrical trade. First, I'd like to thank the Board for giving me a chance to speak and comment on this issue. Being an electrician for this amount of time, I've completed an electrical apprenticeship, and continue to educate myself as the field grows and changes

in the electrical industry, along with the electrical and fire codes we work by.

As a state-certified electrician, I'm required to possess the knowledge, prove that I possess the knowledge to do the work at hand. As these systems evolve, so must we. Having worked on smaller systems and some larger systems up to 200 megawatts, the amount of safety for each doesn't change. Being that I've work for both C-46 and C-10 contractors, I've witnessed firsthand the amount of training that goes into the safety of installing. A C-10 contractor is required to educate their electricians on everything they may encounter in installing these systems. This is instilled in our minds to keep us safe every day. More importantly everyone's safe after we're gone.

Being a father of three girls, a husband, and electrician who takes pride in his work, I feel it is a necessity to have certified electricians installing anything involving electricity. It's what we're trained to do. Thank you.

**Rick Lopes:** Mike, thank you. Our next speaker this morning, Matt Stoutenburg. Welcome, Matt.

**Matt Stoutenburg:** Hi. My name is Matt Stoutenburg. First, I'd like to thank the Board for having this opportunity as well as very proud to be among the group

of people that are in this room. Definitely an established, educated group of people that are speaking here today. I think that needs to go recorded for sure.

Kind of a -- I'd like to tell a little bit more of a story about the personalities of the people. These are people doing this work, and, you know, myself, I went through a five-year apprenticeship program. At that time, there was no state certification. So when you finished that program you are technically an electrician, and when the state certification process came out, we resisted it a little bit because it was challenging the fact that we were already an electrician. So it was a little bit of an ego stab. So these are primarily men, but no insult to women doing this work, but there's egos involved. And we had to take that test. I was among one of the first batches of people to take the state certification test and studied hard for it. It was a hard test, passed it on the first try and was proud to do so.

After that, I had that license in my hand, I was -- I had elevated my ego to be a higher level of electrician. I knew the code better. I knew my industry better. I knew how to apply my skill better. It enabled me to differentiate myself among my peers that also called themselves electricians but had not gone through

an apprenticeship program and had not taken any training but learn from the guy that they worked with on the job here or there, and they knew a couple skills, and they had tools so they called themselves electricians.

Going forward a little bit, I got that license and then became a C-10 electrical contractor and founded two companies, and in the process have been in the electrical industry for 30 years now and have employed hundreds of people doing 6000+ residential solar systems and several megawatts of battery storage. Being a C-10 and a C-46 contractor, I see both egos involved. I see both types of people that do this work. We do the thermal C-46 work as well the C-10 work. There is not a chance in hell that I would put one of the C-46 employees on a battery storage project that are current employees of mine. They're good people, but they don't know how to do that kind of work. Flat out, they just don't know how to do it. They haven't got the training. They really haven't had the education. I can hire anybody to work under my C-46 license to go do that work because there is no state certification required to do it. I can't do that under my C-10 license. So we win projects that qualify for both licenses, but internally within my business I don't apply a C-46 employee onto a battery storage project. It's more than plug-and-play, like the gentleman said

earlier. There's the thought of migrating circuits. There's actual electrical work involved, and to put a C-46 staff member on there.

The other thing I want to point out is it isn't just the license holder doing this work. It's employees with egos. Some of them might think they are electricians because they installed solar systems. But doing storage work requires more than the PV part of the project. So I kind of wanted to share more of the evolution of that ego person working in the field that does not have the proper training to do this work is putting everybody at risk, the entire industry, and it's evolving. The cities, when you submit plan checks, they're finding things that they don't know about. The code's evolving, the people doing the work are evolving, the inspectors are learning things. We're really learning -- I'd like to ask in a room full of professionals how many people in this room actually have a battery storage system in their homes.

For the record, I don't know how many are in here, maybe 50, 60. Two people have battery storage in their homes, and we're the professionals that do the work. So the odds of hazards happening without the proper education, certification, and licensing in this industry as it involves puts people, property, and the industry at

risk. Thanks for the opportunity.

**Rick Lopes:** Thank you, Matt. Thank you for being here. I would certainly echo that we so much appreciate the expertise that all of you here today are helping us. This is an important issue and something we don't take lightly. And so we welcome the people on the front lines, presenting their information to us. Our next speaker this morning is Mark Buck. Mark.

**Mark Buck:** Good morning. My name is Mark Buck, and I'd like to thank the Board for letting me speak today on this issue. I'm a state-certified general electrician with 22 years experience. I helped install the PV solar system backup power at the FAA tower at the Oakland Airport.

I have great concern for safety when it comes these commercial energy storage systems. There are many types of storage units that can be used -- batteries, fuel cells, et cetera, which you've heard about already. Some types of battery such as lead and nickel cadmium can experience thermal failure, which you've heard of, when overcharged, improperly installed, electrical storage systems pose risk to workers, emergency responders, and the general public.

These systems also pose a risk to utility workers when these systems are connected to the grid. That is

why these types of installation should be done by qualified state-certified general electricians. Electrical storage systems include much more than batteries. There are many types of energy storage systems that includes sources such as super capacitors, flow batteries, large-scale, hydro generation. All these systems are separate from PV systems but could be installed or interconnected with a PV system. This is why it is important to have these systems installed, commissioned, and maintained by state-certified electricians and electrical contractors. To expose unqualified persons to such risk is not responsible and will result in injuries and fatalities. And for the safety -- and for other safety issues, excuse me, you can look to NFPA 70 EE, article 320. I won't go through it all, but it has to do with the storage -- battery storage units, which is a whole section in there. So I thank you for letting me speak.

**Rick Lopes:** Mark, thank you for joining us today. Our next speaker is Kevin Johnson

**Kevin Johnson:** Good morning, and thank you for allowing me the opportunity to speak. My name is Kevin Johnson. I'm currently the training director for the San Diego Electrical Training Center. And I'd like to address the public safety concerns related to energy

storage systems.

As the administrator of an electrical apprenticeship for over 500 apprentices who were aspiring to earn their California state general electrician certification, it's our duty as an electrical apprenticeship to ensure that we provide them with electrical theory and hands-on skill to ensure the systems they install will both function as designed and the craftsmanship is of the highest quality. But our top priority has been and will continue to be safety and awareness. Our apprentices will complete 1,020 hours of classroom training, which includes subjects such as DC and AC theory, blueprint reading, codes and practices, motor controls, and other theory and skill-based subjects to ensure they understand not only how to install electrical systems, but how they function and make them fully aware of the potential risks.

We spend five years getting them familiar with the national and California electrical codes, not so they can pass an exam, but so they will understand the minimum requirements as set by the code to avoid fire hazards and shock hazards to the public. By the time our apprentices have completed their apprenticeship, they will have completed OSHA 10, OSHA 30, EM 385, NFPA 70 E, and be first aid and CPR-certified.

As you can see, we put a lot of emphasis on safety

and awareness because our industry requires it, and energy storage systems are no exception. We recognize that energy storage systems have become an integral part in our industry, which is why we, as an apprenticeship, have invested in test equipment, labs, and instructor training to introduce (inaudible) which is an energy storage and microgrid training and certification course into our curriculum so our apprentices and are already-certified electricians not only know how to properly install these systems but are made aware of the potentially fatal hazards through electrical shock, arc flash, chemical spills and explosions, and other fire and life safety risks associated with these energy storage systems.

We recognize that this safety training is essential, and untrained, unqualified person installing these systems not only puts himself at risk, but their coworkers and the public, as well. I strongly recommend these systems are installed by qualified persons who understand not only the proper installation of these energy storage systems but have received the theory and safety-based training that only those working for C-10 contractors are required to receive. Thank you for time.

**Rick Lopes:** Kevin, thank you for traveling up to be with us today. Our next speaker is Hector Meza.

**Hector Meza:** Hi, my name is Hector Meza, and thank you for the opportunity to comment on the issue. I am a third-year electrical apprentice. I work on a 30-megawatt battery storage and some PV solar projects. As an apprentice I have been able to first hand or it will train state-certified general electricians who always make safety their main priority. Their OSHA and NFPA 70 E-trained plus thousands of hours of work make them the safest and most qualified electricians to work, to install energy storage systems. If one doesn't follow NFPA 70 E and OSHA guidelines, personnel could get hurt and equipment be damaged. People without the training of a California state-certified electrician won't be able to recognize the hazards involved in this type of installation. Licensed electrical workers recognize and protect themselves from arc flashes, arc blasts, shock -- sorry -- and shock hazards, which can reach up to 12,000°C.

Under a licensed electrician, I am not allowed to work unless he sees it's safe for me to do so, but it will still -- but I will still get walked through the process in a safe manner. And after I get my 8,000 hours of work experience plus my class time, I will be able to take the state test, which is -- which has about a 44% fail rate. It's not an easy test, but that is why

electricians go through a five-year apprenticeship program in order to prove that they have the knowledge to do any type of electrical work.

In conclusion, as an apprentice getting hands-on training, it makes me feel safe to be working under licensed electricians and C-10 contractors. Thank you.

**Rick Lopes:** Hector, thank you. Our next speaker this morning is Deon Mayes.

**Deon Mayes:** Good morning. I'd like to start by thanking the members of the Board for the opportunity to comment here this morning. My name is Deon Mayes, and I currently serve as the assistant training director for Electrical Training Institute in Los Angeles County, where we currently provide training for nearly 1,600 electrical apprentices.

My intention today is to comment on the issue of public safety as it pertains to energy storage systems installations and the training necessary to protect not only the electrical worker performing those installations, but also system end users, building occupants, and the public at large.

So I'll begin by speaking about the training we offer our apprentices at our facility. Apprentices attending our program receive a combination of classroom training and on-the-job training as part of a five-year

partnership. During those five years, each student receives a minimum of 1,200 hours of classroom instruction from state-certified electricians. Among other things, our students learn basic electrical theory, which includes the interconnection of batteries and other power sources, safe work practices as they relate to electrical installations, Cal OSHA's requirements as they pertain to electrical construction workers, the hazards associated with electrical work, and the steps needed to protect themselves and other workers from those hazards. Because we are committed to worker safety, every apprentice in our program attains a 30-hour Cal OSHA construction certification, 16 hours of asbestos awareness training, 8 hours of lead awareness training, training on the required to NFPA 70 E electrical safety standard, and all must maintain a valid first-aid CPR and AAD certification while they are in the apprenticeship.

In addition to their classroom training, each of our students must complete a minimum of 8,000 hours of on-the-job training employed by C-10 contractors under the direct supervision of electrical workers certified by the State of California of General Electricians. Each of these certified electricians has met California's rigorous guidelines, which include a minimum of 8,000 hours of verifiable experience installing and maintaining

electrical systems covered by the NEC, and that they pass a written exam based on their knowledge of the National Electrical Code.

At the end of the five-year program, all of our apprentices have met the minimum acquired and must take and pass the same exam and become state-certified electricians themselves before we'll graduate them from our program.

Speaking about safety, I feel it's necessary to add that all of our apprentices are strictly forbidden from working on energized circuits and equipment until they've pass this exam and graduated the five-year program because until they reach this critical milestone, they do not meet the NEC's definition of a qualified person and lack the experience and knowledge to perform this work safely.

In addition to the apprenticeship training, we also oversee continued education training for our journey level members who've achieved the state's general electrician designation. State-certified general electricians are required to attend a minimum of 32 hours of continued education to maintain a valid license to do this work. Much of the training we offer addresses the safety concerns surrounding the installation and maintenance of energy storage systems we're discussing

here today.

One example of that training is our NFPA 70 E training, which addresses safe work practices when working on or in the vicinity of energized electrical circuits. As part of this course, students learn about the hazards of working on or near energized circuits including arc flash and arc blast hazards, fed and Cal OSHA requirements when working in the vicinity of energized electrical systems, the proper selection and use of personal protective equipment when exposed to arc flash and arc blast hazards, and the established work practices required to ensure the safety of workers working on or near this energized electrical circuits and equipments.

So while we are proud of the comprehensive training we provided, we are not alone in qualifying students to become electricians in California. This is going to be a little bit redundant, but California law requires persons performing work as an electrician under a C-10 licensed contractor be certified pursuant to certification standards established by the division of labor standards enforcement. The term electricians is defined as any person engaged in the connection of electrical devices for electrical contractors licensed pursuant to Section 7058 of the business and profession code, specifically

contractors classified as electrical contractors, and the contractor state license board's rules and regulations.

As I stated previously, before our candidate can even take this exam, they must have a minimum of 8,000 hours of verifiable work experience for an electrical contractor. In addition to that 8,000 hour as I also previously stated, they must take a very demanding exam. How demanding is that exam? According to the California Department of Industrial Relations statistics --

**Female:** I'm sorry, sir, but your time is up.

**Deon Mayes:** Thank you.

**Rick Lopes:** Deon, thank you. And if you do have additional comments, we would encourage you to present them in writing. They will be included as part of the report if there was other information. Please do that. Our next speaker today is Jay Miller.

**Jay Miller:** Good morning, and thank you for having me. My name's Jay Miller, and I've been in the electrical contracting business since 1988. Before that I was a nuke electrician on the submarine USS Houston, and I'm currently director of operations at the MD Baker doing business as Baker Electric Solar. We are a C-46 and a C-10 license holder.

I'd like to take a minute just to tell you a story about something that happened in 1984. On the submarine

USS Houston, a large battery system obviously connected to the grid. We were doing routine maintenance on the battery, disconnecting the battery as a regular quarterly maintenance. Through some misalignment of the busbars a short happened, and a fireball blew past me and my mentor. I want to tell you that my mentor probably saved my life by requiring all the proper safety equipment, all the proper procedures, and stopping the process immediately and getting us out of there. His name is Paul Disney, and I'll never forget him.

Baker Electric Solar has done 8,000+ residential solar jobs, adding up to 60 megawatts of power. We've also installed so far 60+ energy storage systems, and we are currently backlogged with another, roughly, 50 to 60 energy storage systems for residences.

I want to touch on the types of residential systems are going to -- currently, Tesla seems to be the leader in the sales side of things. Just a couple years ago they came out with a 1.0 unit that was DC coupled, and just last year they switched to their version 2.0, which is an AC coupled unit. Another close runner to Tesla is LG Chem. Just recently literally this month they released their B or their slave battery. Just yesterday, one of our suppliers informed us that we have 23 units that need to be recalled and pulled out of homes and sent

back and replaced. The point of bringing this up is there are still many kinks to be worked out from the manufacturing, all the way through the installation process in energy storage in residential and obviously in commercial.

I believe the best way to mitigate the risk in this early stage of the of the technology is to have state-certified general electricians do the installation. I don't believe we should make decisions on safety based on economics. We all need to pay what it takes to have the right trained, safe worker install the product. Thank you.

**Rick Lopes:** Jay, thank you for being with us. Our next speaker, Andrew Rogers.

**Andrew Rogers:** Good morning. Thank you for the opportunity to speak on the subject. My name is Andrew Rogers. I'm the training director for Sprig Electric, a full-service electrical contractor located in Silicon Valley. We have a significant energy storage solutions portion of our company and considerable interest in this topic.

I am also a senior instructor for the JTC. The Santa Clara Electrical JTC, a fifth-year instructor, specializing not only in code, but in NFPA 70 E standard for electrical safety. I hold inspection certifications

by both the International Association of Electrical Inspectors and the International Code Council. One of our esteemed speakers spoke in favor of the C-46 position, and one of the comments made was that the energy storage system is not necessarily difficult as long -- and I quote -- as you understand them or once you understand them.

And I wouldn't be presumptuous as to question the knowledge or capacity of that particular commenter, the individual who stated it. The question, though, is the barometer with which we measure the installer, not necessarily the designer.

Several years ago, back in 1999 with the inception of the Department of Industrial Relations requirement for state certification, many of us were subjected to an examination. Over the course of the years, the requirements for taking that examination have not changed, but the examination itself has changed substantially. Many people -- and we've heard statistics here -- about 36% of those people who take the examination fail it on the first try. Now that, in my opinion, is a good thing because it requires that those individuals return to the code and get more familiarized with what the code requires.

Now today, we've considered quite a bit with regard

to safety. The comment referent to a qualified person, as noted in the NEC and also in the NFPA 70 standard for electrical safety is probably the crux of this discussion. And I state that because NFPA 70 E states that there must be demonstrated skills and knowledge. Now, that demonstration comes for the C-10 contractor for those individuals who have passed that state examination. That is a demonstration -- that is a quantitative and qualitative impact of the caliber of the installer.

Now, for us in the electrical industry, we realize that safety is an imperative. According to the Labor Bureau statistics -- this is published back from 2016 -- over 2,000 individuals died as result of exposure to electrical current or energy. Of those the majority died as result of direct exposure. So regardless of the impact that we strive to maintain with regard to safety, electrical energy is still a significant threat to the worker, and imposing that thread on an individual who is not totally prepared to confront it is, in my estimation, a significant issue that we are contending with today.

Now, interestingly enough, NFPA 70 E, in its current edition, speaks of that qualified person but also states that energy systems maintain a significant arc flash threat. In fact -- and I quote directly from it -- working on energized conductors and circuit parts or

serious-connected battery cells, including voltage testing, and working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a DC source present the likelihood of an occurrence of an arc flash incident.

Now, that word there "likelihood" is an extremely powerful word because if there is the likelihood of the occurrence of an arc flash, then the aftermath is something that we need to contend with. And unfortunately, the Bureau of Labor Statistics and those statistics related to electrically related fatalities may well have included individuals who, unfortunately, were not aware of the likelihood.

Now, for us as an electrical contractor, we have an energized electrical work protocol with even DC systems. We're required to fill out significant paperwork, risk assessments, both in arc flash and shock hazard. And we do that because even though we consider our workers qualified, it is for us an insurance that they are consistently and constantly aware of the type of issues that they contend with in the field. Thank you for the opportunity.

**Rick Lopes:** Andrew, thank you for being with us. Our next speaker is Troy Strand.

**Troy Strand:** Good morning. My name is Troy Strand.

I want to thank you for affording this opportunity to speak to the Board. I know this isn't about me, but I want to give a little bit of background on where I come from. Been in the industry since 1990, industry meaningful photovoltaic systems and battery energy storage. I am an electrical engineer by degree, not by license, work for Southern California Edison in installment systems throughout their utility territory, as well as moving on to the National Renewable Energy Laboratory, where I sat on two cycles -- the 93 and 99 -- for article 69. From there I went to an inverter manufacturer, where we actually installed battery energy storage systems worldwide from voltages ranging from 120-208, on up to 12,000 or 12 KV. After that, founded my own company, ran it for 15 years, again, doing large photovoltaic installations as well as large battery energy storage systems, coupling them quite often with multiple forms of energy generation, whether it's gen sets, whether it's wind, whether it's the utility, and again distributing up to 12,000 or actually 13,000 volts.

These DC voltages that we were dealing with because volts are free, amps are expensive. What I mean by that is, the higher the voltage, the lower the current, smaller the conductors, changes all your switches. That is the goal that engineers design to. So when that

happens, there are inherent dangers that must be considered.

You have what we call amps interrupting capability or the vault current. So we got to make sure our switches, our fuses, our circuit breakers, our contactors, everything deals with that. And quite often parts get substituted at the supply house, and then they go out to the field. When that fuses arrives, somebody has to be able to read that label and understand what they're putting into that circuit because if they put in the wrong fuse, they put in the wrong switch -- even though it's engineered properly -- because it was swapped out by, gosh, I'm not going to say any names, but by a supply shop -- bad things happen.

You operate a switch with high-voltage on it or when I say high, just say 600 volts on switch that's rated for 250. It will not or may not -- I shouldn't say will not -- it may not extinguish that arc, at which point you can end up with fire life safety issue.

So backing into now where I want to go with this, kind of little nervous, watching the clock tick here. Backing into where I want to go with this. It is imperative that we use trained individuals, qualified individuals for that work, and I'm just really impressed by the individuals around here at all levels from the

high level such as Dan Cohee, on down to the guys that are actually doing the work on their knowledge and their desire for safety. The Matts really did great job. There's a lot of Matthews in here, I've noticed and the Chucks, as well.

So getting back to the training -- the training on safety is critical. The -- in my company that I ran, my guys were OSHA 30, and then my foreman were all certified electricians. And they were all EM 385-trained. Now, many of you may not know what that is. That's the military equivalent of OSHA 30, but on steroids. If you will, much more intense.

Moving onto voltages. The utility scale projects are going to be operating at 800 volts DC and above. You're going to have multiple strings of batteries. You also are going to that same thing in parallel, which increases your fault current. You're also going to have that in the commercial and industrial.

Now, one thing I forgot to mention, I work at Baker Electric, times almost out. We have installed numerous utility scale projects both at the battery level and at the photovoltaic level. So were talking 51 megawatts at the battery, 73 megawatt hours storage. I want to thank you for your time and for entertaining this important topic.

**Rick Lopes:** Thank you, Troy. Again, we do have a time limit for speakers but, again, I just want to reiterate if there's something you feel like you weren't given enough time or something comes to you after the fact is we would welcome you to put that in writing. That will be included as part of the report, and send that to us. We would welcome that. We don't want anybody to feel like they've left here without being able to voice what they wanted to say. Our next speaker this morning is Crystal Sujeski.

**Crystal Sujeski:** Good morning, and thank you for providing us the opportunity to express the concern of our organization. My name is Crystal Sujeski, and I am representing the Fire Prevention Officer Section of the California Fire Chiefs Association. As you know, a solar contractor license is designed to allow licensees to install, modify, maintain, and repair thermal and photovoltaic solar energy systems. The license certification specifically prohibits installation of other building construction trades, crafts, and skills. We are expressively against the expansion of the C-46 license to include installation, modification, maintenance, or repairs to include energy storage systems. The knowledge, skills, and abilities required to install energy storage systems are vastly different

than those required to obtain a C-46 license.

The consequences for the fire service of an improperly installed system are just too high for our firefighters. We have reached out to our partners in building and the California Building Officials Association Board of Directors expressed the same sentiment. Thank you for the opportunity.

**Rick Lopes:** Crystal, thank you for joining us. Our next speaker this morning, Ken Bruce. Did Ken step out, maybe? Okay. We'll move him down and come back to Ken. Allen -- oh, I'm sorry. I didn't see you pop up. Thank you, Ken.

**Ken Bruce:** Hello I'm Ken Bruce. Thank you for the opportunity to speak today. I started my electrical career in 1988, graduated from apprenticeship in the Bay Area in 1995. Since then, I've worked in multiple computer rooms, all that have energy systems and backup systems. Some of them are small. Some of them are larger sizes. Some of them are just for small offices, and I've also worked on some hydrogen fuel stations that have actually larger ones to back them up. I have taken multiple -- all OSHA classes through the years and arc flash classes.

I was asked to come here today to demonstrate and show through my training two years ago, a suit like this

saved my life. I was working on an energy backup system with a labor tech in San Francisco. It was just going to be a simple day installing the meter to read what's going on that someone else installed many years ago. And with this suit, I'm here today to talk about my training and background and why it's important that these young men and women turning out and graduating from classes today have the proper education and training from experienced electricians to do the job right. Thank you.

**Rick Lopes:** Ken, thank you and we, too, are happy that you had that suit on that day, as well. Our next speaker today is Allen Sloan. Allen.

**Allen Sloan:** Good morning. My name is Allen Sloan. Thank you for the opportunity to comment on this important subject. I'm going to be speaking on the safety aspects of the installation and maintenance of electrical energy storage systems. I'm a safety professional, and I work fulltime with hundreds of contractors and thousands of electrical workers in greater Los Angeles. I have approximately 20 years of experience in electrical construction safety. I have achieved multiple certifications through the Board of Certified Safety Professionals, including an SMS, which is safety management specialist, a CHST, which is a certified health and safety technician, and an STSC,

which is safety trained supervisor in construction.

I've been involved with contractors who do electrical storage system projects and have worked with them and their workers on important safety issues. What I find that needs to be talked about during these next two days is safety. When it comes to installing any kind of electrical safety system is about utmost importance, and when dealing with these batteries, we are talking about stored energy potential. That is a major issue even in smaller energy storage systems and clearly an even greater safety issue in medium and large systems.

Let's look at some of the safety concerns. Electrical shock -- electrical power stored in battery cells has the ability to deliver a severe electrical shock when interconnected with battery banks reaching hazardous voltage levels. There'll also be 240 volt rated parts and other components presented on energy regulators -- on the energy regulars inverters and et cetera have hazardous voltages.

Arc flash -- a battery has sufficient energy to cause an arc flash if it short-circuits or if a fault occurs. An arc flash can have temperatures above 35,000°F, capable of melting metal and causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash.

Fire and explosion -- most lead acid batteries generate hydrogen and oxygen gases when charging. Other battery types also emit flammable gases and need adequate ventilation to avoid an explosion or fire. Lithium-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable gases if there is a fault. Fire and explosions can also result from excessive temperatures either under normal operating conditions or due to an electrical overload, electrical component failure, short-circuit, or loose connections. Battery casings can degrade -- let's get to hazard chemicals.

Battery casings can degrade or be damaged from a variety of impacts. They can also rupture as a result of excessive temperatures generated from a change in chemical reaction from overcharging. If a battery casing is ruptured, the fluid or gel inside can leak, resulting in toxic fumes, burns, corrosions, or an explosion. Other safety concerns during installation include insulating live electrical parts to prevent electrical shock, including battery terminals and other electrical connections, knowing how to test, commission or decommission the system as required, ensuring there is sufficient clearance between items to prevent overheating, ensuring shutdown switches are easily

accessible, knowing NEC, NFPA 70 E, and understanding all electrical equipment so the placement of signage and warnings will be done correctly.

This is a set of important important electrical skills needed to clearly identify equipment and shutdown procedures and the battery chemical being used so it can be readily identified by emergency workers.

Safety concerns which are crucial to protecting the safety of workers and those who work in and visit these facilities are highly relevant to the question of whether C-46 contractors and their workers should be permitted to install and maintain electrical energy storage systems.

As I said, I work with hundreds of contractors, thousands electrical workers, and I know from my 20 years of experience that there's a major difference in training, knowledge, skills, and experience. C-10 contractors and electricians that work for them have this knowledge, they have the skills and experience. C-46 contractors employ workers and according to California regulations have no requirements for training or certification. That means by the worker that the worker and the public safety risk related to ESS, I have noted today, and this, by no means, is a comprehensive list that would be extremely hazardous and unsafe if installed by C-46 contractors and workers. Thank you for your

time.

**Rick Lopes:** Thanks very much, Allen. Jim Willson is our next speaker.

**Jim Willson:** Good morning. Thank you so much for the opportunity. You have some great technical experts. I'm going to kind of hit in the common sense approach to this in our mind. My name is Jim Wilson. I'm Executive Director of the Los Angeles County chapter of the National Electrical Contractors Association. Our chapter represents over 300 electrical contracting companies, who employ over 8,000 electrical workers throughout Los Angeles and Ventura Counties.

Our chapter was chartered in 1938, is part of a national organization whose member contractors perform over \$130 billion in electrical construction throughout the US. I've been representing electrical contractors in all facets of their business and industry for over 39 years. My involvement has encompassed education and training, emerging technologies, business development, safety, code, government relations, including licensing and certification.

Our organization played a critical role in the 2016 retrofit of 170,000 square-foot electrical training facility in a net zero boot building, including a microgrid. Our facility is the largest electrical

training center in North America.

I give you this background because of my 30 years of working in the electrical industry, I've never been so perplexed by an issue that should be such a common sense and logical decision in terms of protecting consumer safety. Let me outline briefly some commonsense reasons why C-10 contractors should install the systems.

One, if C-46 contractors are not permitted to install standalone battery storage systems, why should they be allowed to install them just because they're solar?

Two, there is no way anyone should consider these independent battery systems, which can be multiple voltages of multiple amps, incidental or supplemental, to their work. The rapidly changing technology and size of these battery systems make them complex and inherently more dangerous. It is illogical to compare them to basically small car batteries installed 25 years ago.

A few questions on a test does not make you qualified to install these complex electrical systems. The contractor and workforce need to be fully qualified and trained in all aspects for electrical code, theory, and installation standards.

Regarding workforce, why would you allow a licensed C-46 contractor that has zero training requirements to

employ certified workers to install a certain energy storage system? The safety risk in the system is not mitigated by a contractor sitting in an office. It is made safe by the trained and skilled workforce installing them. C-46 contractors have that no state-approved apprenticeship program and, more importantly, no requirement to employ any certified electricians.

I asked a C-46 contractor who also had a C-10 license why don't you just use your C-10 license to install all of your work, and they told me if I use my C-10, labor gets too expensive because they have to be certified. You have to be certified by the state to cut hair, do a manicure, but to install a lithium-ion battery system tied to a PV system and the grid you don't. This is not common sense or logical to me and probably not to most consumers.

In closing you receive letters and testimony from firefighters, code experts, contractors, and utilities that are opposed to C-46 contractors doing this work for safety reasons. You've heard from C-46 contractors that they're qualified because a few test questions on their test and the fact they've installed small battery systems going back 25 years.

I believe if you analyze everything with consumer safety in mind, logic and common sense will lead you to

make the right decision. Thank you for your time.

**Rick Lopes:** Jim, thank you. Our next speaker is Ralph Armstrong.

**Ralph Armstrong:** Good morning. I want to thank the -- thank you for letting me to weigh in on this. My name is Ralph Armstrong. I am a -- been in the electrical industry for over -- about 34 years now. I am a little different than most people in this room. I'm actually a German lineman. I worked in construction, I've worked in the utility industry. I spent 13 years with the Department of Energy. The last three years that as an occupational safety and health specialist. And over the last 11 years, I worked for the International Brotherhood of Electrical Workers. IBEW Local 1245. My current position as senior assistant business manager. One my assignments is safety over -- for over about 19,000 of our members, many of whom are the first responders when -- when the power is out and thousands of the -- thousands of our members will pass or cross with these systems on a daily basis. The last thing we want is our first responders who are trouble men that show up on jobs. I mean, we represent utility, cities, municipalities across Northern California, Northern Nevada. The last thing we want is our members to show up on the job when after a storm or a after fire and these systems aren't working

correctly. They need to be installed, maintained properly so that the job they already have that is hazardous, they don't have to worry about something else taken their lives.

So it's important, again -- I've heard it over and over again -- it's important for us and our members that these systems are installed correctly by state-certified electricians. The licensing board has done a great job as far as requiring the certifications. I mean, it's a no-brainer that they wouldn't be required for this.

Secondly, I work closely with Cal OSHA on a lot of different things. I heard earlier about the 48-volt demarcation point. My time with the federal government in 1910.333 of the fed OSHA standard is where the 50 volts or less comes into play with regards to energized systems.

Cal OSHA has taken it one step further -- any voltages less than 50 volts under 2320.2 of the Cal OSHA standard, it basically states that the employees must receive the instructions of working on these systems, you know, with regards to any energized systems and the safety requirements associated with that. So I think the language is already in place. I mean, the training that the state-certified electricians get covers all that training. I think it's important that the Board takes

that into consideration and only allows C-10 electricians to perform this work. Thank you.

**Rick Lopes:** Ralph, thank you very much. Our next speaker is Gene Acosta. Also, Gene, did by chance do two cards?

**Gene Acosta:** Yes.

**Rick Lopes:** Because I saw your name twice. I just wanted to be sure. Thank you.

**Gene Acosta:** Good morning my name is Gene Acosta. Thank you for giving me the opportunity to speak today. I'm here because I'd like to discuss my safety concerns related to the installation of energy storage systems. I've been in the electrical construction industry for 26 years, graduate from the apprenticeship in 1996, and became a state-certified electrician about three years after that when it was required.

I'm currently the vice president of energy solutions for CSI Electoral Contractors, just outside of LA. CSI's been in business for over 27 years, with the focus of the renewable and alternative energy since 2007. In that time, we've installed over 1.5 gigawatts of solar photovoltaics and near 35 megawatts of energy storage with our largest energy storage project at 10 megawatts.

I've been with CSI since 2004, and have been part of and overseen hundreds of these type of energy projects.

It would be a mistake for the California State Labor Board to treat energy storage systems as simply a subsystem to PV energy systems.

In my experience all the energy storage systems that we've installed to date, when paired with with solar, have been separate systems with their own technical requirements, installation codes, and they, as well, pose very different hazards.

Most current energy storage systems, specifically battery systems, operate at near 1,000 volts DC, much different than systems installed even five years ago. As these systems have grown in size, banks of battery cells are strung and collected together to create high current and have the electrical potential to support not just one home but sometimes thousands of homes for hours at a time.

I recently have been involved with the early development of some upcoming energy projects, some that are with solar, and I would be concerned if these systems were not installed by properly licensed electrical contractors that employ trained and qualified electricians.

The smallest of these systems is about 10 megawatts, and all are rated at 1,000 volts DD with multiple large multi-megawatt inverters with complex interlocks and grid

divulges of 34.5 to 66 KV -- kilovolts, that is. Excuse me. Vastly different than a residential commercial division of one 2240 or even 480 volts. The complexity of these systems along with working with contractors -- excuse me -- the complexity of these systems, along with working with voltages of energies of this nature is much different than what most C-46 contractors would typically install.

Considering the dangers related to energy storage systems, improper installation, and/or maintenance -- maintenance exposes risk not only to those working on the system but to both public, personnel, and property. I strongly believe that only fully qualified contractors with properly educated and trained state-certified electricians should be installing the systems. I've seen the dangers and damage that high potential DC systems can cause when not properly installed. One minor installation error can create an arc fault or short-circuit current that are so strong they'll melt metal and create fire within seconds.

At CSI, our electricians have years of training and education, have passed a state exam. We follow the strict guidelines of the NFPA 70 E and OSHA for construction, and yet we still require additional company training in working on energy storage systems. So by

allowing the installation of complex energy storage system by contractors that have no minimum education, training, or skill requirements would not only be a mistake, but we would be putting all of us at risk. Thank you.

**Rick Lopes:** Thank you Gene. We have another Matt coming up next. We have Matt Nootenboom. Welcome.

**Matt Nootenboom:** Good morning. I find myself in some high company today which I'm not ashamed to be a part of. I want to thank the Board for the opportunity to speak. My name is Matt Nootenboom. I am a state-licensed general electrician. I'm also a graduate of an instructor at the Sacramento Area Electrical Apprenticeship, which is a five-year training program feeding journey-level electricians into our C-10 partner contractors.

What I consider my 15 years in this trade as a short duration has taught me the inherent dangers of electrical systems. I think many people outside the electrical trade have a culturally ingrained respect for our traditional utility provided AC systems, and rightfully so. Unfortunately, I find that that same respect is not given to the rapidly expanding DC systems we are seeing on the market today. Too often I see and hear people dismissing DC storage systems as just batteries.

We've seen examples of recent viral videos on the Internet of some of these simple lithium-ion batteries exploding in unsuspecting people's cell phones. This is an example of the type of energy density that's present in just a single cell. The FAA has restrictions on how they're transported on airlines. That's how much potential energy is out there in just single cells, but these energy storage systems that are emerging on the market today are multiple-connected cells, talking hundreds of times that potential or more.

Seemingly simple batteries, when connected together as a complete system, have voltages and potential arc energy that rival the AC systems they are being integrated with. Regardless of any individual opinions, these systems are inherently dangerous. The NFPA and OSHA agree with that fact.

DC power systems, in fact, are arguably more dangerous than are traditional AC systems, simply for the fact that they can't be shut off at an electrical panel. Storage systems are on all the time and, as such, the required safety protocol's the same as any life electrical work. I'm joined by several of my current apprentices today, and they are undergoing thorough and rigorous study in teaching these safety protocols as well as code requirements for installations. The inherent

danger in battery systems is very real, not just workers but to the property and the public.

C-10 contractors have decades long history of safely working with these energy potentials. I would ask the Board to consider that irreplaceable experience with its due weight when deliberating this matter. Thank you, again.

**Rick Lopes:** Thank you, Matt. And a special welcome to your students. Thank you for being here. Our next speaker this morning is Chris Sommerfeld.

**Chris Sommerfeld:** Good morning, and thanks for the opportunity to speak. So I work for Sun Run, which is the largest residential solar and energy storage service provider in the nation, doing a maturity or a large portion of our business in the State of California. I am responsible for construction standards and applications as well as quality assurance and coordinating licensing and have been responsible in overseeing the installation of over a gigawatt of solar installations and megawatts of energy storage installations.

And today, I wanted to address some of the specific questions that the CSLB had on the matter at hand. So the first one was regarding voltages and currents of energy storage systems versus solar only systems and increasingly we've seen over the past 2 to 3 years that

those voltages and currents present on energy storage systems have become more and more in line with what we've seen in the solar-only grid-tied industry. So in residential, we see 600-volt DC limits. In commercial and industrial 1,000 volts DC. And so more and more we've seen those energy storage products that are coming on the market in line with those same voltage and current expectations.

And so I would argue that the challenges presented to a C-46 contractors in dealing with those voltages and occurrences are very similar to the precedent of the past 20 years or so, as we've been focused on grid-tied solar. So when it comes to overcurrent protection, conductor sizing, those are all very much in line with what we've seen over the past two decades, and what experience has shown.

The other question I wanted to address was regarding liability and the impact to consumers. I think related to the fact that the voltages and currents present on energy storage systems are coming so much in line with what we've seen in the grid-tied solar industry. There essentially is no change to the consumer. So, you know, delivering those products, delivering them to the same types of switchgear, same types of conductors, same types of components that they're used to, you know, effectively

that doesn't change anything for the consumer, and it's par for the course.

The other thing that I wanted to address, which I haven't heard as much about this morning. It's just the future of solar energy and energy storage, and increasingly I think what we see in the State of California, with net energy metering or NEM (phonetic) 2.0 policy coming into play where solar and time of use are inexplicably linked, we see more and more attachment of solar. So for the company that I represent in locations in Southern California we're seeing attachment rates of up to 50 percent of solar plus storage. And other markets that we operate in, including states like Hawaii, we C-100 percent. So the future of solar and energy storage are certainly linked more and more so by both policy and consumer demand.

So as we start to, you know, evaluate this issue, we really need to look at solar and energy storage as combined systems because more and more, we're going to see them linked, as we already do. So thanks for your time. And thanks for everyone's time today.

**Rick Lopes:** Chris, thank you. Our next speaker is Bob Lilley.

**Bob Lilley:** Hello, good morning. Like a lot of the other speakers, I'd like to thank you for the opportunity

to speak, and I appreciate your indulgence in this sometimes technical subject. My name is Bob Lilly. I'm a state-certified electrician. I also hold an EPRI 1 instrumentation certification and Cal CTP energy efficiency lighting certification. I'm the business director for a large C-10 contractor. We also hold an electrical contracting license in Nevada, and we have an A and B license, as well. So as see, we're no strangers to the licensing procedure.

We do not have a C-46 license because, frankly, we use our -- our workers are all state-certified electricians, and we believe that you need to reach that high level of proficiency to conduct -- to perform this kind of work.

As I see it, there are really two issues here. One is the ever-changing technology and solar and the ever-changing technology in battery storage, and let's call it energy storage. Because batteries are not the only energy storage system. And the second one is the safety not just of the workers, but of the occupants in the building and the general public at large.

Years ago, solar energy was thought about as a rooftop array in a residential environment feeding power to the electrical grid. But time and technology has allowed for larger and larger solar projects. My company

performed what at the time was the largest solar project in the nation -- was 240 megawatts in Southeastern California called the Centinela project. We've done many, many 20-megawatt and more projects and probably too many for me to count of projects of 5 megawatts or larger.

I will tell you the more megawatts, the more complex the system is, and that comes with more power. Battery storage has made solar technology a more viable option to green energy production in California because it extends the daylight, if you will, of the solar generation, but it's also increased the potential for danger. Solar panels generally produce about 30 to 35 volts, a couple of amps, as was previously stated, there is no on-off switch. If you're shocked by a solar panel -- and it's possible -- it's mildly uncomfortable. But batteries are add-ons, no matter how you slice it. They are not peculiar to solar and they deliver their energy at fault in one big punch, and it can create a ball of fire that's 25 times brighter than the sun, and I just read the other day that a lithium-ion battery of 2 volts can produce 1,700 amps. So it's a tremendous difference in the amount of power. The potential for danger is obvious.

Frankly, I would not want my son or daughter around a battery storage facility, whether they're working on it

or just in the building unless it was done by qualified, properly trained personnel with continuing updating of their -- of their skills.

In closing, someone mention the National Electric Code. You know, the -- part of the electric code that deals with energy storage is really throughout the code. You can't just learn one section of the National Electric Code and understand battery -- understand energy storage. You have to know the whole code.

I think we should leave this work to certified professionals using proper equipment, and that includes personal protective equipment using up-to-date methods, keeping themselves and their customers out of harm's way. I just want to say in closing that no one in this room, whether you're a C-10 contractor or a C-46 contractor, benefits from an injured worker or an injured member of the public or an injured person just happens to be standing around. Thank you very much for your opportunity.

**Rick Lopes:** Bob, thank you for joining us today. Paul Gutierrez is our next speaker.

**Paul Gutierrez:** Good morning. Hello, my name is Paul Gutierrez, graduated a state-approved apprenticeship program in 2003, and have been a journeyman electrician for the last 15 years. From the start of my

apprenticeship program it was instilled in us that although we were going to go to school for five years and work during the day, it was a commitment to a lifetime of learning. That learning has spanned over 1,000 hours of classroom instruction, studying emerging technologies, National Electrical Code, electrical theory, and electrical safety.

I worked on numerous the energy storage systems over my career, some as large as in a power generation facility where it was critical that the load that needed to be supplied power DC motors that they would ensure a proper shutdown of equipment for the power plant to systems where solar canopies are installed at schools, and those take on a critical load for a power outage.

And when we talk about safety, talk about the projects that are there and the energy storage, it's very complex. I feel comfortable working on these installation, but it is because of the electrical theory and training that I've received, its years of experience of knowing what to do, not just on a standard task, but if something else goes wrong, how do you apply that -- your knowledge to alleviate the system issues.

It's easily possible to teach somebody to perform one task, but is not easy to teach them to perform a task well and know enough to ensure that they're safe and

provide all the theory that's needed. I've only worked for electrical C-10 contractors with -- and qualified electricians on these systems. One, it is my belief that properly trained and -- and safety is the major concern. I need to work with other professionals beside me, and I know that the chain of command in a C-10 contractor shop has electricians and years of knowledge stacked on top of it.

So it wouldn't be a C-46 contractor that has one guy that knows a lot about it tells one guy how to do it and trains you okay. I know that when I worked for C-10 contractor, my foreman, he's a electrician that understands electrical theory and power -- hit the superintendent has years of experience -- and it goes all the way up through the chain. And every level you get to, you have actual experience and knowledge to ensure safety and -- and that the job gets done.

So today I ask the board to allow only C-10 contractors employing state-certified electricians to work on energy storage systems. It is not only in the customer's best interest, but the interest of our public safety as well. Thank you.

**Rick Lopes:** Paul, thank you for joining us. Our next speaker, Alex Carabalto.

**Alex Carabalto:** Good morning. My name is Alex

Caraballo, and I'm very fortunate to be a recent graduate of a state-approved apprenticeship program. We've spoken a lot today about the NEC, and I just want to bring this up, just to let you know this is what we're talking about with the NEC. This is -- these are things that are in place because of cataclysmic events that have happened on jobsites and that have -- you know, many people have had to lose their lives over.

I first want to start by thanking you allowing me to come and speak today on whether or not C-46 contractors should be permitted to install and maintain energy storage systems when paired with PV systems. I'm state-certified general electrician, and I've spent the last six years of my life day and night studying and preparing myself to become a competent worker. All workers in the electrical field come into the field with varying degrees of mechanical skills, being trained. For a long time, it's helped me know how to work safely and taught me orders of operations to be able to do just that and stay safe on the jobsite.

I've spent many hours over the last six years working on solar projects and energy storage systems. These are two very different and distinct systems, and I think it's a poor idea to conflate these two as one.

You have a lot of apprenticeship coordinators,

directors, and electrical teachers, myself included, as a journeyman wireman who would not allow electrical workers with limited experience around us to work on this type of work hot because of you were to do that, there's a very likely chance that they will not be going home at the end of the day.

Any professional electrician in this room can tell you at any point when they walk into any building or any place, you immediately can spot out when things are wrong, especially when it's electrical work. And a few years ago, my wife and I went down, and we were in Oceanside visiting my father-in-law. And I walked in to his house, just happened to be at the time when there was a a solar company installing solar on his home at the time. And of course because I notice everything that's going on around me, I noticed that this system that he was installing was not grounded properly, did not have the adequate support to -- for that system, and I brought it to his attention, as, you know, a common passerby. And he told me that I was wrong and that I didn't know what I was talking about.

Well, this NEC right here is not just a guide for us to stay safe. But it is a tool for all competent workers to be able to find and give out information and utilize this information when needed. I walked over to my trunk,

I pulled it out my trunk, and I brought right back to him, and I showed him exactly why what he was doing was wrong.

The fact is, you know, there is -- there's talk earlier about it being criminal to possibly doing this work sooner rather than later, but I think more than anything, it's negligence. It would be negligent for anyone, especially the Contractors State Licensing Board, to allow C-46 contractors to allow people who are not trained and prepared to do it -- to do their work properly because this is a very dangerous profession. Many people's lives on a daily basis. So thank you very much, and have a wonderful day.

**Rick Lopes:** Thanks, Alex. You, too. Our next speaker this morning is Brian Holt.

**Brian Holt:** Good morning, and thank you for the opportunity to share our concerns on this very important matter. My name is Brian Holt, and I'm a certified California state-certified electrician from Bakersfield, California. I have worked in the trade for 22 years and completed a state-indentured five-year apprenticeship program, which included the requisite 960 classroom hours and 8,000 on-the-job hours. I'm honored to now sit as one of six committee members who oversee their apprenticeship and have done so for the last six years.

I stand before you today in opposition of allowing C-46 contractors and, in turn, noncertified workers to install and maintain energy storage systems, regardless of their location. To be clear, these are separate, standalone systems that are complex in nature. To assume that a solar contractor can install such a system based solely on the fact that it is adjacent to a solar facility is ludicrous. Solar systems are adjacent to many types of facilities. That doesn't mean those contractor should be allowed to build and maintain those, does it?

If a cement mason can finish the concrete dome around a nuclear reactor, does that mean he can build and maintain the nuclear reactor? There's been talk in the industry here lately of possibly going back to all the peaker plants that were built during the power crunch of the late 90s and installing energy storage systems, including technology that are very similar to that found in today's hybrid vehicles. Most of these are gas-fired power plants with very large turbines, your quintessential industrial-type facilities with smoke billowing out of the smokestacks.

Should these systems be installed by a company whose workers are not required to be state certified? Should workers trained only in installing PV module on

residential rooftops be expected to perform this work correctly and safely? As an industry tradesman, I say no.

As far as safety is concerned, I will leave you with this one personal story because I think it's important. A few years back I was the lead electrician at a new data center being built for NASA at Edwards Air Force Base. As you can imagine, it was incredibly complex, and the power systems feeding the building were redundant, meaning it had multiple alternative sources in case of emergency.

Included in this system was a very large UPS, which is an uninterruptible power supply, which is a fancy term for battery backup. By design, I would say that it is no different than the very systems we're talking about here today. One day towards the end of the project, the owner had a testing company on site working through the systems whose workers were not required to be certified or prove any kind of training, much like that of the C-46 contractors. Not understanding the system, one of these workers went to reach into a piece of gear that he thought was deenergized when, in fact, it was being fed by the UPS system, the battery storage which I mentioned earlier.

Without even thinking, I grabbed him by the shirt

collar and pulled him back to safety before he made contact. Luckily it was classified as a near miss, but it could have easily been a very serious injury or worse. I think this is a very good example of what can and does happen when unqualified, untrained individuals are allowed to work on systems they do not understand.

I strongly urge you to vote no on allowing C-46 contractors to install energy storage systems. Thank you for your time.

**Rick Lopes:** Thank you, Brian. Our next speaker this morning is Glenn Dolph. Glenn.

**Glenn Dolph:** My name is Glenn Dolph. I started my career in the electrical industry in 1979, started out with a four-year apprenticeship. Over the next 17 years I've worked on houses, apartments, high-rise buildings, oil refineries, nuclear power plants, gas-fired power plants, and such. For 17 years after that, I was the lead electrician for the Currin County Sheriff's Department, where I maintained numerous -- or helped maintain numerous commercial type buildings and jail facilities. Also somewhere in the middle of all that I did 12 years as an apprentice instructor concurrent with all of that.

My apologies at this point. Following this many people that are so learned and capable and experienced in

this field, there's very little on the technical, code wise, legal aspects that I can actually add. That's an advantage as far as talking. The bad news is my notes is almost just good for paper airplanes at this point.

Just the last four or five years of my career, I actually worked on installing commercial solar photovoltaic power plants. I have the position of electrician, foreman, general foreman on those plants. I was involved with pretty much every type of part of the construction of the testing, commissioning of those facilities. They ranged from the size of 20 megawatts up to close to 150-megawatt units.

What may not have been apparent is in most of my previous career, I actually worked on a large number of energy storage systems and predominantly lead acid battery types. I've actually seen battery storage units explode. It's impressive. Inside all those facilities, even at nuclear power plants, the battery room is considered one of the most dangerous areas.

The technology is ever-changing and this -- both those fields. They're trying to improve wattage per square foot on solar panels. The voltages are going to be going higher and higher and higher to increase the amount of power output. When you're going to have an integrated battery system, at some point, when they're

going to actually probably tie them into the same power inverters, they're going to have to match those kinds of voltages, those kind of power outputs.

Lithium-ion batteries have been mentioned an awful lot lately. It's considered maybe the state-of-the-art at the moment. It's well-known of their problems and their concerns. They're going to be moving to something different. And it's already been asked stated there's a lot of different energy storage systems, a lot of different methods, some exotic, some not so exotic, compressed air even. Nobody's mentioned that yet. There's a lot of that around.

Just in closing, my career, my time in the trade, working on both of these systems, I actually find it very hard to see anybody working on almost any part of the electrical field that has not gone through a comprehensive training program, vetted by some kind of certification program, and then having to maintain their qualification through continual training.

When you talk about two parts of the industry like this, either solar or any kind of energy storage with inherent dangers, I can't conceive of anybody constructing, maintaining those systems without those kind of standards being applied. It's obvious C-10 contractors, the employees of C-10 contractors have these

qualifications. It's obvious that the solar installers don't have those qualifications. Thank you.

**Rick Lopes:** Glenn, thank you. Our next speaker is John Doherty.

**John Doherty:** Thank you to the Board and to CSLB staff for the opportunity to speak. My name is John Doherty. I'm a graduate of the San Francisco Electrical Joint Apprenticeship Training Program for San Francisco. I've been an instructor in that program, and I'm currently the chairman of the committee and charged with ensuring that our 400+ apprentices receive a well-rounded, five-year education and that they also work in a safe work environment.

So there's been plenty of talk today about some of the safety issues involved with this discussion. The top line on the card was do you believe that energy storage systems are new or evolving technology, and from where I sit, I'll argue that, no, it's not. We've been installing these systems for decades. As the gentleman a couple ahead spoke of, working at the data center we have been installing universal uninterrupted power systems, large-scale, for decades, at computer facilities that are sensitive, whether it's for the banking industry, or what have you.

We've installed cogeneration facilities in buildings

around campus properties to help with peak demands. These are in all essence no different. It is -- these are being installed to either take the load off peak, or to shave the peak load down for the customer. And just all these issues about safety have already been talked about. The national safety code training has been covered.

But just to address some of the comments that have come from the C-46 contractors that came in today. All of them that have done energy storage systems have a C-10 contract -- C-10 contractors license. There is no impact to them at all by maintaining this as a C-10 electrical contractor work. If they performed it without qualified personnel under their C-10, then they've broken the law, and it's not a matter of this is some new industry that is coming on the scene. It's -- it's long-standing. We've been doing it for decades, and the only thing that is evolving are batteries or certain components in the installation are evolving, but that's manufacturing evolution. That's not a change in the installation practices, no change to the installation training that we provide our members when they go and perform energy storage systems.

And in and all stories about building a house off the grid aside -- it's nice to hear -- but the

Contractors State License Board is charged with making sure that work is assigned to a proper license classification for all occupancies in the State of California, not someone who wants to live off the grid, the foothills or what have you.

So we ask that you maintain this is the work of the C-10 contractor and not expand the scope of work for the C-46 contractor. Thank you.

**Rick Lopes:** John, thank you. Our next speaker is Joel Koppel.

**Joel Koppel:** Good morning. Thanks for the opportunity to address you today. My name is Joel Koppel. I'm an appointed planning commissioner in San Francisco, so I completely understand the importance in the process of these hearings. Thanks again.

I'm here today acting as director of sustainable energy solutions for the San Francisco electrical construction industry, which is a labor-management cooperation committee, and our management association is the San Francisco Electrical Contractors Association.

As an additional point, I was critically involved in the procurement, approval, and the installation of San Francisco's largest solar project at the PUC Sunset Reservoir, and for reference, this was installed by an electrical C-10 contractor.

Today I'm speaking in regards to public safety of persons and property and how it relates to installing energy storage. I myself am a graduate of a state-approved five-year joint apprenticeship training center. I'm a current state-certified general electrician, DIR license number 110196 since 2005, and also OSHA 30 and NFPA 70 E trained in arc flash safety. Therefore, I am a qualified person to speak on this item and install such work.

I do not believe anything besides a C-10 contractor should be in charge of installing energy storage systems due to the fact the potential for injury and accidents is much higher in this sector, especially since the products involve DC currents at higher voltages than normally dealt with on jobsites. Again, this is purely a life safety matter.

As appropriate here is there an installer certification for energy storage? I don't think so. Again, that's why a C-10 electrical contractor who does employ qualified personnel should be performing this work. This is electrical work with voltages, resistances, amperages. The work has to abide by the National Electric Code. Energy storage is electrical storage. Therefore, it should be performed by an electrical contractor.

One more simple comment to the solar contractors who would like to perform this work. We're electrical contractors, we do electrical work. Please don't compromise our already well-functioning industry, and if you'd like to partake in this work, please do us the justice of keeping it fair, on the same level playing field and become a C-10 contractor.

**Rick Lopes:** Joel, thank you. Our next speaker is Bernadette Del Chiaro.

**Bernadette Del Chiaro:** Good morning. My name is Bernadette Del Chiaro. I'm the executive director of the California Solar and Storage Association. We represent over 500 installers, manufacturers, distributors, and financiers of the local solar and energy storage industry. The California Solar and Storage Association does not believe there is a need to change any of the current licensing eligibilities with regards to the installation of solar and energy storage systems of any size or with any customer class.

One, we see no evidence of widespread health or safety issues in the marketplace today by any of our currently licensed contractors in the State of California. Two, the majority of contractors active in the industry today already hold a C-10 license, along with other relevant licenses in this multifaceted trade.

Three is restricting all solar and energy storage paired systems to the C-10 license and subsequently limiting the workforce would cause major disruptions for the industry and place sustainable hiring practices for the businesses involved in the industry today as well as actually knockout some of the most experienced and qualified workers in the industry, inadvertently causing unanticipated public safety threats.

So to elaborate a little bit further, there's no evidence of widespread problem. We have installed over 500 solar and storage systems just in the past few years alone that are all grid-interconnected, and there's no report of any incidents. This is being installed by multiple licenses. There's, of course, countless numbers of off-grid systems, though we don't have good data on, but once again, no major reports of incidences to date.

To the extent that any incidences are brought to your attention, I would ask that you look into any details related to the situations, such as was that incident -- did that happen in California, what was the type of storage technology that was involved in the incident, was the technology UL-listed as a package system -- which is what we're seeing more and more today -- and was the contractor to blame for that situation, and what was the license that that contractor held.

Secondly, I've done some new analysis of who -- what contractors are involved most actively in the industry today. You know, from the CSLB's perspective, you obviously have the most complete and accurate database of what type of license contractors hold. But I did a -- I think -- first-ever analysis of cross-referencing the licenses listed on your website with the projects actively being installed in California, and I found some interesting results.

If you look just at the solar and interconnected solar PV systems installed just in 2017, it's roughly about 100,000 systems installed in 2017. You'll see that 69% of the most active contractors, a pool of about 110 contractors, hold a C-10 license. Another 62%, and there is overlap in these numbers -- hold a C-46 and roughly 1/3 of the active contractors hold both.

Interestingly, only 10%, just 11 contractors in the entire State of California's installations in 2017 -- residential, commercial, all-inclusive -- hold exclusively a C-10 license, just 11 contractors. I was really floored by that number.

So the vast majority of work is already being done by C-10 licensed contractors, and the remaining work is being done by contractors that hold a C-46, a B and an A. All -- which currently, as you know, have the eligibility

and the qualifications to install energy storage system paired with solar photovoltaics.

There's also no significant difference in the residential and commercial markets, and when you look at this data, there are a handful of contractors actually and interestingly that hold exclusively a C-46, not paired with a B or any other license. And those are doing excessively large commercial, agriculture, and industrial projects, including one that did a 500 KW energy storage system paired with solar.

So this notion that the C-46 contractor is really relegated to small residential off-grid is not actually born out in the experience in the marketplace today.

And similarly, flip side, C-10s, it's not a homogeneous group. We have C-10s that do exclusively residential, and installed, last year, 2.40-kilowatt storage system -- small residential storage system.

So there's no cut-and-dry, you know, easy pairing of where people fit into the market. Interestingly, you know, according to CSLB's own testimony at previous meetings on the subject, there's no significant difference between the number of reported consumer complaints related to any of the licenses currently eligible. I did do these systems, and I would ask that your report actually include that information. I think

it's very relevant here.

So once again, 100,000 solar systems were installed in 2017 without any significant difference, utilizing all of the eligible license classifications.

I also looked into the self-generation incentive program data showing the solar and storage systems. I'll submit this testimony for your review. It saw no significant difference, again, in the licensing. So I just want to close. I see we're out of time.

**Female:** Sorry, ma'am. Your time is up.

**Bernadette Del Chiaro:** Yeah. There would be significant implications that would actually harm public safety if we took out the experienced workforce in the industry today. Thank you.

**Rick Lopes:** Thank you, Bernadette. Our next speaker, Nikolai Suboda. I hope I was close.

**Nikolai Suboda:** I've heard worse. First off, I would like to thank the Board for letting me share my experience. My name is Nikolai Suboda. I'm a state -- California State certified general electrician. I have concerns about public safety of the energy storage system installations.

I have to speak on the dangers I have encountered in the field when I first got in the industry. The first experiences I've had in the industry was for a C-46

contractor. They were out of LA and hired many temporary employees to assist with a 1.1-megawatt solar installation. I was one of those temporary employees. We installed 2,500 solar panels on top of a Costco in Modesto. It wasn't long before the panels were energized -- or installed, energized, and had a voltage differential. I was already terminating wires with less than a month experience in the field and no idea about voltage differential. I bring up that term because that is one of the main -- many reasons making electricity dangerous.

If you have a voltage differential on a path for the voltage to flow, that is when safety becomes an issue. One path that it can take is through the body. Being a brand-new construction worker, I didn't realize how dangerous it was. I had zero training and zero education at that point in my life.

Over the last eight years, I graduated from an accredited electrical apprenticeship, and have seen firsthand the issues that can arise when someone has done electrical work without any education or training. I feel it would be a very irresponsible decision to allow electrical storage systems, many of them that can house hundreds of megawatts of power, to be, in fact, installed by -- to be installed by people that have zero education

and zero schooling.

In my life now, having done close to 1,500 hours of schooling and many of those hours of training paired with safety, I would feel scared for members if there was a construction trade out there that had so much at stake, that one day they might not go home at night because there was not any mandated training or education for those workers and in their trades.

Lastly, I ask the CSLB to really look to have people install these high potential dangerous systems to be installed by trained personnel. Thank you for your time.

**Rick Lopes:** Thank you very much. Our next speaker is Daniel Romero. Are you still here, Daniel? Okay. We'll set that aside and come back to Daniel. Next is Brendan Nelson.

**Brendan Nelson:** I'd like to thank all of you for coming out here today and speaking on this. And I'd like to thank the Board for letting us come out here say our piece. It's a big deal. My name is Brendan Nelson. I am a state-certified general electrician. I have 10 years' experience in the field.

I've worked on numerous jobs throughout my career, and as electrician, a lot of things we do are dangerous. One of the most dangerous places I've ever worked was a UPS battery backup room. Now, I'm not here to talk about

just that. I'm here to come at this as an educator. I am a full-time instructor for the Sacramento area electrical apprenticeship, and we have a five-year program. It has 8,000 hours of on-the-job training and 1,000 hours of training in the classroom.

As an instructor, I myself am tasked with educating and training the apprentices we have at a point in their career, where they're starting off at square one. One of the first certifications that I train, and I certify in is OSHA 10, safety for the construction industry based on OSHA 1926. I'm certified to teach this through the University of California, San Diego.

I would also like to say that OSHA 10 is a must-have certification for anyone performing electrical work or working on a construction site, no matter the size or scale. I also train and certify our apprentices in CPR and first aid. This is critical in a construction jobsite to have as many properly trained individuals in life safety as possible, especially when working around energized conductors while performing electrical work.

Now, one other thing that these apprentices learn in our five-year apprenticeship is DC theory, which is direct-current theory, which is what batteries operate on. They learn that when you put sources in series voltages at, when you put them in parallel currents at,

and they're able to go out on a jobsite and see not just what they're doing, but why they're doing it and what the potential dangers could be if a connection is made improperly. That's just in the first year of our five-year apprenticeship.

And I'm here to ask you at the Board to make sure that C-10 contractors do this work with qualified, trained electricians. And I'd like to thank you, and I would also like to thank everyone out here came out here today who spent five years of their life in a five-year apprenticeship or are currently in it. Thank you.

**Rick Lopes:** Brendan, thank you. Our next speaker is Ed Murray.

**Ed Murray:** I'm glad I general education t to talk. Thank you. Thanks, staff and Rick, for having us. My name is Ed Murray. I'm the president of the California Solar and Storage Association; I work for Bernadette. I am a member of the Solar Energy Industries Association Board of Directors. I'm the chair of the solar heating/cooling division for Solar Energy and (inaudible) Association. I'm a member of the NACEP, North American Board of Certified Energy Practitioners Board of Directors, a member of the Solar Rating Certifications Committee, standards committee, member of the International Association of Plumbing, Mechanical

Officials Code Committee, a member of SEIA Codes and Standards Committee, and finally, chair of the ethics committee for the Solar Energy Industries Association in California since 1987.

I'm also, in my part-time work, I am a contractor, and I've been a contractor since 1980 in California, in Sacramento area, Aztec Solar. I carry a B and a C-46 license. I was a proponent of the C-46 license when I started the business in 1980 and helped write the original test to get it going.

We -- the Association -- California Solar Energy Industries Association wanted to develop a test because at the time the only tests that were allowed were a C-36 plumbing, B -- and I'm not sure if C-10 was even allowed to do solar at that time because most of the stuff being installed was solar thermal at the time.

I watched this business grow up in California and have always been on the cutting edge with my staff and employees to make sure that we're doing the right thing, certainly safe-wise. We have -- many of our people in our office have NEC and the CEC, which supersedes the NEC code on their desks.

C-46 contractors are trained on this code and fire code, and the manufacturers also train us on the latest technology, including Tesla has trained my staff on

installing batteries, which I can always guarantee that a lot of electricians and C-10s probably haven't had that kind of training.

Today, I've seen a collection of members of the IBEW try to prevent C-46s from installing energy storage systems. Where were these people in 1980 when we tried to get this solar license going? My feeling is that the money is the driving force behind today's activity.

And if testing is so not important, why do the people here insist that testing is so important? Some people from the NECA that the testing wasn't important because there were a few questions on the C-46 test licensing. There are more questions on C-46 license test than there are on a C-10 license test regarding energy storage. And there have been -- C-46s had more questions on their test for longer than the C-10. I think the C-10 started maybe 2011, having questions about energy storage, where C-46 has many more years behind it.

I also wanted to let you know that the governor, Jerry Brown, is building a house, and he's having a C-46 contractor install the batteries on his house.

So for the record, I like to ask a few questions of staff, and one of them would be for warranties. If a solar contractor installs the PV system on somebody's house, and then they aren't allowed to do the storage

system, does that then void the warranty on the photovoltaic system, including the panels and the warranties on the installation?

So and this not only goes to the original installation, but years later when a customer calls up and says I want to install batteries. Does that mean the solar contractor can't go back and install batteries on the house?

And I know my company automatically, if something touches my system, will void the warranty. And so then the C-10 contractor will have to buy that warranty.

What kind of liability issues does the licensing eligibility restriction expose the consumer to? What would happen to the workmanship warranty of the C-46 contractor if a different contractor modifies the system by adding EES? And has the CSLB occupational analysis for the C-46 license identified any problems with regard to public safety in the C-46 scope of work as it relates to energy storage?

Finally, on licensing testing requirements, which license test carries the most number of questions as well as the most consistently administered questions related to EES? I'd like to direct staff to include information about the scope and frequency of EES-related questions in the report.

Which license test carries the most number questions as well as most consistently administered questions related to solar? And you can refer to page 18 of the occupational analysis report for this. How many years has the C-46 been eligible to install solar energy paired systems, and are there any requirements the C-46 license needs to have? Is the licensed electrician more familiar with AC or DC wiring? What kind of wiring is needed for solar and EES systems? And finally, which is the license most familiar with solar and EES? I state that C-46 is. Thank you.

**Rick Lopes:** Thank you, Ed. Daniel Romero -- name earlier -- if you're in the room? Daniel? Okay. We'll continue to move on. Alex Lantsberg is our next speaker. Good morning, Alex.

**Alex Lantsberg:** Good morning. My name is Alex Lantsberg. Thank you for allowing me to speak here today. I am the director of research and advocacy for California Electrical Construction Industry. Joel Koppel, who spoke a little bit earlier talked about our organization. I'm not an electrician, so I won't talk about the ins and outs of the technology, the inherent dangers of both the energy its designed to handle and the equipment itself or its installation. I think the many apprenticeship training directors we've heard from today,

electrical and fire inspectors, utility representatives, licensed electricians here have made that point far better than I can.

I am, however, an urban planner with certification by the American Institute of City Planning and with a background in construction industry labor markets, workforce development, and infrastructure. With that in mind, I'd like to step back from questions about specific battery types or code requirements and instead, focus your attention on questions of workforce development and training, wage theft, job quality, public safety, and the types of construction industry that the Board's decision will incentivize.

It is deeply ironic that the representative from the Solar Industry Association actually said certification would make things more dangerous. So first, a little thing about the state of the industry. Since the collapse of the economy in 2008, the construction industry has struggled to return its past levels of employment. According to EDD, construction occupation employment in May 2016 was less than three-fourths of the levels of 2006, at the peak of the industry's pre-recession employment. The declines have generally been spread throughout the industry, with one notable exception among the top 10 major occupations that

comprise more than three-quarters of all construction workers in state -- the electricians.

After dropping to less than 42,000 during the depths of the recession, electrician occupation exceeded its 2006 level of 60,000 in 2016, and actually saw a real wage growth of nearly 9 percent compared to the industry's 5 percent.

The market's demand for skilled and certified electricians is growing at levels higher than the state's most common construction occupations. Solar has also grown from 1,700 workers in the 2012 survey when it first appeared in California to nearly 3,900 in 2016. Yet, despite such rapid growth, real wages in this industry have actually declined by 3 percent according to EDD. Wages were on average two-thirds of those of electricians. As I believe another CIA person remarked, it, in a way, is about money and them keeping more out of workers' pockets.

This is consistent with UC Berkeley research on job quality in the solar industry that showed not only lower pay but less training, few advancement opportunities. It is also -- it is no surprise that there is no statewide network of registered apprenticeship programs for solar installers according to DAS. And this has consequences as the labor center has shown. Compensation levels are

associated with training, and training is directly related to personal safety.

And as we've heard from a variety of speakers today, this technology, safety issues extend beyond just personal protection but to that of the entire built environment where it's installed. It's also no surprise that earlier this morning we heard from cowboy solar installer who has basically stated he will break the law if this is restricted to C-10s.

While I haven't found much research on the issue of wage theft in the industry, my own experience in the construction industry informs my belief that such a defiant attitude towards fundamental safety rules is part and parcel of an attitude that leads to work without worker's comp and ultimately, wage theft.

So what does this have to do with the CSLB? Its regulatory decision will determine whether this growing, nascent battery storage industry, which is projected to handle thousands of megawatts and command billions of dollars within a matter of years, how it develops. As the technology matures and proliferates, particularly within the dense urban environments of our load centers, the license board will play a central role in determining whether the industry installing it will be structured around extensive safety, training, and skills or bare-

bones regulatory framework that, at the end of the day, sets the competitive dynamic around the lowest price and, ultimately, the lowest wages. The high failure rate of certified -- of persons taking the electrician exam is a testament to the difference of these two approaches. Allowing C-46 contractors to deploy their undertrained, under skilled, and underpaid workforce with this technology will not only pose a danger to workers themselves, but the project owners and the entire built environment, and it will, pardon the pun, short-circuit the market's demand for skilled and certified electricians.

In preparing for today's hearing, I read some comments from another SEIA rep objecting to a description of their low-wage, low-skilled workforce model as low road. While I appreciate the recognition of the importance of rhetoric in framing the debate, this is, indeed, entirely an accurate way of saying it. I urge you, the CSLB, to listen to the inspectors, marshals, training directors, and certified electricians to insist on a high-road approach for this importantly -- incredibly important, yet inherently dangerous technology. Thank you.

**Rick Lopes:** Thank you, Alex. Our next speaker is Kevin Allen.

**Kevin Alvin:** My name is Kevin Alvin. Sorry about the penmanship.

**Rick Lopes:** My apologies.

**Kevin Alvin:** Thank you for the opportunity to share my view on this matter. I studied electrical in high school, a public school, and then after that, I joined the United States Navy. I became a gunner's mate missile technician working on a nuclear antisubmarine rocket launcher, learning how to apply solar, chemical, nuclear, hydro, PZO and other sources of electricity.

After serving in Desert Storm and Desert Shield, I received an honorable discharge. Upon discharge, I sought to become a career electrician. I finished the five-year joint-apprenticeship program, received a California general state certification, became a foreman with C-10 contractors like Dina, Sprig, and Baker Electric. Working with these contractors gave me a sense of pride, working on many hallmark projects in San Diego, such as a solar ray system, battery storage, five power plants and many more projects during my career.

At these shops, I taught many apprentices how to maximize their career in the electrical industry by utilizing the skills they would acquire in their own journey and how to do it safely. I currently act as a career counselor of sort for electricians in San Diego

and in Imperial County, learning what skilled contractors need to become successful and how the electricians can utilize their skills with the contractor to maximize their earning potential with each opportunity of employment.

I encourage you to remain with the C-10 contractors on battery storage insulation for the sake of the consumer that seeks a quality installation on their projects and for those like me, veterans, men, women, family people, that seek a career in the electrical industry.

California state general certification has helped me to take and put food on the table, has helped me to take and do things in the community, and C-10 contractors have allowed me to take and utilize my skills, my certification with them. Your decision will have an impact on thousands of men and women like me, veterans, people that are trying to overcome different hurdles, people from, you know, underserved communities that have taken and reached out, tried to get that state certification, tried to take and get with a contractor that has the workload that's going to allow them to take and not just be on one single project but to utilize their skill set throughout their entire career.

On a battery storage plant, the skills that I

learned from one project transferred to that battery storage. Then I took the skills that I learned from the battery storage, and I use it on a high-rise. Then I use those skills that I learned from the high-rise, and I use it at the San Diego Zoo. I use those skills that I learned from the San Diego zoo, and I had an opportunity to take and work at San Diego Unified School District. Those skills working at San Diego Unified School District, I use those skills to take and work at University College in San Diego.

So what we're talking about it's not just the difference between the C-10 and the C-45 (sic), we're talking about the career path for electricians and how we obtain a living wage and the sources that we take, and we utilize to do it.

We believe that the C-46 contractor is going create an undermined -- an underground economy that's going to have a direct impact on general state certified electricians like myself. Thank you.

**Rick Lopes:** Kevin, thank you. Thank you for your service. Juan Perez is our next speaker. Juan?

**Juan Perez:** Hello. My name is Juan Perez. I've 24 years in the electrical industry. I graduated from a state-approved apprenticeship program. I have taken many upgrade classes since graduating and have -- excuse me --

I've taken many upgrade classes to maintain my state certification. I am here in opposition of the C-10 contractors doing electrical storage systems.

There are many safety issues; one being that they are not trained to do this work, and they do not possess the skill set to perform this work. This is unsafe for the individual and to the public. I've heard many people speak on C-46 contractors, but I've talked to many photovoltaic employees. They have told me how they would like to learn how to do electrical work but have no other skills other than installing panels.

So their lack of experience is why I have talked to them and teach them the electrical industry. They're not aware of the dangers, and that's why I'm up here speaking in favor of C-10 contractors doing this work. I will also submit other paperwork to CSLB in writing. There's a lot to go through in here, but I'll save that for writing. Thank you very much.

**Rick Lopes:** Thank you. Yes, we appreciate that, Juan. Thank you. Daniel Romero, one last time we'll call that. That's our last card. Is there anybody else who didn't sign up who wants to speak at this time? If not, thank you to everybody who's joined us today and for your input, especially those who came in from out of town. We look forward to working with all the interested

parties in the weeks and months ahead as we review our process. This hearing will resume tomorrow at 9:00 a.m. in this room. Thank you. Have a safe drive back.

**(Off the Record)**

**Rick Lopes:** Good morning. It is 9 o'clock. We'll be starting with our hearing in just a couple of minutes. I see people are still filing in, but if you can please, you know, come in, get your -- if you plan to speak, please sign in and get the cards. We are going to be taking our speakers in the order that the cards were submitted. So please get your cards, and we'll get the hearing underway in just a few minutes.

Okay, good morning. Today is Thursday, April 26th. It's now 9:05. We're going to go ahead and get today's hearing underway. Welcome to the Contractors State License Board's headquarters in Sacramento for the second day of our public participation hearing on energy storage systems.

My name is Rick Lopes; I am the Board's chief of public affairs and I'll be moderating the hearing this morning. This morning we'll be taking your testimony to help us review our current determinations on the appropriate CSLB license classification or classifications to install an energy storage system, either in a stand-alone contract or when it's included in

the installation of the solar voltaic system. You can find the current determination on the back of a handout that we give you when you signed in this morning along with a list of the general issues that we hope to learn more about during this hearing. We appreciate the time you've taken to be here with us today, and we welcome the insight and perspective that you'll be able to offer us.

It's important to note for you that that there will be no decisions that'll be made at this hearing, and the Board staff are not able to answer questions you might have about our current determination. Today's speakers will be allowed to address the hearing for up to five minutes, and we've got a clock here to help you kind of monitor your time as you're going through.

If you were here at day one of the hearing, you are allowed to -- to give us additional testimony today for your up-to-five minutes, but I do want to note that if after you presented your testimony this morning, if someone else makes a point you that disagree with, we would ask, at that point, that you put your comments in writing and -- and submit that to the Board. And of course, we trust you'll offer the same level of respect and attention to the other speakers as will be afforded to you. Your cooperation will be especially helpful. Yesterday at our three-hour hearing we were able to hear

testimony from almost 50 people, and we hope to be just as efficient and respectful with your time today and get through everybody as quickly as we can.

Also, if any elected officials or representatives from other government agencies join us, we'll be asking them to present their testimony immediately. We are recording this hearing, and all of the testimony will be transcribed and included as part of a staff report that's being prepared for our Board. And prior to the Board taking any action at the public meeting, the entire report will be made public.

If you do want us to be sure we have your contact information, we'd encourage you to add that to the sign-in sheet, and we would be happy to let you know as we move forward in this process. I also want to note that all written comments will be included in the report. The deadline for getting us your written comments is Friday, May 18, 2018, and the handout, again, has all the details on how to send in your written comments.

So I think that covers everything. On behalf of the Board and staff, thanks for your presence and participation, and we're going to go ahead and get started with our speaker. So if you've got a card and haven't turned it in, please turn it in; we're going to take them in the order that they're turned in. And our

first speaker this morning is Stephen Venegas.

**Stephen Venegas:** Good morning. Thanks for your time, counsel. I came yesterday, and I feel that the concerns of the citizens have been observed regarding the safety issues on this topic. I'd like to build and identify a few ideas to help round off the issue. First, from the perspective of a citizen and secondly, as an electrician.

There is absolutely no mistake that the evolving electrical industry needs evolving policy. Electrical work belongs in the hands of more than qualified electricians. The citizens of this state want all electrical work done at any phase of construction to be completed by C-10 contractors at a minimum. The reality in construction is such that electrical trade work demands a very high level of respect on the part of the electrician. As a highly skilled worker in the trade, I can tell you straight up, we're not messing around out there.

Electrical work is inherently dangerous and requires more than just instructions to produce it safely. Electricity commands respect because of its power to both provide and to destroy, life included. Electricity requires the respect of an entire industry in order to be managed properly. Times change, and our policy needs to

change, also, for the better. Citizens of the state want only well-trained people to be the only ones installing electrical equipment of any kind. This is the greatest state in the greatest nation in the world, folks. Our role is to lead the way and set the bar in the country and the world. We need the best possible infrastructure to compete in the global economy.

The decisions this counsel may have -- that this counsel makes may have vast and long-lasting, immediately and unquantifiable effects for all of California's future. The citizens of the state are working hard, and we don't want any policy that would allow for mistakes concerning our buildings and infrastructure and allowing C-46 contractors to continue and/or expand their scope of work to include battery storage electricity would be doing just that -- a mistake, hands down. I urge counsel to let the pros do their job. California -- Californians need the pros to be on the job concerning electricity, period. I'm a California native, and I've lived down the road for 20 years. I speak on behalf of my neighbors and the community. Thank you.

**Rick Lopes:** Stephen, thank you. Our next speaker this morning is Byron Benton.

**Byron Benton:** Good morning. I'd like to thank you for this opportunity to speak on the importance of how

the California State certified electricians and C-10 contractors install and maintain energy storage systems that are paired with solar photovoltaic systems. As an electrical training director for the past 15 years, it's my responsibility to see that apprentices and journeymen who receive training in our program established in 1946 have the proper training to safely perform on all electrical systems.

In fact, safety training, such as OSHA construction, electrical safety in the workplace, NFPA 70 E, the National Electrical Code. It's reinforced throughout the entire five years of the program as well as throughout an electrician's life just as this gentleman spoke to -- the issue of DC versus AC electrical work. DC's the foundation upon which all electrical theory is based. DC is akin to learning the alphabet compared to being able to write an essay. Ohm's law, where voltage equals current times resistance, is the most basic electrical equation, something that we teach in the first year of our apprenticeship program.

During the second year, electrical apprenticeship programs, apprentices are exposed to training in the classroom and related hands-on in solar photovoltaic systems. This training includes the full gamut of solar PV, including related equipment such as solar inverters

where DC current from panels activated by the sun need to be changed to alternating current compatible with the utilities grid.

In the third year of our program, apprentices are exposed to DC semiconductors and electronics with multiple power sources. And in the fourth year, variable frequency drives which converts AC into fluctuating or pulsating DC -- you reduce the frequency to achieve energy savings.

And then throughout the five-year program, which consists of over 1,000 hours of related classroom instructions with hands-on applications as well as over 8,000 hours of on-the-job training on all of these types of electrical systems, particularly what we're talking about here today, with the National Electrical Code being used as a guide to make sure the systems are properly installed, as this gentleman just referred to, on both DC and AC alike -- real world examples.

We've been doing DC since it first came out, and we do DC every day of the week. And we teach it in our classrooms. There's DC motors and industrial. There's solar PV systems that have DC that we have to invert to AC. There's battery storage. There's uninterrupted power supply systems, just to name a few.

So to say that one group are the DC installation,

maintenance experts, subject matter experts, but this group over here, electricians, are AC subject matter expert, it's preposterous. I can't believe we're even having this conversation.

Here's how I'd like to refer to that. I'm an expert on the letters of the alphabet, but you're the expert on how to write an essay. That's this conversation of DC expertise versus AC expertise. California State certified electricians need to be the experts on both, and they are, and they have been from day one.

As for the safety aspect, I had a situation when I worked for Cupertino Electric in the field. where at Chiron in Emeryville; non-electricians tried to do electrical work in one of their main facilities for research and development. A mistake was made; it took out the building, but it also required that that worker immediately be taken to the hospital for electrical burns. The customer immediately came to my C-10 contractor and said we need your help -- how do we go forward and safely install these systems. We put together procedures based on what's already in place. These are the rules we work by OSHA, NFPA 70 E, electrical safety in the workplace, the National Electrical Code. Those are guidelines that we work by every day.

So in conclusion, as a California State-certified electrician and electrical training professional for the past 31 years, I implore you to protect the workers, customers, and the citizens of this state and require that only C-10 contractors and certified general electricians be allowed to install and maintain all electrical energy storage systems.

**Female:** Thank you so much. I'm sorry your time is up.

**Bryon Benton:** Failure to do so will result in catastrophic events. Thank you.

**Rick Lopes:** Okay. Thank you, thank you very much. Our next speaker this morning is Jack Paulson.

**Jack Paulson:** Good morning. My name is Jack Paulson; I'm the training director for the NJTC in the Solano-Napa area. I have over 83 apprentices that we train, and also journeymen or general certified electricians. But following after what the -- Byron said -- I went down to Las Vegas for -- It's called the instructor energy storage microgrid training and certification. It's actually how to teach how to install these systems. And firsthand experience going through that 45 hours of training that we did, these are dangerous, more dangerous than you know. As the technology goes forward, they become more dangerous.

In a nutshell if you were to short it out, as they would say, which is across the terminals because of the internal resistance of the batteries, of the lithium-ion batteries, it can generate, what is it, it can generate between 1,200 to 1,750 amps instantaneously. Now that is sealed in there in this little battery case; with the pressure, it explodes and makes an arc flash of roughly between 30,000 to 60,000°C. Now, that's just one battery. And these things that are -- stacks that are in the houses themselves, the residential, if not professionally installed and double checked, you have about 24 of them, you got 24 potential bombs in there if not properly installed by a certified electrician. Excuse me, I'm a little nervous.

There are many factors that -- there are many things that can happen in the installation, and just -- it's just not plug-and-play, you know, I'm not going to talk bad about C-46s or anybody like that, but it's just that if -- it's not plug-and-play like a solar panel where you just keep connecting them in series and so forth. If you make one mistake across the phases of then, they will explode eventually.

Now, it's not instantaneous. You can go on YouTube and see a lithium-ion battery when they puncture it. You notice that there is a delay. And what that is is that

the electrolyte that's inside, that's negatively charged and positive, it takes time to counteract with each other. And then it explodes, and then it becomes like a thermal runaway. What I mean by a thermal runaway is you can't stop it. It burns and when it's done burning, that's when it's out. You just got to let it burn. Imagine that in your house, and somebody installs it not knowing what to do, thinking that it's just a plug-and-play.

That is why you need to have C-10 contractors or certified California State certified electricians install these. These are extremely dangerous. And thank you for your time.

**Rick Lopes:** Thank you. You did just fine. And if you've -- for any of the speakers, if there are things you -- you may get done with your five minutes and then go, oh, I forgot to say that. We'd encourage you to put in writing and get it to us. It'll be included in the reports, so don't feel like if you forgot to say something that you can't get that information to us. Our next speaker this morning is Richard Dye.

**Richard Dye:** Good morning. My name is Richard Dye with Pacific Gas & Electric Co. PG&E understands that the Board is considering the issuance of a formal determination to clarify whether C-46 solar contractors

be will permitted to install energy storage systems that are paired with solar PV systems. We are opposed to the expansion of C-46 licenses to energy storage systems and instead urge you to require only contractors qualified to install energy storage systems as stand-alone projects to install the same unit paired with PV systems.

Energy storage systems can pose unique and potentially hazardous safety risks if not properly installed or operated. We believe as this relatively new technology comes into maturity, these installations require a skilled, highly trained workforce to ensure the long-term safety of customers, workers, and the public. PG&E's top priority is top priority is always the safety and reliability of the services we provide to our customers. With this in mind, we ask the Board to adopt eligibility clarifications for contractors that will put safety first. Thank you.

**Rick Lopes:** Okay. Thank you very much. Our next speaker is Ed Thoma.

**Ed Thoma:** Good morning, and thank you for allowing us to speak before you today. My name is Ed Thoma. My brother and I own Thoma Electric. It was started in 1961 by our father in San Luis Obispo. I spent the last 32 years as vice president, estimator, and project manager. I know the benefit of having well-trained electricians.

The apprenticeship program in our area understands the need for strict safety training programs, NFPA 70 E and OSHA 30, as well as the code being among them, chief among them.

This is a dangerous business and not performed properly is a danger not only to the electrical worker but to the end user of this work. Our company has installed very large solar systems on commercial and institutional projects. Many of our projects result in an output of 240 to 480 volts and if not properly trained to operate on this, these kinds of systems, they're are extremely, extremely dangerous. And if you're talking about grid-tie systems, you're talking about voltages that are even higher with very special connections that need to be made.

Our company works on many commercial, industrial, institutional, electrical systems and often many of these businesses and industries and institutions require battery backup systems for lights and computer systems and other emergency systems. There are often many complicated connections that must be made to integrate these systems into the electrical system of a facility.

As you know, a general electrician working for C-10 contractor needs to be state certified, must possess knowledge that helps to ensure that certain procedures

are followed, and a modicum of safety employed so as not to injure the worker or the end user. A C-46 contractor is not required to get the same training. And they could potentially employ workers who are completely untrained for this kind of work; it's a safety issue. Untrained workers have no business installing energy storage systems.

Installing photovoltaic panels and plugging them together is far different work than constructing and connecting battery storage systems. One mistake could potentially take a life. DC voltage is a very dangerous voltage. As a matter of fact, all of the work that we've done for AT&T requires we take extraordinary measures to protect their battery storage systems which are very, very dangerous. Many times it takes far more time to protect the battery storage systems and the inverters than it does to actually do the construction work we're there to do this. There's just a lot of potential energy that can be released in a very short period of time with these systems.

In summary, energy storage systems have great potential for dangerous conditions. If this work is not done properly, the only way to perform this work safely is to be well-trained and certified. This work should not be performed by untrained people. By allowing C-46

contractors to install energy storage systems, we open the door for more dangerous work to be done by untrained installers. Thank you for your time.

**Rick Lopes:** Okay. Great thank you very much. And a note here, I've only got one more speaker card. If you are interested in speaking, please send feel free to submit your card. Our next speaker is Rick Umoff. I hope I got that right. I know I got the Rick part right.

**Rick Umoff:** Yeah, you got it right. People often added H in there and say Umhoff, but yes, it's Umoff. So thanks. Thank you for the opportunity to speak today. My name is Rick Umoff, and I'm the director of California Affairs for the Solar Energy Industry Association. CASEI is the national trade association for solar companies. We represent over a thousand companies nationwide, across all market segments, and our members include C-10, C-46 contractors, contractors outside of California who install solar plus storage and storage manufacturers.

As you've heard previous to my testimony, C-46 exams test heavily on battery storage systems. In fact, to our knowledge, we have not seen any statistics or evidence that C-46 contractors are ill-equipped to install solar plus storage systems.

California is not the only state to offer a solar installer license similar to the C-46 license. These

states include some of the largest solar markets in the country, either by volume or on a per capita basis. And each of these states allow solar contractors install solar plus storage systems. Some of the states include Nevada, Connecticut, and Florida.

So one can see allowing solar contractors to install solar plus storage systems is neither unique nor new to California. Therefore, I encourage CSLB to continue allowing C-46 contractors to install solar plus storage systems. Thank you.

**Rick Lopes:** Thank you. It appears a couple more cards are coming our way. Our next speaker is Ed Santos.

**Ed Santos:** Good morning. Thank you for allowing me to speak on such an important subject. My name is Ed Santos. I'm currently a vice president for Moore Meadows Corporation. With over 2,200 employees we're one of the largest electrical contractors in the state and with an EMR of .461, one of the safest. We currently perform work in every sector of the electrical industry, including industrial, power generation, healthcare, film studios, commercial buildings, data centers, hospitality, and sports venues. We have installed batteries in every one of these types of facilities.

Our alternative energy group focuses on photovoltaic systems as well as energy storage systems. They're quite

different. We have successfully installed over 6,100-megawatts of power through PV power generation and battery storage. I attribute most of the success of these projects to our state-certified electricians and their knowledge and understanding of electrical theory and their training and methods installation, ability to understand and correctly interpret the National Electrical Code, the National Fire Protection Code, as well as local codes. This experience primarily comes as a direct result of state-certified electricians working for C-10 contractors.

Battery storage projects are much more complex than photovoltaic systems, as they provide functions far beyond that of converting sunlight to power. They can be installed in combination with the PV system or without one. They can be installed to operate independent of PV and independent of the grid. We are not the only company to recognize this.

The National Electrical Code has created an entirely separate code articles for each system. The California fire code has also recognized these differences and regulates battery storage differently than solar PV systems.

While there are many benefits for the utilization of battery storage, they pose a serious safety risk for both

installers and occupants of the facilities if installed incorrectly. A battery storage system can be composed of banks of batteries that operate up to a thousand volts DC and can store power for eight times as long as a solar system.

In addition, flammable, electrical, electrolyte and lithium batteries make them prone to thermal escape if they are installed incorrectly. This leads to overheating and overcharging, therefore, producing large volumes of toxic and flammable gases. On several occasions, my company has received emergency calls to respond to power outages due to an electrical explosion. These explosions have resulted in arc blasts that have severely injured, burned, and killed individuals. I personally have made visits to these facilities, and the smell of burnt flesh is not one that I will forget. It was apparent that the workers involved were not state-certified electricians nor working for C-10 contractors. There were no precautions for arc flash or use of PPE nor enough knowledge of code and installation.

C-46 contractors are not required to use certified electricians; therefore, a considerable lack of knowledge and understanding may put them and others around them at risk without even knowing it.

The California code of regulations is very clear on

what a C-46 solar contractor may work on. At no point is the installation of an energy storage system a requirement for the installation of the PV system. The two may complement one another as well as other systems, but they are two very separate systems and can be constructed to operate without the other.

It would not be unusual to see battery storage systems installed without a PV system. If you were to visit one of our completed battery storage projects, you would see every aspect of electrical installed, including small and large conduits, small and large wire gauges, electrical switchgear inverters and transformers. Ironically, if you were to visit any of our other projects, you would see the exact same materials, devices, and equipment installed.

What we're defining here is the work of a C-10 contractor through the use of state certified electricians. This should not be about which license gains market share, but about what the correct license is to perform this work safely and properly. Thank you.

**Rick Lopes:** Thank you very much. Our next speaker is Sean Swoboda.

**Sean Swoboda:** Good morning. Thank you for having me. My name is Sean Swoboda. I will be speaking about public safety and concerns about an incident that

happened this past Monday and how it is associated with the installation of ESSs. I'm a state-certified general electrician, went through a five-year training program. I currently am a general foreman doing hospital remodels and upgrades. I've worked on hospitals for almost four years now.

My experiences are mines, working with UMSHAW for two years. I got to know OSHA 191026 very well. For two and half years, I worked with PV, half year for battery storage. My resume is longer, I'll have to leave it at that for that time. I --just a side note, I did get out of PV for handful of things that I saw -- one person.

One of the big arguments that I have seen was the cost. C-46 contractors, you can pay them minimum-wage, have no experience to do the install. C-10 contractors, you have to go through 8,000 hours of work just to take the test, and then when you do take the test, over 50 percent of the people fail. And so by the time you do get your state certification, you're extremely experienced and you do demand more money than an installer.

I would like to ask the Board to look at the turnover for the C-46 installers versus general electricians -- how long -- how experienced are they. I'd also like the Board to take a look at the costs for

both and see -- I would assume that that's probably the big reason why a C-46 is unwilling to get a C-10 license. Why will they not get the C-10 license? Because, in my opinion, because the cost; that's it.

And so I would like to ask the Board to put some serious thought into having unskilled people doing these installs versus somebody who has an extreme amount of experience as their certification. Please do not put a dollar amount on safety. That's all I have, and thank you.

**Rick Lopes:** Thank you for your testimony. Our next speaker this morning is Nicholas Segura.

**Nicholas Segura:** Good morning. So let me start out saying I'm a Navy veteran, and before I stepped aboard the USS Cleveland, I was trained on the AC theory's safety and best practices as -- before I was allowed to step board at a ship and work as an electrician. After that I attended AA and graduated from a state-approved electrical apprenticeship program.

And I remember one of the -- well, it was a number of years ago, I remember one of the first lessons was DC theory. And from there, we, obviously, moved on to all the -- to study and become masters of the National Electrical Code, safety. And with that, I was able to take the state test and become a state-certified general

electrician and have worked for over 24 years for a contractor doing -- installing complex systems, DC systems and battery backup systems at -- for UC systems, school systems, for data centers, for Kaiser Permanente, just to name a few.

Each one of these systems were different in the installation and operation. That is why the energy storage systems need to be installed by C-10 contractors, utilizing state-certified general electricians and apprentices for the public safety. Contractors and installers need to have a strong education of the fundamentals of electricity, DC and AC, in order to work on the wide variety of battery systems. Thank you so much.

**Rick Lopes:** Great. Thank you for your comments. Brian Grana. Hope I got that right, Brian.

**Brian Grana:** Yes, sir.

**Rick Lopes:** Thank you. Welcome.

**Brian Grana:** Good morning. Thank you for the opportunity to speak to you today. My name is Brian T Grana, and I'm a project manager with the HMT Renewable Energy Incorporated team, a C-10 contractor. As a now-retired Marine Corps Lieutenant Colonel with over 20-plus years wearing in the cloth of our nation, who is also in command of a construction-centered organization with as

many as 600 Marines and sailors at any given time, I'm all too aware of the importance of safety, training and education.

A vigilant mindset in all these areas was incorporated into our daily training schedule while preparing for global operations in support of national security policy. Similarly, I proudly express this exact same mindset is pervasive across my C-10-combined company comprised of highly skilled technical experts in their electrical craft.

Although a C-46 contractor maintains the license at the organizational level, it is known C-46 installers in the field require zero training certifications and thus lacked a full appreciation for the overarching safety concerns and technical acumen required of full-spectrum C-10 electricians. Having personally spent countless hours in commercial-sized electrical rooms during shutdowns, the risk factors increase exponentially when connecting sizable solar rays to the larger overall system. This is where the distinct difference in quality and safety is most obvious between C-10 and C-46 contractors.

Further, I understand there were statements previously made inferring C-46 contractors are the DC experts. This is patently a false statement. C-10

electricians' professional training, education and experience incorporates a deep understanding of DC theory, application, and experience which absolutely couples with their AC expertise. The fact a statement like this would even be expressed displays a complete lack of understanding of the inherent risks, training, education, and certification requirements necessary.

I have two high-school-age teenagers; on a very personal level, 12 of my recent interconnections were conducted on the grounds of large high schools where the main electrical rooms were often in high-traffic areas, areas I immediately observed there was no way safety could be compromised by using less than the highest qualified electricians.

As a result of my company's C-10 proud message of continuing professional education coupled with a vigilant safety program, it should come as no surprise, it was nearly a daily occurrence when one of our professionally trained electricians remarked there is no way you can cut corners in this industry. These children's lives are absolutely in our hands.

Further, our electricians always go the extra mile to protect the lives of our first responders. The better our installations are conducted, the less likelihood they will need to be utilized in the first place. I utilize

these discussion points to highlight that although photovoltaic and energy storage systems can be paired together, they are separate systems per the NEC photovoltaic systems and at the disconnect. And California fire code regulates energy storage systems differently from photovoltaic systems. These systems pose a very different fire and life safety risks. These risks include electric shock, fire, flash burns, explosion, or exposure to hazardous chemicals and released gases. Banks of battery cells can operate at hazardous voltages and deliver severe and even deadly electrical shock. The battery bank must be electrically isolated while any work is being performed on it or upstream or downstream parts of the system. Energy storage systems, thus, pose a serious safety risk for occupants and installers if incorrectly installed and operated.

Moreover, the type of risk and the measures needed to be taken to reduce these risks vary depending on the battery type and the size of the energy storage systems. When training Marines and sailors where the preponderance of the personnel are between the ages of 18 to 24, one of the highest deliberate risks events is creating opportunities where targets of myriad sizes and scale are overtly destroyed in order to generate the recurring

lessons learned to protect American forces and our allies in hazardous situations.

On the other hand, seasoned professional C-10 electricians have already learned the necessary lessons to keep C-46 installers, first responders, and all and end users protected from any unnecessary high risk. C-10 electricians provide the clearest risk mitigations and quality product for all stakeholders.

Lastly, one of the truest rules in military planning and operations is no matter how much you prepare, the enemy always gets a vote. In this case we all become the enemy of the four aforementioned demographics if we do not ensure that C-10 experts are handling the transitions from photovoltaic systems to energy storage systems. This is our collective responsibility. Thank you for the opportunity to speak with you on this critically important matter.

**Rick Lopes:** Great. Thank you very much. Thank you for your service, and, Mr. Segura, thank you. I neglected to mention that but thank you. Our next speaker this morning is that Carl Price.

**Carl Price:** Good morning. My name is Carl Price and I'm vice president of HMT Renewable Energy, a C-10 electrical contractor based out of San Diego. I'm also a highly trained electrician with over 18 years of

experience and training in AC, DC solar, battery, battery backup, lighting, and UPS systems as well as maintenance on these systems.

With HMT, I have managed over 200 solar installations, ranging in size from 50 kilowatts to 12 megawatts and over 50 energy storage projects, ranging in size from 18 kilowatts to 2 megawatts. HMT has supervised over half a million labor hours in the renewable market and completed over 130 megawatts of renewable energy projects. Each project we completed required a detailed interconnection to the existing building power source, and some cases, directly to the utility grid.

We have completed interconnections ranging in size from 208 volts all the way up to 35,000 volts. And we have worked with DC voltages ranging from 48 volts to 1,000 volts. These types of voltages and currents, safety is always at the core of our planning, and we always ensure we have OSHA 30, NFPA 70 E and state-certified electricians managing these installations on both the AC and DC site.

Many of our projects have been at schools, airports, hospitals, and various other public facilities where we simply cannot connect our wires until off-hours. This means we've spent a lot of late nights in electric rooms

under immense pressure to complete our work in a timely manner, so we can re-energize the building before everybody can return to work or school the next day. The shutdown I remember the most was our project at the San Diego airport. We had to connect the 1-megawatt rooftop solar installation to the airport main electrical equipment which required two four-hour shutdowns on back-to-back nights. If you want to know what pressure feels like, shutdown an airport in the middle night and give yourself four hours to turn the power back on. This outage took five of our top state-certified electricians who all had over 20 years' experience. It took this kind of experience and training to complete this work safely and timely which we did successfully.

We are also currently looking at other projects at the airport that require similar sized battery systems. The question I ask you is do you really think this work should be completed by anybody who does not have a California State electrical certification? I hope you would answer this with no because if something ever went wrong, it'd be a very hard question to answer after the fact.

Now, I heard a gentleman yesterday stated that solar and batteries share the same safety risks. I find that to be a very scary assumption. For instance, a 1-

megawatt rooftop solar project is spread out over 70,000 square feet, which means power is spread out over a very large area. On the other hand, 1-megawatt battery system can be placed in a container, taking less than 500 square feet. 70,000 versus 500 is a big difference. The reason I bring this up is because the danger in our industry is often measured by potential. I think it's pretty self-explanatory that when you condense 1 megawatt of power into a 500-square-foot area as opposed to spreading it over 70,000 square feet, you increase your potential danger exponentially.

When problems happen in electrical, you often end up with an arc flash. An arc flash happens when there's an electrical short and can create a fireball consisting of ionized air and molten metal that can reach temperatures hotter than the surface of the sun. I can tell you right now with this type of danger in our industry, I'd only trust my life with C-10 state-certified electricians.

To conclude my message, I like to note that even though it's becoming more and more common that battery storage and solar are on the same project, they are not required to be installed together in order to operate. Energy storage and solar are covered under separate NEC and fire codes and should be treated as separate systems. To ensure proper installations, we have only installed

solar and energy storage under a C-10 license with qualified electricians, and I feel our DC training and experience is 100 percent necessary to ensure safe installations compliant with all codes and standards.

Our communities, our schools, our families and friends, all deserve to know we take our business very seriously and that safety and training are the top of our concern. Thank you for your time, and I hope my story experience can help you finalize your decision in this matter. Thank you.

**Rick Lopes:** Thank you very much, Carl. Our next speaker is Jeff Rudd. This is my last card for now so if anybody else does want to speak, this would be a good time to submit your card, as well.

**Jeff Rudd:** Good morning. My name's Jeff Rudd. Thank you for your time. I've been an electrician for 20 years. I was certified when the certification program was first rolled out by the state. I went through the five-year NJATC training, and through that training I was able to learn solid work ethics and be properly trained to work with PV systems and battery storage.

I currently work for Electricraft, a C-10 electrical contractor based out of the central coast. Electricraft does an excellent job with making sure that their electricians work safe and are properly trained. They

have created a culture of safe practice and professionalism. I started installing PV in 2003. Over the years, I have personally installed hundreds of PV systems and managed hundreds more. I've seen the PV industry evolve dramatically.

The NEC has to try to keep up with this new technology that is being introduced to the public. This is a difficult task. Through my years of designing, installing battery systems as well as doing some service and repair work, I have seen where lack of experience, training, and certification has led to potentially dangerous situations for workers and for the public. Improvising during installations leads to code violations and potential safety issues. Proper training and certification requirements eliminate these situations and must be enforceable.

Now that energy storage is available for the general public and is a feasible and practical technology, it is important to minimize hazards created by unexperienced, untrained, and non-certified installers by requiring proper certification. Simply allowing C-46 contractors to install energy storage systems because they already do it, may be a liability to the end customer. By definition, the C-10 classification covers energy storage installation; the C-46 does not. Thank you.

**Rick Lopes:** Great. Thank you very much. Our next speaker is John O'Neill.

**John O'Neill:** Good morning, and thank you for the opportunity to speak with you this morning. Yes, my name is John O'Neill. I'm a city council member from the City of Garden Grove, down in Orange County, California. It's good to be with you this morning.

I'd like to make some -- provide some public comment from my standpoint on this matter, on license classifications authorized to install energy storage systems. On behalf of myself and my fire chief who is submitting a letter, we would strongly respectfully request that these comments be distributed to the licensing board members prior to their meeting regarding the subject.

For myself, I felt compelled to be here today and make the trip up because not only am I an elected official over a city of 200,000 residents where I issued contracts to contractors that do all kinds of work in our city, safety and having the correct contractor on the job is key. And I can't let that go by because I've made my career in the construction industry for the past 33 years as a general certified electrician; I hold the C-10. And I'm not actively contacting now as I'm a very busy guy in politics and things like that, but on behalf of myself

and my Fire Chief Tom Schultz, who has -- I have 33 years in my industry, he has the same --similar 33 years in the fire industry. He's currently the fire chief.

He gave me some notes here, and I'd like to read that to you. As a fire chief, he's also served as deputy chief of fire operations. He's a registered state fire instructor, he's a certified state fire chief officer. And in both of our professional opinions, it would be a mistake for the Contractors' State License Board to treat any storage system as merely a subsystem of the solar voltaic system.

While these systems can be paired together, as other speakers mentioned, they are separate systems subject to their own code, installation, and fire safety standards. To this point, the NEC identifies in article 690.1 B that the photovoltaic installation ends at the system disconnect as the previous speaker had mentioned. An ESS system is a different electrical system covered under another article of the code, 706, energy storage systems.

Moreover, they pose very different fire and safety risks. Banks of batteries can operate at hazardous voltages and deliver electric shock, and the battery bank must be electrically isolated while working either upstream or downstream. You really can't turn it off; as any electrician knows, you still have got this huge power

source that you may be able to disconnect downstream or upstream, but you've got this huge potential danger sitting there, as the previous speakers had mentioned.

Battery system storage can also cause tremendous arc flash, 12,000°C, capable of melting metal and causing fires and explosions. Generally higher energy storage capacities have a higher risk of arc flash, and arcing faults may cause catastrophic failure to the battery enclosures. You have to have -- installing these systems, you have to have the background and the technology and the theory and the education to be able to know what you're dealing with, and actually to know how the system works, not just how to plug-and-play solar panels.

Energy storage systems pose a safety risk to occupants, firefighters, electrical installers if it's incorrectly installed and operated. We recommend that the Contractors' State License Board consider the practice of the California fire code in regulating energy storage systems differently and separately from solar PV systems.

Due to the specialized skill and knowledge needed to install energy storage systems safely, we believe only C-10 electrical contractors that are licensed to install these systems as a stand-alone system should be allowed

to install these systems -- stand-alone systems should also be allowed to install these systems.

Additionally, the scope of the license should be should ensure that the holder is in fact qualified to install, commission, and decommission energy storage systems. We believe that only state certified general electricians, apprentices, and trainees employed by a C-10 electrical contractor can truly perform this work in a safe and correct manner. Thank you for your time this morning.

**Rick Lopes:** Thank you, Mr. O'Neill. Thanks for traveling up here. I know we were in your city last year; we had a board meeting last -- I think it was last June. And I personally spent a lot of money in your town visiting a nearby attraction.

**John O'Neill:** Please keep coming back.

**Rick Lopes:** There you go. I've always enjoyed it. Thank you. Our next speaker this morning is Nova Sayadian. Sorry, I hope I've pronounced that right.

**Nova Sayadian:** Good morning. My name is Nova Sayadian. I'm -- I'm against my peers here, I'm a C-10 license contractor but also a 46 holder. And I agree with them, you know. We -- C-46 holders, we also are into the safety factor of the systems, you know. We are not out here to hurt anybody, to damage property, to

install improperly products.

As I started in the business a long time ago, the C-46, there wasn't much training for us to do on how to do photovoltaic. We learned from other people. But as times are moving along, we've gotten the certification, we've got the training with NSAP certification, with classes like people like Bill Brucks have taught us how to do things properly. And with engineers being trained correctly to help us install solar systems, we are following plans. We are looking at the blueprints, we're doing it the right way, and all of those are being submitted to jurisdictions for approvals. And with that, we have to follow all those rules, and at the same time, those also being checked by field inspectors to make sure things are conducted properly.

As the gentleman spoke, we have very big concerns for fire safety and making sure people are not hurt. We're making sure that firemen are protected because we do everything right. We're making sure people don't get shocked. These are all things we follow as the plans are done by engineers for us and by jurisdictions that say here's the rules we have to follow, plus the NEC. We're following it closely.

We do have training; we're not saying we don't. We don't want to say that we will do large projects, but

this will kind of kill the business for small installers to -- who do homes or individuals like that that they're not be able to do because they think that they have to be a C-10 qualified.

Like I said, I think the installers in the industry has changed. I think they've learned a lot. They have moved on, and they've gained a lot of knowledge as they're moving. I don't think we should use the C-46 is us being the fly-by-night contractors that they are. They have evolved in the past four or five years to be better than they were. Thank you very much for your time.

**Rick Lopes:** Thank you very much for being here. Our next speaker is Greg Gini -- Craig Gini, I'm sorry.

**Craig Gini:** It's okay. Not a problem. Thank you. Thank you for the opportunity to speak before you guys today. My name is Craig Gini, as you said. I work for Collins Electrical, vice president for renewables department, a C-10 contractor. Frankly I'm a little disappointed by some of the testimony offered at yesterday's and today's -- a little bit at today's hearing. Interlaced with any testimony, they'll be opinions, their own feelings, and then there's also facts.

I approached this hearing with a belief that C-46

contractors and their employees have good intentions but may have just been misinformed or uninformed. Many times in life we believe that we are capable of doing something only to find out that there is much more to it than what first appeared.

Now I see that I may have been just a little naïve. I've heard advocates for C-46 contractors claimed that they and their workers had all the skills necessary to install battery energy storage systems in a safe and professional manner. But never once did I hear them describe any of the industry standards such as PPE, and those things are necessary to install modern energy storage systems today.

I did not hear them describe the electrical safety hazards and associated challenges inherent in the systems, nor did I hear them describe any state required worker training, experience, test, or certification to perform their tasks in a safe and efficient manner. I heard a lot about the test questions yesterday on the contractors' exam, but what about the workers? They are the ones who actually install these systems while contractors are employers who run the business.

Instead, I heard that there is little difference between the dangers of a solar energy generating system and battery energy storage system, that the risks and the

challenges are basically the same, and most astonishingly, that the C-46s are really the DC experts. I think we kind of talked about that before -- more expert than the certified and tested personnel that have completed a comprehensive five-year, state-approved apprenticeship program and demanding rigorous exam. That's not misinformed, that's simply false.

C-10 contractors, such as the one that I work for, have installed battery backup system since the 1950s and an uninterruptible power sources or UPSs. Yes, it's a battery bank that supplies the DC power to operate the large circuit breakers for much more of the industrial switchgear. They're in hospital backup systems, computer systems, and data storage systems which cannot afford to have an event, a moment without power for the system and life safety reasons.

Our company has worked with battery backup banks, the size of the computer as well as the size of an entire room, and we've been installing that DC energy storage equipment for over 50 years. Battery backup systems on a solar project have the same issues and challenges that C-10 contractors and everyone else, for that matter, have faced for over 50 years with DC energy storage.

Let's look at another C-46 claim that their experience with PV systems and lead acid batteries

qualified them at to safely install today's and tomorrow's energy storage systems. The fact is that lead acid batteries are not the same or similar to moderate lithium-ion battery systems.

We have all seen the videos of exploding cell phones, hoverboards, and fiery endings to faulty lithium-ion battery-powered devices. The truth is that the cutting edge of technology is a double-edged sword.

So let's look at the facts. The vast majority of solar installations do not have storage systems attached to them and this includes most of the large commercial projects. So what I'd like to do here is just kind of draw -- take a look at an example. A 7,000 or a 7-KW solar system produces 7,000 watts, but a battery storage system stores the energy produced by these arrays. When there is low consumption load of eight hours of sunlight, the battery system will store up to 56,000 watts of power. Not only that, but the solar system can only deliver the power it is producing at that moment in time. Battery storage under a direct fault, short fault condition can deliver all of its stored energy at one time. It's a big difference. Thank you for letting me speak. I appreciate it.

**Rick Lopes:** Great. Thank you very much. At this point, I don't have any speaker cards. We'll stand by;

we are going to be here until noon today if somebody else does want to speak, please feel free to turn the car. Otherwise, we'll stand by in case there's anybody else who wants to offer public testimony.

**Male:** Think you can announce a bio break.

**Rick Lopes:** I'm sorry?

**Male:** Could you announce a bio break? Maybe that would be helpful for people since we have the time -- a break for -- a bathroom break.

**Rick Lopes:** Yes, if anybody would like to use the restrooms, they are just out to the lobby and to the right, so kind of behind the stairway there. If you just go to the right of the stairway, the restrooms are right there.

Okay. We do have a couple cards, so we will continue. Our next speaker is David Mauro.

**David Mauro:** Good morning, and thank you for your time today and letting me speak. I've sat here now for about an hour listening to everybody speak, and I'm going to take this in completely different -- in a totally different vein here.

I'm a state-certified electrician; I've been state certified since the inception of the program. I've worked on -- I've been an electrician now for 32 years. And a couple things came up in this -- when I was

listening to everybody talk. I'm going ask you guys some questions, and I want you to answer these. Because you have driver's license, does that entitle you to drive a bus? No. If you're a dental hygienist, do you perform root canals? No. If you're a nurse, do you perform surgery? No. Because you can fly a Cessna, does that mean you fly a commercial airliner? No. Should a non-state-certified electrician working for a C-46 contractor -- should he be able to install and maintain energy storage systems? The answer is no. Thank you.

**Rick Lopes:** Mr. Maura, thank you. Our next speaker is Eddie Bernacchi.

**Eddie Bernacchi:** Good morning.

**Rick Lopes:** Good morning.

**Eddie Bernacchi:** Good morning, Rick, how are you? Good. Eddie Bernacchi here on behalf of National Electrical Contractors Association. I want to start by saying thank you to the registrar and the Board for putting these hearings together. This is an important topic that our industry has been looking for clarity on for over two years.

NECA represents contractors throughout the state; there's 17 chapters, over 2,500 contractor members. We represent contractors that carry all types of license classifications, A, general engineering contracting

licenses, B, general contracting licenses, and C-46 licenses, C-10 licenses, C-7 licenses. So NECA represents a diverse group of contractors that carry all types of licenses.

But it's always been a long-standing opinion that the California regulations covering the C-46 license definition very clearly reads that the licensee is restricted to thermal and photovoltaic solar energy systems only. That regulation reads a solar contractor installs, modifies, maintains, and repairs thermal and photovoltaic solar energy systems. A licensee classified in this section shall not undertake or perform building or construction trades, crafts, or skills, except when required to install a thermal or photovoltaic solar energy system. An energy storage system is not required to install a photovoltaic solar system. And so we've always had that as our opinion, and we think the Board needs to take a very close look at their own regulation.

As it relates to the report that the CSLB staff will be compiling following these hearings, we would ask that the staff research and include the following information -- there's been a lot of testimony from those in the C-46 industry that there's going to be industry interruptions, so relating to the industry interruption. We think that the Board should be made aware of the number of C-10

licensees in the state and the number of 46 licensees in the state and the total number of licensees holding both. I think that would be helpful in that area.

As it relates to testing, there's been a lot made of the number of questions on battery energy storage on the C-46 test and how that may outnumber the number of questions on the C-10 test. I know that there's a limited amount of space and there's the same number of questions on each test. There's a lot more for the C-10 contractor to have on the test so that makes sense, possibly. But we think that the -- much of the testimony have provided the battery energy storage systems are covered by the California building code under the National Electrical Code.

We would ask that the staff include the report the number of questions on the C-46 test relating to the National Electrical Code and the National Fire Protection Agency Fire Code and then, also, the number of questions on the C-10 test relating to the National Electrical Code and the National -- and NFPA Fire Code. And then as it relates to consumer protection, you know, the charge of CSLB is to protect the consumer and regulate licensees for competency.

We would ask that staff provide in the report the total number of complaints filed against C-46 contractors

since January 1, 2015 in relevance to the number of contractors that are licensed as C-46. I would also have to staff to review and report on all state laws, codes, requirements or attempt to -- and requirements to demonstrate competency, including certifications, availability of apprenticeship programs, and associated training and experience of employees of both C-10 and C-46 contractors who perform battery energy storage, maintenance, and installations; and the staff work with the Division of Apprenticeship Standards to determine what industries have approved apprenticeship programs that have training for battery energy storage system installation and maintenance.

And we also would recommend that the staff make a thorough study -- take and do a thorough study and possibly make a recommendation of the qualifications of both the contractor and the people they employ and determine who is best suited to protect the consumer because that's what this Board is here to do is protect the consumer. And you take a long look, and I think it's been demonstrated very eloquently that these are some of the most dangerous systems that you can put in your home, school, hospital, that if the consumer, the end-user, is who we're here to protect, take long look at who the contractors are and who they employ, and what else is

there in the industry through the Department of Industrial Relations to ensure competency and safety for those consumers. So thank you for time today.

**Rick Lopes:** Great. Thank you very much. Unless there's any other people who would like to speak, we'll be in a holding pattern again. Tom Enslow, Tom, thank you. Welcome.

**Tom Enslow:** Good. morning. Tom Enslow on behalf of the Coalition of Utility Employees or CUE. CUE represents employees of most of the electrical utilities in California, and CUE has been a long and strong supporter of legislative efforts to increase both solar and energy storage capabilities in California in order to address climate change.

CUE's members are also very keenly aware of the difference between solar PV systems and energy storage systems. And so I'm here this morning to address the claim that installing an energy storage system takes the same skills and knowledge as installing a solar PV system and that the systems don't pose any greater health or safety risk than PV systems.

As many people have spoken today those claims are false, but I want to address this from the fire and electrical code standpoint. Those codes treat these systems as separate systems precisely for that reason.

They're located in different areas of the occupancy, they're subject to very different codes and standards and permitting requirements, and they pose very different fire and life safety risks.

For this reason, the fire code sets forth separate permitting, installation, and safety requirements for solar PV systems and battery storage systems. And the fire code requirements that apply to energy storage systems but not to PV systems include safety cap, thermal runaway management, spill control, neutralization, ventilation, specific seismic protection, smoke detection requirements, and all these can vary based on the technology and the configuration.

So you need to understand kind of the concept behind these energy storage systems that aren't actually complied with the requirements. Failure modes and effects analysis or other proved hazard mitigation analysis is required under the fire code when certain energy storage technologies and configurations are used. Specific location and room design requirements, specific permit application requirements, including details in fire suppression, fire resistant assemblies, smoke detection, ventilation, and large energy storages systems may also need engineered fire suppression systems, depending on the technology used.

The 2017 National Electrical Code also makes clear that these systems are separate. Section 690.4 lists the equipment that may be included in the PV system, includes inverters, motor generators, PV modules, panels, AC modules, DC combiners, DC to DC converters, and charge controllers, but doesn't include energy storage systems. This is addressed in section 690.1, which confirms that PV systems are separate systems from the energy storage system by saying that, "PV systems may or may not be connected to energy storage systems."

The energy storage systems are -- requirements that have been set forth in article 706, which is referenced in the 690. Article 706 sets forth unique charge controller, corrosion prevention, interconnection, flow control, ventilation requirements, requirements that are distinct energy storage systems.

And then, also, the NEC has a figure, figure 690.1, that shows the five most common configuration PV systems. And those figures -- and that figure states that the PV system disconnect in each of these diagrams separates the PV system from all of other systems. And in each of these diagrams that show a PV system connected to a facility that also has an energy storage system, the PV system is separated from energy storage system by both the a PV system disconnect and an energy storage system

disconnect. These are systems that are, you know, that are required to be disconnected from each other because they're separate.

And they're treated differently in the codes because energy storage systems have unique functions and attributes that are vastly different from solar PV systems. A solar PV system generates and exports energy but does not store energy. In an energy storage system does not generate energy but rather stores and discharges energy. And it's the storage of energy that makes these systems more hazardous. That that's why the energy storage systems have specific risks of combustion, explosion, hazardous material, gas leaks that are nowhere -- that are either, you know, aren't there at all in PV systems or are a much smaller scope.

And let's be clear here we're not talking about old school 12-volt batteries that used to be used to connect to these systems. These are lithium batteries that have thermal runaway potential, and they're at different scale. On the customer side, we're seeing commercial systems that are now 10 to 20 megawatts. That's essentially small-scale utility systems. We need to make sure people installing these have the skills and knowledge to install them correctly and safely. Thank you.

**Rick Lopes:** Thank you. We're back in our holding pattern now. Okay. We are ready; we have another speaker, Bernie Kotlier.

**Bernie Kotlier:** Correct. Thank you. Very good pronunciation. So, yes, my name is Bernie Kotlier, and I'm with the Labor Management Cooperation Committee, a statewide organization with contractors and electricians all over California, and Nevada actually. And I want to talk about a few things today.

First of all, I want to talk about some things that were said yesterday. Ms. Del Chiaro made some carefully worded statements in reference to the performance and safety and, you know, various feedback on C-46 contractors. And the reason I say very carefully worded is because, and I heard this today also from the gentleman from -- representing the solar industry, that there was no or little evidence about any problems with these systems.

Well, according to the County of Los Angeles Building and Safety Department, the largest in the state of California, there is no county or statewide reporting system on these issues. None. I respectfully request that the Board not accept any claims about performance, violations, safety, and fire records until there is a verified, comprehensive data source to back up those

claims. No evidence was said because there is no reporting system because there is no way to verify this, and those fake claims must be verified before they're accepted to the Board -- respectfully requested.

In addition, Ms. Del Chiaro said, and I'm not quoting exactly, but she indicated that many PV systems are installed by C-10 and C-46 contractors, and there's roughly a one-third overlap according to those remarks. During the committee meeting in February on the same issue and yesterday, we heard contractors and representatives of C-46 organizations saying or imply or indicate in some way that C-10 contractors do not know DC and that they do little PV work. Well, both cannot be true.

What is true and fact-based, and you've heard it yesterday and you've heard today, is that C-10 contractors have done DC work and energy storage work since the 50s and 60s. C-10s are also installing and maintaining gigawatts of DC PV systems and that's the fact. And it can be proven by state and federal data.

What was also said by C-46 speakers at the February committee hearing was that C-10s and electricians are more expensive and that this would hurt the market in some way. Yesterday, Mr. Murray indicated that C-10s were doing this for the money. They were -- we talked

all day yesterday about safety. No one mentioned money, but the claim was at the end of the day that this was being done for the money.

Meanwhile, C-46 leaders continue to talk about C-46 test questions versus C-10 test questions. This is misleading. It's a misnomer. They do not talk about the fact that it is workers who install these systems for C-46s and that those workers have zero state requirements and zero test requirements. We should not be talking about the test requirements for the contractors. We should be talking about the fact there are no test requirements, no skill, and no certification requirements for the workers who actually do the installing. The contractors are running the businesses; it's the workers who are installing. It's their test questions and the lack thereof for their workers that should be really at issue here.

They also don't talk about how little those installers for the C-46 contractors are paid or about how few benefits they receive. And these issues are linked. Training, skills, and certifications are linked to cost, and they should be because it costs money to do training. It costs money to make sure people are well-trained, they have experience, and that they can protect the public. We, as a society, and I respectfully submit, that the

CSLB should not be considering -- even considering trading off cost for safety of the public or the workers. If the CSLB permits C-46s with employee installers with no state requirements, and I trust the CSLB will not do that, the CSLB would be sending a signal to the market and to contractors to do less, little, or no training. How does that work? What does that mean? Well, let me explain.

With no minimum worker certification requirements and a market that rewards the lowest cost or bid to win the job and the knowledge that training does cost money, that puts contractors who do training at a competitive disadvantage and tells the market and other contractors -

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**Female:** Thank you so much. I'm sorry, your time is up.

**Bernie Kotlier:** -- to do less or little training because it costs money. California State policies --

**Rick Lopes:** Excuse me, sir, we need to move --

**Bernie Kotlier:** -- a skilled workforce, not to just incentivize training.

**Rick Lopes:** Thank you Mr. Kotlier.

**Bernie Kotlier:** Thank you.

**Rick Lopes:** I appreciate your comments. Ken Irwin is our next speaker. Mr. Irwin?

**Ken Irwin:** Good morning. My name is Ken Irwin. Thank you for allowing me to speak on this. I'm currently an electrical apprenticeship instructor here in Sacramento. I teach electrical theory, safety and code to our apprentices and journeyman upgrade classes. Again, my electrical career in the United States Navy on a nuclear submarine back in the 1980s, not only did I work on these systems, I lived on the system of a high energy storage system. I did maintenance on these batteries onboard the submarines. I gained a lot of respect for working on those batteries while I was in the navy.

In the 90s, I went through and graduated in the top my class in the five-year apprenticeship program, including 1,000 hours of classroom training, 8,000 hours on-the-job training. I became a state-certified electrician in 2003 and remain a state-certified electrician.

Since 2001, I've been an instructor for the same apprenticeship program that I graduated from. I spend the majority of my time teaching DC and AC theory, electrical safety, OSHA -- and National Electrical Code applications. My concerns on this issue is for the safety of the workers installing these systems and for the public afterwards. I just recently attended an

energy storage and microgrid training session in Los Angeles in August of last year and went again in April, earlier this month in Vegas. I gained even more appreciation for the safety concerns and the potential hazards involved in these high-energy systems. Since these already are and always will be energized even after connecting just a few of these batteries together, they meet the requirements, the OSHA requirements, to require energized work permits, PV, and energized work procedures. Safety requirements that need to be followed are central to the workers involved. Proper safety techniques, proper rigging techniques, proper termination techniques, proper torqueing techniques are all essential to proper installation of these systems.

In my class of apprentices and with the journeymen upgrade classes I perform, I stress the importance of the why and how behind what we do. There's more to our job than turning a screwdriver or turning a wrench. This not only protects our apprentices, our journeymen who are installing the systems, but to protect the general public after the installation. Improper installation techniques and procedures may not manifest into problems until much later after the installation.

The training involved in our electrical apprenticeship from year one through year five built on

each year preceding. We cover these topics during the 1,000 hours of classroom training, backed up with 8,000 hours on-the-job-training just to graduate the apprenticeship. You still have to then pass the state certification test to perform this work as a journeyman electrician. This is a training we provide to qualify to become a qualified and competent general electrician. I really do believe for the safety of the workers, this work needs to be done by qualified, competent electricians. Thank you.

**Rick Lopes:** Thank you, thank you for joining us. Our next speaker Will Smith.

**Will Smith:** So how are you doing? Hello. I had no intention on speaking today, to be honest with you, but after getting here and sitting for the last hour or so, listening to some of the people speak, it kind of motivated me to speak my mind on this issue.

I've been an electrician since 1999 for 19 years. In 2005, I got my state certification as a general electrician, and the trade has been really good to me. I've got 19 years of experience. I've worked on hospital, schools, and data centers, airports, you name it, I've, you know, pretty much done it.

And to me, it's pretty much a no-brainer. In my life, I've use my common sense, and I feel just that

using simple common sense has gotten me a long way. And using common sense, it tells me this -- on one hand, you have highly skilled guys that have been doing the electrical battery installs and electrical storage system for years, and on the other hand, you get a group of guys that are less skilled, less trained, that doesn't have this experience, that's been excluded from doing that type of work because of the potential and the hazard.

To me, if I was on the Contractors State Licensing Board and was allowed the C-46 workers to do electrical energy storage and there was a catastrophe, school was to burn down, there was an explosion at an airport, even at somebody's home, you know, that somebody's mother, brother, sister, cousin, could be your own family member, I wouldn't be able to sleep well at night, knowing that I didn't use my common sense to make the right decision on this. So that's all I have. Thank you.

**Rick Lopes:** Mr. Smith, thank you. We'll continue to standby for additional speakers. Okay, our next speaker is Bernadette Del Chiaro.

**Bernadette Del Chiaro:** Good morning, I, too, am inspired to say a few things. My name is Bernadette Del Chiaro. I'm the executive director of the California Solar and Storage Association. We represent over 500 contractors, manufacturers, and other members of the

California Solar and Storage industry. Over 250 of our members are licensed contractors, and they hold a variety of appropriate licenses -- the C-10, the C-46, the A, the B, along with roofing, plumbing, and other relevant licenses to this multifaceted multi-craft trade.

I want to put into the record the fact that CAL OSHA requires all contractors licensed in the state of California with three more employees to document and certify that everyone on staff is properly trained in accordance with California Electrical Code, Article 100. All contractors regardless of their license are held to this standard. Safety training is of the utmost importance to all of my members, and it's not limited to one licensing class or one specialty license in the State of California. It's important to all of us.

And the record, I think, bears that out in terms of problems reported at CAL OSHA and at OSHA. Since 2013, Pacific Gas & Electric has interconnected more than 200 solar and storage paired systems. More than 200 have been safely interconnected by PG&E themselves, totaling over 4,000 kilowatts of rated capacity. The majority of these systems were installed by contractors who hold a C-46 license. A review of OSHA database shows that none of these projects have resulted in a reported violation, injury, or death.

So this is not a new technology for the C-46 or the A or the B or the C-10. This is not an expansion of the licensing eligibility as been said a couple times today and yesterday. This is something that we've been doing, all of us collectively together, as multiple licenses, multiple crafts, multiple trades, we're doing a really good job. We want to keep doing a good job in working with the Contractors State Licensing Board to enforce rules and make sure that we keep having this excellent track record that we have.

I'd like to also request that should the CSLB embark on an analysis of complaints filed since 2015 against licensed contractors, that you take a look at it as a percentage at the number of systems installed by those holding different licensing classifications, not just licenses held. There's obviously a lot of C-10 license holders that don't engage in the solar industry.

And those databases are easily accessible and monitored by CPUSC, so it's easily verifiable data and independent. Thank you again for holding this hearing. Thank you for everybody here that has showed up. I think it's encouraging that members of the IBEW have such a strong interest in deployment and growth of distributed solar. We need your help, and we welcome you, and you've been part of this growing industry, and I'm proud to

represent all of the workers out in California, all 86,000 of them who are helping to deploy safely and with quality this new clean energy generation. Thank you.

**Rick Lopes:** Thank you. My apologies, I'm going to blame it on Cassy. I was going to -- it's Salkauskas.

**Cassy Salkauskas:** Salkauskas.

**Rick Lopes:** Salkauskas. Welcome.

**Cassy Salkauskas:** So, yes, my name is Cassy Salkauskas. Thank you for letting me present. Brief history on myself, I started my adult life in the United States Navy submarine service. I have 20 years' experience as a construction electrician. I currently work in the utility industry.

Starting my life off in the submarine service, it was instilled in me to become qualified on a submarine that you understood how the systems worked and why they worked that way. We went over training, training, training. It's always training in the military.

When I got out of the military, I discovered the electrical industry, and when I found out about it, knowing that they train, train, train 8,000 hours OJT before you can even take your state certification, I thought this a very groomed, experienced workforce. That being said, I've moved around the country and worked on electrical systems.

Now that I'm in the utility industry, we -- the utility industries have battery backup maze -- types of energy storage systems for substations to keep the power to the people. In that, the dangers that are involved with those systems, all of our battery backups, our energy storage systems are kept in separate buildings with separate code, with the, you know, things have to be vented. We have to have explosion-proof fittings for conduits.

And when I started to hear about the solar industry and how it's expanding, it's a great thing. But the batteries, to think about a lithium-ion battery or a lead acid battery installed into a school or a hospital or home, me knowing the dangers that are involved in that, I'm very cautious of that.

The construction electricians -- the certified electricians that have that on-the-job training, that have the state license, continue to be trained on that always. In the utility industry whenever we do the maintenance our batteries, we do what's called a tailboard, which is the job hazard analysis in the morning to reiterate the methods and procedures that we will do while we're conducting business around those batteries.

I brought some of the -- this is -- these minimal

requirements of protective equipment that we must wear while we're doing that because of those dangers. After a break, we redo the job hazard analysis, we re-tailboard. After lunch, every single day, so that it's on the minds of individuals that are working on that, so that they don't get complacent. They understand the dangers that are involved.

To think of an installer that has had minimal training -- and installing these installations is a very scary thought. It's one of those things where you may know how to -- in but you don't know what all is involved in the whole system. So I would just like to conclude that individuals that are going to be installing these should be very thoroughly versed in and trained, and they should have the state certifications to install this. So thank you.

**Rick Lopes:** Okay. Thank you, and thank you, as well, for your service. We appreciate that. Our next speaker is Barry Cinnamon.

**Barry Cinnamon:** Hi, good morning I'm Barry Cinnamon with Cinnamon Energy Systems. I'm a C-46 contractor and a C-10 contractor. I passed the test for the C-46 in 2002. Since then, I've installed over 10,000 residential and commercial solar and storage systems under my direction.

Last year, I worked with the CSLB to develop the newest C-46 test, so I'm familiar with the hard work your organization does to ensure qualification of the contractors. The C-46 test has been and will continue to be very focused on energy storage. The simple reason is that solar customers have historically needed batteries when the sun doesn't shine at night. So C-46 contractors are trained and tested on batteries because that's what customers used to need, and now they need it again.

I recently took the C-10 test, and on the test that I took there were zero questions that related to battery storage at all. Now, I've reviewed a lot of the previous comments that were made here today and yesterday, and it's apparent to me that very few people here have actual hands-on experience installing the latest battery storage systems. Much of what I heard was simply incorrect from a technical standpoint. Some of these fake facts are being used to scare you.

Of course, my fellow solar installers, many of whom are union workers like Baker Electric and C-46 contractors and C-10 contractors have actual battery experience. So let's talk about what's in the current California Electrical Code.

Batteries are covered in detail in the PV section, Article 690 because until net metering became popular,

that was the only way you could install affordable voltaic system was with batteries. Article 480 in the electrical code covers storage batteries, but it doesn't even mention lithium-ion batteries. These technologies will not be covered in the California codes until 2020.

Now, photovoltaic voltages are 400 volts. I brought a sample of the battery over here. That battery and other popular lithium-ion batteries run at 400 volts DC. Your EV that many of you have parked in your garage runs at 400 volts DC. Solar installers work all the time, for the last 20 years, at 400 volts.

Now, there's also concerns about flames and thermal runaway and explosions. Well, the flame-spread propagation for these battery storage systems is covered in UL 5940 and 9548. Thermal runaway -- these things are just going to blow up and burn -- are covered in UL 1973. These battery systems cannot be installed without these listings. So the popular battery systems are indeed designed to be safely installed.

So let's connect the most popular battery storage system now. First, I'm going to open the access covers. And this is a 10 kilowatts hour NG battery. Two access (inaudible). One on the inside, one on the outside. Connect in the wiring, and you can see, there's only three wires: a plus, a minus, and a ground. Once those

are connected under the terminals and note that the terminals are not live because there are circuit breakers in here. We can add the (inaudible) wire if necessary, replace the inside cover. They'll replace the outside cover. Turn on the circuit breaker and the power switch inside, and finally close (inaudible) covers.

Now, it's very important on these systems, Tesla, LG, many others, if the terminals are shorted, the circuit breaker trips. There can be no fire, no explosion, no arc flash. Those are the systems that are going in in homes and businesses.

So the speakers who incorrectly claim that these systems will burn or explode or going to have an arc flash are apparently not properly trained on these systems.

Now, I have a lot of respect for C-10 contractors; they do terrific work. I am one myself, but there's no objective technical, safety, or training issue at all that would disqualify C-46 contractors. In fact, based on what I've heard, C-46 contractors are the most experienced and trained on battery storage systems. Thank you.

**Rick Lopes:** Thank you very much. All right. Our next speaker this morning is Lydia Van Note.

**Lydia Van Note:** Hey, good job.

**Rick Lopes:** Thank you.

**Lydia Van Note:** It's usually like Van Notay or something.

**Rick Lopes:** After two days of practice, I'm getting -- pretty well. Welcome.

**Lydia Van Note:** Thank you. Lydia Van Note -- I greatly appreciate the opportunity to make some remarks. I really wanted to just focus in on the first question that is asked by the Board, basically on the different technologies. And I think that some folks in this conversation, which I appreciate, have been focusing on one specific type of technology and one certain application. I just want to encourage the Board to look at all -- and what I could gather -- the five different types of energy storage systems. So this isn't just residential; this is across the board, residential, or excuse me, storage.

So you have pumped hydro is a category, you have mechanical, which is typically your compressed air. You have thermal, which you have solar radiation heats a molten solids or a liquid of some sort, and then you have electrochemical which seems to be the focus of everybody's comments today, which is, you know, specifically, batteries -- what we're used to calling batteries.

So within that battery family of storage, you also have at least 16 types of chemical compounds that happen within the batteries. So, you have five categories of batteries and then 16 categories within one. So I just wanted to encourage the Board to make sure that when they're making a ruling on energy storage systems that they're taking all of those categories into account and subcategories.

And specifically, to the battery, and I want to just specifically talk about that last presenter, or comment on the last presenter. That's a pre-fabricated system, and I'm sure LG makes a fantastic system, but not all of the systems that are installed are going to be that easy. And so I just wanted to flag that for the Board or for staff when they're reviewing to really dive into the different technologies that are out there and then how they come together in the installation of them. And I think that that's been an underlying theme that you've heard throughout many of the commenters.

You know, I think that there's also concerns of during the installation at a pre-fabricated -- I'm told, I'm not an electrician -- but you can have issues of, you know, arc flashes on both DC and AC sides. So I just would like the Board to look into that further. Thank you.

**Rick Lopes:** Great. Thank you very much. Our next speaker is Bill Anderson.

**Bill Anderson:** Good morning. My name is Bill Anderson. Thank you for letting me speak. I've been in the electrical industry for 20 years. I've held state licenses in several different states, and the State of California requires an electrical license to do electrical work, and there's a reason for that. So I'd just like to see the electrical work stay in the hands of the qualified, licensed, state-certified electricians, and to me, that's a no-brainer. The state requires you have the license. Let's keep it in the hands of the licensed professionals. And that's all I have to say.

**Rick Lopes:** Thank you very much for being here. It is now 12 o'clock. Thank you everyone who joined us today and for the input you provided during this hearing. We look forward to working with all interested parties in the weeks and months ahead as we work through our review process on this important issue. This concludes our public participation hearing. (Recording Ends)

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# **JANUARY 18, 2019 C-46 INDUSTRY EXPERT MEETING TRANSCRIPTS**

**CONTRACTORS STATE LICENSE BOARD**

**TRANSCRIPTION**

**C-46 Stakeholder Meeting**

Prepared for: Contractors State License Board

Transcribed by: Trans-Lang

## LEGEND

[First name]:	Example: "Dave"
UIS:	Unidentified Speaker
(?):	Speaker identification unclear
[OL]:	Overlap
[IA]:	Inaudible
[UI]:	Unintelligible
[Ph]:	Phonetically
/:	Two or more words separated by a "/" are options, due to lack of clarity or specificity in the original language
[ ]:	Text within brackets are inserts by the translator to aid in comprehension

**NOTES:** *Best effort was made to correctly cite acronyms or professional or industry boards, bodies, organizations.*

TRANSCRIPTION	TIME	SPEAKER
<b>[Beginning of recording]</b>		
<p>[UI] on? Okay, I'm Dave Fogt, I'm the Registrar with the Contractors Board and I wanna thank you all for taking time to attend this- kinda, this, uh, industry expert meeting this afternoon. I'm gonna provide just a little bit of background as to why- why we're having the meeting and that is because February of 2018, our Board directed staff to conduct public meetings and to look at the classifications that were most appropriate to perform energy storage sti- sisi- systems, whether they're in a standalone contract or one included in the installation of a solar system. And, we've had public participation hearings; we have more than five hours of testimony. We've received over two hundred and forty-nine [249] letters and this is kinda the next step, and that is to talk to experts from the C-46 solar industry and also the C-10 electrical industry. Yesterday we had a similar meeting with the C-10 industry. And, what I would like to do is- is go around the table, we'll all introduce ourselves. There is a sign-in sheet, I would ask that you sign in, for future reference. And then after we've done that, uh, we'll ask that, uh, our experts that are with us today would provide their background and their experience. So, starting from my left; Felice:</p>	00:00:00	<b>Dave</b>
Felice Jones, Executive Office.		<b>Felice</b>
Bill Brooks, Brooks Engineering.		<b>Bill</b>
John Berdner [Ph].		<b>John</b>
Barry Cinnamon [Ph].		<b>Barry</b>
Bernadette Del Chiaro, with the California Solar and Storage Association.		<b>Bernadette</b>
Ed Murray [Ph] with Aztec Solar and CalSSA.		<b>Ed</b>
Becky Lake, uh, Enforcement Analyst.		<b>Becky</b>
Uh, Mike Jameski [Ph], Legislation Chief.		<b>Mike</b>
Missy Vicori [Ph], Chief of Enforcement.		<b>Missy</b>
Brian Melvin, Enforcement Supervisor.		<b>Brian</b>
Justin Paddack, Licensing Chief.		<b>Justin</b>
Tanya Corcoran, Chief Deputy Registrar.		<b>Tanya</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Okay, thank you, and as we discussed before we went- went live, we've agreed that this will be recorded today. So, if you would, please give us your background, maybe your experience in this industry.</p>		<p><b>Dave</b></p>
<p>Yeah, Bill Brooks of Brooks Engineering; uh, been, uh, I have a Master of Science Degree in Mechanical Engineering. I'm a registered mechanical engineer in the State of California, registered electrical engineer in the State of California. Um, have done a lot of the training for, um, electricians and, uh, solar contractors over the last 20 years in California. Um, and, uh, helped developed [sic] a lot of the NAV 7, North American Board for Codes and st- uh [clears throat] um, sorry, um...certified energy practitioners, um, those requirements. Um, I'm on the National Electrical Code, Code Making Panel 4 was instrumental in doing quite a bit of, uh, rewritin', reorganization Article 690, Article 705 this code cycle. Um, my alternate is John Berdner on Code Making Panel four. I've been on code banking panel four since 2009. Um, let's see...um, been in the field of grid-connected PV since 1988. Thirty plus years...and, uh, one of the few people, uh, that's been his entire career in photovoltaics.</p>	<p>00:02:16</p>	<p><b>Bill</b></p>
<p>I'm Paul Beeson [Ph]. Um, I'm with a battery manufacturer, I work for a battery manufacturer by the name of Simplify Power...and, uh, based out of, say, California-based manufacturer. And we, uh, manufacturer, uh, lithium-iron phosphate batteries. I've been in the PV and, uh, storage business industry for about twenty years now. And, uh, I've worked, ah, I am also, um, IBW and Union member, electrician. Uh, I also have worked for, um, in the capacity of, uh, project management for both, uh, C-10, C-46 contractors building out commercial and residential, uh, PV systems...uh, all around the United States.</p>		<p><b>Paul</b></p>
<p>[clears throat] I'm, uh, John Berdner, currently with Enphase Energy. Uh, Enphase is a, an inverter manufacturer- solar and storage inverter manufacturer. Uh, I've been in the solar industry since 1983. Um, so, thirty-six years now, um, uh, so, I think Bill and I are probably of the small handful of folks that have made it their careers. Um, I'm on Code Making Panel 4 with Bill. Um, for Article 690 and 705. Um, I am a founding and current</p>		<p><b>John</b></p>

TRANSCRIPTION	TIME	SPEAKER
<p>member of the, uh, UL Standards Technical Panel for UL 17-41, which is inverters, uh, and converters. Um, several other Standards, Technical panels at UL relating to, eh, photovoltaics and renewables. Um, 37-41, which is, uh, risks of PV systems 3001, which is P- PV, uh, uh, systems, which is a new standard that's being developed. Uh, 67-03, which is connectors and there- there's a long list here, so...um, very much involved in- in development of UL Standards, um, for 25-30 years now. Um, uh, I'm, uh, Vice-chair of IEEE 15-47, which is the Interconnection Standard, the National Interconnection Standard that was just revised in 2018. I'm also Vice-chair of IEEE 15-47.1, which is the, uh, performance testing and compliance, um, standard that is a companion to IEEE 15-47. Uh, member of the smart inverter working group in California for Rule 21. Uh, member of the smart inverter technical working group in Hawaii for, uh, Rule 14-H, which is the interconnection, um, uh, requirements in Hawaii. Um...trying to think, that- there's probably more but, um-</p>		
<p>[OL] There's more.</p>		<p><b>UIS</b></p>
<p>Yeah! If it has to do with PV and codes and standards I- I- I'm pretty much involved.</p>		<p><b>John</b></p>
<p>I am Barry Cinnamon, uh, CEO of Cinnamon Energy Systems. We're a C-46 and a C-10 contractor based in San Jose. Been doin' solar since the late 70's, thermal and then got into solar PV in 2001. Kind of a very hands on guys so, um, I do supervise my teams directly, so, I've- I've actually installed these things and we're doin' a lot of battery systems right now, um, down in the San Jose area. And, um, I just am really glad that, uh- the- the CSLB is taking the time to look at this from a perspective that's gonna be good for the customers, the solar industry, the utilities and- and the state as a whole so that's really good. And, also, I'm- I'm very happy to say that I'm a member of the B Team that Bernadette got here. Um, Brooks, Beeson, Berdner, Barry, Bernadette [laughter] um, it'll all- all kind of managed by Ed, the president of CalSSA.</p>	<p>00:06:52</p>	<p><b>Barry</b></p>
<p>Um, Bernadette Del Chiaro, Executive Director of the California Solar and Storage Association. Um, I've been running the association for almost six years now. Uh, just for the record, we are a 40-year-old organization, um, over 40 years now. Um, we have over</p>		<p><b>Bernadette</b></p>

TRANSCRIPTION	TIME	SPEAKER
<p>five hundred [500], uh, business members here in the state of California, um, that half of which are licensed and registered contractors. Um the other half are the remaining entities that serve us- uh, the contracting side of the business. Uh, manufacturers, financiers and- and other service providers; software developers and such. Um, we are, uh, so, we represent the entirety of the, uh, distributed energy, um, solar and storage and thermal, um, uh, business and- and- and market in California. Um, we are, um, uh, uh, represent all different types of contractors, so, we represent C-46's, we represent C-10's, we represent General A's, General B's, um, our contractors are very diverse in terms of the licenses they hold, um, and, um...we also are all different types of, uh, business, um, uh, structures, uh, from union to workforce development, um, education and, uh, and just, you know, regular, uh, private companies, so, it is a very diverse industry and we represent everybody. Um...and, so, that's, I think that's all I'll say right now on background. I do have some other thoughts and comments to share, as you might imagine but I'll stop there.</p>		
<p>Hi, good afternoon, Ed Murray with Aztek Solar and the California Solar and Storage Association, President, Chair. Last couple of years, I've, uh, been with CalSSA since the inception and I- we were instrumental in, uh, helping to put together the original C-44 license and helped, um, try to push that so, we got away from just C-36 was the- the license of the, uh, day- was gonna be the solar license but we pushed for C-44. So, we were, um, ever since then, working with the State License Board. I, um, am also the, uh, Director for [the] Solar Energy Industry's Association of the National Solar In- industry Association. And I'm on the board of NABCEP, the North American Board of Certified Energy Practitioners. I am on the Standards Committee for Solar Rating Certification Corporation and I'm on the Standards Committee for IAPMO and I help with the, um, rewrite of the, um, IAPMO Code for Solar Standards every few years. I've been on that for about 10 years and I just got appointed this week to, eh, the Code [of] Standards again. So, um, I think that's it for me. I also run a little company down the street; Aztek Solar, it's a couple of exits up the road and we've been doing business in</p>	00:09:26	<b>Ed</b>

TRANSCRIPTION	TIME	SPEAKER
California with solar thermal and solar electricity...commercial and residential...C-46 and B license.		
Well, very good, thank you. Our first topic of discussion relates to residential, light commercial, commercial and industrial energy storage systems installations. We're trying to gather more information to better understand how these installations may differ, if in fact they do. I know that we had the public participation hearings and I think, Barry, you brought in an example of a plug 'n play, so, we're- we're kind of wanting to learn more about that, whether residential has a lot of plug 'n play and then, you know, what would be considered light commercial and then you go to commercial and industrial.	00:10:50	<b>Dave</b>
Well, the- the, uh, the products that are most commonly installed in the market are- are generally plug 'n play from Tesla and from LG. They're a number of other companies that are coming out of them but I- I would characterize them more along the lines of a simple to install appliance that has to be done really to code, so there's not a lot of, you know tremendously dangerous wiring or anything. The other good thing about these appliances, which is very important, is they have built-in circuit protection, so, um, I- I- I, even if I tried, I don't think I'd be able to create a fire or short- short 'em out unless I actually open up the case. So, very, very similar, I think, to what'd you see in- in- in a car. Um, I'm personally not that familiar with much larger systems but the- to me the big difference is when you've got these larger systems, the batteries are generally assembled on-site in, um, in modules or they may just be delivered in containers and you don't have the same degree of circuit protection there and those are gonna be the- the- certainly on the utility scale. Commercial's probably somewhere between in- in, um, I don't know if anybody else can comment on the scope of the commercial systems...and the utility scale.		<b>Barry</b>
Well, I- I was just gonna add on the residential side, 'cause that's what we do. Uh, Enphase is, um, one of the largest, uh, uh, suppliers of residential PV inverters and we launched a storage product a few yeas ago in Australia, sort of a test market. We have over fifteen thousand [15,000] storage systems installed, and they are all- I- I, um, uh, I'll		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
<p>say plug 'n play. Uh, they're essentially a- an appliance. Um, there's no access during the installation period or throughout the products life, there's no access to any of the internal battery terminals. Um, it's, uh, the- the installers- as Barry said, has some basic wiring to connect, um, no different than any other PV inverter. As a matter of fact, it is the exact same PV inverter that we use in our storage product, that we use in our PV [clears throat], uh, products and, uh, the- the product i- does not, as I said, does not have any exposed terminals, um, other than the basic electrical AC-side interconnections. Um, we do sell some of those products in, uh, commercial, e- what'd you call 'light commercial' application. Uh, the packaging is a little bit different, um, because of three phase packaging, so it's a little bit larger but, um, essentially it's the same in terms of, um, the access that the installer has and, um, you know, they- a- again, don't have any access to, uh, any of the, uh, battery components themselves. They're all completely internal to the product. And all our products are- are both UL 19-73 compliant, which is the, uh, the UL standard for the battery cells and the battery management system as well as being UL 19, uh, uh, star- sorry, 95-40, which is th- for the complete battery system. There is a new standard that is out for- uh, which is called, uh, UL 19, uh, 95-40-A, which essentially looks at aggregated groups. So, 95-40 would test a single unit. Well what happens if I put ten of these next to each other on a wall in a room? 95-40-A addresses those issues and we're in the process of getting 95-40-A cert-</p>		
<p>[OL] Joh- hey, John, wha- how- how do those standards relate to the safety aspects of these package systems? Or- or ho- how is that tested?</p>	00:15:05	<b>Barry</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Well, uh, I mean, that's essentially what- what- exactly what these standards do. The- the 19, uh, 73 standard, uh, addresses the safety of the- the individual battery cells, what we call the chemistry. Um, and, so, for example, you have, um, overcharge testing, uh, that you have to do, i- you sub- you subject the product- the battery itself to a- a number of abnormal conditions and, you know, your- in the UL world, i- we're all worried about what is the risk of electric shock and fire. That's pretty much what UL does. So, um, you- you punch holes in it, you overcharge it, you do all kinds of nasty things to it and then you determine what happens. Uh, does the electricity stay inside the box? Does the fire stay inside the box? Does it- any nasty chemicals come out, and so on. So, that- that would be under n-uh, 19-73. That's the battery and the battery management system which can be together as a single component. And then 95-40 takes that and says, okay, now I take one of these battery units and I add an inverter to it, I add some other, um, you know, packaging around it, uh, maybe, um, there might be switch gear included and so on. And that now becomes a 95-40 system. And then if I use a bunch of those 95-40 systems together then those need to be certified under 95-40-A.</p>		<p><b>John</b></p>

TRANSCRIPTION	TIME	SPEAKER
<p>But i- two things; one is, I think one of the things that T's out and what John just went through is that these systems, whether we're talking the PV components, the inverters or the storage devices, are modular. They are, um, so, if you're talkin' about a larger sized system, because the onsite electricity demand is greater, you're talking about the same products strung together. Again, that's the basic concept here. So, the battery that Barry brought in to this hearing room several months ago was for a typical residential-sized home. If you were to string that battery together for a commercial or larger sized project, you may actually physically see that same battery, just five of 'em next to each other. Or, in some cases in might come actually pre-assembled by the manufacturer in a shipping container. So, one of the videos we'll share with you at the end of this month is a, um, uh, a movie theater installation down in the high desert and literally, the man- body manufacturer, um, delivered the battery in a shipping container with the inverters and everything all packaged up inside, and- and- and that looks basically, essentially just take what Barry brought to you and think of it in just that scale. But, it's the exact same kind of concept, just all packaged up in a big giant metal box as opposed to a small metal box. So, the- the- these technologies are modular, I think is one of the key things to- to get across. Um, and it's about putting them all together.</p>	00:16:42	<b>Bernadette</b>
<p>Could you describe for us though, when talking- look, I guess clarify- residential, are we talking about single family homes? And then for light commercial, what would light commercial be? Say a- a, like a 7-11, something like that? And is there a difference between residential- are residential and light commercial virtually the same? Is there a difference with commercial and industrial?</p>		<b>Dave</b>
<p>Yeah, I think so, these are obviously different sectors and they're divided primarily by utility service types. Um, so obviously your residential is gonna be split phase, 240, 120 volts, and so, those products are generally designed and built for that particular single-phase market. When we get into, um, light commercial, light commercial could include both single-phase, uh, which would often be a 208, 120, or, uh, three phase, which would be 208, 120, or 480, uh, 277, so, that's- those are gonna be your standard, uh, u-utility</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>services. And, so, at the end of the day, your energy storage systems are, um...generally have two sources that- that charge them, because they're energy storage- you gotta- you gotta find the energy from somewhere so you're gonna get it either from either solar or you're gonna get it from the grid. And in either case, um, your PV systems by and large, are- create, uh, AC output, okay? They may be DC inherently, internally, but they have an AC output to them so, you have combinations of AC equipment on the PV side. You also have DC coupled systems. I think one of the things Barry brought in, that's a DC coupled system. Those DC coupled systems can be anywhere from 48 volts up to 400 volts. Um, and, uh, for- for the residential and light commercial markets. Then from there you can get into large commercial which could be almost any scale that could even get toward utility scale.</p>		
<p>So- were- we, when we look at a distinction between residential, light commercial, it's just a different electric rate. So, it's, you know, the- either going from any one rate on- on residential, and if it's light commercial it's gonna be the A-1 or the A-10 rate. Um, it's just based on the size of the- the- the company, the- how much power they're using. But, the- the equipment is basically identical. And then when we talk about commercial systems, as Bernadette had mentioned, for many of the commercial systems we'll just string together, um, multiple light commercial units and- and that's the- i- there's a big change that's happening in the PV industry, which is really encouraging, is the manufacturers of the equipment, like Enphase, like- like SolarEdge, there- they've come to the conclusion that instead of making one big huge five hundred [500] kw inverter, it's more cost effective to make, you know, just use fifty little ones. And it's more reliable. So, i- we're- we're basically almost using the same equipment, the only difference is the voltages may be different.</p>	00:20:24	<b>Barry</b>
<p>How long have this- how long have you been installing these kind of systems? These modular, uh, battery systems? I mean, how many years?</p>		<b>Dave</b>

TRANSCRIPTION	TIME	SPEAKER
They start- they- Tesla and, uh, Sol, um, LG, I think first started shipping in mid-2017. A- but, on the other hand, the- the regular battery systems that- that we've all been- as, in the solar industry, have been installing 'em, really forever.		<b>Barry</b>
But like, 'forever' being ten years or eight years? Four years?	00:21:48	<b>Dave</b>
Forty years.		<b>UIS</b>
Yeah, I mean, again, just as a quick history, w- w- we didn't pass net metering in the state of California until 1995. I- it, post that policy, that policy basically enabled a market of photovoltaics being interconnected to the grid without a battery. Pre-1995, nobody was doing photovoltaics without a battery. So, anybody that's been in business for more than those twenty years has been installing batteries.		<b>Bernadette</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Yeah, see, you had the whole off-grid market, which Bernadette's talkin' about. And then, um, after the net metering program, after net metering was passed in 1996, in 1998 I moved from North Carolina where I helped to start the North Carolina Solar Center, moved to California in 1998 because the rebate program started in California. Um, at that point [clears throat] that, uh, was also right before a very historic point in history which was 2000. So, we have the Y2K, there are probably in the room that don't remember that. But, um, uh, Y2K was a really big deal. And there were probably on the order of- in the rebate program, with PV, over two thousand [2,000] systems that were installed in the '98, '99 timeframe, uh, for battery storage, for Y2K. Um, these were primarily of two types of batteries, uh, which still exist today. Uh, flooded lead-acid batteries and valve regulated lead-acid batteries. Um, valve-regulated las- lead acid batteries became very commonly used in the timeframe. Uh, many of those systems are still around. A lot of those being twenty years old, those lead-acid- those -tho- V- VRLA batteries are gone, uh, but e-e- we're talkin' about over two thousand [2,000] systems installed into that, uh, program and, um, these were mostly 48 volt, uh, systems with lead-acid batteries. And, uh, and those systems still exist today. Um, there's still products on the market. Um, they can still be installed according to the code today. And, uh, uh, and- and they're slightly different than some of these other, uh, technologies where, um, your lithium ion batteries are required to have, uh, battery management systems. That's a- that's a basic requirement of the National Electric Code, it's also a basic require- requirement of the building code and, um, where as lead-acid batteries are much more simple in their, uh, application and, uh, uh there are much simpler battery management systems that are basically just charge control systems, we call them, and, um, there are numous- numerous charge control systems on the market today. They have ground-fault detection in 'em, there's all kinds of different safeties in them and- and those systems are also part of this market. Although lithium ion is certainly taking over a big share of it.</p>	00:22:23	<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>One other thing, David before we move of this, um, section, um...these, I think, I just wanna e- suggest some caution on, um, defining this market by these categories, um, because there's al- there- they s- these def- these categories: residential, light commercial, commercial, industrial, they are, um, on one hand, utility rate structure-defined. On the other hand, they are just customer defined. Is this a home that we're installin' a system on? Or is it a mutli-family residential project that is actually large in size, but it's still considered residential to- you know, in the marketplace. So, these- if you're- if you're loo- obviously there's patterns there, there's gonna- generally you're not gonna have an industrial sized, um, storage and solar system on a residential property, but I think, you know, one of the things Paul could speak to is, you are gonna have some pretty large systems on a residential that is pro- definitely bigger than a 7-11, right? 'Cause you're gonna have some big- and Paul can speak to this, um, so, we just have to be really careful that, um, what we're talking about in terms of divvying up the market, um, is just, it does- nothing fits neat and clean into any one particular category or size definition.</p>	00:25:01	<b>Bernadette</b>
<p>I'll just add, uh, um, brief story. Years ago, there's a fellow up near Auburn, California. And, he had, uh, for a while, he had the largest residential PV system in the state. And then somebody in Southern California built a bigger one so he wanted to regain the top position, so we went out and we expanded his array and we finished the work and, uh, the company I was working for had supplied the inverters and I was asking him, I said, you know, we expanded the array, you know, "...what do you think?" and he says, "Well, it's- it's, I-", he says, "I like it, looks great bu- but it is a lot farther walk to the heliport. So, let's not, you know, we need to be careful, as Bernadette said, about when we say 'residential', I think we think of the homes we live in but some of these homes can be very large or, you know, ranch properties, things like that. So, we need to be a little bit careful about trying to define these things very precisely. These- these terms, I think, while they do have a utility aspect and a tariff aspect, um, as you get into commercial,</p>		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
light commercial, commercial vs. industrial, those lines get very, very blurry. We- we just need to use caution there.		
Okay, I guess- I guess what I'm trying to understand though is the installation and the type of systems, you- I- you're saying that they're very similar. No matter how they're- what type of- of project it would be. Yo- you're- there's no, like, you don't go- you don't go from the separate component system to something else if it was, say industrial?	00:27:29	<b>Dave</b>
Yeah, I thi- I think, um, e- eh- as Barry mentioned, the- the industry- the solar industry and the storage industry, the- there- there is this, um, uh, strong, uh, uh, component of being- being modular. And so, you can say, well, we, uh, we can have, um, you know, one big thing or twenty medium sized things or four hundred [400] little things. And those design trade-offs, there's costs and reliability and so on. So, um, the company that I work for, we build very little things and we have people install lots of them. Um, and that works, but we would not try to do, like a utility scale system because it- it just ec- doesn't make economic sense. So, in general, there is a pretty broad range where this modular approach can be used but then it really starts making sense to say, "Well, we have the smallest module, then we have the medium sized module, let's start using the medium sized." And then at some point you say, "Well, that doesn't work, let's use the big one." So, while it is highly modular, the building blocks, um, can be different sizes.		<b>John</b>
So, so, in- just in terms of those building blocks, you kn- when you get into industrial and utility scale, the batteries are generally delivered in containers and, you know, Tesla will put in ten containers of huge batteries and that' that's different than what we're talkin' about here?		<b>Barry</b>
Well, and its- it's all party of the market, I mean, so, I- I have clients- I work with, uh, wineries in- in Napa Valley and, uh, one of- one of my clients, they had, you know, two days during- right in the middle of harvest where they were without power. Um, they're very serious about needing backup power, they're, um, through a variety of methods, both diesel generators as well as battery power and things like that, and so, um, th- these clients, uh, and- and- and- and the market really parses out in- in a very similar		<b>Bill</b>

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<p>way to the way PV has historically. Um, and the products are very similar in that way and that, you- we have very small inverter systems, we have medium sized inverter systems, we have large inverter systems and then we have massive inverter systems, which are in the three to five-megawatt range. Um, and each one of them has their place, each one of them has their markets. Uh, we don't see 3 to 5 megawatt, uh, inverter pads being used in commercial at all. Um, uh, we see mostly anywhere between thirty to a hundred and fifty kilowatt units being used in the- in the commercial and industrial market. Uh, and we see lots of- lots and lots of those. Uh, the smaller- the small commercial side of things we're gonna see residential-sized inverters up to the thirty to forty-kilowatt inverter sized range. And then in the residential, when you say the word 'residential', everybody things about single phase, two forty [240], one twenty [120], but as we've seen a couple examples here, and, uh, folks like Clint Eastwood, um, they have four-eighty [480] vol- three phase, they may even have medium voltage supplies to some of their facilities, and so, uh, you know, so the- the term 'residential' obviously, we can say, 'single phase', uh, that would be a better delineation because residential in California, because of movie stars and billionaires can be just about anything. And, uh...</p>		
<p>But Bill, co- just a clarifying questions [sic]; when you were giving those sizes for some of the, um, commercial, um, industrial, those were, um, pads, inverter pads, as you were talking about, up to a certain size...</p>	00:31:35	<b>Bernadette</b>
<p>Mm-hm.</p>		<b>Bill</b>
<p>But any typical, uh, solar and storage system would have multiple, um, pads strung together? Correct? To be something bigger than the sizes you were talking about.</p>		<b>Bernadette</b>
<p>[OL] Po- possibly. Possibly, so- so there is a break point. At some point, uh, just as there is in ss- in medium sized inverters to large inverters and things like that, um, in the PV side of things there's also in the storage industry this break point where at some point the modularization just doesn't make any sense anymore. And it's easier to bring a container. And when you bring in a container, turns out that bri- container's got switch gear, it's got all kinds of equipment, uh, already built into it. It's not like, somebody's out</p>		<b>Bill</b>

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<p>there with a- with a pair of wire cutters going, "Oh, let's see if I can hook this up to that."</p> <p>And, it's like, "No, no, no!" This is engineered, built, uh, very serious equipment, um, and, uh, so, so, I think one of the really encouraging things, um, about what's happened in the last, say five years, in the energy storage world, is that we have a lot more engineered systems. From the very small range, which would be Enphase, that's about as small as it gets, uh, up to even megawatt size range. Very eh- very well integrated, very well engineered and, um, and what's really pushed that has been the lithium ion world. Because the lead-acid world was pretty well established. I mean, everybody that worked in the lead-acid world, that's the telecom industry has lived on lead-acid for a hundred years? Plus? I mean, y- you know, they- they have their way of doin' things, and nobody can tell them how to do lead-acid batteries. Um, and so- th- and there are good products around that whole lead-acid world. But lithium ion was a fundamentally unique thing where you were actually having to control on a cell-to-cell basis and string-to-cell basis in a way that lead-acid just doesn't require it. And when you get to that level of- of battery management, it requires- the safeties and everything that go into that are so intense that the installer is really somewhat insulated from a lot of those issues. It's like, you know, before, with lead-acid, I have to know something about what the short circuit capability of that lead-acid battery is. I gotta make sure my over current protection is- is sufficient for that. And I've gotta go through all the things that you do when you design a system in- in the electrical world as an engineer. Um, with- with the lithium ion phosphate batteries, or cobalt batteries, it's just, tell me how big the breaker is. Okay? Tell me what size wire I gotta connect to it, okay? Okay, here's the fault current capability of it. Well, you know, especially stuff that's goin' through electronics, which most of this stuff is goin' through electronics. Once you hit a piece of electronics, your fault currents go to nothin'. I mean, they absolutely go to nothin'. And- and, so, it's like, "Okay, I'm kinda waiting for the shoe to drop here, what's- what's so hard about this?" And, uh, so- so the fact is that these standards, 95-40 for energy storage systems, se- 1973 for the battery systems, for the</p>	00:32:43	

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stationary battery systems, have really moved the ball way down the field from a safety point of view.		
One thing I- I would like to mention is, we're- this- this dev- uh, report development is a group effort and two of the leaders on that group effort are with us: Mike Fra- Mike Shimnenski [Ph] and Justin Paddack. Did you guys have anything you'd like to- any questions you'd like to add regarding the first two, uh, issues- topics?	00:35:09	<b>Dave</b>
So, I- I appreciate the distinction between the Clint Eastwood home and the normal home. Can someone just walk me through your typical job? Twenty-five hundred [2,500] square foot home? Wh- what's it gonna look like? I want solar and I want a battery.		<b>Justin</b>
Well, you- you can do that now, right? [laughter] So, so, typical system, um, customers interested in solar and a battery. Um, the- the contractor's going to gung- go there and gather information. So, the- the information that we like to gather is how big is the roof? Which is gonna, you know, tell us how many solar panels will fit on the roof. Other bit of information is, um, wh- what's their electrical consumption? So, we wanna kind of match that. An- and now with the batteries we also want to try and kind of help them in terms of, um, reducing their peak energy use. So, with that information and some insight into what their budget is, the- then we'll develop a system, say twenty solar panels on the roof, uh, and then, you know, one or two big lithium ion 10 kw hour batteries, then, uh, that customer will make the decision as to whether or not they wanna buy that system. Assuming they purchase the system then, um, and- and, uh, then, uh, it's a matter of getting a building permit. So, we go through the building permit process with varying degrees of streamlining and pain, depending on the locale. Some cities are really fast, like San Jose, um, they just, you kn- sits online. Eh- once- once the permit is received, we can then schedule a time to go to do the installation, make sure that the crew is- is, you know, properly trained, has the right qualifications. We'll go to the job with a battery, with the battery components that are necessary, with the solar panels, with the racking, um, you know, go up to the roof, put the, uh- uh, we always, the first thing to do is put, uh, safety devices into the roof; roof anchors so that the team who is on the roof can		<b>Barry</b>

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<p>make sure that their- their, that they've got the proper fall protection. Put the solar panels on the roof with the racking. Run some wiring down to the location of the inverter, the inverter goes on the wall. N- generally, next to the inverter, there's- the battery's located and- and generally that location is all near the service panel, near where the electrical meter is. Uh, make sure everything's wired up properly. Test it, check the voltage, make sure that everything's done safely and turn the system on, test it, make sure it's operating, turn it off. Then, file the interconnection pap- uh, get- then, once it's off we then get the final building inspection done and once that final building inspection is received, we then sc- uh, send paperwork to the utility to get the interconnection permission. Once we get permission from the utility that it can be interconnected and PG&amp;E c- th- th- h- has been, um, very, very fast at that over the past few years; I mean, less than a week. Um, then the customer gets a note that they can turn the circuit breaker on and then the system just operates automatically. Commercial and, uh, light commercial, commercial; almost identical process. It's just that every single step takes longer.</p>		
<p>Can you give us the two seconds on what gets submitted to the Building Department and how is it ge- who reviews it? Um, and then also just a clarification; interconnection's only fast on the residential side?</p>	00:38:37	<b>Bernadette</b>
<p>Go- goo- good clarification. Yeah, I- I- I feel the pain occasionally on commercial. Um, i- and by the way, the interconnection is so slow on the commercial side that generally, when- when we do commercial projects, we do a "pre-interconnection". So, even before we start work, even sometimes before we even sign the contract, we make sure that it can be interconnected, otherwise you get a situation where they say, "no." Um, wh- what gets- th- there's a design process that there's a handoff at every job. Let's say the customer says they want twenty solar panels and a battery, um, usually an engineer, or a very skilled person who's NABCEP Certified will then either go to the house or look at all the- the photographs in the aerial photos. Um, and then have an engineer put together a set of building plans. And- and I'm just kind of skipping through in my mind what goes</p>		<b>Barry</b>

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<p>into those building plans, but you've got a- I mean, this is just a standard set of plans that you'd see for any electrical work. You'll have a site plan, you'll have a list of all the codes that are required to- ta- to be met in that case. You'll have a picture of the house, aerial photo of the house plan view where you can see where all the panels are located, making sure that we're cu- um, uh, properly set back. There's an eighteen-inch setback from the ridge and things like that so, those are fire restrictions. Uh, then there- then there's usually a one or two-line detailed electrical drawing that specifies every piece of equipment, every wire, every conduit, has calculations to make sure that the, um, conduit and the wire can handle the necessary voltages and current. Um, and- and, uh, I think that the next page usually is a- a page full of labels, bizarrely. These are all the labels that are required by the various electrical codes to make sure that the equipment is properly marked for safety reasons. And then you'll have some cut sheets with all the equipment that's- that's being done on that installation. And that whole package typically, a dozen pages or so, is submitted to the building department, reviewed by the building department and then either approved, I mean, in which case we can schedule the installation, or they may have some questions or clarifications and the plans are modified.</p>		
<p>And- and how is that any different if it's a solar and storage system? If at all?</p>	00:40:55	<b>Bernadette</b>
<p>There's- the only difference if it's a storage system is that the, um, the electrical page and the plan will show that there's a battery. That's it. There's like, no other difference.</p>		<b>Barry</b>
<p>Yeah, I- I would just point out that in California we- we had some legislation pass that, um, expedites that and standardizes those permitting packages. Um, because it's- it's a, you know, the solar industry has grown so quickly. We had different, um, different jurisdictions with different levels of expertise and so, there was a, um, a directive from the legislature to develop a standardized permitting package and standardized way that all of the building departments, uh, use. Now, um, it's one of those 90/10 kind of things, i- it catches the vast majority of installations but, um, you know, if there are other complexities then it may- may exit out but, uh, my point in all that is, that's very well</p>		<b>John</b>

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defined, um, and, uh, the company I work for worked very closely, um, uh, a lot with, uh, L.A. Department of, um, uh, Building Safety, uh, to develop those- those, uh, permitting packages and the engineering behind them and so on. Um, and so, it is very much standardized, um, and, uh, particularly for residential it- it's pretty much a cookie cutter type approach.		
An- and I have- I have sample- actual- actual plans that we use for another- number of our jobs on my computer so, I can show you the difference between a- a battery plan and a regular plan, but the only difference really is that picture of a battery on the plan on the engineering page and then a cut sheet for the battery.	00:42:31	<b>Barry</b>
And can I just elaborate one more thing, and Barry can correct or clarify, um, the recent install that I- os- um, had the pleasure of going on of a solar and storage residential system. The same team, um, [UI] two guys that were the ones down on the ground doing the inverter, um, and the storage system and the telecommunications components on the wall, those are the same two guys that if it was a plain vanilla, just PV system, would have been doing the inverter pa- side of- of the- the install, and so there's that and another big box, uh, essentially. So, and from a installation [sic] practices point of view, from what I observed, so Barry, you should clarify [if] there's anything there to elaborate on, but it- it was the same folks and the team that did the inverter.		<b>Bernadette</b>
Yeah, that- that's exactly it. Sometimes th- the only difference may be that you might need a third person if you have to lift the battery up very high.		<b>Barry</b>
And an inverter is a- what translates the- or transfers from the PV panels to DC power, to AC power, just so you know.		<b>Ed</b>
Is it the same permit if you're doing the solar, eh, system and the, uh, battery? Is it just one permit or is it separate permits?		<b>Dave</b>
It's just one permit. Um, and- and as Ed pointed out, it- it's the same exact inverter. So, m- um, most of the new inverters on the market are gonna be designed so that they have a battery input or there's a control box that can control- that can connect the invert. And		<b>Barry</b>

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Enphase's product just has a, you know, there's just an extra box that- that hooks into the regular system that provides the battery power.		
Some of the manufacturers, um, have now adjusted their equipment, um, with this onslaught of, you know, required or requested storage to go along with these systems. There's some [sic] contractors out there today that won't install PV any longer with PV only. They're preparing for the changes with the rate structures and so on so they're adding, uh, storage and we're a company, uh, Simplified Power, that are not only a battery manufacturer, but we are answering the call, um, with that equipment to integrate it. So, we've taken, like for example, Outback Power is a- a very, um, very, uh, reputable and long time, uh, company out there that's- that have been installing and, I mean, have been manufacturing, um, s- equipment and PV systems for, um, inverter systems for, uh, the industry for, uh, I would say now-	00:44:17	<b>Paul</b>
[OL] Twenty years.		<b>John</b>
...twenty some years. And they have adj- recently adjusted their offering with a- a- an inverter that, uh, that is now including storage and there not only UL Certified, like John was sayin', but they all have all the safety features so, pretty much it'd be- has become like an appliance and then they take our battery which has all- again, all those safety features that, uh, you know, Barry, Bill and John were re- referencing. And that has, um, an on-off switch included with that battery, so you can leave it off. So, it's unlike the older flooded lead-acid batteries that were pretty much represented some similar battery to a car battery. They were flooded, they had electrolyte in there, um, they- there was no way to turn it off, you know, it was- pretty much sat there live all the time and could be dangerous even in a 12 volts configuration, um, through- with explosion because of the outgassing and so on. Um, this is no longer the case with batteries like, what we manufacturer. Uh, they're very safe battery- very sta- safe storage system. Um, it has, like I said, over current protection built in to it. And like Bill was sayin', is part of the standard is, there's a battery management system. What we reference as a 'BMS', that's included in every battery that we manufacture. So, you leave the system off, and then		<b>Paul</b>

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<p>when you commission the system you turn it on, you turn it- all those individual modular batteries on and, um, now you have a no- a working commissioned system.</p>		
<p>I, I- I think it's, I mean, the reason why we're here is there's really just a- a sea change in- in the whole energy storage and- and- and PV industry and the energy industry as a whole is- tha- that PV systems have always been DC, they are DC, um, and the batteries are DC. But the biggest change is that it's- because of the way the rate structures are developing, an- and now because of the issues that we're having in terms of electrical reliability, and they may get worse, um, the whole- the whole PV industry is changing to PV and storage. I mean, my company was called Cinnamon Solar two years ago, we re- we rebranded to Cinnamon Energy Systems because our customers were asking for batteries. There used to be a great, um, association called the California Solar Inerse- Industries Association and because of the demand for the batteries and- and the match with the- the contractors, rebranded under Bernadette's direction to California Solar and Storage Association. So, this jus- it's just kind of a seamless migration to, um, solar with storage now.</p>	00:46:58	<b>Barry</b>
<p>Ye- an- is- well, it's also t- important to realize that the birthplace of PV was with storage. It was not...the- they were not separate items whatsoever. Um, the fact was you did not install a PV system until...until '99 and maybe 2000. In '99, even in '99, I don't think there were very many, if any, systems that went in without battery storage at that point. There were a couple of reasons for that. Obviously, the Y2K was huge. Um, and I've worked with massive organizations that were dealing with that but- but, um, you know, battery storage and PV were hand and glove, always. And then, um, in order to save money, in fact, right down the street here we have Sacramento Municipal Utility District and they were very involved with PV and they did- they did some systems in their Pioneer Program that were battery-less systems. They- they kind of pioneered battery-less systems around here as grid-tie-only. Uh, because they really- they weren't, as a utility, interested in the- in the storage aspect of it and- 'cause it was all grid-tie. And then after Y2K came and went, then several manufacturers, uh, Trace Engineering was the first</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>one, uh, came along with their smud inverter and they sold it to other people. Um, and- and people started buyin' that because it was cheaper, they didn't have to have, uh, batteries. And then, uh, they built a purpose-built product, which as [an] abysmal failure, but that's another story, and then John Berdner came to the rescue with SMA, uh, for systems that did not have battery storage. That was totally unique, totally new. Nobody had every done that before. "A PV system without a batter? What are you talkin' about? That just doesn't seem right." And so, the idea of the world we're in now which is PV only, is- is so common, was never the way it ever was before. Um, and so, we're actually seeing, kind of, returning to our roots in many ways, as the energy storage, uh, has- has a purpose. Uh, these electric rates, as the Public Utilities Commission continues to put out horrible electrical rates, cannot understand that. It makes energy storage absolutely required. It's not like it's, "kinda nice", it's like, "well, I can't do PV without energy storage now because what do I do with all that power that they're not gonna give me any money for? I gotta stick it somewhere." And so, so now he's like, well, PV panels are inexpensive. They help the State of California, they help me. I gotta have storage to make 'em work. And so, PV plus storage- and then there's one other piece of this game, and we were chattin'- s- got several PV owners over here, it's really, the way I see the future of- of in California of- of energy, especially in the residential world, is PV plus EV first, plus storage. Actually, is really the- the- the key combination, is a combination of a PV system and EV for transportation and a local storage system that provides resiliency, provides backup power. But that- that local storage is fairly small compared to the EV which is- could be quite large, I mean, you know, a bolt has what? 60 kilowatt hours?</p>		
<p>Fi- fifty.</p>		<p><b>UIS</b></p>
<p>Fifty kilowatt hours. That's- that's a pretty s- healthy, you know, we've got obviously Tesla's got a hundred [100], hundred and five [105] kilowatt hour storage systems and, um, and now we're startin' to talk about some real storage so...so that's- that's really where the market is going and- and when- let's turn it back the other way and think of it upside-down, a battery system without PV, you know, we were chattin' about this earlier,</p>	<p>00:51:38</p>	<p><b>Bill</b></p>

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<p>is like- is like a day without sunshine. It's like, "wait a minute, um, why would I have a storage battery without PV, particularly from a resiliency point of view?" It's like, okay, the power goes out, and I start eatin' into my battery and I'm like, "...well wait a minute, I've got 10 kilowatt hours of battery storage here, I'm gonna be out of that in 3-5 hours, maybe- maybe even less but- or, I might be able to conserva- conserve and go a little longer." Well, typical outages that we're having for- whether it be for storms or- or whether it be for wild fires or earthquakes, 2 to 5 to 10 days is what we're talkin' about. And so, it's- you can't have a big enough battery to make it through those things. There is no resiliency benefit to a 10-kilowatt hour battery, you know, because you're gonna be out of it so quickly, you have to have something to- to charge it back. And that's where PV and storage has to work together.</p>		
<p>It- it's just interesting, you know, we're talking about the size of the batteries in our garages, um, you know- the- the- the- the batteries that have been commonly installed initially with solar, 10-kilowatt hours for LG that, um, Enphase is at 1.2-kilowatt hour modular battery, so you use a bunch of 'em. Tesla's 13.5, but we're routinely driving cars with 50 to 100-kilowatt hours of storage so, you know, people have those parked in their garage. And- and Bill's point about these- these power outages, it's not academic, I mean, I got two phone calls yesterday, um, or earlier this week from customer's whose- they called basically to say, "...my power's working, I got my lights on, I can use my microwave, none of my neighbors have power." And then, that- that battery will gradually decline but on a sunny day or even a partially sunny day, they're back in business because it's- the PV is connected to the battery and chargin' it up.</p>	00:53:01	<b>Barry</b>
<p>I really wanna let you guys ask questions but I know from sitting through a lot of conversations on this topic over the past 12- months, a- a- a lot has been made about amps and volts and- and so, you know, I just wanna come back to this one question of ESS ampy- amps. Um, can- can our- one of our experts elaborate on the, sort of, amp ridge, voltage, slash-danger of a storage device versus a PV panel? So, C-46 there's not question, the question is not at all on the table that what has historically been put on the</p>		<b>Bernadette</b>

TRANSCRIPTION	TIME	SPEAKER
<p>table, that the C-46 is capable of installing safely at PV system. Now, we're putting on the table that the C-46 is- is not capable of installing safely a storage system and much ado has been made about storage devices on a safety front. Can we just elaborate on the relative safety issues of PV versus storage?</p>		
<p>Sure, so, um...if we look at, uh, PV systems, um, the- the- if we look at residential PV systems you can have DC voltages up to 600-volts DC on the rooftop. If we look at commercial systems, it's currently a thousand [1,000] volts DC. Um, and, uh, in other parts of the world, up to fifteen hundred [1,500] volts DC. Um, and, you know, it- it- it has some, eh, characteristics that are similar to energy storage in that, you know, PV modules, when they're exposed to sunlight, they produce electricity. So, this, sort of, "...how do you turn it off?" question, um, you know, is also true in PV and, uh, in the national electrical code there's a number of ways to do that. We- we have, um, we call them 'Series Strings of Modules' and they have to have dedicated over current devices and then there's the different levels of switches and- and the connectors can be used to segment, um, segment those arrays. Um, I- I would say the area where they differ- PV systems differ then, um, energy storage cells. Let's be very clear, we're talking about the individual battery units, is that they are current limited. So, the amount of current that you can get from a PV module is going to be based on the sunlight intensity and those currents during normal operation versus fault situations, they're very similar. Um, because the PV modules are inherently current-limited. If we look at a energy [sic] storage system, again, we look at the individual cells, um, again, they're- they're, uh, wired in series to increase voltages, um, there's sort of two classes that you see- the world kind of breaks into this 48-volt world. Um, or a- a quote, unquote "High-voltage World", and- and, Bill, I believe it's four hundred [400] volts DC? Um, so that- there's an actual electrical code limit at 400-volts DC which is obviously less than the PV limit of 600- volts DC. Um, however, the- the individual battery cells, and as Paul said, it can even be true of a 12-volt battery, um, they have a higher ability to deliver, uh, fault currents. So, if you were to, uh, let's say, drop a wrench on top of a battery cell, um,</p>	00:54:51	<b>John</b>

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they'll be a large spark followed by expletives by everyone nearby, um, and, uh, uh, so, there- there is that potential for, um, for high-fault currents.		
And that would happen under the hood of your car?	00:57:40	<b>Barry(?)</b>
It would also happen under the hood of your car. Um, years ago, uh-		<b>John</b>
[OL] And they're worse because starter batteries have much higher currents-		<b>Bill</b>
[OL] Absolutely.		<b>John</b>
...than- than normal stationary batteries.		<b>Bill</b>
<p>[UI] Yeah- yeah. So, um, I think the principle difference eh- between, uh, PV and- and energy storage is that the battery cells themselves have the potential for, um, very high fall currents. Um, and of course, if you put something directly across the terminals, there's no...over current device because it's intrinsic to the device itself. So, um, I would say that- that's the principle difference that I would see. Um, when we start looking at the- the systems that are routinely being installed today, uh, residential and- and light commercial, um, the- those battery, individual battery terminals are not accessible to the installer. They're – they're, essentially e- buried inside the unit and then that- the unit has of course has been evaluated by- by UL or the other NRTL, um, to the relevant standards and that includes, um, you know, a lot of testing about the enclosures and, again, how do you keep the fire and electricity inside the box? Um, and so, that's been fully evaluated. So, we have to- i- in my mind, when we- we talk about batteries, we have to be, uh, um, very mindful of, is this an individual cell with exposed terminals and- and if you assemble a lot of them together, are those terminals and associated, uh, cables or bus bars, are those live? Are they accessible? And, uh, you know, what voltages are present on those exposed terminals? When we talk about a lot of the products that are being sold today, again, they are very much more, uh, like an appliance. There are no exposed terminals. Looking at, even a- a- looking at the LG battery, um, it has, uh, uh, circuit breakers, and so on, on it so, there- or- are no lo- live terminals that you could accidentally come into contact with in our- <b>[cont.]</b></p>		<b>John</b>
<b>[END OF RECORDING]</b>	00:59:59	

TRANSCRIPTION	TIME	SPEAKER
<p><b>[cont.]</b> ... product we actually include the inverter inside the battery enclosure. So, there is no DC terminal to our device, it's external. It only produces AC power. Um, so, uh, what'd I miss, Bill?</p>		<p><b>John</b></p>
<p>Well, yeah, I mean, I- I think that t- the market, particularly in the- in the vast majority of PV plus storage market is moving toward lithium ion, which- by, as we said before, by its very inherent, uh, needs is very straightforward to install. Um, like I said, you know, you can take a simplified battery and short the terminals and it's got a, it's got a breaker sitting on top of it...an ADM breaker. And, it's like, all you're gonna do is trip the breaker. I- I do that in a minute compared to my car battery. I mean, a car battery- that- that wrench jumps off the top and shoots off, you know, to the ceiling and you go, "Oh, that was bad!" You know, but eeee- the f- eh- the other part of this is I- I been teaching [sic], you know, installation of- of these systems for a very long time and lead-acid batteries were the only batteries in town for a I- very long time and it will be arou- they will be around for a very long time to come in the future. And it's not that lead-acid batteries are dangerous. Lead-acid batteries are very workable, you know, we have VRLA batteries and- and that's the vast majority of the batteries that are used on the lead-acid side of things. They have very high current capabilities. They're still less current capability than your home panel. Okay? The- the panel in your house, the electrical panel in your house is ten times more dangerous, ten times more dangerous than a lead-acid battery. And it's like, where's all this concern coming from? I know that I don't put a wrench across a battery. I- I wire it a certain way. I- I can enclose it so that the terminals aren't accessible, all this kind of stuff. So even if I'm doing a lead-acid battery, which is becoming more rare, quite frankly, because these other products are very good. And quite frankly, lead-acid batteries are great for standby power but they're not good for cycling power. So, where we're going with a lot of things that are going on today in the energy storage world is, we're going toward systems that are having to do two different aspects of energy storage. One is daily cycling, a lot of people call that 'energy arbitrage', where we're storing morning power and then taking it out in the evening, that's one way. And then we</p>	<p>00:00:14</p>	<p><b>Bill</b></p>

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<p>need backup power, we need both. We- we want both, right? And so, we're using the- the battery for both purposes and lead-acid's not so good at that market. What it's always been good at is cell towers, you know, and telecom and it sits there, it never gets used until there's a power outage. So, if that's the application, if all you care about is power outages, lead-acid battery's your battery. And that's by far the cheapest battery and the way to go. But if you wanna do daily cycling then you're gonna really need to go to lithium ion, that's where the cycle life is. And so, that's where a lot of these products are being sold, that's where they're going. And then it's just like, so, uh, so, a lot of these- these permitting guidelines that you see were things that I developed over the last twenty years here in California. And we've come up with national permitting guidelines, we came up with state permitting guidelines, all this kind of stuff. We're, we- I- I'm on the committee doing the permitting guidelines for energy storage right now. And the energy storage guidelines are requiring 95-40 equipment. Well if you have 95-40 equipment it's like, okay, w-w-what am I doing? I- I so- so simple, so sate- straightforward, I- I open the manual, it tells me what size conductors to install, it tells me how to install, and I hook it up and I'm like, okay, now what? Well, you flip the breaker on. Okay, now what? It works. You program it, and it's like, "Oh." You know, in the past, so, what I had to teach people when we're doin' lead-acid batteries is, okay, there's your lead-acid, here's series parallel arrangements, okay, you can get your series parallel- series arrangement to get your voltage up to 48 volts, 'cause they were all 48 volt batteries, and then you put 'em in parallel because that only has a hundred [100] amp hours and you wanted four hundred [400] amp hours. Okay, so you do 4 sets in parallel. And then here's your cables, they're four aught cables and here's the right connectors, here's how you ten- you know, tighten 'em down, all this kind of stuff. And here's your two hundred and fifty [250] amp breaker, he- keep it close because you gotta fa- high fall currents here. This breaker has to be properly rated for all this equipment and here's your enclosures, all this kind of stuff. And then you gotta set all your- your charge controllers up, okay? So, now you gotta- you gotta tu- you set your charge controllers, you gotta- you gotta go through and you take</p>	<p>00:02:47</p> <p>00:04:31</p>	

TRANSCRIPTION	TIME	SPEAKER
<p>your volt meter out and ya- and you set your charge controllers and you get all that stuff straight and they all have to match one another and then you have this oth- you gotta put your temperature sensors on here, and there was a lot to talk about. We'd spend several da- you know, w- i- in a- in a 3-day class, a day and a half of it was going through all the things that we'd do in- in d- that energy storage system. And so, and this is twenty something years ago. And so, and these were all solar contractors that were doin' this work.</p>		
<p>C-46 contractors.</p>		<b>Bernadette</b>
<p>C- that's absolutely right.</p>	00:05:34	<b>Bill</b>
<p>The license was invent- created in the eighties, right? So, this is what they were doing-</p>		<b>Bernadette</b>
<p>[OL] That's right. And this is- this is 1999. Um, partying like Prince, but anyway, that's another story, um-</p>		<b>Bill</b>
<p>So, I have a question. This is more really for my own understanding. Um, one of the things we heard yesterday was that, uh, the installation of a solar PV system, uh, a battery is not necessary for the installation of a solar PV system. It's something that could be ancillary, but it's not required. Um, but what I'm hearing is thirty years ago it was. I was necessary to have a battery.</p>		<b>Mike</b>
<p>Absolutely.</p>		<b>Bill</b>
<p>And it always was.</p>		<b>Mike</b>
<p>A, and it is because of the rate structure changes that are stem- i- being driven by the state's need to get to one hundred [100] percent clean energy-</p>		<b>Bernadette</b>
<p>[OL] Right.</p>		<b>Mike</b>
<p>...they are absolutely coming, if not already pretty much necessary.</p>		<b>Bernadette</b>
<p>So, pretending for a second that I know absolutely nothing about the technology or bat- any- any of that, which I don't, can you just very basically explain for me- th- the core purpose behind the, um, flooded lead-acid battery from before 2000, and then [the] Tesla stuff we're talkin' about today, their sole function, does it remain the same? It stores energy?</p>		<b>Mike</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Correct. So, back pre, um, back in the '80's and '90's, the battery made the sun shine at night. Today, what- what- what I think Bill was trying to get at is today the battery does two things. It makes the sun shine at night, maybe 3. It makes the sun shine at night, more importantly it makes the sss- electricity turn on during an outage, but the third thing it's doing is it's pre- it's allowing us to integrate more renewables by making the battery work during heavy demand periods.</p>	00:06:50	<b>Bernadette</b>
<p>Right, and in some ways, perhaps ironically, the new batteries are safer and there's less concerns, or you're more insulat- 'cause of the circuit protection and all that stuff, the lead-acid stuff was more dangerous.</p>		<b>Mike</b>
<p>Exactly so, the C-46 license has been created and the folks have been tested to a much more complicated system that it [i]ronically is today.</p>		<b>Bernadette</b>
<p>[OL] Yeah.</p>		<b>Bill</b>
<p>As these batteries become more common.</p>		<b>Bernadette</b>
<p>An- and I- I hesitant [sic] to call it dangerous. I mean, that's i- I- I always get a little worried about that. 'Cause we work in codes and standards and I'm all- on all the same standards committees with John and everything and- and we're working really hard to make sure everything's safe and done safely and things like that. And if we were to compare the two, you know, is it safer to install a lithium ion battery versus a lead-acid battery? And the answer's absolute yes. I mean without a doubt. Um, does it mean that lead-acid's dangerous? It's like, no. I- It's- it's a hazard like any electrical piece of equipment. Photovoltaics can be operated anywhere from 48 volts up to, now fifteen hundred [1,500] volts and utility scale equipment. Um, routinely in our commercial equipment, a thousand [1,000] volts. Uh, six hundred [600] volts on residential all the time and so, uh, these, an- and when you- when you talk about those things, those are all- those are all shock hazards...okay? Um, and they have to be done correctly, they have to be done- so, we can't say that PV system's unsafe and our energy storage system's unsafe, they are safe, they have safety standards that govern how we do those things and, uh, if we don't follow those rules, oh yeah, they can become unsafe, for sure.</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>And let me just add-in one more thing and that is that the C-46 contractors in the state of California today have been installing PV systems, plus PV and storage systems of all sizes. So, I think there's a common misperception out there that the C-46 is, uh, just a small residential single phase, uh, systems. And the C-10's do the large- it's a mix, um, so I just wanna be clear that- that the history of folks that have been installing successfully without major incident, large commercial and industrial PV, as well as PV and storage, includes C-46.</p>	00:09:00	<b>Bernadette</b>
<p>So, I can just clar- I'd like to just clarify a few things I think I heard. Uh, you're not aware then of any real safety issues that have- that have happened? There've been anybody electrocuted? Any pro- properties burned?</p>		<b>Dave</b>
<p>I'm unaware, we reviewed Cal OSHA incidents. The only thing we saw was somebody dropped a battery on their foot.</p>		<b>Bernadette</b>
<p>Okay.</p>		<b>Dave</b>
<p>Uh, I would actually ask you, um, [UI] is any, um, safety incident been presented to the CSLB to warrant this investigation?</p>		<b>Bernadette</b>
<p>Well, we're just asking the questions right now and it'll be something- it'll be disclosed later. I me- people can say what they wa- what they wish, and we'll have to verify it. Now as far as, is an ESS a distinct and separate system? I think you've said it's not, it's part of the- is it separate from the PV?</p>		<b>Dave</b>
<p>So-</p>		<b>Bill</b>
<p>[OL] Would you consider it to be included or separate?</p>		<b>Dave</b>
<p>So, it's- it's important to understand that, um, these are energy systems and I think that's, you know, even indicative of- of, uh, Barry's company name change is that, um, when we're talkin' about a resin- residential energy system, uh, historically those things did include PV and batteries and possibly a generator. You know, so, so, back in Y2K it was energy plus storage plus generator. And, um, because everybody knew that after four hours that- or whatever, they might run out of power and so, there was a lot more to it and, um, and so, anyway, the- the point being that, um, when a customer comes to Barry</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>or one of these other companies and says, "I wanna do solar." We- we have to ask several questions; what do you want the solar to do for you? And so, historically, you know, battery storage just came along for the ride, whether you needed it or not. In fact, there were systems that were put in, in the late 90's, that people didn't even hook up their battery storage systems but, because the predominant inverters on the market had battery storage [UI]</p>		
<p>[OL] You know, if I could though, if I go to Barry and I say, "Barry, I want a PV system with a battery." B- Barry's gonna say, "Okay, yes, I'll- I'll include that in the contract." And when you go to your manufacturer do you, I mean, just help me understand this, do you buy a PV system from a manufacturer that also has a battery?</p>	00:11:36	<b>Dave</b>
<p>Right now, in general the- the PV modules come from, you know, a group of companies. The inverters come from a different group of companies, the batteries come from others. Companies like Enphase and Tesla are basically integrating it all in- in one- one box together. I mean, I think the most important distinction is that the- the brains and the controls of these- all these PV systems are the inverters. And all the inverters are being designed to connect both the DC input from the- from the PV system and now the DC input from the battery. That's the way the industry's going. And when we do upgrades to systems, we're putting in those inverters that can handle both PV and battery and- and it's- it would be kind of difficult for me to say to a customer, "...we're gonna put a system in, you can't add a battery later." They're all gonna be designed for batteries in the future.</p>		<b>Barry</b>
<p>Who designs it...w- with your company? Is it- do you have to draw a plan? E- and you would submit that plan to the Building Department, it would be for the PV system and the battery...storage?</p>		<b>Dave</b>
<p>Yes, yes-</p>	00:12:56	<b>Barry</b>
<p>[OL] You do that yourself? Or you have somebody on yours- on your staff?</p>		<b>Dave</b>
<p>W- we- u... Uh, I have somebody on my staff, uh, or there's third parties that- that do it, um, very, very quickly. So, w- we outsource that.</p>		<b>Barry</b>

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<p>But- but th- it's, um, to ask the question, the- the- the- the battery device, the square box is in- with the- with the battery inside it, it is no more indistinct from the PV, uh, the- the solar modules on the roof, the black boxes on the roof, than the inverter. The inverter is a separate- comes in a separate box, you order it from a manufacturer that specializes in inverters just like- and it comes in a cardboard box from your distributor. You get a bunch of cardboard boxes that have modules in them. And you get a bunch of cardboard boxes that have storage devices in them. Increasingly, the guys that make the inverters and the storage devices come in one box.</p>		<b>Bernadette</b>
<p>We- and when we-</p>		<b>Barry</b>
<p>[OL] And it's no difference then...</p>		<b>Bernadette</b>
<p>...yeah. When we talk to customers, you just check a box on the software that designs the system, "Do you want a battery with this?" And then it- it all flows, the plans are gonna show a battery on the plans.</p>		<b>Barry</b>
<p>[OL] So...sss- so in other words we could just as easily be talking about needing a separate license for- to install inverters as is any ESS?</p>		<b>Mike</b>
<p>Exactly. Yeah- one of- one of the things, uh, ta- to answer your question, you know, about, uh, how do you distinguish, uh, uh, PV from a, um, energy storage system? Increasingly you will have a single inverter, uh, on the site. And that inverter will have two inputs; one for the PV array and one for the energy shto- storage device. So, if you say, well, are those two separate systems? Eh, not really. From the utility perspective it is a single inverter, it is a single system. Um, and the onl- the- they are connected together internally inside that inverter, uh, the PV array is connected to the energy storage device. Um, so, it- it's very difficult to say, "Well, this is the PV system over here and this is the energy storage system over here." Now, people may install standalone energy storage systems so, um, uh, for a number of reasons. A- a good example is, um, uh- uh, a UPS system. For example, Bank of America down in San Francisco has massive battery storage systems to keep their computers running because you don't want the entire west coast Visa transactions to go down, right? So, that would be an example of a standalone</p>	00:14:10	<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
<p>energy storage application. Um, if you have that facility- that's an example of- of [a] facility that has a critical, uh, load requirement. They have to service that load regardless of what the utility's doing. Um, you- you could potentially have a standalone energy storage system that was doing energy arbitrage, for example, buying electricity cheap at this time of day, s- s- providing it at peak periods. That could be a standalone system. Um, commercial facilities, it is becoming economically viable to use that energy storage device, standalone, to manage demand charges, um, where you have a- a electricity rate that has very high demand charges, they may have a standalone energy storage device. In the context of PV plus storage, you know, that's- that's, it's becoming increasingly common. You'd ask, uh, are they, um, do you have to do it? Do you have to have storage? It depends on where you are. So, for example, in Queensland, Australia, which is where we've installed the majority of our energy storage devices, you're not allowed to export power to the utility. It's no longer allowed. Because they have such a large amount of solar that they- the grid just can't take anymore. So, in that- in that context, unless you have a lot of load during the day, PV, you- you, it wouldn't be economically viable so, energy storage is essentially required due to an economic necessity. Same thing's true now in Hawaii. Um, the state of Hawaii now has, uh, no longer has an exporting tariff. They have what's called 'Customer Self-Supply'. And increasingly, in the interconnection, uh, uh, world within California, there is um, uh, uh, uh, a increasing discussion about, we are going the same way. And it is inevitable because if you want to meet the- the- the society's goals, being a hundred [100] percent renewable, as is in Queensland, as is in Hawaii, as is now the stated goal in California, you cannot do it, um, without energy storage. And so, uh, today it's kind of, we're in that transitional time where storage is increasingly making more and more sense and again, what Bill said, what's old is new again. And I would say within 5 years you virtually will not install a PV system without energy storage.</p>		
<p>And these inverters are so smart. And their- the companies are so smart that they are advancing- for instance, now they have, um, EV plug-ins on the inverters so, they have</p>	00:18:13	<b>Ed</b>

TRANSCRIPTION	TIME	SPEAKER
110 outlets on the inverters. So, they, they're- they're with the times. They're- they're right there.		
<p>Yeah, they're- yeah, they're full-on EV chargers. Uh...e- you know, a- to answer your question maybe a little bit different way, every- every PV inverter that's been manufactured, that I'm aware of since about 2009, somewhere in there; every single PV inverter on the market today has a frequency shift function in it. And what that fre- just to explain what that is, um, that function is- so a grid-tie, when we say it's a 'grid-tie' only system, well that's really not true. Because that inverter has been designed such that it is, it has- meets all the grid functions that are required to operate, uh, in parallel with the utility system. But if also has the function so that when it is operating independent of the utility, we have another inverter and that other inverter has a- so, we have- we have energy storage inverters and we have PV-only inverters. And so, we can do what we call AC coupling of these systems, and those systems, uh, the- the most common way that's done- it could either be done with direct communication between the two inverters, to- to- to talk to one another, um, but the more common way's using the frequency shift method. And what that- what that does is that as the energy storage, as the battery system becomes full, what the inverter does, the batter inverter does, energy storage does, is it starts to increase its frequency, okay? Instead of running at 60 hertz, it runs at 60.1 hertz, or 60.2 hertz, okay? It is fundamentally off of the 60 hertz signal on purpose because it's telling everybody out there, if you're s- if you're giving me power, you need to start backing off because I don't need your power anymore, okay. So, it is...cre- it is absolutely communicating with other devices out there. So, because these inverters have fundamentally already been built that way, it's fairly straightforward to incorporate energy storage with an existing inverter that's on the market today. And so, um, the idea of saying, "Well, hey, I put in PV 5 years ago, I know want to do energy storage because the utility company or the Public Utilities Commission is screwin' me on the rates." That's actually very doable. And so, and it will become- as- as those rates become more and more, uh, punitive, it's gonna become common place. 'Cause people are gonna be</p>	00:18:30	<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>sayin', "Hey, I don't care whether the State of California's helping me out with this or whether the utility's helpin' me out with this, I've got my system and I don't wanna be left holdin' the bag 'cause I installed this big PV system. And- and w- the way the rates are going, they're taking away the value of my system. So, I- the only way that I can bring that value back is to put an energy storage system in to augment that."</p>		
<p>So- so the system designs, they, um, often times they're led by the manufacturers. Because through the, uh, manufacturer equipment specs, they, you know, help out with that design. And then they'll also provide training to the installers. So, that's something important to know. So, they- these features that are now being added on including, like what everyone is saying here, the safety features, which are switches, also internal communication systems, and included in the batteries now themselves. So, we include in our more, uh, recent version is, we'll have a, uh, battery management system that has the ability to communicate with the power electronics, meaning the inverters and so on. So, these will be able to be shut down on a module- modular level. So, and then, as far like, voltage and amps...uh, the level of those, um, there absolutely is a difference between residential and the commercial. And- and what that means is that, like, we were just recently putting out a high-voltage stack- a higher voltage stack. But those, again, are all modularly, um, built. So that they- each one of those little modules, um, have a over current protection switch that- or breaker in there and it also has a internal [sic] battery management system that communicates to a master- a master controller. So, when these go into a commercial environment and if it isn't a standard system, like John was sayin', they're from like 30 to- to say, a hundred and fifty [150], you know, kilowatt systems, those inverters were designed for that commercial sector and if they- if you need to exceed that, it becomes a customized system. That's all going through engineering, through plan check, um, you know, I come from a, uh, from a large electrical contractor, Baker Electric Solar. When I started out with them like, seven, six, seven years ago, they were- we were installing, you know, on the residential side about under twenty systems a month and we- within a 2-year period we grew to three hundred [300]</p>	00:21:29	<b>Paul</b>

TRANSCRIPTION	TIME	SPEAKER
<p>systems a month. And had 22 crews. Most of the- the contra- uh, most of the, um, electricians, uh, were not trained in the PV or the solar world. They had to- we had to bring 'em in from typically C-46 licensed contractors. And why? Because they really understood the- the solar industry and they understood DC power, which was more important than- at that time, then- then just being an electrician with AC knowledge. And that was something that we, uh, highly regarded and then grew those crews and then on the commercial side, which I's- I was also involved in, then we adjusted the- the equipment, you know, to the commercial application and then we had on- on staff, we had engineers that we could then train with the DC power and also the AC power. So, where there was a DC coupled system all going from, you know, DC off the roof, which is what the PV panels are, those are all- they all produce DC power. There's no panel out there that's gonna produce, you know, alternating current in that panel itself. There- it's gonna be an applied micro-inverter like John's talkin' about or, you know, some of their devices n- you know, inverting that A- that DC energy into, uh, AC energy. But point is, is that- that all of those voltages are all controlled and then the t- and the people that we train out there then, they may come from either world. The DC world and the PV side, the- the solar, or it may just- they may just come and know nothing about that and come purely from the AC side. And they need to be trained and that's where we all come in as manufacturers and also, like in Bill's case, which ironically, I took his- his- his course in PV USA back in 1999. The 3-day intensive course P- code compliant PV systems, you know? And, uh-</p>		
<p>[OL] Did you get an 'A'?</p>	00:25:47	<b>UIS</b>
<p>I think I barely passed that course or something, you know?</p>		<b>Paul</b>
<p>[OL] One of my students from twenty years ago.</p>		<b>Bill</b>
<p>No, I actu- actually, I h- had to stay a little bit later so that Bill could, you know, get me on- on course with that, but anyway...So, um, but, um, the point is, is that understand that systems need to be designed and like Barry was sayin', you know, you- you- you- regardless of the application, whether it's residential, commercial or i- an industrial, or</p>		<b>Paul</b>

TRANSCRIPTION	TIME	SPEAKER
<p>even utility scale, those systems need to be, uh, standardized or engineered if they're custom, and then those plans need to be followed re- regardless of the voltages or the amps. So, three different voltages, pretty much out there in- in the DC and the AC side, residential, commercial and into the utility scale. But pretty easy stuff to really understand but, um, you know, there's a lot of training that goes in those different, 3 different sectors there, so...</p>		
<p>So, I guess, wh- number 4 on our, kind of our agenda here is, is there a difference, uh, as to- wh- whe- as to the need to upgrade the electrical panel or the wiring in the house if you're doin' a PV system or a battery or an ESS? Does the ESS change in any way the need to upgrade the existing electricals?</p>	00:26:49	<b>Dave</b>
<p>And just to tack onto that, imagine, as a homeowner, we probably did a couple of unpermitted things before you walked out and checked out the house.</p>		<b>Justin</b>
<p>So, um, th- th- the reason, uh, the reason I said I- I'll take that is, um, uh, in the 2020 National Electrical Code- t- to answer your question, in terms of general electrical, uh, upgrade requirements, um, the- the answer is- is- is, "Yes, but..." Um, so the- the way the National Electrical Code reads today is, um, you can connect a PV system into, let's just- let's just constrain it to a, like a main service panel. Um, so, you're gonna- you're gonna connect it into the main service panel. Well, we don't want to overload that main service panel so there are some, uh, requirements in the code that limit how much PV- how much generation- how much onsite generation you can connect into that- that main panel. Doesn't matter if it's PV or energy storage or whatever. Um, and then if you go above that level, what you actually do is you, instead of interconnecting in the main panel, you interconnect on t- we call it the 'Line Side' of the main service disconnect. You're still on the customer side of the meter but you're on the line side of the main service disconnect. And, um, uh, that prevents us from overloading that main service, but the only reason that we're allowed to do that with PV is because we're not adding any additional load. Like, we wouldn't- if we have a two hundred [200] amp drop to a residential home and we have a two hundred [200] amp in service, if we connect a</p>		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
<p>hundred [100] amps worth of PV into that service, that's- we know that it's always going to be feeding back to the utility so we're not potentially overloading that service drop. So, now we introduce energy storage. We still have that 20 percent rule. If we have a two hundred [200] amp panel, we can put 40 amps of onsite generation. However, because energy storage can charge or discharge, it can be both a load or it can be a source. So, if it's acting as a load then, uh, it- just a load in that- in that load center, like any other load. If it's acting as a source, it comes under this 20 percent rule. You say, "Well, I'll just interconnect it on the line side." Well, you can't. Because when it's acting as a load it would be adding additional load in addition to the onsite load and you could potentially, um, pull too much current from the- the utility drop. So, um, we recognize this in the National Electrical Code and, um, I, uh, uh, uh, one- one of my colleagues at work and I developed a proposal for the 2020 National Electrical Code and we're introducing something that is called Power Control Systems. Because in theory you could say, "Well, I have this energy storage device and it's exporting to the grid. And I also have my PV array and it's exporting to the grid." And the way the National Electrical Code looks at that today, it assumes both of them- it always assumes worst case. National Electrical Code assumes worst case. So, we ta- well, they're both exporting at the same time. When you really start looking at the use cases you- you realize that that's not how these systems operate. Um, PV arrays typically charging the battery and then the battery would be exporting at a time when the PV array isn't. Um, so, that's a very typical use case. So, we developed a new, uh, section in the code, uh, which is 705.13, uh, which is in the 2020 code and which is on- on track to be published, um, here shortly. We just completed second revision-</p>		
[OL] Yup.	00:31:04	<b>UIS</b>
<p>...balloting. So, um, uh, that's- that's a new code section because what was happening- people would say, "I wanna add energy storage." And they had a two hundred [200] amp main service. They would have to upgrade that main service, for example to a four</p>		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
hundred [400] amp. Really, when the use case that actually was happening didn't justify it. Go ahead Greg.		
So- so to- to answer the question in- in a different way as far as all the battery storage systems that we've installed, we've never, ever once had to even consider a bu- making a change to the main electrical system. Because-	00:31:28	<b>Barry</b>
[OL] If- if one wasn't already required.		<b>Bill</b>
[OL] If one- yeah.		<b>Barry</b>
S- se- and that's- that's important to understand and, I mean, there's a-		<b>Bill</b>
[OL] [UI]		<b>UIS</b>
Yeah, so- so- so, I think th- the- the best way to answer your question directly is- as- as we can, and- and [I] apologize 'cause we- 'cause we- we kind of...we're a lot of thought leaders here and we're kinda goin' way down the pike and you're like, "Whoa!" Um, ha, um...uh, service upgrades- service equipment upgrades of a variety of types, um, are common place in the PV world. And there would be no difference- so, let's say I had a 40-amp PV system and I decided because I bought a Tesla that I want another 40-amp PV system. Well, okay, with that- wi- maybe with your service equipment that's just not gonna work with your service equipment, so now we may have to remove the service panel, do a service panel change out to come up with a different piece of equipment that's more suitable for a larger PV system, still can work with the service conductors and things like that. Very occasionally, and probably far more unlikely is the need to do a service upgrade, which is a very different thing. A service upgrade is where the utility comes out, takes their conductors out, puts in new conductors, new transformer, new everything. A far more expensive process, particularly if it's underground and then it's extremely expensive. So, that normally will kill a project. So, it's very rare to see those. What is much more common is to service equipment replacement where you're shutting off the utility power, replacing the equipment because the old equipment is maybe antiquated, falling apart, um...maybe just unsuitable for the application. That is very common for a solar contractor to do that kind of work. That's...e- I see it all the time. Um,		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
and it probably- if- I would say 20, 15 to 20 percent of installations in my- in- in my history have- have had to do that kind of equipment change out. Is that make-		
[OL] That's about right- Zinsco [Ph] is one of the ones we have to change all the time 'cause it's faulty equipment. So, it's the breakers.	00:33:56	<b>Ed</b>
But the addition of a storage system i- i- impacts that, yes or no?		<b>Bernadette</b>
Th- the point is, whether I put in another 40-amp PV system or 40-amp energy storage system, the equipment is the same. The way the rules are right now, from- if we were to make connections on the AC side, so the reason that John talked about this whole issue of ne- the new Article 705.13, um, is that we ha- we a- we understood that we had a critical problem with PV and storage that the- that the National Electrical Code was fundamentally not written to address this particular issue. Now, with- with SolarEdge, which is a- a company that does DC coupled systems- they have a four hundred [400] volt DC system through the LG chem system, it- it's unimpa- it's unimpacted on the AC side, so, there's no- there's no issue there. Uh, but the vast majority of systems like the Enphase system, uh, and other systems, it would be impacted.		<b>Bill</b>
So- so- so just, you know, if- there- there's certain percentages of PV systems where it would be beneficial to upgrade the panel. A- an old Zinsco panel, um, I've got one of those in my house now. Um, or- or somebody says, "I want a 12-kilowatt system, not an 8-kilowatt system like my neighbor." They're gonna wanna put a four hundred [400] amp panel. Then it- that- that has to be upgraded. But- but adding a battery a- no impact, and then on commercial systems, as John was mentioning, um, adding a battery, there' provisions in next year's electrical code to- to have that done with g- with an additional electronics [sic].	00:35:05	<b>Barry</b>
Uh, uh, I would say that, um, I- I would guess that it's- as Bill said, 15 percent of PV systems require a- a service, uh, panel upgrade. If you start talking about A- EV's, I bet the percentage is much higher...you know, 60-80 percent. You buy a new Tesla, you're gonna probably have to do a main- main panel upgrade. It just- very, very common. So, increasingly, um, you know, as customers start generating their own electricity, they have		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
either an electric vehicle or they have onsite storage that works in, um, uh, connection with their PV system. Um, these services, uh, main service upgrades are- are not all that uncommon.		
Um, so, when you're looking at service equipment upgrades is that always on the customer-side of the meter? Or is- is that...both?	00:36:31	<b>UIS</b>
We- well, I mean, so much of our service equipment are all on one panels [sic]. So, I- I'd say, in California, uh, residential panels are probably 50 percent all-in-one panels...easily. And in the last 20 to 30 years, 90 percent of- of- of, uh, like, uh, track homes are almost all hundred [100] percent all-in-one panels and so, those all-in-one panels have the meter, eh, the meter main at least, or meter main plus breakers in it. And therefore, that type of- if you- if you're having to replace that piece of equipment then that requires- typically what they do is you- you wire up a new panel right next to it. Um, you bring your conductors to that panel and then you call the utility to come out, shut their power down s- and cut into the new panel, um, and...depending on the jurisdiction, depending on, you know, who's pulling permits and things like that, um...I- I don't know what you guy's experience are [sic]. Sometimes it's done by a separate electrical firm to do that cut in, sometimes it's done by the- the solar contractor.		<b>Bill</b>
Yeah, so- so, when that's required some contractors will, um, do it themselves? C-10 or C-46 contractors can do it themselves, their not- u- th- that's where I fit in. Um, but it's important to note that everything's that done on the utility side of the meter is done by the utility. So, we- we don't touch that whe- whether it's C-10 or C-46.		<b>Barry</b>
The only time it isn't for instance is, Smud [Ph] had at one time done direct burial cable without conduit and whenever you get into a situation where that is occurring, they'll want to come out and put a conduit underneath, so we have to- the customer's expense has to trench from the transformer to the house, 'cause it's usually underground and they have to put a new conduit in and they have to put new cable in. And t- at the customer's expense.		<b>Ed</b>

TRANSCRIPTION	TIME	SPEAKER
But the key is again, the utility is doing all of that side of the work besides the paying for the trenching.		<b>Bernadette</b>
Yeah, we char- [UI]		<b>Barry(?)</b>
So- so the utility actually i- identifies whether the, um, the wire has to be, you know, upgraded and so on. So, they'll come out and they'll- they'll, uh, do a site survey and so on for it.		<b>Paul</b>
<p>But- but the upgrade is gonna be based upon additional load, not the PV. And so, the- the question comes up, um, if you were having to do a service upgrade, let's say you had a hundred [100] amp service. Uh, very common in California, especially for homes that are more than 40 years old. A hundred [100] amp services were common place, and you wanted to do a Tesla. A hundred [100] amp service is not gonna cut it for ya. Um, and so, you're going to- then the utility company's gonna say, "Well, if you want to do that, that's gonna be a- you're gonna have to install a two hundred [200] amp service, here's what the costs are." And then it's up to the customer in whether they want to do that.</p> <p>Were it gets really interesting and really, uh, where I think the pioneering aspect of this whole issue is, is that with s- with the new 705.13 on power control systems, you could actually do a fairly large energy storage system, fairly large, uh, electric vehicle, and because of the power control system you could do it quite fine on a hundred [100] amp service. And the- the fact is that the- that the cost savings of not having to do a service upgrade to- from a hundred [100] amps to two hundred [200] amps, will actually sell thousands of these systems in California, because especially in the Bay Area, where most everything is a hundred [100] amps and people want electric vehicles, okay? These power control systems will be how things are sold and how things are done. And, um, to an enormous scale. And so, um, and, at the end of the day it makes it safer for everybody. 'Cause quite frankly, doing a service upgrade, a full-service upgrade is a pretty ma- you know, that's a- that's a big job. That's a big job. Not all C-46's will take that job. A lot of them, some of 'em will- will actually sub that job to an electrical contractor because it is a big job.</p>	00:38:59	<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
Some C-10's won't take it either.		<b>Paul</b>
Yeah.		<b>Bill(?)</b>
But- but again, these are all, um, age-old issues that aren't any th- there's nothing new that's being brought to the table with storage.		<b>Bernadette</b>
Now, I wanna share some- some numbers with you and- when we get onto, uh, Agenda Item number 5 and, we ran some numbers this morning, found that we have two thousand, nine hundred and seventy-six [2,976] C-46 contractors. We have seventy-nine thousand, two hundred and ninety-four [79,294] C-10 and we have five hundred and ninety-nine [599] contr- licensees that have both the C-46 and the C10. So, Governor Newsome has talked about building- I think it's 3.5 million new homes...that's a lot. And I believe most of them will have to have solar, will they not? I think it's a mandate now. How do you see that getting i- i- that so- those solar systems being installed? Would it be the C-10 that's wiring the house? Will it be a C-46?		<b>Dave</b>
Well, one- one thing is, I would love to know if, um, what would be- if you actually added in also the general, um, B's. Uh, 'cause a lot of our contractors have a general B license that do general construction.	00:41:58	<b>Bernadette</b>
I know, and i- it's been get- l's- I'm gla- glad you mentioned that because if you look at the Board's actual Agenda item it was to look at the other B's and other classifications as well. Justin, as the Chief of Licensing, how many B's, uh, exactly, do we have today? [laughter]		<b>Dave</b>
A hundred and fifty thousand [150,000] active, something like that.		<b>Justin</b>
There- there's a lot. [UI]-		<b>Dave</b>
No- eh, uh, a- bu- but there's a lot in our membership, I know 'cause I've take a look at those that have, uh, C-46 and a B, is my point. So, the C-46 and the C-10 is one combo. There's the C-46 and the B and then- there's like, there's actually maybe- basically every permutation out there [laughs]. There's the A and the 46 and the B and the 10 so, it's- it's all over. Um, but this is actually- to [ad]dress your- your question in the broader issue, um, Title 24 has been modified and adopted and officially established as code in		<b>Bernadette</b>

TRANSCRIPTION	TIME	SPEAKER
<p>California, um, to essentially require solar and increasingly you get a lot of extra points, if you will, if you add a battery as well to the home, so we are going to see an influx of new solar homes being built in California starting next year. Um, the building industry association, um, is extremely concerned about this very topic, uh, because they do not, uh, they- they rely on their general contractors, um, to do this work, um, and it is incorporated, um, into the construction of the entire home. And they, uh, you know, add a, uh, production home scale. Um, so, um, this is- this is something they have weighed in on and they are concerned about.</p>		
<p>So- so-</p>	00:43:44	<b>Barry</b>
<p>[OL] It's all hands-on deck. 'Cause it's gonna be every one of us, gonna be doing this. We're- not just C-10's, and it's going to be with the construction of the house but it's gonna be low bid, too, just like with everything else.</p>		<b>Ed</b>
<p>Yeah, I- it- you know, i- it'll get done, what's- what's interesting in my experience, having worked with lots of electricians, you know, generally C-10's, um, the work involved in putting in a solar system on a residential home is incredibly paperwork intensive. And, um, uh, lots and lots of electricians have wanted to get into that business because hey, it's just, you know, more business, but the majority of them basically say, "I don't want my guys goin' on the roof. I don't want to have to deal with all these- this paperwork with the [UI] program and the utility and the- the strange permits. So, I- I think that in order to meet these requirements we're gonna need a lot more trained C-46 contractors that h- that- that know how to train people and work on the roof safely. Because it's generally something that the electricians don't like to do.</p>		<b>Barry</b>
<p>Yeah, that does bring up another question tha- that's regarding the- the, uh, electrician certification requirement...that a C-10 would have and the other classifications do not have. I mean, do you feel that is a s- would that- especially you, having that certification yourself, is that beneficial...for doing solar? Or, I guess ESS, not solar necessarily, but the ESS installations?</p>		<b>Dave</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Yeah, I think that actually, combined ESS and PV, um, it's- it- it's actually very helpful certification. I mean, I- I went through schooling to get it. But I don't that that's, um...it's really limited to any cla- you know, licensed classification. I mean, I went through- I was being a- a union electrician. I went through the [U] training program for it. Um, mostly because I was required to, but I already had the experience and the knowledge to install solar and storage 'cause I came from there. M- and I looked around it, some of my fellow classmates and I- I realized that most of them were coming from the C-10 industry as electricians and the ones that really had the knowledge were the ones that came from a C-46 and solar contractors. And that- that was a real statement. So, yes, I think that training is without a doubt, essential and impor- you know, important, and helpful. Um, but I don't think it's limited to any one, you know, licensed classification.</p>		<b>Paul</b>
<p>I, i- it's-</p>	00:46:14	<b>Barry</b>
<p>[OL] So, you think it should be required for other classifications? The electrician certification?</p>		<b>Dave</b>
<p>Well, I- I- I'm kinda lookin' at the s- the scope of work that our workers do and- and it's a very multi-disciplinary kind of task and you look at the- the electrical certification a- tha- I took the C-10 test a year ago or so. Um, there's so many special things involved with the solar training tha- it' really- th- the electrical training is not exactly what's only needed. There's more [sic] questions on the C-46 test about, um, roof attachments and- and structural issues related to putting panels on the roof and historically, you know, forever, about batteries. Is- a- it's- it's more specific. So, if we wanted to go train another ten thousand [10,000] people to help put solar on to meet these residential new home construction requirements, the C-46 test is gonna be much more specific to exactly what they need to know then the- the C-10 test or the certified electrician test.</p>		<b>Barry</b>
<p>I, I wanna go back to your original question, uh, 'cause I- because I think there's another question that you kinda brought in on top of it, which is a ver- a big one, obviously. Um, we're right down the street from about, I would say, a dozen subdivisions that are a hundred [100] percent PV. Um, between here and Cameron there are at least a dozen</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>subdivisions that are at least a hundred [100] percent PV. Um, and I'm familiar with several of those subdivisions and the installations were not done by the electricians that el- that wired the house. They were done by specialized, uh, solar contractors that, uh, i- in one case there was a sun- Sun Power subdivision, they were done by Sun Power contractors, um, that were specialized in that install, a hundred [100] percent of 'em. And it was cheaper to do it that way because to train the electricians to understand all the things, uh, to bring them up to the level that a Sun Power contractor had to be at was way too expensive and way too difficult. Um, and, uh, and so, those were done- these subdivision- new subdivision projects are typically done just like any other sub in the process. So, you have a sub for the roof, you have sub for the- the drywall, you have a sub for the electric- the re- the electrical, and you're gonna have a sub for the PV and storage that's gonna go into that. And, uh, and those are specialized subs that are overseen by the general and, um...and it's- it's done on the subdivision level so that a lot of the paperwork is a lot simpler. So, it- it's just like anything. If you build something in a subdivision, it's far cheaper than retrofit. Um, because, uh, just like if you put an air conditioning system in a new- new home, it's way easier to build it into the home than it is to put it in afterwards. And so, so these subdivisions, um, all those systems were probably 60 percent of the cost of a retrofit system. And if you looked at the numbers of what it cost to do those systems, uh, so there's very attractive economically [sic]. Um, but, again, all the ones that I'm familiar with, you guys may have some other examples but we're specialized contractors that were selected- I know Lennar is another homebuilder, I- I- I- I know the president who was in charge of- of all their solar projects and, um, and they had their contractors that did all their work. They did not rely on their electrical contractors at all because they were not the ones that were specialized and understood. And- and we- we mentioned NABCEP. Um, NABCEP, North American Board of Certified Energy Practitioners is a- is a voluntary, um, certification, uh, that was established nearly 20 years ago now for the very purpose of establishing criteria that were relevant to the PV world. And, so, a lot of electricians have gotten NABCEP</p>	00:47:32	

TRANSCRIPTION	TIME	SPEAKER
Certifications, um, and, um, a- and, you know, and some C-46's have gotten electrical credentials, too.		
On new construction, um, uh, the same thing happens. We- we get hired all the time by developers to install the solar part, they don't have an electrician. So, we just did Catalonia Apartments in San Jose, we've done, uh, a Montessori school in Tracey that was- we were- we worked because we can separate where we stop and where they start. We can just tie in equipment, it's real easy, we communicate with the electrical contractor. But we're solar contractors.	00:50:43	<b>Ed</b>
One- one thing to point out about the 2020, uh, new home construction mandate, which I think will have a big impact on- on, um, the amount of energy storage so, a lot of the work I do lately is regarding interconnection standards, uh, and how- how we interconnect with the utility. Um, particularly for these subdivision which are now going to be a hundred [100] percent solar; if you were to put in a hundred [100] percent solar to- just to meet the Title 24 requirements, what I think is going to happen, and it seems highly likely, the utility connection to that subdivision is- is going to have to be oversized. Uh, um, because a hundred [100] percent of those homes are gonna have solar. However, if we use this new power control system and we can limit the amount of export, then that- there's gonna be a large cost savings on building out that utility infrastructure to serve that subdivision. So, when- when we look at the- the, um, the economics of saying, well, we're gonna have PV plus storage that can limit the peak currents, which there- therefore can reduce the, uh, the expenditure that's required on the utility side to serve that subdivision. Remember, we're talking about every new home in the state and a hundred [100] percent renewable, uh, in the future. So, i- from my perspective, when you say to- to the homeowner, "Look, we can, um, we can give you a PV-only system, but it won't be able to export when you're not at home, when you're away at work. Or, we can give you a PV system plus storage and, oh, by the way, if there's a power outage, your lights won't get- go out." Um, you know, that will be desirable. Uh, when we talk about a whole subdivision, there's a new mandate based on legislation, um, that was		<b>John</b>

TRANSCRIPTION	TIME	SPEAKER
<p>recently passed that, um, the CPUC has to investigate, how are we going to do microgrids within the state, and the main purpose is to increase resiliency. If we look at the, uh, fire- the recent fire in Paradise, um, you know, there's a lot of debate saying- and- and there were rules at the PUC saying, "Utilities required to shut down those transmission lines during high-wind periods and high-fire danger periods." Well, with climate change, eh, if you believe that's true, I think the evidence is clear, that's going to happen more and more. So, there is a growing need for, uh, building in resiliency, which we haven't really talked about in the past, into the grid. So, if you take that subdivision and it's capable, if the utility says, "Hey, we're heavily loaded, it's a high-wind period. We need to shut down the entire subdivision." And that subdivision can become its own microgrid...become its own micro-utility. It will require a large amount of energy storage within that subdivision. And I think the economics, just for the cost of building out that utility infrastructure, when you then make that economic, uh, uh, offer to the homeowner where- where you can have energy storage and backup power and, oh, by the way, we can get a preferential rate for the whole subdivision, because we can- the utility can shut us off when they need to. U- from my perspective, that will be a major driver of the 2020 requirement for residential storage. I- I almost think by 2020, or maybe shortly thereafter, within the next few years, it's gonna be all subdivisions have PV plus storage.</p>		
<p>Can I make one clarification there here- [UI] we're going down these long...um, from the contract to the- the boots on the roof and the boots down screwing bolts and nuts and bolts into the wall with the inverter and the...the- the microgrid vision that John just laid out really doesn't change. What changes is the- the brains inside the inverter that'll- and a couple other widgets and controls that are then added to the inverter size, uh, the inverter itself to allow communication within, you know, a- a subdivision. So, from a- the- what we're focused on here and what this body is focused on is our- are the guys and gals out rollin' trucks an- and climbing up on roofs, are they capable of installing these things? Nothing re- yes, uh, you know, the whole fleet, and we need more of 'em, nothing really changes even if we ultimately go down this road of microgridding, um, vis-à-vis</p>	00:54:57	<b>Bernadette</b>

TRANSCRIPTION	TIME	SPEAKER
<p>interconnecting and communicating between properties of these different systems. Um, so I just want to clarify- and then again, I just wanna reiterate, this is a- this a- i- i- a- this is a, um, perennial debate within this industry. Whether it's the plumbers wanting to have complete control of the hot water systems, the roofers wanting to claim the roofing component, the electricians wanting to campaign- this, by nature and be definition in the CSLB is a- a- upheld, uh, before, it's a multi-craft trade. It brings in all these difference skills. And that is what this license is all about and it's what this trade is all about, and yes, a general can do it, a C-10 can do it, but a C-46 can do it and then it's all com- the storage doesn't change the very nature...of- of what these guys are doing, and gals.</p>		
<p>Yeah, so I th- I think that the 2020 mandate on the, uh, PV on- on all residential is going to be satisfied by specialty contractors. Which will be identified as a C-46. I mean that's- that's my conclusion from the perspective that- I've got a son who recently is a- you guys would all be happy here that he's a recently licensed general contractor.</p>	00:56:34	<b>Paul</b>
<p>[from the crowd] Congratulations!</p>		<b>UIS</b>
<p>Yep, you know, 29 years old and u- and I can happily say I had an influence on him 'cause I said don't go down the path of doing this work without being a licensed contractor. And so, he has and then I said to him, now there's a mandate coming in 2020, you're gonna have to put solar on all these homes and what're you gonna do? And he just had this hazed-over look at me and said, "Dad...", you know, and he said, "...what do I do?" And I said, "Well, alright, uh...specialty contractors. You already get 'em for plumbing, electrical, for everyone else. Make sure you know what that specialty contractors license requirements are." And that's pretty much, you know, I think...is a strong influence on where we're going here in the future.</p>		<b>Paul</b>
<p>I, I think, you know, you- you brought up the really important- or the issue, which kind of is part of the elephant in the room of- of, uh, certifications and things like that and, um, I know that, uh, these issues, since most of us in the room with the exception of Bernadette, uh, were around when, um, when these issues were brought up related in the PV world. Um, and i- back in the mid-2000's, and early to mid-2000's there was a lot</p>		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>of debate about this particular issue and whether or not the C-46 should be allowed to do solar, uh, if they were allowed, what restrictions would be placed on it and would they be allowed to touch anything in the electrical panel. All those- those issues came up and there was horror stories [sic] that were brought up here, there and everywhere and, um, uh, and- and mo- you know, mostly from- from, uh, organized labor but, you know, from a lot of different locations and- and, uh, I've worked with organized labor for many decades and so, I have nothin' against them whatsoever, uh, but they were obviously looking to corner a certain part of a- a market. And they felt, uh, very strongly that, um, that they were gonna be cut out of a market that, um, that was- was theirs. Um, and I've been in many debates and many discussions on this issue and- and- and a lot of times I'll- I will sit back because I'm an engineer. I- I- you know, I've got my own issues. You know, engineers have their- their stuff that they have to deal with as professional engineers and so, um...and the laws ultimately come down as to what- what should be done. But, a lot of these concerns that were brought up in the early 2000's, um, the sky was falling and that they weren't gonna get the work and things like that, never happened. And- an- and it's like, okay, if- if we were back then, it was- it- d- it was kind of a decision that had to be made because nobody knew, nobody- <b>[cont.]</b></p>		
<p><b>[END OF RECORDING]</b></p>	00:60:00	
<p><b>[cont.]</b>...knew what was gonna happen and so, all these arguments were coming down and CSLB had to make the decision. And I believe they made the right decision, but now we have 15 years on those decisions, and they were good decisions. And union electricians are getting an enormous amount of work from PV. I would say the vast majority- maybe not vast majority, I would say 70 percent of all PV installed in the United States is installed by union electricians. It's huge! It's massive. Now, do they do all the residential work? No. They do almost all the utility work. And they do a s- huge percentage of the large commercial-industrial work...huge percentage. And those are the jobs they wanted. And they got 'em. And...e- but, all the safety concerns and all the- all the things that were gonna happen and all- it didn't happen. Now, are there bad eggs out</p>	00:00:00	<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
<p>there? You guys know that. Every- every industry's got 'em. Every contractor industry's got bad eggs, and so we could go out there and we could find problems, we could find- I do inspections all the time, I work with local jurisdictions, try to enco- encourage them on improving their inspection procedures and things like that so that the bad eggs are weeded out and they, you know...uh, but- but the reality is that these things just didn't happen and so, I believe that, you know, what- what's being asked of the CSLB is to make a major change to something that has historically been a part of the C-46 license without- w- r- with actually far more evidence on the side that says that there's not a problem, than to say that there is a problem. And so, to make that shift, when the evidence doesn't- doesn't- doesn't share that position seems very political to me. And that's- that's tough for CSLB. I would rather the legislature deal with that kind of issue because...I- I think that the evidence says that these- these s- ss- projects and these systems have not been safety hazards. They have- the work that's been done has been done decently in order. We've all been working hard to train people on how to do it right, to have the right things and, you know, CalSSA has been out there, you know, pounding the, you know, making sure that their contractors avail themselves to their proper training, you know, it'd be a really good opportunity, uh, next week I'm going down to train, uh, A- A- E trip- A, um, AEE solars, uh, conference down in San Diego. The best contractors in the country come to that thing. I love goin' down there and meetin' with these guys. They're just hard-core, they- they're really committed to what they do and then shortly after that, in the su- in San Diego is gonna be the NABSEP National Conference and you're gonna have, you know, five [500] to seven hundred [700] contractors coming in there, training, teaching, all the stuff tha- for their- for their continuing education licenses and- and things like that. Um, so, you know, the checks and balances are there, and those things really were just in their infancy 15 years ago. A- and now they're well-established, uh, yeah, there's bad contractors out there. We're always gonna have 'em. But, uh, is this, wou- would removing ESS from the C-46 license</p>	00:00:56	

TRANSCRIPTION	TIME	SPEAKER
make the difference? And I'm like, "No." That's not gonna- that's not the change. Um, so, anyway.		
We've been under attack. When- the early 80's, the C-36 contractors came after C-44 contractors stating that they couldn't put in w- the sol- solar contractor couldn't put in a water heater because it was something that the plumbers should do. And we fought that, and we won. And then i- in the 90's it was the roofers, and I remember the roofers were coming after us that, we couldn't touch a roof because we didn't know what we were doin' on roofs and we squashed that because they didn't know anything about connecting wires together. So, now it's the electricians are coming after us because they wa- they think this is a big, um, pot- pie and they-	00:03:32	<b>Ed</b>
[OL] For the second time, this is not the first time.		<b>UIS</b>
...but PV- when they- and 2000 they came after us. So, now they're coming after us again. It's just, there's- there's enough business out there, I think that we can all share.		<b>Ed</b>
Look, not only i- is there enough business, the business is gonna increase and these energy storage systems are gonna have to go in as we talked about, pretty ubiquitously. But, also, you have to think about what happens to all the people that have existing systems and, based on the warranties that we're required to provide by the state, as C-46 contractors we have to provide a 10-year or a 15-year warranty on the equipment. And if that customer says, "Okay, now I want a battery." And it has to be done by a different contractor then we've got a warranty mess for everybody who's got solar in the state. Because, I'm- I'm- I'm not gonna warrant a system if somebody else went in there and put a battery and changed all the settings.		<b>Barry</b>
It might be a good thing.		<b>UIS</b>
[UI] we take care of our customers, that's okay. And there-		<b>Barry</b>
[UI] [laughter]		<b>UIS</b>
Sh- should a C-46 do a storage only project?		<b>Justin</b>
No.		<b>Bernadette</b>
Why?		<b>Justin</b>

TRANSCRIPTION	TIME	SPEAKER
Because the license is clearly about a solar energy system.		<b>Bernadette</b>
I, I- I ge- I- I- I get the- what's written in the reg. I mean, what's your opinion, just policy-wise.		<b>Justin</b>
Oh- I- I- I think...the reality is, the- the- the standalone storage business, which is a huge business by the way, and it's been around for 50 years-		<b>Bill</b>
[OL] Well, I- now I want one. [laughter]		<b>Justin</b>
But, I- the point is that s- standalone storage has, you know, for the UPS market, for all these markets, have been huge from- for decades. A- and those guys are, you know, you- if you want that product you pick up the phone and you call that contractor. And they're not just your standard C-10 electrician, at all. They are an energy storage technician, um, UPS...you know, supply, whatever- whatever the issue is. Um, I- I think th- those guys, that's a clear delineation of- of what they do. Now they are- they're- they're probably gonna be either B or a C-10...h- holder. Uh, one of the two. And, but the vast majority of PV systems are going to include or augment- be augmented with storage, so, the project will be adding storage to an existing PV system with all the concerns of making sure that it matches, that it is properly designed, that it works with the existing inverters, or you switch out the inverters and all that kind of stuff. And so, that's not your basic electrician, that's a specialized contractor that understands all that. So- so, the actual project may be adding battery storage to a PV system, but I don't see somebody picking up the phone and calling up, I mean, I- I'm sure they do get requests, I just want the s- storage, I don't want solar. Because, PV's gotten so inexpensive, it's like, why wouldn't you add...you still have a tax credit. It's like, it's a slam dunk. You're gonna have to pull a permit and people actually understand PV permits way better than they understand storage permits now, because we've been workin' on it for so many decades and so, it's like, there's really no reason that a customer would want a...unless all they want's a UPS. And they're not gonna call you if they want a UPS.	00:05:41	<b>Bill</b>
An- and from a technology standpoint, I don't know, John, but- but Enphase's inverters are designed to work with PV and- and SolarEdge inverters are designed to work for PV		<b>Barry</b>

TRANSCRIPTION	TIME	SPEAKER
so, if you were a residential customer calling [UI] saying, "I just want a battery. I'm gonna give you everything you need for a- a PV system without the PV.		
I, I think that's a real intelligent question because the direction-	00:08:01	<b>Paul</b>
[OL] Hold on, before you go.		<b>Justin</b>
Yeah. Go ahead.		<b>Paul</b>
What you're telling me though is, you've already got the experience to do this. So, why are you telling me a C-46 shouldn't.		<b>Justin</b>
Yeah, so that's where I was goin' with this. So, I'm sayin' that you- you-		<b>Paul</b>
But you have wi- wind or something else, right though? I mean, or I could just put one on my house without having anything else. And I'd have a battery-		<b>Dave</b>
[OL] You're just droppin' into-		<b>Justin(?)</b>
So, there are gonna be some situations, some sights, that maybe wouldn't allow for PV. It may be because you got a north-facing roof, or- or you have complete tree cover, but you still want battery backup. So, in this case, you would be able to take a- a hybrid inverter and you're absolutely right. That- that electrical contractor's C-46, has all the ability to install that system without PV and it would absolutely work. So, like a- an Outback Skybox right now, it's designed for energy storage and you don't necessarily have to put PV on it. So, you're absolutely right, on the residential side, but if you get into like, very large storage for utility scale, for demand-		<b>Paul</b>
[OL] [UI]		<b>UIS</b>
Yeah, well, I- you bring up a- an excellent logic point. Eh- eh, and- and, so I- from a logic point of view I think you're dead, straight-on correct. The fact is that an energy storage project, let's just say for residence, um, the customer doesn't want to do PV right away...I think if- to select the correct contractor to do that job, the person that's got the experience with the energy storage is the one that you're gonna want to go with and they happen to be the one that happens to do- has a C-46 license. So, an- and if you want to make it s- super ridiculous, I could put a PV module on the house; one, wired in, whether		<b>Bill</b>

TRANSCRIPTION	TIME	SPEAKER
it does anything or not and if- if- if for whatever reason my local jurisdiction said, "You must do solar as part of your project." I just did solar-		
Well, a- also, you get a 30 percent tax credit on the whole thing, but when it's all in.	00:10:10	<b>Barry</b>
[OL] Yeah, exactly, an- and so-		<b>Bill</b>
[OL] Yeah, I think it- I think you're really though expanding this into an area you don't want to go.		<b>Dave</b>
Yeah, yeah.		<b>Bill</b>
I really do. I- I don't see it. I thought-		<b>Dave</b>
[OL] No.		<b>Bill</b>
...we were talking about here is the C-46, which is a solar classification being able to include a battery within their solar project. I mean, yo- you start getting into installing batteries without a solar system, you're getting into hydro-electric, wind, if somebody wants to put a battery in.		<b>Dave</b>
Yeah.		<b>Bill</b>
I think, that's gonna take a regulatory hearings [sic], if that's what your suggesting.		<b>Dave</b>
[OL] Sure, no.		<b>Bill</b>
We- we're not, that's why I answered, 'no'. That's why I answered, 'no', but what I thought what I heard from Justin was a clarification that this was a hypothetical about skill and capability and that's where I think Bill and others answered, around skill and capability and knowledge base. But I want to be clear, there ar- i- there's no push by the C-46 licensees to expand into non-solar storage w- into standalone storage unless it is paired with either, during the original installation or in a retrofit-type- retrofitting a solar system, to do storage in that context. That's-		<b>Bernadette</b>
[OL] Yeah, I- I would just ask, we're not gonna put that in our report.		<b>Dave</b>
Yeah.		<b>Bill</b>
I really wanna stay with- stick with what's gonna go on the report. Did we get the answers that we need?		<b>Dave</b>
Yes, I got them.		<b>Justin(?)</b>

TRANSCRIPTION	TIME	SPEAKER
'Cause this is gonna go to our board. It's gonna be a public document, okay.		<b>Dave</b>
Are there any other tough questions we just haven't really adequately answered or...any other burning things that, uh, folks have brought up?		<b>Bernadette</b>
[UI] burning.		<b>UIS</b>
"No burn..." [laughs] it's almost 4 o'clock.		<b>Bernadette</b>
I, I- I'd like to actu-		<b>Paul</b>
[OL] [UI]		<b>UIS</b>
Yeah. I'd like to just thank the board for, um, really se- setting a designation of a C-46. And the reason being is that, when I hear C-46 I know that they should, and most likely do have the capabilities of installing solar energy.	00:11:48	<b>Paul</b>
And also, just, I- I know how many meetings we've been to and Bernadette's been to even more but- but thanks for all the time to work through all these details and for not falling asleep when we start talking about these crazy numbers and voltages and certification things. So, thanks for all the- the effort.		<b>Barry</b>
So, hopefully you've all signed in so we can reach out to you if you need any clarification.		<b>Dave</b>
S- two things, David, one is, um; if you'd be interested in talking to SunPower, Peterson Dean or the BIA, um, to elaborate further on question number 5. I'd be more than happy to help make those connections. I didn't come really prepared to have those folks elaborate further but it's an important-		<b>Bernadette</b>
[OL] Well, thank you.		<b>Dave</b>
...part of your questioning. Um, can I ask, when I observed Barry's, um, installation of a solar and storage system, nobody wore a hazmat suit. That was made a big deal about last May, that storage and batteries require hazmat suits.		<b>Bernadette</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Th- tha- that, according to the- the code, wou wanna- an- and OSHA, they have to have a, um, uh, head protection if there's somebody working above, if they're working up on the roof they have to have fall-protection, they have to have, uh, pr- uh, suitable clothing. But you don't need the hazmat suit unless you're going to be dealing with some kind of arc-flash. Um, and- and I can't se- conceive of having- have an arc-flash with the systems we're putting in. Um, and the only time you'd really need that is if you're working on live utility equipment without a disconnect and we just don't do that.</p>		<b>Barry</b>
<p>I think we're good, thank you.</p>		<b>Dave</b>
<p>Everybody have a great 3-day weekend.</p>		<b>UIS</b>
<p>I think you're ready f- to, uh, to do your first system. So-</p>		<b>Barry</b>
<p><b>[End of recording]</b></p>	00:13:38	

# **JANUARY 17, 2019 C-10 INDUSTRY EXPERT MEETING TRANSCRIPTS**

**CONTRACTORS STATE LICENSE BOARD**

**TRANSCRIPTION**

**C-10 Stakeholder Meeting**

Prepared for: Contractors State License Board

Transcribed by: Trans-Lang

## LEGEND

[First name]:	Example: "Dave"
UIS:	Unidentified Speaker
(?):	Speaker identification unclear
[OL]:	Overlap
[IA]:	Inaudible
[UI]:	Unintelligible
[Ph]:	Phonetically
/:	Two or more words separated by a "/" are options, due to lack of clarity or specificity in the original language
[ ]:	Text within brackets are inserts by the translator to aid in comprehension

**NOTES:** *Best effort was made to correctly cite acronyms or professional or industry boards, bodies, organizations.*

TRANSCRIPTION	TIME	SPEAKER
<b>[Beginning of recording]</b>		
With-how [do] these microphones work? The button? And that way it will be recorded. what I'd like to begin with is to self-introductions. I'm Dave Fogt from the Registrar for the Contractor's Board.		<b>Dave</b>
Tanya Corcoran, Chief Deputy Registrar.		<b>Tanya</b>
Eddie Burnaki, [Ph] uh, National Electrical Contractors Association.		<b>Eddie</b>
Brian Melvin, Supervisor Enforcement.		<b>Brian</b>
Missy Bikri, [Ph] Chief of Enforcement		<b>Missy</b>
Dan Coghie, [Ph] Pde Total Energy Solutions.		<b>Dan</b>
Troy Strand, Baker Electric.	00:00:36	<b>Troy</b>
Jay Miller, Baker Electric Home Energy.		<b>Jay</b>
Justin Paddock, Licensing Chief.		<b>Justin</b>
Heather Young, Executive Analyst.		<b>Heather</b>
And just to provide you some background, at the February 28, 2018, uh, board meeting, the board directed staff to conduct public meetings and to research the classification that would be most appropriate to do energy storage systems. And in furtherance of that directive we've had a public, uh, participation hearing in this room. We had approximately, I don't know, Heather, it was like 300 people that showed up; quite a few. We have almost over 5 hours of testimony that will be ultimately included in the final report, and we've received 249 letters. But the reason for this meeting today is that we have a better understanding of energy storage systems and how they relate to solar installations. So, I really want to thank all of you for attending especially Eddie Burnaki for helping us put this meeting together. And with that we have some questions that Eddie has reviewed and also, I would mention that tomorrow afternoon will be meeting with the similar group from the solar industry. They've received the same questions. Eddie, would you want to add anything to that?		<b>Dave</b>

TRANSCRIPTION	TIME	SPEAKER
<p>I would just add that I appreciate the board's time. I know this is been kind of a protracted and lengthy discussion on this issue... Um, you know, these are the-I think, what makes the board important, you know, as industry changes, technologies change, you know, license classifications can morph into each other or become at odds with each other and- and I think, you know, the directive of this board is to protect the consumer safety. I think that's one of the things that the National Electrical Contractors Association prides itself on and its contractors is protecting the, uh, safety of the end-users for the systems we install and- and we think this is an important conversation to have and- and to provide clarity, um, 'cause we- we still feel pretty strongly that the, uh, existing regulations, uh, are not clear and may, uh, be being interpreted, uh, not in the way that they are stated in regulations, so, with that we just want to say thank you.</p>		<b>Eddie</b>
<p>Mike Cherneski [Ph] has joined us, he's our Chief of Legislation and I would like to mention that the report is being put together in kind of a team approach. It's being directed out of the executive office, we have Justin Paddock, our Licensing Chief, Mike Cherneski, and Heather young are all playing a part in developing this report and our goal is to present it publicly at our March 22<sup>nd</sup> board meeting in San Diego. We had talked about distributing it at a legislative committee meeting in February however we had a meeting yesterday with our-the Sunset review committee consultant and learned that the Sunset hearing date will likely be the last week of February and we're gonna be given a whole lot of questions to answer approximately one week before that and that would conflict with our legislative committee meeting. So, I don't know, Eddie, if you're okay with that approach?</p>	00:03:04	<b>Dave</b>
<p>I think from our standpoint we-if the report is submitted to the board in a time and fashion that if and asked to or if there is the will to make a decision one way or the other at the March meeting that- that they would be able to do so- I- I think we'd be fine.</p>		<b>Eddie</b>

TRANSCRIPTION	TIME	SPEAKER
<p>So, with that were very interested in learning from experts such as yourself more about energy storage systems and the first agenda item we had is to have a discussion, kind of a free-flowing discussion regarding residential, light commercial, commercial and industrial. For those of you who may have been present for the public participation hearings one thing that we did learn is that some of the residential installations, at least some of the-those that, uh, testified, were stating they're more plug-and-play. Somebody brought in what looked like a briefcase and, you know, so you could just plug it in, and you buy on Amazon. I don't know, so, we'd like to learn more about the different type of-of units that are being used.</p>		<b>Dave</b>
<p>Um, and would it help if we all describe a little bit of our backgrounds? Um, 'cause-</p>	00:04:49	<b>Troy</b>
<p>[OL]. Absolutely. That would be very helpful.</p>		<b>Dave</b>
<p>That would establish what our expertise is. Okay, you want me to start?</p>		<b>Troy</b>
<p>[From the crowd: yeah sure.]</p>		<b>Public</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Okay, so, education, I'm an electrical engineer. I am not licensed. I came out of the defense industry. In 1990 I worked for Southern California Edison as a photovoltaic system design engineer in their R&amp;D group, was there until '92. '93- I was re- or, '92 I was recruited by the national renewable energy laboratory where I served 4 years, again working as a photovoltaic-systems, uh, design engineer and a staff researcher. Primarily focused on emerging technologies and photovoltaics, as well as codes and standards. Uh, these codes, um, IEEE standards later became UL listings, such as 17 – 03 and, uh, 12 – 72 as well. Uh, and then from there I was recruited yet again and went and worked for an inverter manufacturer for a year where I got involved with large energy storage systems as well as photovoltaic systems worldwide, where we would be powering either villages, um, military facilities, um, public, um, facilities such- or maybe even a, um, um...state park- uh, - I ki- North Mandetoi Island out in the middle of whichever lake that is- Michigan, I forget. Um, but sometimes distributing it at 12,000 V, other times distributing it much lower, 120, 208, or even, uh, 482-77. Uh, from there went to a module manufacturer, worked there for about a year and half. Again, doing similar type things and then founded my own company that I ran for 15 years. Uh, installing systems worldwide as well as throughout California. Uh, did the US Embassy in Rwanda. Did Quaduline Island, uh, did a, uh, large Island that competed with Necker Island, Sir Richard Branserd's island- Branson's island. Um, as well as multiple utility scale systems and then I've now been at Baker electric for 4 years on the second next month doing exactly all that. So, again continuing installation of those types of systems, whether they be, uh, energy storage- photovoltaic or what not. So, we are doing a lot of just straight energy storage now. Uh, standalone as well as coupled with photovoltaics at Baker Electric.</p>		<b>Troy</b>
<p>I'll go next. Um, my names Dan Coghie with Pde Total Energy Solutions. We are a general electrical contractor with offices in San Francisco, Los Angeles and, uh,</p>		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p>started in the DC power realm were 20 years ago managing the western United States for MCI telecom, at the time. Um, so, installed over 60 MWh of battery energy storage at multiple voltage levels, as Troy talked about. From 48 volts to 15,000 volts. Um, our company has built the largest completely off grid desalinization plant ever, in the world, that we're aware of, at the time. Um, four years ago in the Caribbean, which makes about 300,000 gallons of water a day off photovoltaic and battery only. So, it's grid completely independent. Uh, constructed the largest, uh, battery system on- it- the largest type 2B Military microgrid at Twenty Nine Palms, Southern California which was a 15,000 V battery at 15,000 V AC uh, to couple to the existing solar system that when the grid failed that the base could continue to use the renewable energy while on generator and not on the utility. We just finished building the military, uh, NAVFACS military microgrid testbed at Port Hueneme last year. We're working on phase 2, I'll be there tomorrow as a matter of fact. So, we built the backbone and the testing facility that the military uses to, uh, test battery energy storage installations, so, very familiar with multiple types of battery installations, from lead acid AGN, to lithium ion to sodium metal halide, um, to aqueous batteries, so, flow batteries we've installed, um, so, have a broad range of technologies that are out there. Um, so, that's my background.</p>		
<p>Good afternoon, I'm Jay Miller, Baker Electric Home Energy. Uh, we are a separate division-or separate company from Baker Electric with common ownership. Um, we are the residential solar division. Um, my background started in the Navy as a Navy nuclear electrician. I was on a submarine for 4 years after two years of Navy nuclear power school. Um, after that I have been in the electrical industry with three different contractors for about 30 years. The last 15 years of those have been in solar. Pretty much purely solar and about the last 5 years starting to get into batteries. Uh, and now director of operations at Baker</p>	00:09:42	<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
Electric Home Energy, purely. We did about two thousand [2,000] residential solar, um, installations. About 10 to 15% of those also had batteries with them.		
Well, thank you. We definitely have a lot of extensive backgrounds in the electrical industry. So, can we start with the, uh, if you can tell us, is there really much difference between residential, commercial, industrial? What do you see in the industry?		<b>Dave</b>
I think the difference is scale, right? So, residential smaller modules of batteries and commercial, really all you're doing is paralleling more and more of those modules' batteries in the commercial world. So, you're looking at scale. You still have a modular battery in a residential home, and you may have up to- we've installed up to 6 Tesla batteries, 6 Tesla what they call Powerwall 2.0's now, in some homes. Obviously much larger homes with the wherewithal to pay for those and the desire to have that many batteries in their home. Um, so it's really a modular scaling- scalable thing Um, on the simplest scale you put in one Powerwall with a solar system and you, um, over-current-protect that battery and that home properly. It's a pretty small modular job. The 6- the 6 Tesla job that we did was much more complicated and the jurisdiction getting the permit, we kind of had to consult with them-the walk through it, and the utility company had different rules for somebody who's just getting one battery versus, I think it's over 10 kw worth of batteries, it's a whole different world for the utility companies to look at and make sure that it's been a protect their grid. The jurisdictions are also looking at it, lo- making sure it's gonna protect the general public and the worker. Um, and it gets to be scalable real fast... If-and the only limit is the service on the house, the size of that service-the electrical service and how much money and how much desire that homeowner wants to put into that house to buy batteries.	00:10:53	<b>Jay</b>
Jay, could I- could I ask just, when you say it's "scalable", are your- the installation doesn't change though, right? The-the what goes in to-		<b>UIS</b>

TRANSCRIPTION	TIME	SPEAKER
<p>[OL] No- it sur- it changes- if you put one battery in and your back feeding through one single 30-amp breaker, that-that is somewhat simpler than six batteries with six 30-amp breakers and now you have to start looking at the- they call it "Over Protection Coordination", so, you're coordinating breaker sizes throughout the home. The main breaker to a sub-panel breaker, to the breakers feeding the brand circuits. And it gets a little more complicated as you're putting multiple batteries in the same electrical service.</p>		<p><b>Jay</b></p>
<p>Yeah, I think the- uh, the comment, you know, you, an- basically, an appliance was brought in- you looked at it, it appears, right? So, now Tesla, LG Systems, Sunrun System, well that's- that's where it starts, right? And then you go- start as- as Jay was talking- you start with Over Current Protection. You look at means and ways to disconnect that. You look at wire size. You look at conduit size. You look at bus bar size where the- the device connects, um, there's multiple NEC codes that now have to comply with and understand. I mean, yo- you're connecting, you know, people look at energy storage, I look at it as-imagine it as gasoline in a sense. It's stored energy, you know, it-that energy is stored in a box and, um, it really integrates with every part of the electrical system from, you know, the- from that appliance or that box, all the way through the home or the business including to the utility. So, it's not just that box. The- the depth of experience and code compliance that is required to make sure that it's installed safely, um, and compliant to protect both property and life is paramount to a successful installation. So, as the voltages change and the sizes change, um, there's obviously different lezel- levels of property and life hazards but a lot of the same steps are taking place, if not all of the same steps are taking place on all installations.</p>	<p>00:13:08</p>	<p><b>Dan</b></p>

TRANSCRIPTION	TIME	SPEAKER
<p>And one of the things that's overlooked is the fault current, uh, coordination, if you will. 'Cause you have fault current it's going to come from the utility back into the battery storage system. You also have fault current from the battery storage system that can go into the house, into the load center and ultimately back to the utility. That is actually a-a, uh, there is a science involved with that, there's codes [sic] that-that governs it and it is a matter of not only protecting equipment but requires of course and personnel...and fire, ultimately. You can look at the systems, as Dan mentioned, as like they are gasoline. There is different battery chemistries and the different battery chemistries should be considered more like the octane levels...which is gonna influence your flammability if you will. So, in lithium, there's multiple chemistries. Uh, there's the ferrous, which is a little bit less, um, susceptible to thermal runaway. Then there's gonna be the other technician- uh, technologies that have higher cobalt levels in 'em that are more, uh, susceptible to thermal, uh, runaway. So, the-what that means is your battery energy storage- so, I'm talking about stuff that would be more considerations of manufacturers but the p- the installers and the providers need to be knowledgeable because where they might cite them, like in a hot garage, or where you get more airflow. Then also, the other considerations is [sic] that amps interrupting capability. As you parallel batteries, each battery string can have thousands of amps of fault current and a short circuit can- sc- uh, scenario, so, if you have more batter stacks in parallel, they're additive. Now, does your over current protection- is it sized appropriate to handle that amps or that fault current, if you will.</p>		<b>Troy</b>
<p>Troy, a- but as they, as the question was kind of the- as they pur- presented as plug-n-play, you know, the- these are- these are in the residential setting, they were pretty simplistic in installation...um, as you- as you kind of graduate from residential, light commercial, to commercial, is the interplay between the battery energy storage system and the existing electrical system pretty much the same?</p>	00:16:33	<b>UIS</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Tha- that you're going to be in the panel on a residential project with a sim- with- with one battery or three, and then on a commercial project that may have a hundred [100] kw hours of storage, you're still gonna be in the panel, or is there any difference in- in- between them-</p>		
<p>Well, there's, thank you for that clarification. Um, in both residential and in commercial, depends on how much amps I'm putting back on to that panel. 'Cause battery storage systems are bi-directional. So, they pull current from the grid to charge the battery, they push current back onto the grid, they're bidirectional. So, if you have solar systems or if you will-when we look at sizing panels, we have to sum all that current coming into it. Make sure we don't overheat the bus. 'Cause people have a tendency to add loads and you could conceivably over current the bus and that's where some of the concerns come. So, to answer your question I-I believe is, in a commercial scenario there might be a service upgrade involved. We might be tapping on the line side of the main circuit breaker, in between the meter in the circuit breaker. So, we call that a line side tap. Um, we might build to come right in through a main-I mean through one of the actual circuit breakers in a distribution panel. That's all determined during our calculations and our design process. Residential it's the same exact thing, there's no difference. Residentially speaking, uh, what we see is we see voltage levels for the DC, for the battery bank, ranging from 400 V to 600 V. That would be, uh, an LG chem battery bank versus a Tesla Powerwall. We also see lower voltages. A 48 V, which is what has been historic, but to get the same kilowatt hour rating out of that battery bank, if your voltage is 10 times lower guess what's 10 times higher? Your current, so, you better darn well have your wire sizing correct and your Over Current Protection correct 'cause we all know that an improperly sized wire becomes a very good heating element, or in other words a very good igniter for fires.</p>	00:17:12	<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
I just have a follow up question for something you said. I suppose you could be electrocuted on one 10 Vs, I don't know. But, at what point does it become very dangerous? Is there like a threshold in the industry, were you talking about four hundred [400] V? What happens if you were subjected to that?		<b>Dave</b>
I, I- the one- what I learned as I went through all my schooling in, uh, through my-I didn't mention I was a field service technician, uh, out of Control Data Institute in 1980. So, that said, uh, 10 milliamps through your hearts kill you- kills you. All you have to do is overcome your, you know, th- the resistance, the internal body resistance. So, the potential can be pretty low...that does that. 400 V certainly will do it, absolutely. Uh, a hundred and twenty [120] will do it in the right circumstances.	00:19:41	<b>Troy</b>
I, I honestly, I think the code is 50 V's it is really the threshold of, hey, you're starting to get dangerous enough to be life-threatening.		<b>UIS</b>
I, I kind of want to go back-		<b>UIS</b>
And-and even under 50 V you still could have a scenario where you're standing in a puddle of water and it's life-threatening.		<b>UIS</b>
What does a solar system generate as far as volts? Does it vary?		<b>Dave</b>
Anywhere from the-the traditional solar way back 30 years ago, powering maybe a fluorescent or an incandescent lightbulb at 12 V, so the panel would've been a 17 V panel, uh, on up to today, we are looking at fifteen hundred [1,500] V. So-		<b>Troy</b>
[OL] On the DC's?		<b>UIS</b>

TRANSCRIPTION	TIME	SPEAKER
<p>... And the-and the 1,500 V is what's happening behind the fence on ground mounts or utility scale projects, what were seen in the commercial world is a thousand [1,000] volts. Were also seeing 850 V battery banks, which again the difference between a solar array and a battery bank is the fault current. This is the one thing that's real important to understand. A photovoltaic array is limited by the current that that array can produce and the sun intensity at that time. A battery bank can have thousands of amps of fault-one battery can have a thousand-thousands of amps of fault current. So, when we parallel those that is additive quickly.</p>		<b>Troy</b>
<p>It's interesting, we had our hearing-there was a lot of discussion about the safety aspect, but nobody could identify-someone had been electrocuted, so, are you aware of anything that's happened? If you were a part of those hearings.</p>	00:21:49	<b>Dave</b>
<p>I was present at the first day. I was not present at the second day. Uh, in terms of electrocution's, I don't have any definitive dates, names or locations. You know, we've heard of them just like folks will fall in to their deaths through skylights while installing on rooftops within our- within our industry as well. But from an electrical standpoint, yeah, it's a good question. I-I can't point it to a specific example today.</p>		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
<p>So, I've seen a lot of bad things in my career on the DC side, extremely bad especially in the telecom world which runs at about 540 V DC nominal, which goes up and down but nominally. Uh, when I was working for MCI telecom, uh, their inner electrician was not electrocuted but was, you know, third-degree burns over the majority of his body. And the district attorney was at the facility when we got there because it was an OSHA crime at that point. You know, lack of wearing personal protective equipment, lack of training, improper tools that were being used. When you look-there are cables that are this big, multiple cables that big that went along what they call cable laddering down the wall. Well, it had ionized all over the wall. There was nothing left of it. Completely ionized, so, you saw copper that looked like someone took a spray can and sprayed along the wall. Um, when you looked at the panel, it's completely exploded and blown up. So, I think, if you look at an electrical OSHA incident, I think you'll see a lot of people – electricians, die by infection because of the burns they suffered and not in relation to actually being electrocuted. So, there's two types of hazards that happen to an electrical worker and burns in the DC world, it's like a welder. So, that's something to take into account. I just wanna go back to the residential specific code changes, so, and I- and I'm from the Los Angeles area and so, very familiar with the codes in Los Angeles. They're adopting the new, um, energy storage codes Article 706. Um, and it's being enforced in L.A. County today so, those Article 706 standards are part of the 2017 NEC Code, which will be adopted in 2020, correct? By law, State Law, right in that area. But regardless, Los Angeles- and Mustafa Kashi is enforcing that July 2018, so we've already been under that for 5 months of the new Article 706. And they're dramatic changes in there in regards to energy storage. So, this is telling you that the H-J's, the 30's having jurisdiction are recognizing that energy storage systems are separate systems with very separate code language to comply with. Um, I'll give you one example; I don't know if anyone's <b>[cont.]</b></p>	00:22:40	<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p><b>[cont.]</b> remodeled their house in here but, um, if you've remodeled your house so, I don't know if you remember, um, if you have a bedroom you have to install a specific type of circuit breaker, what's called an AFCI Arc Fault Current Interrupter. It's a very specific breaker, like if it's feeding your bathroom or your bedroom. So, like, I have a new sub-panel in my garage, and it has one specific breaker for that- that, um, occupancy of my house. So, uh, codes that you'll see in there are, uh, the breaker that this appliance in- in a residential system, uh, goes to your panel on. Typically, you go to a Home Depot or- or a wholesale house the breakers push on. Well tho- and, in Los Angeles County they won't allow that because if it's just pushed on it doesn't have the integrity of the connection and it can heat up more. And as Troy says, power's going in and out of that at a high rate, so it heats up. So, they make you put an adapter kit on an existing panel to bolt that breaker on to that panel. So, it's a specific change that happens, and on the AC side downstream of the energy storage system. Um, you've heard of the systems that Island, right? Everybody wants to use their energy systems for backup power when the grid fails, right? So, if you take the certain load, so you want your refrigerator, your bedrooms and your- maybe your tv, you know? Just something's that gonna- you're gonna be able to live while the power's out if that's the case. Well, if those loads are moved from the panel that they existed before the energy storage system and they're moved to, uh, what we'll call the critical load panel which is going to be fed from this energy storage system, um, if they're moved more than 5 feet, all of those breakers also have to have AFCI on 'em. So, you're starting to see specific codes to energy storage on the 8 downstream of these on the AC side that affects residences.</p>		<b>Dan</b>
<p>So, so what's happening in L.A.? Are you saying were a C-46 would be installing the, uh, I think it's the photovoltaic system – and then a C-10 comes in and does- will install the ESS? Is- so, there's two separate contractors doing those installations?</p>	00:26:39	<b>Dave</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Yeah, Mus- and I'm off- I'm not speaking for Mustafa but he- I was at a presentation he did, and it spec- he specifically stated in there it takes- requires AC-10 to do an energy storage system. And he's- I was at a seminar- a seminar, a- a lecture he was giving, there were probably 15 different jurisdictions in the audience, and he was basically- he's a leader in this field and he was outlying the interpretation of the new codes and what- how he was enforcing it.</p>	00:26:54	<b>Dan</b>
<p>And, so, now there's a separate code for energy storage systems in the- in the new electrical code, and so there's a separate code for photovoltaic and then they have the overall-</p>		<b>UIS</b>
<p>[OL] What's the Code number?</p>		<b>Dave</b>
<p>Uh, Article 706.</p>		<b>Dan</b>
<p>[OL] Article 706.</p>		<b>UIS</b>
<p>And the existing is Article 690, or 80 for the batteries. It- it's basically taking all the past and adopting it to what's actually happening right now. Kind of putting it all in one code-specific section versus having it reference different codes to make sure it's code-compliant. You know, and then you deal with the, you know, the other adoption is- and I'm gonna speak for L.A.- is- is the fact that- that he, it's Article 608-1.1 in the California Fire Code, which is- an- speaking on L.A. County, as Mustafa, will not complete your plan checking, give you a permit until the Fire Department has signed off on the energy storage system and the design. So, that is also an effect that's- that's gone into place.</p>		<b>Dan</b>
<p>And that's based on just the hazard or the danger they represent, or...</p>		<b>UIS</b>
<p>Yeah, I mean, First Responders need to know how to respond to these. So, there's specific, you know, rapid shutdown you've heard on solar installations where the inverter is a certain distance away from the- what is it? 10 feet? 5 feet? Uh, from the conductors. Well, battery energy storage's the same way. So, the last installation we did in Los Angeles, the Fire Department has their own Knox box, you know, those box [sic] they only have a key to, it's red, it's right by the</p>		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p>electric room door, there's signage. They go to that, they know there's an energy system there. They go into the Knox box, activate what we call the emergency power-off and it trips the- the circuit breakers to the batteries so they're no longer connected to the- the inverter. The inverter trips offline and then we have a very large 7-ft. tall, 42-inch-deep piece of electrical switch gear integrated to probably 25 ft. of el- you know, electrical gear that integrates directly to it. Um, that shut- I- it opens the- that breaker- all the generation is tripped off as well at that point of connection. I mean, in the main electrical realm. So, all the batteries, inverters and the last connection point of coupling to the utility all trip off of the Fire Department.</p>		
<p>All installed through the existing electrical system [UI]</p>		<b>UIS</b>
<p>Exactly, a retrofitting of the existing electrical system. We're adding switch gear to the existing ele- electrical system. And that particular device is rated at twelve hundred [1,200] amps, 480 V. It's large...e[nough for] the power for this whole building.</p>	00:29:35	<b>Dan</b>
<p>At what point do you generally have to do a general electrical upgrade? Say you're doing residential; if you're just installing one battery, would you have to do some type of an upgrade to the panel?</p>		<b>Dave</b>
<p>We upgrade approximately 20 percent of the services that we install in. Uh, and it's all based on the load calculation of the existing service, what is on that service – by breaker handle readings, and the main breaker and the main feed from the utility company's size of that speed to that- to that, um, that house, or that service. So, it could be an electrical vehicle charger, it could be a solar system, it could be a battery or some combination of all those things that cause you to go over that threshold to make you need a main service panel upgrade. So out of the two thousand jobs that we installed last year, we- we upgraded- we did a main service panel on about 20 percent of those.</p>		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
On- on the other 80%, do they- do you still have to- when you're just putting a battery storage system, do you still have to get into the panel and-		<b>UIS</b>
[OL] Yeah, you have to-		<b>Jay</b>
...and [UI] panel?		<b>UIS</b>
...lay in it. Th- so, there's two kinds of battery systems: DC-coupled, and AC-coupled. AC-coupled goes right to your panel, right in- you have to land it in the panel on a breaker just like any other circuits in your panel. Uh, the DC-coupled goes through an inverter that can also handle a solar system. Uh, both of those units, the battery or the solar are independent of each other but they both feed into the same inverter and then they would still have to go into that panel to land that inverter's feeder.	00:30:55	<b>Jay</b>
Wh- what's the more common installation? The AC-coupled or the DC-coupled?		<b>UIS</b>
Uh, we're- we're almost 90 percent AC-coupled.		<b>Jay</b>
So, directly in the-		<b>UIS</b>
[OL] Yeah, directly into the panel.		<b>Jay</b>
...[UI] stored system directly- not even touching the PB systems...		<b>UIS</b>
[OL] From the battery. Yeah, so, if we're doing a PV and a solar- or a PV and a battery install at a house, with an AC-coupled, we'll land the PV on one breaker in the panel and we'll land the battery on another breaker in the same panel, or it could even be in different panel in that house.		<b>Jay</b>
So, just to kind of summarize something I think you said earlier; when you look- when you're looking at these different types of installations: residential, light commercial, commercial-industrial, uh, what I understood you to say is that the systems themselves are very similar. The only difference is the complexity when you get into, uh, probably the commercial and the industrial. And the amount of energy that is stored.		<b>Dave</b>
I was gonna say, correct. It's all driven by the application, you know, from a commercial battery energy storage traditionally, are clipping the peak demand-		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
you're clipping- you know, the peak, if you will, uh, in the demand. Also, they also might be doin' some time shifting with, uh, the solar, as well as arbitrage.		
Justin or Mike, do you have anything, uh, you'd like to ask regarding the different types of systems?	00:32:41	<b>Dave</b>
In the residential, what sort of trip do you have? Is it just in the breaker just like everything else or is there anything where you may need something the Fire Department requires under the L.A. Code?		<b>Justin</b>
Uh, we haven't seen jurisdictions require us have more than what either the battery and- and the AC-coupled battery has an inverter built into the box, so you look at that Tesla Powerwall and it's a battery connected to an inverter changing DC power to AC power, right? So, there's an inverter in there and internal to that there's some- some devices, protection devices in there: fuses, breakers, that protect- try to protect itself, eh, inside the battery. But then the feed from the battery to the- to the house is- that's predicated on if I need a means to disconnect there, depends on standard electrical code, line of sight, and- and various other things und- do I need tha- regardless of what the load is. Whether it's a battery or not, I may need a means of disconnect for that.		<b>Jay</b>
Yeah, the- the- the UL 95-40 pre-built systems that come out comply with NEC for the most part. It's what happens from there to the main panel is where the AC wire-size, conduit size, Over Current Protection, is it a AFCI Breaker, is it a lockable breaker- it's- there's a disconnect with- inside the panel. You know, all- that's where a lot of the work happens.		<b>Dan</b>
And you would need to identify that on a residential project, commercial proj- that doesn't change?		<b>UIS</b>
My personal experience is, I- I've seen more code violations in residences because of homeowners doing their own work, uh, not pulling permits, uh, so when you walk into a home I- I think you need to be very, very cognizant that there may be existing code conditions. Uh, not saying you're not gonna have		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p>none in a commercial installation but typically commercial installations are required to be permitted because of insurance regulations and let's be honest, a lot of homeowners don't pull permits for w- uh, you know, incidental work they do. I'm adding a, you know, Sonnet Tub, I'm, you know, the- they're just not gonna go through the time and the expense to do it. So, from my standpoint, when you walk into a residence, uh, we're hyper-aware of identifying any- 'cause we're, as a contractor we're ultimately responsible for life, protection, our well-being, our client's well-being, all of that. So, we are very, very cognizant of making sure everything we do, all the way to the AC panel is done correctly and identify that. Or we won't do the job, it's just- it's not worth it.</p>		
<p>Eh, the- to back Dan's point up, roughly about 5 percent, maybe a little less than 5 percent of our jobs, we find some code violation that's pre-existing that w- stops us in our tracks. More often it's an un-permitted structure, 'cause the homeowner built some lean-to or something, or it's a main service panel upgrade they did without getting a permit and without even telling the- the utility company that they did it. So, when you do a main service panel upgrade you have to get a permit from the jurisdiction, and you have to get the utility company to do a study on that little micro-grid in your neighborhood to make sure your upgrade's not gonna overload that neighborhood's transformer. Um, those are the two main things that we find when we go to a- a- a home that has some un-permitted work done. It's mainly the structures, some structure they built on, maybe turned the garage into a bedroom, or the main service panel upgrade, or- or sometimes it's a subpanel, too that they added onto without pulling a permit.</p>		<b>Jay</b>
<p>Are you finding any, uh, examples of where the system- the SS was installed im- improperly and you had to go back and correct deficiencies?</p>	00:36:07	<b>Dave</b>
<p>I can't recall any that we found, um, with ESS systems that way. Now, um, residential ESS systems really haven't been- been- been installed, maybe the last three years it's really started to grow, right? So, ten years ago, nobody had a</p>		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
battery in their house unless it was an off-grid guy who- who, you know, a very small percentage of the population had batteries and now it's startin' to be a little more prevalent.		
Are you finding that they're more common with power-purchase agreements? I was just-		<b>Dave</b>
[OL] No.		<b>Jay</b>
No?		<b>Dave</b>
No. Actually, um, our business flipped from lease-finance power-purchase agreements about 2-3 years ago...it was about 75 percent leased, or financed, or PPA, some type of financing in place. Almost overnight it went to 50-75 percent cash. People realized that there is not a whole lot of value-add with that financier in the middle, right? Unless they flat-out didn't have the capital and still wanted to go and install a 30-40-thousand-dollar system. So, the battery, I don't know that the battery makes sense just because it's a PPA or a finance system. The battery makes sense if I'm in a time-to-use rate scenario and I'm a heavy user during the peak periods which typically are when the solar is startin' to turn off, right? Or at least reduce its production.		<b>Jay</b>
And to add to that, um, commercially speaking, batteries make sense- again, peop- people are spiking. We call that a low load factor. Um, so, that's a ratio of demand to, uh, energy consumption.	00:37:45	<b>Troy</b>
If you could maybe, just maybe describe and- why the C-10 is the appropriate class for the ESS...installation.		<b>Dave</b>
I, I think the biggest reason is Dan's point, um, when you put a battery on a service, you have to more holistically look at that services code compliance over code protection, uh, breaker study coordination and- a- and- and that's not a typical thing you do in a residential job, right? In- in a larger commercial job where you have a large electrical distribution system you really need to focus on the main service panel's breaker size, that's sub-panels and the sub-sub-panels.		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
<p>When you start adding energy storage systems into a residential house, then you start doin' that same kind of a concept. Okay, where is the- the- the Over Current Protection concept in general is try and trip the breaker as close to the fault as possible. So, you get the breaker that's gonna contain the damage, right? And it's a function really of how much, um, engineering wherewithal do you have and are you gonna spend on this residential job compo- compared to, say, a commercial job, to make sure it's designed and engineered and installed properly. Um, so, it's a more holistic view of- knowledge of the whole code and not just certain articles in the code that get you by to do an install.</p>		
<p>Yeah, we- we've done commercial installations where we'll have two people rack and stack and build and construct the batteries in two days and we've got, you know, electricians on the C-10 side working for months with the, you know, uh, utility- with the infrastructure upgrades, the disconnecting means, the First Responder requirements...all of that is happening also. So, it's, you know, the DC portion of it can be very fast and they're done and then...major amount of infrastructure has to go and be code-compliant on the AC side.</p>		<b>Dan</b>
<p>Justin, did you have something?</p>		<b>Dave</b>
<p>Uh- uh, so, just because I'm not- I'm not the expert that others are, what I'm- what I'm hearing from you, just from a broad perspective is there really isn't a job you can think of where you can sort of go in on auto-pilot and just install. Like, you've really gotta get in the home, specifically residential, you've gotta get in the home and really sort of, after you've evaluated what you've got, you've gotta create a plan. Is that accurate?</p>		<b>Justin</b>
<p>Yeah, absolutely. Um, our process is- is we sell a job to a customer and within about five days we have a- a- a- what we call a site-survey technician go in, take the panel apart, take pictures, check about 40 different things in that home; from grounding methods to sub-panels, basically...documenting an as-is scenario before we touch that home, construction-wise. Including, you know, checkin' the</p>		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
<p>roof integrity, checkin'- you know, several different things. Uh, then we bring that back, basically upload it to a folder and the team- project management team and the engineering team, review all of that data and then start draftin' plans and doin' the design. Um, we don't s- we don't feel- and this was before we even started doin' batteries, we followed that same process. We don't feel comfortable, um, havin' a guy show up and start- start workin' the same day that we get a contract signed. We need to make that we've thoroughly gone through that home and found potential issues that could happen either during or after we install either a solar and a battery or a solar-battery combo.</p>		
<p>And, from a commercial standpoint the process is incredibly similar. So, when we look at a potential customer's project, we're gonna acquire all their utility data. So, their interval data, we're gonna acquire billing statements, uh, we're also gonna go and walk the job site. We're gonna come back, size a battery energy storage system for that facility that may or may not have photovoltaics on it and that'll be a 30 percent design level at that point in terms of submittal process. So, a significant amount of effort. And then we complete the financial analysis. We deliver that to the client; the client says go. The contract gets signed. During that contracting negotiation phase, we jump on- we get ahead of the- the- the process and we send out our crew to go walk the job, and we call that the "90 percent walk", and that's where our engineers, um, our designers on-staff will go and walk the job. Then they'll come back and do the permit package. Usually the contract's signed by then, which is a good thing, then we submit for permit and then deal with the, uh, the jurisdiction's questions at that point. Once those questions are behind us then we go build. And then while you're building there's, you know, construction is not a- a, uh, uh, how do I put this, "perfect process". You always encounter something on-site that you then will either go back to the authority and have some RFI's, you know, "Request-For-Instructions", um, you might wanna change your design, or the guys in the field will have to go, and yo- and consult</p>	00:41:47	<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
<p>their knowledge and code, which is why, um, I've always felt very strongly that this work should be done by C-10's because you want a actual certified electrician on that site overseeing that work. Uh, for me it's not a, um, a trade issue, or whether it's a merit shop, or a union shop- I come from the merit world, by the way. Um, it's always been about the safety of the inhab- you know, the- the folks that are inhabiting that dwelling, if it's a house, or the public that might be in that building if it's a- if it's not a dwelling, as well as the worker safety.</p>		
<p>So, what I'm hearing...if you're installing a battery energy storage system, whether it's residential or commercial, you need to some calculations of the- whether or not the existing electrical system is sus- you know, uh, able to handle that- that system.</p>	00:44:19	<b>UIS</b>
<p>Absolutely. And not only that but i- it goes down to your wire selection for your connection, 'cause you gotta look at a battery energy storage system from start to finish. So, the start's gonna be the battery. So, [UI] that's if you're the battery manufacturer, it's absolutely the battery. The finish is the point of connection at the utility. The design goes all the way through. Now, yes, uh, with a Powerwall...a lot of that is taken care of. But from the Powerwall through to the point of connection is not. And that i- um, again, you have permits, you have designs, wire sizing over current coord- you know, nations, eh, coordination studies as we've talked about, but you also have the utility involved. You have the utility interconnection, Rule 21 out here, that must be adhered to, and then also, the interconnection process.</p>		<b>Troy</b>
<p>Yeah, i- had a tailing on their conversation. I mean, there's- there's really three pegs in the stool, right? You've got plan ch- plan checks- you submit your plans, engineering drawings and then you've got the installation contractor and the competencies of the actual person doing the job. And that person actually doing the installation, it's the last line of defense. Uh, their error- plan ch- and plan check doesn't catch everything, inspectors sure don't catch everything. Changing</p>		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p>codes, um, the inspector's ability to- to manage the work load they have. Some are electrical-only, some are combo inspectors, that is all happening right now in the real world, and we know that. Um, so, the competencies of the person doing the installation and the knowledge, uh, in my opinion, as a business owner, um, is- is paramount to being successful to protecting property and life. And, you know, one thing that always comes to mind on residential and commercial- and we do both, and big commercial stuff, but, commercial buildings are protected by a fire alarm system and fire sprinklers and it's monitored and the Fire Department's here in 10 minutes if the flow bell goes off, right? But residential typically does not, Uh, and energy storage systems, a lot of them we just talked about, are used when we're asleep, right? So, ch- you know, time of use rates now from 5 to 9 pm are the most expensive so, we're gonna discharge your batteries during that time or when we get home from work and we're eat- cookin' dinner, doing laundry, charging our car, whatever it may be, but at nighttime that's when that system was on autopilot recharging itself at a lower rate. So, you know, there- there are definitely use case differences.</p>		
<p>And getting to charging the car, for instance...uh, you know, the Level 2's or even Level-1's, are the- the larger chargers that we are gonna see more of 'em. Those are gonna be going into residential applications...and there's gonna be considerations that are gonna need to be, you know, taken into account as well. And they're very similar. Uh, there- ar- there is a movement for- for cars to, you know, vehicle-to-grid, so, they'll go both ways. Charge the car, or discharge from the car. The car will become the battery bank in other words.</p>	00:47:02	<b>Troy</b>
<p>I have a question, uh, in the industry, um, is the battery considered part of a solar photovoltaic energy system or is it considered separate?</p>		<b>UIS</b>
<p>It's- it's definitely separate, um, we- when we look at a customer's load profile- and load profile being the average usage by 15-minute increments over the day for your whole year, right? At- we typically pitch a customer a battery when they're</p>		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
<p>a high-user in the time-to-use rate structure. Now, when you go solar in SDG&amp;E and SE territory, I'm not sure about PG&amp;E, you are mandatory on a time-of-use structure. So, if you're on a tiered rate structure now and go solar, you have to go time-of-use. If you're a heavy user between 4 and 9 o'clock every day, on average, then we would say, you're a good candidate for a battery. Now, you may also look at w- what is the orientation of the roof and how does that roof face? 'Cause if I can put solar facing west, maybe your solar system stays on a little longer than the average solar system. Um, and maybe I can put enough solar on your house to overcome the cost of that high energy that you're buying between 4 and 9 o'clock. But, we- we leave it up to the customer. We have some customers that aren't really good candidates on a return on investment side that want batteries. They just want a battery. Maybe they run some- some business out of their house that they want that battery back-up side- there's two components to the battery; a backup for your house and usually we put a subpanel in so, it's just protected loads; your refrigerator, your computer, you know where you're going to have your computer plugged into, maybe your garage door opener and your alarm system, right? So, if the grid goes down, those things are gonna stay on. Everything else in your house won't work but those things on a protected load panel will. Um, we will often find a customer that it doesn't make financial sense for them to go with a battery from a return on investment to save electricity and money on your electric bill, but they want the battery backup, or they just feel like they want a battery with their solar. But, like I said, 20, 15 to 20 percent of our customers right now we're selling batteries to, about 90 percent of those are because they're a time-of-use customer and the return on investment on the battery makes sense. Um, but we also have had many customers that we installed [sic] solar years ago on and we came and put a battery in later because the battery now- technology now is much more prevalent. I don't know if you guys are familiar with the SGIP Program, the self-generation incentive program where</p>	00:48:10	

TRANSCRIPTION	TIME	SPEAKER
there's a- there's a rebate for the battery- ranges from- from, I think about forty five hundred [4,500] dollars, depending on what step-level you get into the program down to about two thousand [2,000] dollars, so...		
And, forgive my ignorance, is there, um, are they ever sold together? Like, if there's, you know, "Johnson's Solar Company- Solar Power Company", do they make batteries and make photovoltaic cells and sell them both? Are they ever sold sep- can you sell a- the whole thing together?	00:50:22	<b>UIS</b>
Um, we- we sell the whole thing together, but we integrate the components-		<b>Jay</b>
[OL] Okay.		<b>UIS</b>
...from the manufacturers. Um, Tesla's the most prevalent battery company. Um, LG Chem, Sonnen, a few other manufacturers are out there. Uh, I don't that many of them, if any, are also manufacturing solar modules. And they're certainly not manufacturing a kit that is already bolted together.		<b>Jay</b>
[OL] Right, so, generally you have different manufacturers for the batteries and the panels?		<b>UIS</b>
Correct.		<b>Jay</b>
Okay.		<b>UIS</b>
A, matter of fact, we- we do have an issue right now between an inverter manufacturer and a battery manufacturer that, the inverter on the DC-coupled system, the inverter has the charge controller for the battery but it's allowing a couple of the systems that we've installed- it's allowed the battery to go down to zero charge and you can't bring that battery back anymore. Once you- once you drain a battery down past a certain amount of ch- of discharge, or charge, then the battery's useless. So, I've got two manufacturer's kinda pointin' at each other sayin', "mm, I don't know whose problem this is."		<b>Jay</b>
I, I- is- is your question though, were you're going with this is, the- you know, two separately systems. I think Code drives that very clearly. I mean, you've got Article 706 specifically to energy storage systems. You've got, uh, Article 690:		<b>Dan</b>

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<p>storage, 706: energy storage, 480 is specific- Article 480 specifically for batteries. Um, then you got UL 95-40, UL 19-89, UL 19-89, UL 17-76 and the California Fire Code 608.1-1. There are very specific codes that are in place because they see it as a very specifics- [sic] installation.</p>		
<p>And solar has its own codes as well?</p>		<b>UIS</b>
<p>Yeah, solar- solar is 690. Yeah, solar is 690. Um, the prom- you're question on whether or not they're- they're a package, BYD makes, you know, Chinese manufacturer makes solar modules and battery storage. So, they would love to sell you a complete thing but they- they address the commercial sector-</p>	00:52:17	<b>Troy</b>
<p>[OL] Right.</p>		<b>UIS</b>
<p>...and with a commercial client in- involved, again, we look at that load profile, we look at the bill. We don't just come in and prescribe something without having done our homework. Quite frequently it's batteries only. Quite frequently it's solar only. Quite frequently it's both and some- an- a lot of times we look at it and say, "Neither, none of it."</p>		<b>Troy</b>
<p>Let me ask a question about 3- do you view photovoltaic systems and battery energy storage systems as separate systems- separate electrical systems?</p>		<b>UIS</b>
<p>Uh, tech- tech- technols- separate technologies.</p>		<b>UIS</b>
<p>Ab- absolutely.</p>		<b>Dan</b>
<p>Absolutely.</p>		<b>Troy</b>
<p>Yes, definitely. There's no doubt that they're separate.</p>		<b>Jay</b>
<p>[OL] I mean, if you look at- you look at, uh, Southern California Edison, the LCR Program they have, where San Onofre nuclear plant closed, Oliso Clique- uh, cr- Aliso Canyon gas issue we had, so there's obviously a lack of generation. You look at the public offering that went out there for demand response or capacity replacement. I mean, batteries were the biggest awarder of that, you know, so, you're just seeing hundreds of battery installations. Just, specific battery installations solving a specific problem for the utility.</p>		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
And, I have- just to kinda figure out [U] for my own, I- yo- you don't need a photovoltaic system to have a battery energy storage system in your home and you don't need a battery energy storage system to have a photovoltaic system and you can work in concert through the existing electrical system of the facility or home, but they can work also independently?	00:53:46	<b>UIS</b>
Yep.		<b>UIS</b>
Correct. Now, what battery energy storage systems are, is they're a form of distributed energy resource: DER. As is a photovoltaic system, as is a motor generator, as is an electric vehicle. They're all DER's, if- you know, so, let's put this really clear- out there. And we- we can mix 'em all together; fuel cells, uh, microturbines, we can mix 'em all together into one system with a controller. We would call that a micro-grid controller, or we could have just one at our facility. We're lookin' at a job right around the corner from our headquarters right now that's gonna get a- a natural gas internal combustion engine. And that's it, that's what they're gonna have and it's gonna be- it turned out to be the best bet for that client in terms of cost reduction for their energy consumption.		<b>Troy</b>
So, you can charge a battery storage system not only off PV or off the grid, but you can do it off of fuel- you can do it off of I do- I don't- wind-		<b>UIS</b>
[OL] Any connected generation.		<b>Dan</b>
...any- any kind of connected generation.		<b>UIS</b>
Any connected generation. You know, this is...what- what our grid really is, is a mish mosh, right? Of different forms of generation. In our state we have hydro, we have nuke, we...don't have coal, I don't believe anymore, but we have natural gas and we have a lot of solar and we have a lot of wind. And there's, you know, there's fuel cells, there's- and- I've always looked at it as, that's what our grid is and that's what our grid needs, and it's all a matter of what is best, not only for the client but I do like to think, the environment as well, when you think about it. And		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
then there's reliability, there's constructability, there's the whole 9-yards that must be considered when you're looking at your long-term return on investment.		
Energy storage is like this, I'm [UI] bicycle wheel, right? You have the hub, it's a utility, one spoke is energy storage, one's phot- PV, one's wind, one's fuel cell, one's- could be anything. And all of those make up the components of the grid.	00:56:05	<b>Dan</b>
I have a dumb question; there's nothing inherently photovoltaic about a battery?		<b>UIS</b>
No, photovoltaic is purely turning light energy into electrical energy.		<b>Jay</b>
Battery- batteries are just pure storage, electrical-chemical.		<b>Troy</b>
And I think one confusion- a battery is not a generator, it's a consumer of energy. I mean, it's- runs in the low 90's, depending on the technology- 90 percent efficiency, so, it loses about 10 percent every time you charge and discharge it through the electrical-chemical reaction, line losses, blah, blah. But a battery i- is not generation, it's load.		<b>Dan</b>
[UI]		<b>UIS</b>
Yeah, and photovoltaic is obviously generation- it's a [UI] generates, load consumes some of it and the utility gets the rest of it.		<b>Dan</b>
So, one thing we have to look at is, we regulate the construction industry, but we have a real focus on the residential market place and currently the C-46 classification can contract for the installation of a solar system and the SS if they're together, part of the same contract. So, what we're looking at is whether or not that's appropriate, and at the same time we have a new governor that wants to build 3.5 million, I think, residential homes and many of them will likely be required to have solar. So, i- is there enough- will there be enough contractors to meet that market need? [UI] for example-		<b>Dave</b>
Can- I would- can- can I answer this as a non-Baker employee; uh, having been my own business owner, uh, the answer is: absolutely, there is enough. When you- and if there isn't enough, there will be enough. And it's a matter about turning out qualified persons to do that work. The market will rise, um, the- the		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
installers, if you will. And, so, when I look at- at C-46's, I see an opportunity for them. I see an opportunity for them to become C-10's. To do more work than just solar and battery storage, 'cause the C-10's are coming into their world, right? Or have, let's not say "are", they have. And I see opportunities for C-46 to expand their knowledge. Their- their employee's safety, if you will, and grow their businesses by having proper certifications for different work.		
An- in the new construction residential world, there's already a C-10 on the jobsite putting the electrical in that house. This is just one more component that he wires up.	00:58:44	<b>Jay</b>
Yeah, I mean, for a business owner it's very inefficient to be bringing both the crews an-		<b>Dan</b>
[OL] Another contractor. It'd be like bringing in- yeah...		<b>Jay</b>
You gotta hit the ground running.		<b>Dan</b>
Yeah. So, the C-10 runs the air conditioner circuit to the air conditioner spot, he runs the...the other branch circuits, he runs the pool pump's circuit and he runs the circuit to the roof for the- for the solar and puts the solar on the roof.		<b>Jay</b>
[IA]		<b>UIS</b>
Well, to- to your question, I don't see that- th- that being any- any way- being a labor shortage to handle that extra work load. There's already laborers [sic] there on-site doin' very similar work.		<b>Jay</b>
So, Missy, uh, Brian, Tanya, and Heather have been pretty quiet. Do you guys have any que-		<b>Dave</b>
Great questions, thank you very much.		<b>Jay</b>
<b>[End of Recording]</b>	00:59:42	
Do you have a rough idea of what your shelf-life is?	00:00:00	<b>Justin</b>
Uh-		<b>Jay</b>
[OL] Like, the Tesla, let's just [UI] the Tesla.		<b>Justin</b>
...so, out of the box warranty is 10 years.		<b>Jay</b>

TRANSCRIPTION	TIME	SPEAKER
Okay.		<b>Justin</b>
Uh, we expect 10 to 15 years. Um-		<b>Jay</b>
[OL] So, mid-2020's is when you're gonna start seeing, okay-		<b>Justin</b>
[OL] Potential failures of ex- of batteries that have been installed? Fo- that- that's what we'd expect, yeah. Uh, there's reasons why the manufactures didn't go further. Like, solar- solar module manufacturers are typically 25-year warranties, at least production-wise, uh, workmanship-wise. Um, but we expect batteries to be, uh- uh, a- 10 to 15 years would be there life-expectancy. The same- inverters are typically- out of the box warranties are 10 years as well. Now, you could buy extended warranties, just like any other extended warranty on any other pr- pretty much any other appliance or product. Um, but mostly that's just to replace- that's just an extended warranty replace an inverter or replace a battery.	00:00:18	<b>Jay</b>
E- yeah, there's two- there's obviously calendar life, shelf life which is the degradation naturally of the battery and the components and electrolyte within it and then there's the duty cycle, so, depending- you-		<b>Dan</b>
[OL] Yeah, another ten thousand cycles, I think, is pretty much the standard on a- on a residential-type Tesla Powerwall is ten thousand cycles.		<b>Jay</b>
And the- the there's different technologies, so, we have a great understanding of lead acid energy storage systems and we traditionally get anywhere from 5 years, if you use it, to 10 years if you don't use it. And, what I traditionally saw with all the systems I historically did was about an 8-year life. Uh, Santa Cruz Island's a great example. At the Nature Conservancy and Navy site I did 'em both and did 'em twice each, throughout their lives of their systems. And they're still operating to this day on lead acid. Um, and, you asked about electrocutions. I- I remembered one. Um, it wasn't an electrocution, but it was certainly a bad day for a worker on a lead acid battery. As he was welding above the lead acid battery and- and the sparks were dropin' on the top and he had some hydrogen go off on him, so, you know, that's a different animal. I- I get it, but there's a lot of		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
<p>considerations that go into the designs of these battery banks and what happens; torque, mechan- there's mechanical issues that must be thought through. A lot of the battery systems on a commercial level, when the battery cabinets come to us, there is a bunch of battery racks that we call modules that are usually in it and then they are bused together, um, electrically as well as with communication cables. A lot of manufacturers do not ship 'em installed. That is our job when they arrive on site. Some manufacturers like NEC do. So, there's kind of a- in the commercial world there's even a level of differences that must be taken into account and then, again, working on li- batteries are live. They're not like solar. You can put a blanket over it or work on it at night. Batteries, they're live, they're charged. And so those considerations must be taken into account.</p>		
<p>And I think one thing that very clearly dif- transportation requirement aside from weight correct?</p>	00:03:19	<b>Dan</b>
<p>Yeah- yeah, our- our, uh-</p>		<b>Jay</b>
<p>[OL] So, it's [Ui] there.</p>		<b>Dan</b>
<p>...our warehouse and transport personnel had to be DOT certified to transport batteries and...</p>		<b>Jay</b>
<p>[OL] And that's because-</p>		<b>Dan</b>
<p>...solar modules, anybody can...right...right.</p>		<b>Jay</b>
<p>...stored energy vs. a generation that's waiting for light to convert.</p>		<b>Dan</b>
<p>Just to share some statistics with you, we ran our license records and determined that two thousand, fifty-two [2,052] licensees have a C-46 Solar Class, seventy-eight thousand, five hundred and sixty-two [78,562] have a C-10 and five hundred and seventy-six [576] licensees have both the C-46 and the C-10.</p>		<b>Dave</b>
<p>What was the last one?</p>		<b>UIS</b>
<p>The C-10 is seventy-eight thousand, five hundred and sixty-two [78,562].</p>		<b>Dave</b>
<p>Only five seventy-six [576] have both?</p>		<b>Troy</b>
<p>Five hundred seventy-six have both.</p>		<b>Dave</b>

TRANSCRIPTION	TIME	SPEAKER
Wow! I'm very surprised.		<b>Troy</b>
And the five seventy-six [576] is a subset of the two thousand number or it's in addition to the two thousand number?		<b>Jay</b>
Yeah, it would be that they'd have both, so, that's why it would be a subset of the two thousand fifty-two [2,052].		<b>Dave</b>
Right.		<b>Jay</b>
Thank you for sharing that. Um, just one comment, just again out of my history was that my company, we originally set up a B license. Then we added a C-10, and then we added our C-46. And, we did that because, again, we saw that the C-10 was the most important for doing batteries, solar and generators. You know, basically energy, renewable energy. And then what we wanted was the B to over arch when we were building steel structures or, you know, buildings to house batteries, things of that nature. The C-46 was something we felt the public wanted us to have, so we did the C-46.	00:04:22	<b>Troy</b>
I'd like you to comment on the B because we have- I've had the opportunity, uh, to meet with building officials. We have a board member who's a Sacramento County Building Official – Nancy Springer – she has invited me to different functions and they- they, the building officials are raising concern about the B's doing the energy storage systems. About perhaps not having trained, uh, workers to do the installation. Do you have any thoughts on that?		<b>Dave</b>
I, it- when we had just our B, we always subcontracted C-10's to do that work. We never did it ourselves. So, we- what we looked at is we had multiple trades on the project, we would be erecting a steel structure; we would be erecting a- a building and we'd be doing photovoltaics, or battery storage and all electrical would be done by the C-10. So, it- it still holds that a C-10 would do that work.		<b>Troy</b>
I guess under our cat- classification scheme, a B could do the solar. They could install the solar system and they could install the SS...Justin?		<b>Dave</b>
Correct, correct.		<b>Justin</b>

TRANSCRIPTION	TIME	SPEAKER
<p>Even for- for, you know, it's been a long time, Dave, and we've- we've looked at that issue and, you know, that goes back to the Home Depot world that- that's one of the first pieces of legislation I ever worked on and, you know, that's just been kinda the policy of the State of California, that a B, you know, Classified Building- General- General Building Contractor, if they're performing two additional trades and th- other than framing, that they can self-perform any craft...you know, that's licensed by the board and that, you know, I- I think that's more of a function of the licensing law rather than, you know, the industry. And- and some of them, you know, they- you know, they- you know, they- they scr- you know, use that to skirt some of the things like, certification and- and such, but I think that's a whole 'nother animal, you know, to deal with. Um, while I have the mic, can I ask just one question while we're here? 'Cause, you know, I'm the political guy an- and- and from a political standpoint, you know, the C-46 solar contractors, you know, throughout the testimony have- have stated, you know, they've been installing, you know, off-grid energy storage for two decades, three decades and, you know, I- I- I- I- is there- can you maybe elaborate on, you know, the technology change or, you know, why that was and why- why we need- you know, it's important to move this to, you know, the new battery systems that are, you know, is it being deployed more frequently now and it's gonna be in places where it could cause more damage or, you know, because they make that claim and it- and it's compelling, that they've done this work for a long time, you know, why would you make it- a change to say, that only a C-10 could do the work and, you know, is- is it- was it much different twenty years ago, whether it was a dangerous different-</p>		<b>Mike(?)</b>
<p>[OL] Yeah, so, since I've been in the industry for 30 years, I- I believe I can address that very well. So, in the early days of our industry, we were looking at 17-volt panels that may have operated 20 volts open circuits, 17 volts max power and charged a 12-volt battery. And then you'd have a battery and maybe a light</p>	00:07:48	<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
<p>associated with that for a remote cabin or if you're in Northern California, believe it or not, there was some illegal activities going on up there and they needed to power lights. And I kid you not that that spurred this industry. Uh, then folks started adding inverters to that which are now- we call RV inverters, but smaller inverters, and they were bringing in more traditional appliances into their systems. So, that market was a small market, incredibly small. So, our- our manufacturing volumes for solar panels and batteries weren't there, and our technologies for our solar panels and batteries weren't there. Now, fast forward to today, uh, with California successful, um, uh, CC Program, the S-chip, which later became the CSI, which were the rebates, and then couple that with the nation's investor-Investment Tax Credit, the ITC of 30 percent, and with the Chinese- the, I'm sorry, the German program, then the Chinese program, then the Chinese manufacturing and there was a huge plummet in cost. And what cost us in the early 2000's, a hundred-kilowatt system for example would've costed about a million, and today you're lookin' at maybe two hundred thousand. That's the price difference in 19 years in terms of a drop, so, volume-wise, huge difference. Technology-wise, huge difference. We're not talkin' lead-acid batteries anymore, we're talkin' lithium-ions- ion, which has thermal runaway potential. And it's a real potential and needs to be considered. We're not talkin' 12-volt systems anymore. We're talkin' 400-volt battery banks for residential. We're not talking about standalone systems of 30 years ago. There weren't grid-tied systems 30 years ago. There is today. There's a big difference out there. The commercial sector didn't exist 30 years ago. Uh, it does now and it's- it's rapidly growing, but from a volume standpoint, of what uses the most solar modules in our industry, where the shipments go, they go to utility scale first, residential next, CNI last. CNI's a fraction of the others, um, if you compare to 'em. So-</p>		
<p>"CNI's", commercial industrial?</p>	<p>00:10:44</p>	

TRANSCRIPTION	TIME	SPEAKER
<p>Commercial Industrial, yes, so, getting back, big changes, big differences, um, the biggest voltage we used to see, uh, twenty years ago, and a lot of guys didn't like doin' it, was 48-volts on the DC-side. And again, the- the analogy is this, if we're gonna reduce cost of the inverters, the- what we call the "Balance of System", outside of the batteries and the solar panels, uh, 'cause those are the expensive items, and the- historically they were really expensive but they've come down a lot. If we were gonna reduce those costs, the way you do it is the voltage. Because higher voltage uses less current. Voltage times current is power. So, so it- it's pretty simple math if you think about it. The higher the current, the bigger my conductors, the bigger my switching elements, the bigger my boxes, the bigger my bending radiuses, so you understand why, uh, higher voltage is better than low voltage, because of the reduction in current. And that's why voltage isn't gonna drop, it- it's gonna continue to be high.</p>		<b>Troy</b>
<p>Are there specific safety changes when you're going from lead-acid to lithium ion? Is it- is it or- is- I know you've mentioned the voltages and the size but is that- inherently these new technologies that are now considered energy battery- energy storage systems and being placed in residential, are they much more dangerous than the old lead-acid systems?</p>	00:11:53	<b>Mike(?)</b>
<p>They both have their challenges. Um, lead-acid of course vents hydrogen. Hydrogen's explosive. Lead-acid can be flooded lead-acids, it can be an absorb glass mat which, picture the electrolyte in a sponge and sgl- glass mat, or a gel-cell which, it's like in a Jello...in- in between the plates. So, both, uh, absorb glass mat and gel-cells can be on their sides, you're not gonna spill. They're not gonna out-gas a bunch of liquid like a flooded might. So, flooded's have the real electrocution, uh, issue, because of that buildup, um, of the electrolyte on 'em. Lithium ion, however, has a much broader operating range from its max voltage to its minimum voltage, in other words, from the nominal it swings further per cell than lead-acid does, and it also, dependent upon- well, all it's chemistries, some</p>		<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
chemistries are a little more volatile than others, have the real thermal runaway concerns, uh, associated with 'em. And they also can delivery current faster than a lead acid can. So, they're fault currents on a similarly sized amp hour rating are higher. So, I- d- I don't know if that helped, uh, explain the dangers and the hazards?		
Can you explain the thermal runaway; like, what's the impact of that, how- wh- how would that affect something?	00:13:42	<b>Heather(?)</b>
Okay, so, a- a battery that is discharged too fastly [sic] or charged too fast is gonna build up temperature. And if you cycle it enough it could heat up- once it gets to a point, it can't cool down, it'll just continue to heat up. And then you have the scenario's that Dan was describing a little earlier where you actually melt down, if you will, and you end up with battery fires. Uh, Hawaii has had battery fires with lithium-		<b>Troy</b>
[OL] Kahuku, S&C Electric.		<b>Dan</b>
Yep, yep, S&C locally on our- in here. Of course, we've all heard about the airplane that had, uh, lithium ion battery fire but you also all heard about these things goin' off in your pocket or even some Tesla cars, if you will. So, it comes down to battery management and there's two levels of battery management. So, there's at the cell level, to protect the cells they're monitoring voltage, current and temperature. And then there's also the grand battery management which is pullin' the big current in and out of the battery bank. So, you have two levels of battery management.		<b>Troy</b>
Dan, when- and you mention the thermal runaway, can- can a thermal runaway be caused by a faulty installation?		<b>Mike(?)</b>
[UI] environmental concerns need to be taken into account. The duty-cycle, how the battery's being used is- is very- y- you don't want to ever exceed the battery's, um, ability to- to duty-cycle, as Troy was saying. It's- they're runaways- simply the battery's creating more heat than it can dissipate, right? It's- it can't- it can't cool		<b>Dan</b>

TRANSCRIPTION	TIME	SPEAKER
<p>itself so as it gets hotter and hotter and hotter it hits, like- as chemistry in high school- 'member 'flashpoint'? [laughs] Always that flashpoint on the periodic tables. Once you hit that it's almost an unextinguishable [sic] fire. Um, in Hawaii with a- with an installation, I mean, the- the Fire Department takes a defensive posture, they put water on it, which is an oxidizer, which feeds the fire and it just continues to burn and they just wait until it burns out. So, um, but I've been in- personally- we've been personally, um, him- eh, um, in the telecom worlds, you know, a lot of thermal runaway, which was basically mismanaged, when the battery was too old it was overcharged, it wasn't operated properly, but as Troy said, every chemistry has its pros and cons and, you know, a battery is stored energy and stored energy needs to be treated very seriously no matter what the technology is.</p>		
<p>And from a, uh, installation practice, absolutely, I've seen poor installation practices cause these issues. So, for instance, if I- if you have multiple strings of batteries in parallel, you have to match the impedance from that inverter to each string. So, you might have a room this size in a commercial, uh, installation full of batteries and that means if they're all feeding back to the same charge source, I have to match the impedance in each conductor. And we all know is impedance is involved with the resistance, or the wire size, but you also have inductance, you also have capacitance. So, there's a lot of design that goes into that and then also if you use the wrong the wires, uh, is that really the right comment? Nah, maybe- yes? Uh, but if you have any nicks in those wires or if those wires are undersized then they overheat and then you get, um, a scenario where you arc, either to ground or to another conductor, you are absolutely gonna see thermal runaway. It's gonna happen. And especially if you don't have over current protection on each end of that string. There must be over current protection at the battery itself and then over current protection at the battery combiner. A lot of people miss that point. They'll only do the over current protection at the battery combiner.</p>	00:16:11	<b>Troy</b>

TRANSCRIPTION	TIME	SPEAKER
And- and- and not to be too self-serving or- is, do you believe that licensed electrical contractors are probably the best to protect against that in far as installation goes?	00:17:42	<b>Mike(?)</b>
They're- in my opinion they are the best line of defense.		<b>Troy</b>
Now we, eh, we just did an installation where the manufacturer shipped the wrong size fuses on top of the batteries. Uh, so, the manufacturer shipped it, the plan checker didn't catch it, the field inspector for the city didn't catch it, our guys caught it; saying, "...this wire looks too small and is too small, Dan, compared to the fuses." Um, ultimately it was a recall by the manufacturer and, um, that's a real-life example that's happenin' on a real project we just completed.		<b>Dan</b>
That happened to Baker with that same exact manufacturer two years ago. Dan is far more articulate than I am because he was able to get the manufacturer to listen-		<b>Troy</b>
[OL] [laughs] To pay me.		<b>Dan</b>
...I was unable to.		<b>Troy</b>
I think that was very educational, very thorough. I don't think we have any more questions. I really appreciate your time. And we may need to follow up with you so, thank you for providing your email address.		<b>Dave</b>
Alright, thank you.		<b>Mike(?)</b>
<b>[END OF RECORDING]</b>	00:19:01	

# **LETTERS RECEIVED ON BEHALF OF THE SOLAR CONTRACTOR (C-46) INDUSTRY**

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**Captain Richard Birt**

17 Timberline Drive  
Las Vegas NV 89124  
702-523-6945

May 17th 2018

**Ms. Heather Young**

CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Heather Young,

I am currently serving as a Fire Captain with Las Vegas Fire and Rescue with 28 years of experience as a firefighter. I have lived for 13 years in a house powered by solar panels and batteries with no connection to the grid.

In the last 2 years I created Solar And Fire Education, SAFE and have taught over one thousand firefighters across the country how to safely respond to emergencies involving solar panels and battery storage. I have been teaching SAFE to multiple departments in California and would like to explain why I am in opposition to revising licensing eligibility for energy storage systems.

1. The SAFE program is designed around the fact that solar panels and storage are one entity and have to be approached in that matter. I teach that there can be deadly consequences to a first responder if they don't respond and shut down the system as one unit. The idea of separating the two systems is very impractical and could lead to confusion in an emergency situation.
2. The SAFE program has been teaching the departments in California these facts, that have been vital in keeping Californian firefighters safe in their state for a number of decades.
  - a. To my knowledge, there have been no worker or public safety incidents reported to OSHA, CSLB, or any other authority in the state of California caused by the installation of solar and storage systems. The fact that there has been over 700,000 solar PV systems interconnected to the electric grid and thousands of storage systems installed with this exemplary safety record is a testimony to all the C-10 C-46 and A and B contractors. This safety record has a direct result on

- 
- the safety of the first responder community and should be celebrated and not dismantled.
- b. Storage manufacturers are quickly meeting market demands for more pre-engineered packaged systems that are plug-and-play and fully integrated with solar inverters. This advance in technology not only makes installation safer, but also increases the firefighters ability to deenergize a system more efficiently and safely.
  - c. The C-46 license was the original solar and energy storage installer in California and was created in the 1980s. The C-46 contractor has been installing off-grid solar plus storage systems for many years with an exceptional safety record that in turn has kept Californian firefighters safe.
  - d. Part of SAFE's goal is to also highlight the resiliency of renewable energy, and how civilians can use this new technology to take control of their own power needs when the grid is down. SAFE teaches that if whole communities have a chance to invest in this affordable technology it has an effect on National Security. If civilians have regular backup power in their homes the burden on the first responder communities decreases. People who are diabetics will have the ability to keep their insulin cool in refrigerators, people with breathing problems will be able to use their C-pap machines and nebulizers. Firefighters who would be at home trying to protect their families because of a power outage would be available to report to duty and serve their community. The CSLB has to realize that the decisions ahead of them will dramatically impact someone investing in their own critical infrastructure, which literally could be a matter of life and death during a natural disaster.

The fact that this technology is available should drive a decision to encourage everyone in the state of California to become part of a solution of reliable resilient energy that protects everyone. To increase the price and to decrease the availability of these systems to people who want to invest in their own power is completely wrong and will affect the safety of California and its citizens.

**Captain Richard Birt.**



April 10, 2018

**TO:**

David R. Fogt  
California Registrar of Contractors  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**FROM:**

Richard Umoff  
Regulatory Counsel and California Director  
Solar Energy Industries Association  
600 14<sup>th</sup> St. NW Suite 400  
Washington, D.C. 20005

**RE:** C-46 Solar Plus Energy Storage Installations

Dear Mr. Fogt,

The Solar Energy Industries Association (SEIA) submits this letter in response to the Contractor State Licensing Board's (CSLB's or Board's) pending determination on contractor licensing requirements for installations of energy storage when included as part of a solar system (a "solar plus storage system").

Established in 1974, SEIA is the national trade association of the United States solar energy industry and is a broad-based voice of the solar industry in California. Through advocacy and education, SEIA and its 1,000 member companies are building a strong solar industry to power America. SEIA member companies in California install a large portion of California solar projects, including solar plus storage systems.<sup>1</sup>

SEIA has a robust consumer protection initiative and codes and standards department informed by extensive industry experience throughout the United States. SEIA strongly urges the CSLB to allow C-46 contractors to continue installing solar plus storage systems as they have done safely for years, and to reject stakeholder recommendations that a C-10 license be required. Requiring a C-10 license is unnecessary to ensure safe installations and inconsistent with national best practice. Further, it would expose consumers to significant economic risk by potentially

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<sup>1</sup> The views expressed herein represent the views of SEIA and not any individual member company.

disqualifying the storage portion of their system from Investment Tax Credit (ITC) eligibility. For these reasons, SEIA strongly urges the Board not to require a C-10 license for solar plus storage installations.

**i. There is no evidence that limiting installations to C-10 licensees improves safety**

SEIA supports safe and properly installed solar plus storage systems. However, SEIA is unaware of any pattern of conduct that necessitates new licensing requirements to install these systems safely. In fact, the only basis for the recommended change appears to be an assertion by some stakeholders that improperly installed solar plus storage systems pose safety risks.<sup>2</sup> While it is self-evident that any technology that is improperly installed may pose a safety risk, these stakeholders provide no basis for their claims that C-46 contractors cannot properly install solar plus storage systems, or that a C-10 license would make these installations more safe. Further, these stakeholders fail to acknowledge that C-46 contractors have installed solar plus storage systems safely in California for years, and that regulatory structures are in place to promote safe, quality installations. Thus, the recommendation to require a C-10 license is unsupported and should not be adopted.

**ii. C-46 license holders are well equipped to install solar storage systems safely**

The purpose of the C-46 license is to allow contractors to perform electrical work in connection with a solar system installation. C-46 candidates go through rigorous training and testing to learn about appropriate design and safety practices associated with solar installations such as the California Electrical Code and the California Fire Code. In fact, the C-46 examination study guide lists storage as one of the main topics covered by the C-46 exam.<sup>3</sup> C-46 contractors have specific expertise on how to install solar plus storage systems. In contrast, the C-10 contractor exam does not cover as many questions on storage as the C-46 exam, requiring less expertise about storage.

While new technologies are in development, battery storage is still the dominant storage technology, and C-46 contractors are already very familiar with battery storage. As new storage technologies emerge, codes and standards organizations will update their guidance and the State of California will adopt the updated codes, and C-10 and C-46 contractors will incorporate the new rules into their installation practices. Finally, inspectors provide an additional layer of safety by conducting safety checks of the installations.

**iii. Requiring a C-10 license for solar plus storage would contradict years of best practice in California and throughout the United States**

Solar plus storage systems have been deployed in California and elsewhere for decades and changes in electricity policy along with improving economics are now making storage an integral part of a solar system installation. Allowing solar-specific contractors to install storage

<sup>2</sup> <http://www.cslb.ca.gov/Resources/BoardPackets/CommitteeMeetingPacket20180223.pdf> at page 93

<sup>3</sup> <http://www.cslb.ca.gov/Resources/StudyGuides/C46StudyGuide.pdf>

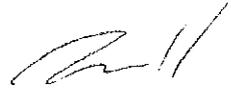
in conjunction with solar is neither unusual nor unique to California. In fact, multiple states outside of California offer solar-specific contractor licenses: Hawaii, Nevada, Connecticut, Utah, Idaho, and Florida. Each of these states expressly allow solar contractors to install storage or state that solar contractors can install all equipment connected with a photovoltaic system installation. For example, Nevada's photovoltaics license covers "[t]he installation, alteration and repair of photovoltaic cells, batteries and invertors."<sup>4</sup> Idaho states that Photovoltaic Installer License holders may "[i]nstall, maintain, repair, and replace all electrical equipment, wires, and accessories up to and including the inverter."<sup>5</sup> And in Connecticut, PV-1 license holders may engage in "the installation, erection, repair, replacement, alteration or maintenance of photovoltaic or wind generation systems, including storage."<sup>6</sup>

**iv. Requiring a C-10 license creates a significant financial risk for consumers**

Finally, a holding that storage is not part of a solar system would endanger a consumer's ability to leverage the federal ITC or other government incentives to update their homes and businesses with solar. The residential and commercial ITC allows a system owner to receive a tax credit based on a "qualified solar electric property expenditure" which includes energy storage when it is part of a solar system.<sup>7</sup> If storage is deemed to not be part of the solar system, this consumer tax benefit could be lost.

For the above reasons we urge the CSLB to continue to allow C-46 contractors to install storage as part of solar systems. You can reach me at 202-603-0883 or [rumoff@seia.org](mailto:rumoff@seia.org) with any questions. Thank you for your consideration.

Sincerely,

/s/ 

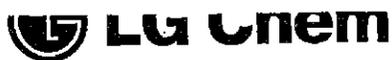
Richard Umoff  
Regulatory Counsel and California Director  
Solar Energy Industries Association

<sup>4</sup> NAC 624.200(2)(g), available at <https://www.leg.state.nv.us/NAC/NAC-624.html#NAC624Sec200>

<sup>5</sup> [https://dbs.idaho.gov/forms/electrical/e\\_spec\\_con\\_appl.pdf](https://dbs.idaho.gov/forms/electrical/e_spec_con_appl.pdf) at page 7

<sup>6</sup> <http://www.portal.ct.gov/DCP/Occupational-and-Professional-Division/Occupational--Profess/Solar-Trades-Licenses-and-Scope-of-Work>

<sup>7</sup> <https://www.irs.gov/pub/irs-wd/201809003.pdf>



1657 Technology Drive  
Troy, MI 48083

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of LG Chem, I am writing to express opposition to changes with the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

LG Chem has been in business since 1947 developing advanced battery technologies since 1991. LG Chem has launched their first lithium ion battery product for residential applications, called RESU. Our RESU launch provided us the opportunity with the industry's skilled solar installers. These qualified solar installers have successfully installed, operated and maintained our energy storage products. LG Chem's RESU home battery is simple and easy to install and is just a component within an installer's full residential solar installation

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce. Solar installers are required to be certified to install RESU products to even purchase the battery from their distributor. Then the RESU must be installed by a certified installer in order for the product warranty to apply.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the



1637 Technology Drive  
Troy, MI 48083

contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

*Simon Y. Tsou*

Cc: David Fogt, Registrar



May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

The California Building Industry Association (CBIA) is a statewide trade association representing over 3,100 member-companies involved in residential and light-commercial construction. CBIA member-companies are responsible for over 90% of the new homes built in California each year. Please be advised that CBIA currently opposes any revision of licensing eligibility which would significantly restrict the pool of those licensed contractors who could install energy storage systems.

On May 9th, the California Energy Commission adopted updated energy efficiency standards which will take effect on January 1, 2020. These new regulations include a first-of-its-kind solar mandate for new homes and apartments. In negotiating a position of support for these regulations, CBIA was able to gain CEC approval of significant compliance credit for the voluntary installation of battery storage technology (in combination with the rooftop solar PV system). CBIA recognizes that there will be increasing consumer demand for battery storage technology as Time-Of-Use electricity rates kick in throughout the state in 2019. Also, there is a growing need to use this technology at the micro-level as part of an overall grid-harmonization strategy.

**The perfect storm:** Given the two points cited above, we will see an increasing number of these energy storage systems installed in new residential construction and, if CSLB approves the change being considered, we will simultaneously see a significant reduction in the available workforce that could legally install these systems.

**Why do this?** As California is still struggling to emerge from the worst housing crisis in the past 60+ years, it seems perplexing that CSLB would be considering such a restriction in the available workforce when the installation of these systems to date has been going so well. CBIA is unaware of a worker or public safety issue being documented. Also, these smaller-scale systems are becoming even easier to install. Manufacturers are understandably responding to market-demand and producing systems that are "plug-and-play" and fully integrated with the solar system inverters.

Lastly, the existing C-46 licensee has been installing these systems for years and, more importantly, the CSLB exam for the C-46 license places a much greater emphasis on battery storage technology than does the C-10 license exam which only recently began to focus on issues related to this technology.

I would welcome the opportunity to discuss our concern with this proposal in greater detail. Please feel free to contact me at your convenience. My direct line is (916) 340-3322.

Sincerely,

*Bob Raymer*



May 18, 2018

David R. Fogt  
California Registrar of Contractors  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: C-46 Solar Plus Energy Storage Installations

Dear Mr. Fogt,

The Solar Energy Industries Association (SEIA) submits this letter in response to the Contractor State Licensing Board's (CSLB's or Board's) April 25, 2018 workshop on contractor licensing requirements for installations of energy storage when included as part of a solar system (a "solar plus storage system").

Established in 1974, SEIA is the national trade association of the United States solar energy industry and is a broad-based voice of the solar industry in California. Through advocacy and education, SEIA and its 1,000 member companies are building a strong solar industry to power America. SEIA member companies in California include both C-10 and C-46 contractors who install a large portion of California solar projects, including solar plus storage systems. SEIA member companies also include storage manufacturers and contractors who install solar plus storage systems outside the state.

SEIA has a robust consumer protection initiative and codes and standards department informed by extensive industry experience throughout the United States. SEIA strongly urges the CSLB to allow C-46 contractors to continue installing solar plus storage systems as they have done safely for years, and to reject stakeholder recommendations that a C-10 license be required. As others have written, requiring a C-10 license is unnecessary to ensure safe installations.

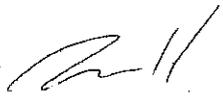
Solar plus storage systems have been deployed in California and elsewhere for decades and changes in electricity policy along with improving economics are now making storage an integral part of a solar system installation. Limiting installations to C-10 licensees is inconsistent with national best practice.

Multiple states outside of California offer solar-specific contractor or sub-contractor licenses including Nevada, Connecticut, Utah, and Florida. These states include some of the largest solar markets in the country either by volume or on a per capita basis. And each of these states allow

solar contractors to install solar plus storage systems. Thus, allowing solar contractors to install solar plus storage systems is neither new nor unique to California.

For the above reasons we urge the CSLB to continue to allow C-46 contractors to install storage as part of solar systems. You can reach me at 202-603-0883 or [rumoff@seia.org](mailto:rumoff@seia.org).

Sincerely,

/s/ 

Richard Umoff  
Regulatory Counsel and California Director  
Solar Energy Industries Association



April 10, 2018

David R. Fogt, Registrar  
Contractor State Licensing Board (CSLB)  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: david.fogt@cslb.ca.gov

Dear Mr. Fogt:

**RE: C-46 Solar Plus Energy Storage Jurisdiction**

On behalf of our 500 business members who are installing and manufacturing the vast majority of behind-the-meter solar and energy storage systems in California<sup>1</sup>, I am writing to provide some background information regarding the contractor licensing issue that was raised at the Licensing Committee in February related to energy storage systems (EES). We strongly urge the CSLB to reject any suggestion that a C-46 licensed contractor be restricted from installing an energy storage system when paired with a new or existing solar photovoltaic (PV) system. We look forward to productive conversations and fact discovery on this matter and ask for the opportunity to present educational material to the CSLB on this subject.

**Key Terminology**

We wish to establish a few key terms and to clarify some important forces shaping the California energy marketplace.

**Solar PV System:** Solar photovoltaic (PV) systems contain many different parts that include, but are not limited to:

- PV modules made up of many photovoltaic cells; an PV array is several modules strung together
- Racking and mounting hardware
- Inverter
- Energy storage (both AC and DC coupled)<sup>2</sup>
- Solar charge controllers (for the battery), combiner box, wiring and conduit, signage, disconnects, transfer switches and other misc. components

<sup>1</sup> The California Solar & Storage Association (formerly CALSEIA) represents over 500 companies. Over half of our members are contractors registered and licensed in the state. Approximately half of our contractor members hold a C-46 license and the other half hold a C-10. In 2017, our membership installed nearly 75% of the behind-the-meter storage capacity in the state and over 80% of the behind-the-meter solar.

<sup>2</sup> The National Electrical Code defines a solar PV system as "the total components and sub-system that, in combination, convert solar energy into electric energy suitable for connection to a utilization load." For many storage products on the market today, the battery and the PV system share the same inverter. If the CSLB were to revoke the C46 license holder's ability to install a storage-paired solar system, it would have the effect of revoking the C46 license holder's ability to install solar PV of any kind given the trends in the marketplace.

**Paired Solar and Energy Storage System:** Any energy storage device installed either with with the solar PV array or as an added feature later that is directly charged by the solar PV array is considered a “paired system.” Solar and storage paired systems were the foundation of California’s solar market in the form of “off-grid” systems and today are becoming increasingly popular as utility rate structures shift to “time-of-use” rates. Federal IRS rules regarding the solar investment tax credit require that the energy storage device be directly charged no less than 75% by a paired solar system. Currently, both the C46 and the C10 licenses are qualified to install paired solar and storage systems.

**Stand-Alone Energy Storage System:** An energy storage device that is paired with a non-solar technology (fuel cell, microturbine, etc.) or has no external source of electricity outside of the grid itself is considered “stand alone.” Of the 12,000 Self-Generation Incentive Program (SGIP) funded storage systems built in the past few years, the vast majority are paired with solar. Only the C10 license holder is qualified to install stand-alone systems.

#### **Eligibility of C46 to install an energy storage system paired with solar PV**

The C46 license holder has always been qualified and eligible to install an energy storage system when paired with solar PV (whether concurrent to the solar PV system or as an add-on) since the inception of this license over thirty years ago. As Wendy Balvanz, CSLB testing chief, testified before the Licensing Committee on February 23, 2018, every version of the C46 test has questions related to energy storage. In contrast, the C10 test has only included questions related to solar and storage since its revision in 2013, and even then, not every C10 test will include any solar and storage questions. Based on the testing requirements alone, the C46 is the most prepared license holder to install energy storage paired with solar PV.

#### **Eligibility of a C46 to install a stand-alone energy storage system**

To our knowledge, no C46 contractor is arguing for the eligibility to install an energy storage system that is not connected in any way with a solar PV array. An energy storage system, when paired with a solar PV array, is a fully integrated component of that solar system, not a separate component. Furthermore, we categorically disagree with the claim expressed by the proponents of this rule change that because a C46 is not eligible to install a stand-alone energy storage system, regulators should infer that the C46 is by extension also not eligible to install a solar and storage paired system. One could employ the reverse logic to conclude that the C46 is eligible to install a stand-alone energy storage system because it is eligible, and has been eligible for decades, to install a paired system.

#### **Warranty Issues Related to Change of Licensing Qualifications**

It is of the utmost importance to consumer protection that the CSLB consider the ramifications of a wholesale licensing change such as is being proposed. Most solar contracts include a provision voiding warranties if the consumer allows or modifies the solar system. If the CSLB were to block the C46 license from installing energy storage systems, and a different contractor were to be hired to add a storage device onto an existing solar system, the warranty on the existing system would be nullified exposing the consumer to financial risk. For this reason alone, we strongly urge the CSLB to not modify the existing authority of the C46 license to install energy storage when paired with a solar system.

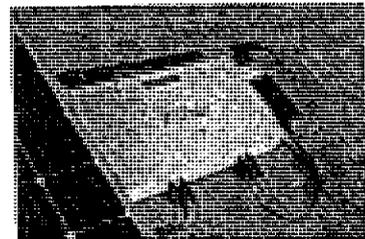
#### **The CPUC’s Self-Generation Incentive Program & the C46 License**

During the testimony presented to the Licensing Committee on Feb. 23<sup>rd</sup>, one of the proponents of the C46 change in eligibility suggested that the recent opening up of the Self Generation Incentive Program (SGIP) to include contractors with a C46 license was evidence of the C46 license holders trying to expand their market within California. This characterization is patently false. The SGIP program dates back to

2002 when it was first created in the wake of the electricity crisis. The rebate program was set up to encourage the use of “behind-the-meter” generation technologies on commercial properties (the state had a different program for residential systems). Both the CPUC and the CEC, which oversaw the administration of these programs, identified C46 and the C10 license holders as being eligible to receive rebates. In 2006, when the California Solar Initiative was created, the solar portion of the SGIP funds were taken out and put into their own solar-only rebate program. The SGIP funds that remained provided rebates for non-solar technologies such as fuel cells, small wind turbines, and natural gas microturbines. Because solar was pulled out of the SGIP program in 2006, the C46 license classification was also removed from the handbook declaring which contractor licenses were eligible to apply for rebates. Recently, energy storage systems were added to the SGIP program as an eligible technology for rebates. When this happened, CPUC staff accidentally overlooked the need to reinstate the C46 license as being eligible for rebates. Once this oversight was identified by the CA Solar & Storage Association, CPUC staff updated the guidebook to include the C46 license holder. As justification, the CPUC cited CSLB’s authorization of C46 license holders to install storage as part of a solar system and CPUC defers to the “current pattern and practice of CSLB”. A letter on this matter from the Center for Sustainable Energy, which administers the SGIP program for SDG&E, is attached.

**The difference between residential and non-residential solar and storage systems**

The lithium ion (Li-ion) battery is the most common battery in use today, both within the general consumer electronics industry (cell phones, computers, electric vehicles, etc.) as well as within the solar and storage market for commercial, residential and utility-scale systems. One of the attributes of the Li-ion battery is that it is modular, meaning it can scale up or down depending on energy needs of the consumer. Its modularity enables manufacturers to integrate the storage device seamlessly with the rest of the solar PV system. Take, for example, JLM’s product that attaches to the bottom of a solar module. Many inverter manufactures are incorporating the technology within the inverter itself.



JLM's Phazr product mounted on roof, with solar module

**What kinds of voltage do battery storage systems put out? How big are these systems?**

The short answer to this question is that it depends on how big the solar system is that the battery is connected to and/or it depends on the consumer’s energy load. The battery, as mentioned above, can be scaled up or down in size depending on the need of the consumer. The DC circuits of a one- or two-family PV system are permitted to operate at up to 600V. For other PV systems in California, that maximum operation voltage is 1000V. Conductors for residential energy storage systems will rarely exceed these maximum voltages, with which C-46 contractors are quite familiar. With newer pre-packaged / pre-engineered solutions in the market, even commercial/utility-scale energy storage systems are leaving fewer and fewer high-voltage connections to the installer, especially with regards to AC-coupled systems.

**I hear that energy storage is both “plug and play” and that it is complicated and dangerous. Which is it?**

As of July 1, 2018, the CA Residential Code will require new stationary storage battery systems for use in one- and two-family dwellings to be listed and labeled in accordance with UL 9540 (excluding approved,

<sup>3</sup> CSE Disposition AL 82E; Proposed modifications to the SGIP Handbook to incorporate the CA LSB’s C-46 solar contractor license classification into the list of SGIP-eligible licenses for the combined installation of solar photovoltaics & energy storage. Issued by CPUC Energy Division on December 19, p.9.

repurposed electric vehicle batteries). In addition, the CA Fire Code will soon require prepackaged and pre-engineered energy storage systems to be listed to UL 9540 when the system exceeds a certain size.

More and more energy storage system manufacturers are selling products that comply with UL 9540, which is generally associated with pre-engineered, prepackaged systems that some will refer to as "plug and play." These systems require far less engineering on a per-project basis and many of the major components (including the battery) can be considered a "black box" with minimum and maximum specifications for connection to other equipment. Manufacturers of commercial/utility-scale energy storage systems are even adopting this mentality with developments like pre-assembled, containerized and modular systems that are ready for interconnection. The upcoming addition of Article 706 for Energy Storage Systems in the 2016 CA Electrical Code will also provide more of a prescriptive approach to installing storage systems.

#### **Closing**

A resilient and reliable electricity grid is critical to California's future. Consumers are harmed when proper investments are not made to our electricity grid. Robust deployment of distributed energy resources, including solar and storage, is of the utmost importance to meeting the state's clean energy and consumer protection goals. We encourage the CSLB to consider all of the facts and the full ramifications of this decision for both the consumers and the contractors you regulate.

Sincerely,



Bernadette Del Chiaro  
Executive Director

Cc: CSLB Board members



May 18, 2018

Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Dear Ms. Young,

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

On behalf of our 500 business members and 86,000 employees who are installing and manufacturing the vast majority of local solar and energy storage systems in California, I am writing to provide information regarding the question of eligibility of certain licenses to install solar and energy storage systems. I have enclosed our earlier letter, dated April 10, 2018, for additional background information.

We strongly urge the CSLB to reject any proposal to revoke the eligibility of the C-46, the General A and the General B license holders to install solar and energy storage systems. There is no public safety justification to make solar and storage the exclusive jurisdiction of the C-10 contractor.

Please note that we take no offense to the C-10 contractor having exclusive eligibility to install stand-alone energy storage systems that are not paired with a solar photovoltaic system. However, the ability to install solar and storage systems has been and should remain the purview of the C-46, General A, and General B, as well as the C-10 contractors inclusive.

We look forward to productive conversations and additional fact discovery on this matter and ask for the opportunity to discuss and present additional information to the CSLB staff on this subject at a one-on-one meeting to be scheduled in the near future.

**Solar is a Multi-Craft Trade**

Solar installations have long been considered a "multi-craft" trade by state regulators. As solar contractors can attest to, the on-the-job work entails many different skills including site analysis, building structure suitability and reinforcements, roof penetrations, sealants and flashing, free standing ballasted systems, mounting and assemblies, piping and raceways, support structures, trackers, and ground mounts excavation and drilling, methods for walking on roofs to prevent damage, pouring and cutting concrete structures for footings, etc. The list goes on and while it encompasses electrical work and requires a strong understanding of electrical codes, it is much broader in scope. This broader scope has as much to do with protecting public health and safety as the knowledge and skills around the electrical components of a solar and storage install.

CSLB has asked stakeholders to answer four questions related to energy storage.

- 1) The types of energy storage systems being installed and if they utilize new or evolving technology.**

A brief review of the Self-Generation Incentive Program (SGIP) database of energy storage technologies installed in the past five years suggests that there is a wide variety of battery chemistries being deployed including Fused Iron, Lithium Iron Phosphate, Nickel Cadmium, Saltwater, Flow, and Lead Acid. These various technologies make up approximately 10% of the energy storage systems supported by the SGIP

program in the past five years. However, approximately 90% of the energy storage systems being installed today through the SGIP program are some form of Lithium Ion battery.

To the question of the newness of these battery technologies there is no simple answer. Some of these technologies have been around a long time (e.g. 100 years), while some are relatively new (e.g. within past 15-25 years).

**2) The range of volts an energy storage system can store, and differences between residential and commercial systems.**

There is no significant difference between the voltages in a battery pack and the voltages in a grid-tied solar PV array. I would refer the CSLB to comments submitted by other stakeholders, specifically by Sunrun, for more information. You may also wish to review my earlier letter that reviews this question as well.

**3) If any National Electrical Code requirements specific to energy storage systems indicate the license classification(s) most likely to be knowledgeable about installation.**

In the eyes of the NEC, a successful contractor is an individual who is fluent in multiple sections of the NEC including but not limited to: 690 (solar PV), 705 (interconnection), 250 (grounding and bonding), 110 (general requirements), Chapter 3 (wiring methods), and 240 (overcurrent protection) as well as 706 in the NEC 2017 concerning storage. The C-46, as well as experienced General A and B contractors, are well versed in these code sections and able to safely install solar and storage systems.

With regards to the claim that a photovoltaic system does not, by definition, include energy storage, I would point the CSLB to 2016 CEC/2014 NEC 690.2 Solar Photovoltaic Systems Definitions. NEC states, "Inverter: Equipment that is used to change voltage level or waveform, or both, of electrical energy. Commonly, an inverter [also known as a power conditioning unit (PCU) or power conversion system (PCS)] is a device that changes dc input to an ac output. Inverters may also function as battery chargers that use alternating current from another source and convert it into direct current for charging batteries." Simply put, any energy system with an inverter is "a system" in the "eyes" of the NEC.

I refer you also to the NEC definition of Energy Storage System [706.2], "One or more components assembled together capable of storing energy for use at a future time. ESS(s) can include but is not limited to batteries, capacitors, and kinetic energy devices (e.g., flywheels and compressed air). These systems can have ac or dc output for utilization and can include inverters and converters to change stored energy into electrical energy."

In other words, the inverter is the "middleman" connecting the solar array with the storage device. This has always been known, since the early days of the off-grid movement in the latter part of the last century, as a "solar photovoltaic system." Given the fact that the C-46 license was defined as, "A solar contractor installs, modifies, maintains, and repairs thermal and photovoltaic solar energy systems" long after the common practice of pairing solar and energy storage, it is clear that the phrase "photovoltaic system" includes the solar array, the inverter, the energy storage device and the many other components that make up a solar photovoltaic system.

**4) Any public safety concerns with specific examples of problems/accidents related to the installation of an energy storage system.**

We are unaware of any accident or problem related to the installation of an energy storage system in

California, and especially not one installed by a C-46 contractor. As I testified on April 26<sup>th</sup>, none of the worker accidents related to batteries found in a review of the OSHA database of incidents involved the electrical installation of the battery. The handful of "battery" oriented incidents that were found in the OSHA database were related an electrician dropping a battery on his or her foot, or something of that nature.

If any accidents are brought to the attention of the CSLB, we ask that staff investigate whether the incident involved a behind-the-meter system, what license the contractor held, whether the accident happened in California, and what year the accident occurred.

**5) Additional issues/research CSLB staff should perform and include in the final report.**

There are several additional issues and research that the CSLB should include in their final report related to the negative repercussions of any decision to restrict the eligibility and subsequently the workforce able to install solar and storage systems in California.

First of all, it is important for consumer protection that the CSLB consider the ramifications of a wholesale licensing change. Most solar contracts include a provision voiding warranties if the consumer allows or modifies the solar system. If the CSLB were to block the C-46 license from installing energy storage systems, and a different contractor were to be hired to add a storage device onto an existing solar system, the warranty on the existing system would be nullified exposing the consumer to financial risk.

Secondly, I'd like to submit our research regarding the licenses held by the top 110 most active solar contractors installing grid-tied solar photovoltaic systems in California in 2017. The data reveals that 69% of these contractors hold a C-10 license. However, only 12 of the 110 most active contractors in California hold exclusively a C-10 license. The vast majority of contractors hold some combination of a C-46, C-10, General A, or General B.

This fact illustrates that the main impact of restricting energy storage eligibility to the C-10 contractor exclusively, would be the loss of California's experienced solar installer. California's solar installers are sometimes also certified electricians and are trained in proper electrical, structural, fire, and OSHA code just the same. Proper safety training and strict adherence to code is not the exclusive jurisdiction of the Certified Electrician or any one particular type of license.

In investigating this issue, I urge the CSLB to place a high burden of proof on the claims that there is a problem to be solved, and to weigh that proof, or the absence thereof, with the abundance data showing that all currently eligible license classifications are capable of doing good, safe work. For example, consider the fact that over 700,000 solar photovoltaic systems, some including energy storage, have been installed and interconnected to the electrical grid throughout the state over the past fifteen years. CSLB should also consider the safety record of the off-grid market as well. If the claims that only Certified Electricians have the proper training to adhere to public safety codes had any truth to them, California's rooftop solar market would have come to a screeching halt a long time ago.

I'd also ask the CSLB to include your agency's own data about the complaints received by customers specifically involving workmanship. Is there a significant difference in complaints received around workmanship for all four eligible licenses? Does this data suggest there is a problem with any one licensing classification?

We also request that the CSLB include information related to the occupational analysis as well as the tests for the C-46 and the C-10 licenses. As Wendy Balvanz, CSLB testing chief, testified before the Licensing Committee on February 23, 2018, every version of the C-46 test has questions related to

energy storage. In contrast, the C-10 test has only included questions related to solar and storage since its revision in 2013, and even then, not every C-10 test will include solar and storage questions.

I'd ask the CSLB to include the ramification of limiting energy storage and solar to the exclusive jurisdiction of the C-10 contractor with regards to workforce availability. There are approximately 30,000-40,000 solar installation workers in California. If the C-10 exclusive requirement were to become state policy, there would simply not be enough licensed electricians to do the work of a growing solar and energy storage market.

I can attest that most of my contractor members complain that their number one challenge as a business is finding trained and qualified workers. This holds for all of the licenses, as well as the union and non-union shops. While a challenge today, it would become an industry disaster should this licensing change be adopted and California were to have to find 30,000-40,000 or more Certified Electricians who were trained and capable of conducting the multi-trade aspects of solar installation work. I contend that adopting a policy that would put 30,000-40,000 of the nation's most experienced solar installer workforce out of a job, replacing them with inexperienced electricians in the multi-craft skills of solar, would result in negative consequences for public safety.

Further, while public safety concerns must reign supreme in the CSLB's deliberations on any licensing issue, in the absence of evidence that such a public safety threat exists and needs to be resolved through licensing decisions, we urge the CSLB to consider the financial implications of requiring that all future solar and storage systems be installed exclusively by Certified Electricians. By our estimates, such a decision would increase the installation costs of going solar by over 50%. And, again, while safety has no appropriate cost cap, if there is no justification for this cost increase, then the cost benefit of any decision for the very consumers the CSLB is mandated to protect must be considered.

#### **Closing**

A resilient and reliable electricity grid is critical to California's future. Consumers are harmed when proper investments are not made to our electricity grid and energy choices. The fires of 2017 illustrate the need to invest in modern technologies that will strengthen our grid during times of extreme weather events and give consumers access to their own clean sources of power.

Robust deployment of distributed energy resources, including solar and storage, is of the utmost importance to meeting the state's clean energy and consumer protection goals. We encourage the CSLB to consider all of the facts and the full ramifications of this decision for both the consumers and the contractors you regulate.

Sincerely,



Bernadette Del Chiaro  
Executive Director

Cc: David Fogt, Registrar

Attachment: April 10, 2018 letter CALSSA



05-15-2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Quick Mount PV, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

Quick Mount PV (based in Walnut Creek, CA) is the leading manufacturer of flashed roof attachments for residential solar and we are proud to be part of helping California achieve its clean energy goals. California is an incredibly important market to our company as it is our home state, and our largest single market.

From a safety perspective, energy storage technologies are safer, simpler to install, and more plug-and-play than battery systems from years past. UL listed equipment now exists as UL now has safety standards for both the battery cells and the fully engineered Energy Storage Systems. Part of the requirement of listing to the UL standards is safety testing that includes fusing and breakers that prevent thermal events from causing any problems, and these listed systems include many other safety features designed for easy installation and widespread use while improving long term system safety.

In addition to making progress on simplifying designs, installation procedures, and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce. We have worked with hundreds solar contractors throughout California over our 12 years in business. Quick Mount PV values education and works hard to provide training resources ranging from both live and on-demand webinars, video tutorials, in-person hands-on training workshops, as well as job site training. We believe in safety and feel the industry takes seriously the importance of proper system design and education regarding energy storage systems.

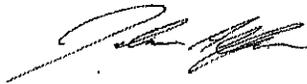
C-46 contractors have installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest

purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Johan Alfsen  
Director of Training  
Quick Mount PV  
Walnut Creek, CA



619-507-6255

760-749-7664

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Waymon Arnold, Solar Designer, 26759 Banbury Dr., Valley Center, CA 92082 (760)749-7664

May 15, 2018

Ms. Heather Young  
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[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Waymon Arnold, and I am the President with Arnold Solar Inc. I am a C46 contractor with over 10 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 5 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. It is my experience that electricians are familiar with AC current but not DC. Batteries operate under DC current. As an C46 contractor, I am experienced with both currents and am better qualified for battery install than most electricians.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Waymon Arnold  
Cc: David Fogt, Registrar

# ADVANCE: SOLAR, HYDRO, WIND, POWER CO. INC.

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5/15/18

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RE: C-10 Union (IBEW) bullying tactics of Energy storage qualifications of C-46

Dear CSLB:

I have filed formal complaints against 3 sitting board members mainly for their obvious IBEW bias. Mr. Schetter, Mr. Dias & Mr. Simpson all show not only contempt, bias, but also, in my opinion corruption. They should be removed from any further discussion on this matter.

CSLB meeting "handout" March 2, 2018:

Summary: Existing law defines a solar energy system as either: (1) any solar collector or other solar energy device, whose primary purpose is to provide for the collections, **STORAGE**, and distribution of solar energy for space heating, space cooling, electric generation, or water heating; (2) any structural design feature of a building, whose primary purpose is to provide for the collection, **STORAGE**, and distribution of

solar energy for electricity generation, space heating or cooling or for water heating.

Page, 60, 3/2/18

CSLB meeting "handout" 2/23/2018

Considerations for ESS Fire Safety

The main conclusion from the program is that installation of battery systems into buildings introduces risks, ***though these are manageable within existing building codes and fire fighting methods*** when appropriate conditions are met. Page iii

This illustrates that a smoldering Li-ion battery on a per kilogram basis can be treated with the same precautions ***as something like a sofa, mattress, or office fire*** in terms of toxicity, but during the most intense moments of the fire (during 2-3 minutes that the cells are igniting exothermically) precautions for toxicity and ventilation should be taken. Page 10

CSLB Committee meeting 4/25/2018

Many C-10 representatives extolled the virtues of C-10 contractors based on the incredible, lengthy and fully diversified training C-10 apprentices get. However all these, so called authority figures, instructors, never referred to the CEC (CA Electric Code) as a training guide and rule book. They all and many C-10s, continually sited, the NEC as the basis for their training. So, as CSLB members, do you stipulate we as CA contractors go by NEC or CEC? Just one of many problems with the assertion that C-10s are more qualified because of intense training. There were very, very few, in attendance, that day that had any knowledge of battery installations. Two C-10s came out and specifically mentioned Tesla, LG as very complicated, needing extensive training and the vulnerabilities of incorrect installation. Nothing could be further from the truth. I know both these manufacturers and products. They are TOTAL plug and play. They will absolutely not let you get inside the battery compartment. If there is a

problem you ship it back to the manufacturer. They are plug this wire into this socket, turn this switch on and look at the screen. The total ignorance of these people is astounding. Both these Li technologies are LMC (Lithium Manganese Cobalt). However, I doubt anyone in the room even understands, let alone knows, what this means and what inherent issues this creates. Plus both of these systems NEVER put cells in series above approx. 120 vdc. They install a DC to DC converter to boost the DC voltage up to 400. So why would they do that? BVD does not do that. We do not do that. Our Lipo4 systems are rated to 1000 vdc cell voltage. Again, the total incompetence and misinformation that these individuals espoused to was amazing. The culmination of this was when one of them asked for a show of hands of anyone in the room who has a energy storage system. Two hands raised up and I was one.

I have lived off grid for over 40 years. I have installed hundreds of thousands of battery systems. I have powered complete islands, businesses, homes. I have been manufacturing lead acid batteries for well over 10 years. I have been manufacturing Lipo4 systems for well over 7 years. Li systems, in my opinion are actually much, much safer & more inert than lead acid systems.

When C-10s talk about training people for battery installations I question their assertions. There is no training that can outpace years of installation knowledge. When you get to my level, there is NO TRAINING. It is all proprietary. Corp. secrets and getting or teaching these secrets will land you in court and possibly jail. I purchased a 1200 vdc Mitsubishi LI system with a 500 kW Eaton inverter, just so I could tear it apart and reverse engineer it. Actually, the system was very, very simple. Battery systems have very simple rules and guidelines to observe and follow.

In closing, I want to emphasize that energy storage systems, on the market today, are plug and play. They are AC coupled, utility support systems, that do not allow the customer, installer or anyone to get inside the battery system. It is virtually impossible for an installation to be installed improperly. Larger systems are stipulated under CA 2018 fire code to be fully engineered by a licensed electrical engineer. Once a system is fully engineered the only duty of the installation contractor is to follow the engineering and diagrams. Again, plug and play, in my opinion.

C-46 have ALWAYS installed battery banks. We invented home battery systems. We are the ones who changed the whole industry by utilizing MPPT circuits to increase the efficiency of off grid systems by close to 40% by utilizing the Lead acid battery required equalize voltage during normal bulk charge. This alone changed the whole grid tie world because now high voltage (600 vdc) inverters could be used for split phase 120/240. Not to mention it was the solar industry that totally changed the inverter industry by initially inserting a time pulse at the 0 point of the wave form. Does not sound like much now, but 40 years ago this was revolutionary. And, again, it was the solar industry that gave birth to the present inverter technology. And lastly, C-46 work with DC all the time. 600 vdc, 1200 vdc and now even 1500 vdc is common.

Thank you for your consideration  
Pete Gregson  
Advance Power Inc.



May, 18<sup>th</sup> 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is William Crane, and I am the President with Crane Exteriors Inc. dba Chico Solar Works. I am a General B License 775265 contractor with over 18 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have been installing Solar Systems and Storage for the past three years and have a perfect record on safety. Our staff is well trained, and we have put in place safety protocols that has kept us safe and our customers protected from any safety concerns.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required, and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

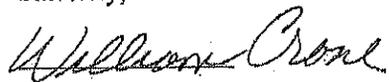
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From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in cursive script, appearing to read "William Cron".

Cc: David Fogt, Registrar

SUNLIGHT ENERGY SYSTEMS

5/15/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Richard Wagenseller, and I am the owner with Sunlight. I am a C-46 652186 contractor with over 40 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 4 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

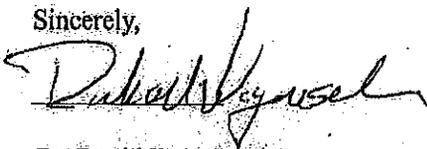
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Cc: David Fogt, Registrar



May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Chris Wood, and I am the Director of Business Development with Sunny Energy. We are an Arizona contractor in the process of expanding into California. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

We have about 35 employees in Arizona and expect the California payroll to quickly dwarf the Arizona business. The safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We hold a NABCEP PV installation certificate and have passed the required safety standards to be an APS approved contractor for their Solar Communities program.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

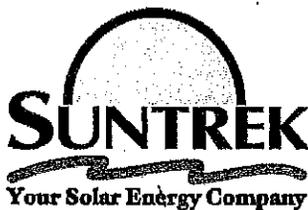
Sincerely,

Chris Wood

Director, Business Development

Sunny Energy

Cc: David Fogt, Registrar



Ms. Heather Young      [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

5/3/2018

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Roy Heine, and I am the President/Owner of Suntrek Industries. I am a C-46 contractor with over 40 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems. Over 30 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,  
Roy Heine

Corporate: 5 Holland #215 • Irvine, CA. 92618 • Phone: 949-348-9276 • Fax: 949-348-1626  
License #859460

Martinez, CA 94553 (925) 372-8983  
Las Vegas, NV 89119 • (702) 362-3611 • License # 0039030, # 0070340

[www.suntreksolar.com](http://www.suntreksolar.com)



5/18/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jeff Mathias, and I am the Owner with Synergy Solar & Electrical Systems Inc. We hold both a C46 and C10 contractor, license Number 913951 with 6 12 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

6 People work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. To date we have not had a claim from an injured employee and have been install solar with storage since opening our doors.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

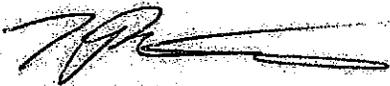
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy

708 Gravenstein Highway N. #134, Sebastopol, CA. 95472  
Ph - 707-823-8003, Fax - 707-823-1233, Email - [sales@synergysolar.com](mailto:sales@synergysolar.com)  
Web-site - [synergysolar.com](http://synergysolar.com), License #913951

storage would be to effectively cut those contractors off--contractors like myself--from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Jeff Mathias  
Owner and CFO  
Synergy Solar & Electrical Systems Inc.

Cc: David Fogt, Registrar



**SYNTHESIS  
CONSTRUCTION  
CORP**

5/15/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jason Johnson, and I am the CEO and director of Operations with Synthesis Construction Corp. I am a Licensed B (907796) contractor with over 11 years of experience performing solar PV and solar thermal installations for both residential and commercial projects. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

We have more than 25 employees that are currently working for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. In fact, we have performed countless jobs including LAUSD, SMMUSD, NMUSD solar projects making sure we uphold the OSHA requirements and standards for all projects to ensure 100% job and installer safety to the highest level.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Synthesis Construction Corp. - 4728 Marine Ave. Lawndale, CA 90260 - 424.383.1886

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Jason Johnson  
CEO / Director of Operations  
Synthesis Construction Corp.

Cc: David Fogt, Registrar



C-46 608260

17150 Newhope Street #403 Fountain Valley, CA 92708  
(714) 968-8845 phone  
vascosolar.com [info@vascosolar.com](mailto:info@vascosolar.com)

May 10, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Richard Vasquez, and I am President of Vasco Solar. I have been a C-46 licensed contractor with 40 years of experience in the industry – an industry veteran since 1978. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of our employees and customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate and absurd.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Richard P. Vasquez

Cc: David Fogt, Registrar



SOLARTRONICS, INC.  
1476 Dorset Ave.  
Thousand Oaks, CA 91360  
(818)889-0440  
Lic. #372231

5/25/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a "B" (General Building) and C-10 (Electrical) contractor with over 40 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

I have eight employees, and the safety of my workers and my customers is of the utmost importance. To imply that only a C-10 licensed contractor only can install solar and/or energy storage systems is not accurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Ronald L. Mulick  
President



May 4 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ben Siebert, and I am the CEO with Planet Solar Inc. I am a General B and C46 contractor with over 35 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 35 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades, with a higher than average safety and customer satisfaction rate. In addition, the General A and B contractors have been able to install energy storage. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. In fact, there are a number of energy storage questions on the C-46 test, because it has always been assumed by the CSLB and the trades that the solar contractor had the greatest expertise with energy storage, and this remains to this day. Nearly all energy storage systems require an inverter, which is rarely used by C-10 electricians but used every day by C-46 solar installers.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read "Ben Siebert", is written over a horizontal line. The signature is stylized and cursive.

Cc: David Fogt, Registrar



5/15/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Marksiane Senelath, and I am the President with Sun X Solar. I am a Solar contractor with over 8 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 10 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Marksiane Senelath

Cc: David Fogt, Registrar



14256 High Valley Rd., Poway, CA 92064  
Phone: 619-251-6167  
Email: [msnell@sungenia.com](mailto:msnell@sungenia.com)  
[www.sungenia.com](http://www.sungenia.com)  
Lic. No. 998985

4 May 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Dr. Michael Snell, and I am the President and CEO of Sungenia Solar Solutions. We are a licensed B contractor with over 3 years of experience in the solar area and our qualifying individual has over 16 years as a general contractor. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

We are a small company with just 5 employees, however, this change would almost certainly put us out of business. We have a strong track record in both the quality of our installations and the safety of our workers and our customers. Although we are not a C-10 contractor we strictly adhere to every safety precaution and procedure required by C-10 and C-46 licensees. We are intimately familiar with the NEC code in all solar-related and many non-solar-related areas. In addition, we often use licensed C-10 contractors in any area which we feel is outside of our scope or comfort level e.g. panel replacements, service upgrades, three-phase power connections, etc.

I must say that not only have we not had a single incident or accident, we have identified numerous unsafe and non-code compliant situations at worksites previously performed by licensed C-10 contractors. We have had to, more times than I care to remember, correct their deficiencies before receiving a passed inspection. To suggest that our staff is unable to install solar and energy storage systems safely is not only inaccurate but ignores completely our obvious and demonstrated ability to do so. And to further suggest that using ONLY C-10 licensees will increase the safety of solar and storage system installations is erroneous. My personal discussions with numerous C-10 licensees and their Certified Electricians have indicated that they know no more about electricity and power systems than do we at our company, and, in the area of solar, less so.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, General A and General B contractors have also been successfully installing these systems for decades. If the CSLB can provide hard data on accident rates relating to these industries in their solar activities we would be happy to see it. As it stands there is, to my knowledge, no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact

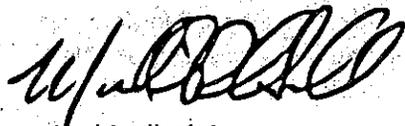
that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Michael Snell, Ph.D.  
President and CEO  
Sungenia Solar Solutions

Cc: David Fogt, Registrar



Your Local Solar Energy Provider

May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Gary Gordon, and I am the President of Santa Ynez Valley Solar a division of Fresource Energies, Inc. I am a C-46 contractor with over ten years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Currently five people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. I have been certified by NABCEP since 2009 and attend at least a dozen webinars and conferences each year to keep up to date on all advances in the solar industry, including extensive battery storage system information. The safety and quality of our work are my most important goals on all projects that I undertake. We are very proud to have never had an injury at work or a system failure.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

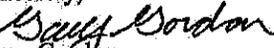
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Gary Gordon  
Cc: David Fogt, Registrar

May 7, 2018

CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)



**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ben Scurfield, and I am the President of Scurfield Solar & Heating. I am a solar contractor California license #1036962, with over 14 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have been through several battery manufacturers' training and have extensive experience with off grid solar and battery integration. We take training very seriously and make sure every installer has the appropriate training to handle battery systems safely.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

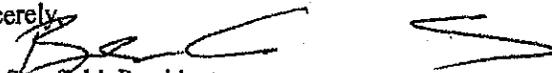
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Ben Scurfield, President  
Scurfield Solar & Heating  
550 South G St, Arcata CA 95521  
(707) 825-0759

Cc: David Fogt, Registrar

Updated: 3/18/2019

337



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Local  Established  Trusted  Experts

5/16/2018

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a C-46 Solar contractor. Sierra Pacific has over 34 years of experience in solar and specifically over 14 years' experience with solar electricity. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 160 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

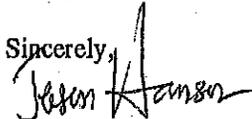
As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,  


Jason Hanson  
President

Cc: David Fogt, Registrar

DIVISIONS

*Solar Electric • Heating & Air • Solar Pool Heating • Windows • Solar Water Heating*



www.SkyPowerSolar.com

3130 Crow Canyon Road Ste F  
San Ramon, CA 94583  
(925) 327-0980  
(925) 226-0628 (fax)

April 25, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Robert Winn and I am the President and owner of Sky Power Systems. I am a General Contractor (800947) with over 13 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink that reads "Bob Winn".

Robert Winn  
President  
Cc: David Fogt, Registrar

# SOLARCRAFT

CLEAN ENERGY SOLUTIONS

May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

I am the RMO with SolarCraft Services, Inc. We have been C-46 contractors since 1986 and I am writing to express my strong opposition to proposed changes to the licensing classifications authorized to install solar and energy storage systems.

More than 60 people work at SolarCraft, and the safety of our employees and customers is of the utmost importance. Over the past 35 years we have installed over 8,000 solar energy systems and serviced tens of thousands of others, and over that time period we have never had a complaint against our license or a claim against our liability insurance due to faulty design or workmanship.

As you know, C-46 contractors have installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

Energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. In addition, all systems must comply with NEC, Section 690, which has been continuously re-written and updated over the years with input from the C-46 community.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely



Bill Stewart CSLB 497797

Cc: David Fogt, Registrar

# SOLARPONICS

SOLAR ELECTRIC & WATER HEATING

05/18/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a B, C46, C36 and HIC (391670) contractor with over 44 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 40 People work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We already have 25 systems installed and we have another 40 in our pipeline. To revoke these opportunities from our team is unacceptable. We follow all safety protocols and I assure you our teams safety is our top priority. We are fully capable and comfortable performing all installations having to do with Energy Storage.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

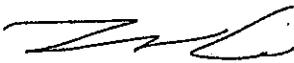
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off--contractors like myself--from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Kristian Emrich  
Solarponics, inc.  
Atascadero, CA 93422

May 3, 2018



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jeff Parr and I am the President with Solar Technologies. I am a C-10 and C-46 contractor with over 9 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 75 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. All of our installers, regardless of title, go through an extensive amount of internal and external training on a continuous basis.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

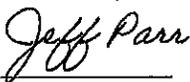
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From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

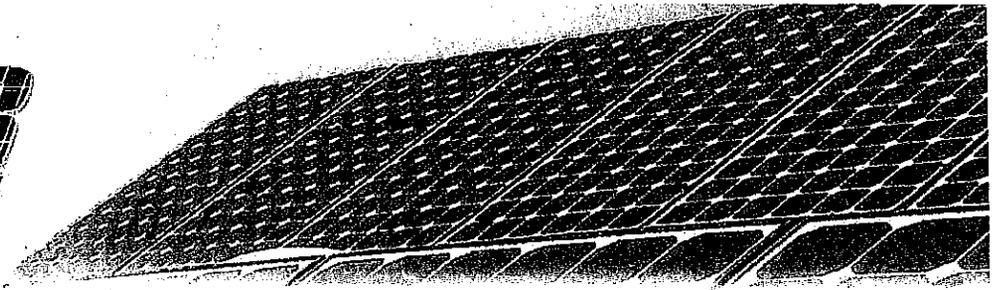
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
\_\_\_\_\_

Cc: David Fogt, Registrar



May 4, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Daniel Galvez, and I am the President with Solar Unlimited, Inc. I am a licensed solar contractor with over 38 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over fourteen people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

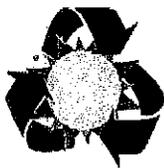
Sincerely,

A handwritten signature in black ink, appearing to read "Daniel Galvez".

Daniel Galvez

Cc: David Fogt, Registrar





SOUTHWESTERN  
**SOLAR SYSTEMS**  
RENEWABLE ENERGY FOR EVERYONE

Date: 5/8/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Clint Walker, and I am the President of Southwestern Solar Systems. I am a B, C46 contractor with over 9 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 6 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar



May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Tod Dustin Howze, and I am an owner of Renewable Solar. I am a General B licensed contractor, Lic. 827900, with over 14 of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 30 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the General B contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the General B license has been able to install energy storage is evidenced by the fact that the General B test has contains many questions on energy storage.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the B contractor, or the C-46 and A, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Tod Dustin Howze

Cc: David Fogt, Registrar



May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Rowland Stack, and I am an owner of Renewable Solar. I am a C-46 contractor, Lic. 944636, with over 14 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 30 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Roland Stack

Cc: David Fogt, Registrar



May 7, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@csib.ca.gov](mailto:Heather.Young@csib.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Keith Kruezfeldt, and I am the President of Kruezfeldt Construction Company, Inc. dba REPOWER Santa Rosa. We are a B, C10, C46 contractor with over 9 years of solar experience and 40 years of construction experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 12 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

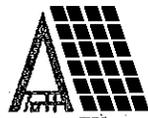
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off--contractors like myself--from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Keith Kruezfeldt

Cc: David Fogt, Registrar



# Roof Tech

Smarter PV mounting solutions from top of roof to bottom line®

Roof Tech, Inc. 333 H Street, Suite 5000, Chula Vista, CA 91910

O 619 551 7029

www.roof-tech.us

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## **RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Roof Tech Inc. I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

Roof Tech Inc. is dedicated to the Solar PV industry and manufactures the mounting structures for it. Being a wholly subsidiary from Yanegiken, Japan, Roof Tech brings 20 years expertise for the roof mounting structures. Our product technical benefit to a contractor is the time savings up on a roof.

I myself have been in the California Solar Industry since 1997. I am a C-46 and I have experienced the technological advancements of components. From hardwired modules, 48 VDC input inverter systems to simply plug-and-play arrays. The solar contractors are dedicated and have the knowledge. On top of that, all manufacturers provide training to installers and contractors. Roof Tech is a member of the MSMC, Mounting Systems Manufacturers Committee (a Sub-Committee from the Solar Energy Industries Association (SEIA, DC). Roof Tech is also a member of the NABCEP (North America Board of Certified Energy Practitioners <http://www.nabcep.org/about-us>).

From a safety point of view, energy storage technologies are getting safer and simpler to install (plug-and-play). Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use and eventual proper disposal and recycling.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to Roof Tech Inc. We go to great lengths to ensure that our products are installed by a trained workforce. Being a NABCEP registered training provider, Roof Tech Inc enhances the solar contractor further knowledge. In fact a solar contractor (C-46) has the knowledge of multiple trades that include building, solar azimuth, electrical and plumbing. A Solar contractor is a dedicated Solar Contractor!

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In fact it is where the solar industry began. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked and contributed to its success.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Milton Nogueira, M.E. C-46  
Sr. Business Development Manager  
(415) 583-8541  
Milton.n@roof-tech.us

Cc: David Fogt, Registrar



## BLUE PLANET ENERGY

May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

### **RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Blue Planet Energy, LLC, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses. We sincerely hope you will see past the special-interest groups driving this effort in an attempt to hurt the renewable energy industry and support the operating of our proven, mature, safe and well-functioning industry in California.

Blue Planet Energy unlocks energy independence for home and business owners with Blue Ion, the world's most powerful, reliable and safest energy storage at the lowest lifetime cost of any battery on the market today. We manufacture the Blue Ion systems in California and Hawaii. Powered by safe lithium batteries, the Blue Ion energy storage system has been installed in residential and commercial systems by our certified dealer network across the US, Hawaii, Puerto Rico, Canada and Mexico for use in back-up, self-supply/consumption, and off-grid use. Our batteries are designed to be zero maintenance, and even with the most demanding installations – off-grid – our batteries provide reliability and high performance.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. In addition to being one of the easiest battery systems to install already (often taking under an hour and requiring no specialized equipment), Blue Ion 2.0 product just finished UL 9540 testing from a Nationally Recognized Testing Facility, demonstrating overall system safety. We have numerous safety mechanisms built into the system which make installation safe and quick.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce, drawn from top-notch installers across the country. We only allow Blue Ion Certified Dealers to install the product. Each Dealer is vetted by our team to insure they have qualified staff and adequate experience. Many of our installers have been installing solar and storage systems for over a decade! Even so, each Dealer must complete our technical training before being allowed to install the system and works directly with our engineering staff to be qualified. Dealers also arrange for real-time support during their first installation, in case any questions come up.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Energy storage has over 40 years of history in the off-grid market, where we have many customers and Dealers. Now energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates, demand charge management, the need to smooth out the intermittency of renewable energy, and the need for options to ease strain on the grid during peak times of demand. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Christopher Johnson

Chief Operating Officer  
Blue Planet Energy

Cc: David Fogt, Registrar



# SANTA CRUZ SOLAR

5360 Freedom Blvd. Aptos, CA 95003  
(831) 685-2786 tel  
(831) 251-2786 cel  
andy@santacruzsolar.com  
Lic. #464505 Classes B, C46, C43, C36, C4

5/15/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems

Dear Ms. Young:

I am a B and C46 contractor, Lic. # 464505, with over 40 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Several people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely, *ANDREW CAZZATO*

Cc: David Fogt, Registrar



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

**RE: Opposition to Changing Licensing Classification for Energy Storage Systems**

Dear Ms. Young:

On behalf of Sunrun Inc., I thank you for providing the opportunity for the industry to provide comments during the public hearing on April 25 and to submit comments in writing. This letter serves to provide additional information to aid the CSLB's decision on whether to change the licensing related to energy storage. We write to strongly urge the CLSB to NOT change the licensing classifications authorized to install solar and energy storage systems.

Sunrun is the largest residential solar, storage and energy services company in the U.S. with nearly 190,000 customers, 3,000 direct employees and over 8,000 other jobs we support. California is our headquarters and home to 16 branch locations across the state. We are committed to customer-centric solutions - making clean, safe, and affordable solar directly accessible to Californians of all walks of life. As of 2017, we started providing a storage product for our California customers. In less than one year, the attachment rate of solar plus storage has soared as high as 50% in Southern California. California continues to lead from the front with renewable energy goals, and storage is increasing here due to its ties to solar.

I am a Class B contractor with 15 years of experience. Based on my expertise and experience, making the proposed changes to the licensing classifications authorized to install solar and energy storage systems are not necessary and would cause more harm than good.

As you know, a C-46 contractor is very qualified and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

In response to your question about how the National Electric Code views solar and energy storage installations, it is important to note that in order to be a successful solar contractor (including C-46) an individual must be fluent in multiple sections of the NEC including but not limited to: 690 (solar PV), 705 (interconnection), 250 (grounding and bonding), 110 (general requirements), Chapter 3 (wiring methods), and 240 (overcurrent production). Similarly, to be successful in solar plus storage in California, a contractor must be familiar



with all of the above code sections plus section 706 in the NEC 2017. And the fact that the NEC does not address solar and storage in a single cohesive section does not mean that these two components are not installed as a system and does not preclude them from being installed as such. The C-46 contractor is well versed in these nuances and able to safely install solar and storage systems.

I'd like to also respond to the CSLB's question about the difference, from a voltage and amperage perspective, between a stand-alone solar system, that a C-46 is eligible to install, and a solar and storage paired system that some people are suggesting a C-46 is not qualified to install. With recent advancements, energy storage products, particularly in higher voltage and with lower currents, are increasingly more closely resembling standalone grid tied products from a voltage and amperage perspective. Voltages of 300 to 400 VDC in battery packs is very similar to the 300 to 600 VDC that are typically seen in grid-tied solar that C-46 contractors are very familiar with. Currents in the 20 amp range also closely resemble the wire sizes and types typically seen for grid tied solar systems with #10 and #8 wire. In summary, C-46 are familiar with and prepared for the voltages and currents present in current and emerging energy storage technologies.

Additionally, energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained significantly more questions on energy storage, and for many more years, than any other test administered by the CSLB. Thus, the C-46 license is the backbone of California solar.

Generally speaking small, medium, and large installation companies have been successful in adapting to a very dynamic industry with new products, code changes, and changing regulations. They are good at what they do, do their homework and deliver good products. Consumer choice will absolutely be adversely impacted if they are excluded from installing energy storage products. When it comes to liability, as mentioned above, the voltages, currents, and installation practices of solar and storage are very similar to solar only, thus the liability or risk for the consumer does not change.

In summary, from a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use (TOU) rates and the need to smooth out the intermittency of renewable energy. NEM 2.0 and TOU rates are market forces driving solar and storage ever closer together. For Sunrun, as an example, the attachment rate of solar plus storage has soared in less than one year to as high as 50% in Southern California and even 100% in other states like Hawaii. California continues to lead from the front with renewable energy goals and storage is increasing as well due to its ties to solar.



To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to maintain the reliable status quo and reject any proposals to restrict solar and energy storage installations.

Sincerely,

Jeff Vasek  
Director of Training and Professional Development

Cc: David Fogt, Registrar





May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Alexander Deeter, and I work for AMECO Solar Inc. I have 6 years of experience in the industry and AMECO has over 44 years of experience installing solar. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my continuing training and on-the-job experience reinforce that priority every day. Choosing the right technology, manufacturer, and installation method are key practices to satisfying a customer and having them refer future business to us. AMECO has only continued to be in business for so long because we do quality work and have continued to learn new technology and installation standards. When solar electricity was getting more popular in the 1980s, off-grid systems with batteries were the only ways to install solar, thus being required knowledge for a solar electric contractor. Over the last few decades, improvements in the designs of batteries have made them safer and easier to install.

"There was an 83 percent increase in the number of solar complaints filed with CSLB in 2017 as compared to 2016; 43 percent of these complaints were filed against 33 contractors. Further analysis revealed that 10 of these 33 contractors held the C-46 (Solar) classification as part of their licensure. The remaining 23 contractors held the following classifications: "B" General Building (11), C-10 Electrical (7), "B"/C-10 (3), and C-39 Roofing (2)."

-Solar Task Force Update, CSLB (P. 30)

During the April CSLB board meeting, I heard the reason for banning C-46 contractors from installing battery storage was to be pro-active rather than re-active. I believe the information from the Solar Task Force report shows issues exist for all license holders and the claim to be pro-active unjustifiably favors C-10 contractors.

Furthermore, the tests required for the CSLB licensing for battery storage is incomplete for C-10 licenses. The test for C-46 contractors always includes questions about energy storage systems but the C-10 license is so broad, the test does not always ask the applicant for proficiency in batteries, and yet the conclusion is to say C-46 are the unqualified ones. However, the CSLB is questioning the legitimacy of the C-46 contractor, but not C-10 contractor who has not necessarily been tested on battery systems.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Battery systems must be UL listed, with circuit breakers and sensors to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Alexander Deeter

Cc: David Fogt, Registrar

(888) -or- (562) 595-9570

Fax (562) 426-8248

[www.amecosolar.com](http://www.amecosolar.com)



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Fronius USA, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems.

Fronius USA, a subsidiary of Fronius International, provides single and three phase inverters to the US PV market for use in residential, agricultural, and commercial PV solar systems. Our next generation of inverters will feature energy storage options (high capacity Lithium-based batteries) that easily integrate with our inverters in a DC Coupling manner. This means no additional charge controller or battery maintenance system is required as it's all built into the inverter. This is a 'hybrid' solution (see below). Based on the 2014 National Electrical Code Article 690 - Figure 690(1)b, energy storage is a component of a Hybrid or Stand-alone PV system. It's not a separate system. With our Hybrid solution, there is no construction of a battery system but just a connection of equipment via standard wiring practices already employed with non-battery systems.

Our US market solutions are certified to UL and other standards. Installation is only one aspect of battery system interaction by trained personnel. Service may also be required. In this regard, Fronius is well-known for its training program in which we train and certify personnel and companies to provide inverter system maintenance and repair.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink that reads "M. Mendik".

Michael Mendik, Dr.  
Head of Solutions Management  
Fronius USA LLC  
395 Oyster Point Blvd / San Francisco, CA 94080

Cc: David Fogg, Registrar

Ward Bower Innovations LLC  
13108 Hidden Valley Road NE  
Albuquerque, NM 87111.4210  
Ph. 505-385-1294  
Ward Bower – President  
wibower@centurylink1.net

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am writing to express my opposition to proposed changes to the licensing classifications authorized to install energy storage systems that are integrated into solar photovoltaic systems. Limiting the installation of solar and energy storage systems to C-10 license holders eliminates the substantial work force of already qualified C-46 license holders, which employs numbers nearly equivalent to licensed electricians. The C-46 installers have been safely installing the energy storage components and systems with solar systems for years, and in-fact since the solar industry infancy. The C-46 installers not only provide safe and code compliant installations, but also supply the expertise and knowledge-based installations with critical design intricacies of coupling the unique characteristics of photovoltaics systems with the requirements of charging, discharging, and maintaining battery-based energy storage.

I am a retired engineer from Sandia National Laboratories where for nearly 4 decades I provided engineering, project management and guidance for components, including batteries, for complete PV systems. During my work at Sandia, I established the first PV test facility where inverters, controllers and complete systems were developed and evaluated. I managed the development of early high-reliability inverters and the Solar Energy Grid Integrated Systems (SEGIS) project where all the advanced functionalities now being required and mandated for grid interconnectivity was developed and demonstrated. I have served on National Fire Protection Association code-making-panels responsible for Article 690 related to PV systems for more than two decades. I have served on numerous UL standards committees since the first UL1741 standard for listing inverters was approved. I was a pioneer in establishing the North American Board of Certified Energy Practitioners (NABCEP) and am currently chair of the exam committee for PV installation professionals. I have served on critical IEEE standards groups that have guided the industry toward compatible installations that are now providing the utilities with value added support such as VAR (Volt-ampere reactive) support, and high- and low-voltage ride through. I am currently the chair of the IEEE P2030.8 for testing microgrid controllers after serving on the working group for 2030.7 now being used to specify microgrid controllers.

I very strongly support safety of electrical systems, as evidenced by my many years of continuous service for the codes and standards that are available for renewable and energy storage systems. With that support, I quite frankly don't understand a need to eliminate at least 50% of the qualified workers on solar systems that include energy storage and urge your committee to not eliminate the C-46 workers from the solar installations that are increasingly looking to energy storage to add value to the systems as well as to support the utility infrastructure. Of note, many of the C-46 workers are also certified NABCEP installers and they are very proud of their accomplishments, work hard on continuing education to maintain their expertise and certification, and know very well the intricacies of matching solar systems and the requirements for successful and safe systems with energy storage.

Thanks for considering my comments and I again urge you to reject the proposal to eliminate or restrict C-46 contractors and workers from participating in the future of your state's and our Nation's energy supply.

Sincerely,

Ward Bower



May 18, 2018

Heather Young  
Contractors State License Board Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: Heather.Young@cslb.ca.gov

**RE: Licensing Eligibility for Installing Energy Storage Systems**

Dear Ms. Young:

Thank you for the opportunity to submit comments following the Contractors State License Board (CSLB) board workshop last month. I am writing to express our company's opposition to proposed changes to the existing licensing classifications authorized to install solar and energy storage systems in California that are under consideration by the CSLB. Limiting the installation of these systems to only C-10 (electrical) license holders, as has been proposed, would exclude C-46 (solar) license holders as well as the "A" and "B" classifications from performing this work.

Tesla's mission is to accelerate the world's transition to sustainable energy. Powerwall, our home energy storage product, is being deployed in residential applications through Tesla's direct installers, as well as through our certified installers and resellers. To support the State's ambitious clean energy and energy storage goals, we should be increasing – not limiting – the number of qualified persons who can install energy storage systems for Californians. The proposed changes would shrink the available labor pool to install these products, which could increase installation costs for customers resulting in fewer Californians being able to deploy energy storage systems and receive their benefits.

Energy storage technologies are becoming simpler to install and more "plug-and-play," and the cost of battery storage has declined significantly in recent year. Today, battery storage systems are becoming UL listed as an engineered system with circuit breakers and other safety features that are designed for easy installation and widespread use. In addition to making progress on simplifying designs, installation procedures and safety features, our company invests significant resources to ensure that our energy storage products are safely installed by a well-trained workforce.

As you know, C-46 license holders can and have installed solar and energy storage systems for decades. As a manufacturer and installer that is active in California, our company has worked with C-46 contractors for years and found no lack of knowledge, skill or training needed to properly install our energy products. Furthermore, I am not aware of evidence that safety or other considerations require that installation of solar and energy storage systems be restricted to the C-10 license.

**T E S L A**

Tesla, Inc.  
3500 Deer Creek Road, Palo Alto, CA 94304  
p +650 681 5100 f +650 681 5101

Thank you for considering these comments. We encourage you to maintain the existing licensing classifications authorized to install solar and energy storage systems.

Sincerely,

/s/

James H. Cahill, Jr.  
Director of Operations  
CA PE 13629  
RME C-46 license, Journeyman Electrician (CA) and C-10 license holder

cc: David Fogt, Registrar



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

**RE: Opposition to Changing Licensing Classification for Energy Storage Systems**

Dear Ms. Young:

On behalf of Sunrun Inc., I thank you for providing the opportunity for the industry to provide comments during the public hearing on April 25 and to submit comments in writing. This letter serves to provide additional information to aid the CSLB's decision on whether to change the licensing related to energy storage. We write to strongly urge the CLSB to NOT change the licensing classifications authorized to install solar and energy storage systems.

Sunrun is the largest residential solar, storage and energy services company in the U.S. with nearly 190,000 customers, 3,000 direct employees and over 8,000 other jobs we support. California is our headquarters and home to 16 branch locations across the state. We are committed to customer-centric solutions - making clean, safe, and affordable solar directly accessible to Californians of all walks of life. As of 2017, we started providing a storage product for our California customers. In less than one year, the attachment rate of solar plus storage has soared as high as 50% in Southern California. California continues to lead from the front with renewable energy goals, and storage is increasing here due to its ties to solar.

I am a Class B contractor with 15 years of experience. Based on my expertise and experience, making the proposed changes to the licensing classifications authorized to install solar and energy storage systems are not necessary and would cause more harm than good.

As you know, a C-46 contractor is very qualified and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

In response to your question about how the National Electric Code views solar and energy storage installations, it is important to note that in order to be a successful solar contractor (including C-46) an individual must be fluent in multiple sections of the NEC including but not limited to: 690 (solar PV), 705 (interconnection), 250 (grounding and bonding), 110 (general requirements), Chapter 3 (wiring methods), and 240 (overcurrent production). Similarly, to be successful in solar plus storage in California, a contractor must be familiar



with all of the above code sections plus section 706 in the NEC 2017. And the fact that the NEC does not address solar and storage in a single cohesive section does not mean that these two components are not installed as a system and does not preclude them from being installed as such. The C-46 contractor is well versed in these nuances and able to safely install solar and storage systems.

I'd like to also respond to the CSLB's question about the difference, from a voltage and amperage perspective, between a stand-alone solar system, that a C-46 is eligible to install, and a solar and storage paired system that some people are suggesting a C-46 is not qualified to install. With recent advancements, energy storage products, particularly in higher voltage and with lower currents, are increasingly more closely resembling standalone grid tied products from a voltage and amperage perspective. Voltages of 300 to 400 VDC in battery packs is very similar to the 300 to 600 VDC that are typically seen in grid-tied solar that C-46 contractors are very familiar with. Currents in the 20 amp range also closely resemble the wire sizes and types typically seen for grid tied solar systems with #10 and #8 wire. In summary, C-46 are familiar with and prepared for the voltages and currents present in current and emerging energy storage technologies.

Additionally, energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained significantly more questions on energy storage, and for many more years, than any other test administered by the CSLB. Thus, the C-46 license is the backbone of California solar.

Generally speaking small, medium, and large installation companies have been successful in adapting to a very dynamic industry with new products, code changes, and changing regulations. They are good at what they do, do their homework and deliver good products. Consumer choice will absolutely be adversely impacted if they are excluded from installing energy storage products. When it comes to liability, as mentioned above, the voltages, currents, and installation practices of solar and storage are very similar to solar only, thus the liability or risk for the consumer does not change.

In summary, from a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use (TOU) rates and the need to smooth out the intermittency of renewable energy. NEM 2.0 and TOU rates are market forces driving solar and storage ever closer together. For Sunrun, as an example, the attachment rate of solar plus storage has soared in less than one year to as high as 50% in Southern California and even 100% in other states like Hawaii. California continues to lead from the front with renewable energy goals and storage is increasing as well due to its ties to solar.



To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to maintain the reliable status quo and reject any proposals to restrict solar and energy storage installations.

Sincerely,

Jeff Vasek  
Director of Training and Professional Development

Cc: David Fogt, Registrar



May 8, 2018

Ms. Heather Young

CSLB Executive Office

9821 Business Park Drive

Sacramento, CA 95827

[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Gary Gerber, and I am the founder and President of Sun Light & Power in Berkeley CA. I am a B and C46 license holder (contractor lic. # 326203). I founded Sun Light & Power in 1976, and my company has been installing solar systems, both with and without battery storage, for over 41 years. I have never felt the need to acquire a C10 license, and we have never had a problem getting a permit for our work (PV, solar thermal, battery storage) using our B or C46 license. I see absolutely no good reason to suddenly change the licensing requirements that have been working fine for decades, and in fact I see a lot of harm that would be done by this change.

A little history: The installation of grid-tied residential PV started in CA around 1998, with the advent of NEM and the SGIP rebate program. At that time there were no grid-tied PV inverters that would operate without batteries. This was the case until around 2003, at which time the first direct grid-tied inverters showed up in the market. From about 2003 to 2005 the number of systems with batteries tied to PV dwindled to a very small percentage, but for a 5 full years all residential PV installers (mostly B and C46 licenses like me) were building our experience with battery storage plus PV systems.

There is clearly no consumer or industry benefit to limiting energy storage installation to C10 license holders, and the so-called safety concerns of batteries are being trumped-up by the C10 advocates. I have seen NO evidence that modern battery storage systems are dangerous to install or that a C10 license guarantees a safer, better-built project than one built under a C46. In my opinion the typical C46 is far **better** qualified regarding batteries than the typical C10 – a look at the questions on the licensing test makes this abundantly evident. Frankly, I don't know whether I would allow a typical C10 to touch my PV/battery system unless they could first demonstrate experience in solar and batteries, whereas I know when I hire a C46 that they will know the PV system well and at least have been tested on

batteries. As for safety, it is incumbent on ALL license holders to train their people properly and provide a safe place to work, and simply having a C10 license does not guarantee that employees will be properly trained and outfitted. Sun Light & Power employs 80 people, about half of whom are in the field daily installing PV, Solar Thermal and battery storage systems. We have robust safety training and an excellent safety record. In addition to our regular tailgate meetings we conduct mandatory monthly safety meetings, attended by all field personnel. All new employees get extensive fall protection training and electrical safety training. We own all required PPE and we maintain the equipment per OSHA guidelines. Sadly, the few accidents that have happened are just as likely to occur under a C10 as a C46, and the only two solar-related fatalities that I am aware of in CA happened at C10 licensed companies. But the fact is that solar, installed largely by C46 license holders, has been remarkably safe, and there is no reason to believe that C46 license holders are suddenly going to start acting unsafely when we install batteries!

Lithium-ion batteries today are far cleaner and safer to handle than the lead acid batteries that I started installing in homes 20 years ago. Most battery systems now have built-in battery management systems and are pre-wired and essentially "plug and play", exposing the installer only to the same wiring conditions that they are already dealing with. Judging by the trajectory of the rest of the PV industry, I expect that PV-linked batteries will continue to get easier and safer to install, not more difficult and dangerous as the IBEW would have you believe. On all but the largest projects these batteries are completely self-contained. When I talk to battery manufacturers about supposed safety issues with their UL-listed battery systems, they don't know what I am talking about. Please don't be fooled – safety is a scare tactic made up by the utility electricians who want to squash the independent PV plus battery market.

The real danger here is to jobs – there are nowhere near enough certified electricians to service this large and growing industry. Forcing A, B and C46 license holders out of battery installation will create a huge crisis in the solar plus storage industry, while facilitating the stranglehold of the industry by a very small labor force of certified electricians which is largely inexperienced in dealing with batteries. My personal experience is that certified electricians would rather be doing what they were trained to do, which is inside wiring. I see it every day in the solar industry; when we bid on rooftop PV systems we are consistently told that the IBEW electricians don't want the PV work, they don't really understand the DC wiring and they don't want to install racking and solar modules, they just want to do the conduit and wiring and connections and so they wisely leave the PV work to the contractors that know solar, which is largely C46 licenseholders. And in the situations where we have no choice but to hire union C10 electricians, we are facing not only sky-high labor rates but also productivity that is about half of what a well-trained C46 PV crew can do. This is resulting in huge overpricing that makes these systems unaffordable, and the same thing is going to happen with batteries. Making this change will put tens of thousands of trained solar installers out of work, and might very well put my own business in peril, at a time when the solar plus storage industry is poised to expand dramatically. This makes no sense at all, and will do great harm to both the environment and to California's economy. We need more battery installers now, not fewer.

A comment was made in an earlier hearing that this change is “no big deal” because “the C46’s can just go get a C10 license”. Aside from the fact that getting a new license IS a big deal, this comment totally misses the point that under our C46 license our employees, though highly trained and competent in PV and all of the skills needed to connect battery storage to PV, are not required to be certified electricians, and in fact their experience under a C46 doesn’t even qualify them to take the test (a test that is largely irrelevant to their jobs). So “just getting a C10” does nothing for my company except to qualify ME to personally perform the installations, while laying off all of my installers!

The solar + storage industry needs to expand, not shrink, and we C46 old timers welcome the C10 license holders to join us in growing the renewable energy industry safely and cooperatively. I urge you to reject any proposals to restrict solar and energy storage installations to the C10 license only.

Sincerely,

Gary T. Gerber

President, Sun Light & Power

Cc: David Fogt, Registrar

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PO Box 70829, Richmond CA, 94807  
www.SolarRichmond.org

May 7, 2018

**Executive Director**  
Cheryl Vaughn

**Board of Directors**  
Officers  
Chair  
Toney Wright

*Interim Secretary*  
Cheryl Vaughn

*Treasurer*  
J'Keitha Richardson

**Board of Directors**  
Emily Lundberg  
Shiuh-Wuu (Victor) Liu  
J'Keitha Richardson  
Toney Wright

**In Memoriam**  
Anthony Allen

*Solar Richmond's Mission is to enable people to effectively participate in the green economy and advocate for environmental justice through vocational training combined with professional and leadership development.*

*Solar Richmond serves as a solar and green-jobs advocate, working to promote inclusive economic development in Richmond and the Bay Area.*

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Energy Storage Systems Public Participation Hearing

Dear Ms. Young:

On behalf of Solar Richmond, I am writing to express our opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. The C-46 contractor, as well as the General A and B, should continue to be allowed to install solar and energy storage paired systems.

The installation of solar energy systems has been determined to be a multi-craft occupation numerous times by the state of California. Energy storage has been a part of the solar photovoltaic installation and market for over forty years.

This multi-craft designation is vital to the workforce development community. Emerging markets, such as solar and energy storage, must remain accessible and inclusive for all workers entering and/or re-entering the workforce. Preserving multiple pathways out of poverty through access to meaningful work is critical to our mission. This is especially important to us at Solar Richmond. For more than ten years we have been at the forefront of supporting ratepayers from low-income communities and communities of color to have access to new and emerging career and entrepreneurship opportunities in the clean economy. Our analysis indicates that making sure that C-46 contractors can install paired systems will keep the playing field level for the community that Solar Richmond is on a mission to serve.

Energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off--as well as their current and future workers--from this important market.

Thank you for considering these comments. I urge you to reject any proposals to restrict licensing classifications for the installation of solar and energy storage paired installations.

Sincerely,  
Solar Richmond

Cheryl Vaughn  
Executive Director  
Cc: David Fogt, Registrar

*Solar Richmond is a 501(c)(3) non-profit corporation, Federal Tax ID # 26-2428044.*



May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems

Dear Ms. Young:

On behalf of SimpliPhi Power, I am writing to express my strong support for maintaining licensing classifications authorized to install solar and energy storage systems.

As you know, the C-46 contractors have installed solar and energy storage systems for decades. As a successful California manufacturer of residential, commercial and mobile lithium ion energy storage systems, SimpliPhi has worked with both C-46 and C-10 contractors since 2010 to install our systems safely, efficiently, effectively and in compliance with all codes and standards. We have found C-46 contractors to be knowledgeable, reliable, skilled and properly trained. In short, based on our extensive experience, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Energy storage technologies are safer, simpler to install, and more plug-and-play. Batteries today are UL listed as part of engineered systems, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. SimpliPhi's cobalt-free lithium ion battery chemistry (Lithium Ferro Phosphate) in particular is non-toxic and poses no risk of fire or thermal runaway.

With demand for photovoltaics and energy storage ramping up dramatically, it is essential that we maintain or increase the number of qualified installers – not limit them – especially given the extensive track record C-46 contractors have installing these systems. In fact, the earliest solar+storage systems were installed by C-46 contracts. They should be credited with building the entire industry.

Thank you for considering these comments. I urge you to reject any proposals that restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read 'Catherine Von Burg', written over a horizontal line.

Catherine Von Burg  
SimpliPhi Power  
Chief Executive Officer

Cc: David Fogt, Registrar

May 11, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young,

My name is Charles P. Kuffner. I am the Chief Operating Officer and Responsible Managing Officer" (RMO) (formerly RME) for Promise Energy - a solar, energy efficiency, energy monitoring and energy storage design build installation contractor - since its founding in 2012. I have been a Licensed General Building "B" and specialty trade contractor since 1985 with over 33 years of experience as a CSLB licensed contractor.

It has been brought to our attention that the California Contractors State License Board (CSLB) is currently contemplating the license classifications that will be authorized to install Energy Storage Systems (ESS) - commonly known as "battery storage back-up".

In evaluating this issue, the current State of California Business and Professions Code and CSLB published definitions for appropriately licensed installations of solar systems. These classifications are as follows:

*"A" - General Engineering contractors are authorized to install solar energy systems.*

*"B" - General Building contractors are authorized to install solar energy systems within the definition of B&P Code Section 7057, since an solar energy system constitutes the use of two unrelated building trades or crafts as required by Section 7057.*

*C-4 - Boiler, Hot-Water Heating and Steam Fitting contractors are authorized to perform projects including solar heating equipment associated with systems authorized by this classification.*

*C-10 - Electrical contractors are authorized to perform any solar projects which generate, transmit, transform or utilize electrical energy in any form for any purpose.*

*C-36 - Plumbing contractors are authorized to perform any project using solar equipment to heat water or fluids to a suitable temperature.*

*C-46 - Solar contractors install, modify, maintain, and repair thermal and photovoltaic solar energy systems. A licensee in this classification shall not undertake or perform building or construction trades, crafts or skills, except when required to install a thermal or photovoltaic solar energy system.*

*C-53 - Swimming Pool contractors are authorized to include the installation of solar heating in swimming pool projects.*

Although all of the classifications listed above are licensed and authorized to install solar projects per the CSLB, there is no specific reference to energy storage systems (ESS) in any of these license classifications - including C-10, electrical.

Based upon publicly available information, it is clear to any clear minded and unbiased observer that the International Brotherhood of Electrical Workers (IBEW), and the National Electrical Contractors Association (NECA) - likely to be joined by the Western Electrical Contractors Association, Inc. (WECA) - have been waging a purely political and special interest campaign in an attempt to "corner the market" for energy storage systems for their special interest groups in an attempt to convince the CSLB that they are the only qualified contractors capable of safely installing Energy Storage Systems.

This is a purely political move by the well-funded and well-placed IBEW and NECA special interest groups to exclude other completely qualified, licensed contractors from performing this work. If so implemented, these restrictions will without a doubt lead to higher prices paid unnecessarily by the consumers of the State of California for no added safety benefit. It is completely inappropriate, and will only result in higher prices for consumers and residents of the State of California, at a time when the CPUC is advocating for more Solar PV and Energy Storage Systems to reduce energy costs for CA consumers as utilities shift to Time of Use pricing.

The WECA statement\* published on their website on this issue, clearly shows this inappropriate special interest bias by these (C-10) electrical contracting (NECA) and electrical labor (IBEW) groups actions related to this issue. As noted in this article, the IBEW and NECA affiliated members on this CSLB committee make up 2 votes in favor of not allowing solar contractors to do energy storage system work and a sympathetic to labor member affiliated with the Sheet Metal Workers Union the 3rd vote in favor of the C-10 special interest groups position to not allow solar contractors to do energy storage installation and reserve it to only their own special interest group.

Setting aside politics and special interests, the real issue at hand is the **SAFETY** of the workers and consumers of Energy Storage Systems. There is no evidence that, for the sake of public health or safety, or for any other legitimate public interest purpose, the installation of solar and/or energy storage - for new or retrofitted projects - needs to be restricted to a C-10 license holder only.

Today in California, solar systems are routinely installed by all of the properly licensed CSLB contractor classifications listed above. These systems operate at 600 volts and many hundreds of Amps. Ground mounted and utility-scale installations are typically 1,000 to 1,500 volt systems and many thousands of amps.

\*[https://www.goweca.com/NewsandEvents/newsDetail.aspx?newsUID=3381&Category=,NEWS\\_A,NEWS\\_T,NEWS\\_J,NEWS\\_C,NEWS\\_GA](https://www.goweca.com/NewsandEvents/newsDetail.aspx?newsUID=3381&Category=,NEWS_A,NEWS_T,NEWS_J,NEWS_C,NEWS_GA)

There are NO ELEMENTS of any Energy Storage System that pose any threat to the workers, consumers, or residents of California that is any greater than that of the currently installed solar systems.

From a safety point of view, energy storage systems continue to evolve to be safer to install. Batteries today are UL listed to meet all codes and local jurisdiction building permitting and inspection requirements. In fact, installing an Energy Storage System is not more complicated than installing a solar inverter. They include circuit breakers to prevent thermal events, and other safety features designed for safe and uncomplicated installations and widespread use.

Additionally, there are a variety of trades involved in the installation of a solar or energy storage system. A typical energy storage system with a concrete foundation (as noted in the WECA written comments) would entail the following trades working under a solar C-46 or General A or B contractor:

1. Excavation (if with a piece of equipment - Operating Engineer. If dug by hand - Laborer)
2. Forming the footing - Carpenter
3. Installing reinforcing steel for the concrete pad for the Energy Storage System - Ironworker
4. Placing Concrete - Laborer
5. Finishing Concrete - Cement Mason
6. Stripping Concrete forms - Laborer
7. Backfilling footing - Laborer
8. Landscaping around new footing and backfill - Landscaper
9. Installing seismically designed racking and mounting elements for Energy Storage System - Carpenter or Ironworker depending on racking and mounting system used.
10. Mounting and connecting Energy Storage System - Electrician properly individually licensed by the State.
11. If underground electrical is involved - Operating Engineer (with equipment) or laborer (dig by hand) to dig and backfill trench. Electrician to pull wire in underground buried conduit).

This is 5 to 7 unique trades, with Electrician being only one trade with a very minimal scope of the overall work in terms of total hours for a typical Energy Storage Installation.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates being pushed by the CPUC and CEC. In fact, many Cities and Counties are REQUIRING Energy Storage as a part of new solar, wind and other renewable power generation systems as they drive toward more renewable power and utility company independence. This will not only save Californians money on utility operating costs, but lead to cleaner air, better community health, and lower healthcare costs as we emit less pollution from burning fossil fuels. In the last few weeks, there have been days where solar power has contributed to over 70% of California's instantaneous electrical energy demand. The California Independent (Grid) System Operator (CAISO) is pushing for more and more Energy Storage to supplement intermittent renewable energy systems with the need to "smooth out" the intermittency of renewable energy and reduce peak demand.

Scaling up energy storage on the grid solves our critical "duck curve" issue, by reducing peak demand from fossil fuels, in favor of cheap clean solar energy stored in battery systems for use during peak times. Together, these systems are improving grid reliability, reducing cost, and

supporting our nation's energy independence and national security by reducing our need for importing foreign oil.

Preventing C-46 solar contractors, or the A and B General Contractors, from doing energy storage work under the false pretense that only C-10's can safely install energy storage systems would remove qualified, duly licensed, and safe contractors - like Promise Energy - from the very market we've worked so hard to build.

Such an inappropriate, unwarranted and 100% politically motivated and lobbyist driven action by the CSLB could lead to the bankruptcy of Promise Energy and other similarly properly licensed firms currently doing solar and energy storage work. This would unnecessarily leave many workers that have been making good wages and supporting their families, unemployed and on the State of California Government dole. Instead of earning paychecks, they would be receiving unemployment benefits without providing one iota more "safety" to the workers, consumers, and citizens of California. Any such limitation to installing energy storage systems by currently licensed contractors doing solar work as authorized by the CSLB would clearly be against the public interest of the State of California.

There is a "convenient" argument being made by the IBEW and NECA, as stated in the WECA comments, that the rate of CSLB complaints is higher for the solar contractors than for the C-10 contractors. However, they conveniently left out all of the Non-solar complaints lodged against the over 24,000 licensed (and many, many unlicensed) electrical (C-10) contractors in California. To compare only "solar related" complaints against C-10 contractors - which are the ONLY complaints filed against solar contractors - without calculation ALL complaints about C-10's is like comparing consumer complaints in one mid-sized state against all consumer complaints in the entire USA. Sure, you can make ratios and figures look like you want when you only include a small fraction of the data.

Furthermore, there is no breakdown of "residential" as opposed to "commercial" solar contractor complaints. Based on the statement that "Home Improvement Salespersons" make up a large portion of these complaints would suggest that many (if not most) of the solar contractor complaints are related to single family residences. There may be some relatively small Energy Storage Systems installed on single-family homes, but the sector of the market that is growing fastest in Energy Storage Systems are commercial installations like the ones that Promise Energy is installing now and planning to install in the future.

Promise Energy predominately provides solar solutions for multifamily affordable housing. Our projects are highly regulated by federal, state, and local authorities, and safety is our number one focus on the job.

Promise Energy currently employs 45 people, with an average of 30 in field/craft labor positions. The safety of our workers, our customers and their tenants is of the utmost importance to our day-to-day work. Safety First is one of our mottos. We institute Pre-Task Planning for proper safety procedures and equipment on all of our projects, all of the time. If ANYONE in the Company identifies a potential safety or risk factor that has not been mitigated, they have the ability - and responsibility - to STOP ALL WORK - until the hazardous situation is rectified to meet all safety requirements, and smart and safe work practices.

Based on this "Safety First" culture at Promise Energy, the company has had no (Zero) Recordable Incidents in 6 years of Field Operations. Even though almost all of our work is on commercial building rooftops (new and retrofit), our current Workman's Compensation Experience Modifier Rating (EMR) is 0.71, which is outstanding by any measure in the General Contracting, Roofing and Solar Contracting Industries in California.

Limiting the installation of Energy Storage Systems to only C-10 license holders goes against the efforts of local and state governments seeking to encourage energy storage - not just on new projects, but also in augmenting existing renewable energy projects to offset Time of Use pricing, shave peak demand load, and implement Demand Response programs. These needless restrictions will simply drive up the cost of these systems by limiting who can install them while providing NO ENHANCED SAFETY to the workers, consumers and residents of California.

Thank you for considering these comments. We urge you to reject any proposals to restrict solar and energy storage installations by currently licensed and authorized by the CSLB contractors currently doing solar installations.

Sincerely,



Charles P. Kuffner, PE

**Chief Operating Officer**

**Promise Energy, Inc.**

E-Mail: [Charlie@PromiseEnergy.com](mailto:Charlie@PromiseEnergy.com)

Phone: (415) 652-8553

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CSLB No. 978353

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Cc: David Fogt, Registrar

April 08, 2018

Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Adam Boucher and I am the Founder and CEO of Promise Energy. Our company operates as a General Contractor with a B-License. Our Chief Operating Officer holds our B-License, and is a contractor with over 30 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 40 people work for me on our team, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. In fact, we have Zero Recordable Incidents in 5 yrs of Field Operations at Promise Energy, and a Workman's Compensation Rating EMR 0.71, which is outstanding in the Solar Industry.

We provide solar solutions for multifamily affordable housing. Our projects are highly regulated by federal, state, and local authorities, and safety is our number one focus on the job.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



**Adam Boucher**

**CEO**

**Promise Energy, Inc.**

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8695 Washington Blvd., Suite 205

Culver City, CA 90232

Cc: David Fogt, Registrar



# Planet Plan Sets

EASY SOLAR PERMITTING

05-16-2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## **RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Planet Plan Sets, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

I have recently launched my new business Planet Plan Sets which is based in Southern California and offers engineering plan set services to residential PV installers. While my new venture has just started, I have worked in the field of PV training and codes/standards development for over 11 years. I currently chair the committee on codes/standards for the California Solar and Storage Association where I also serve as a board member, and I serve as a UL 2703 standard technical panel member (the standard for rack mounted PV systems) where I lead the task group on Bonding and Grounding. As you would expect, the UL 2703 standard is focused on system safety, and much of the focus comes from system bonding/grounding. In addition to these roles, I also serve as Secretary for the North American Board of Certified Energy Practitioners (the solar industry certification organization) where we certify solar installers, sales reps, and companies with the major focus on having competent quality installers that are trained to properly sell, design, and install PV and energy storage systems safely, to help consumers improve long term system performance. In summary, I have devoted my career to helping solar installations be done right, with safety as a core element of doing solar right.

From a safety perspective, energy storage technologies are safer, simpler to install, and more plug-and-play than battery systems from years past. UL listed equipment now exists with new UL safety standards for both the battery cells and the fully engineered Energy Storage Systems. Safety testing is at the heart of the UL listings and the safety systems include fusing/breakers that prevent thermal problems. These UL listed energy storage systems include many other safety features intended to improve easy installation and widespread use while preserving long term system safety.

When I first started working in the PV industry in 2007, I was the director of training for the second largest wholesale distributor, AEE Solar - which was originally founded as Alternative Energy Engineering in 1979. In the mid 2000's getting a C-10 contractor or licensed electrician interested in installing solar was difficult to impossible, they simply had no interest in this technology. As a result, the significant majority of the solar and energy storage systems in California were installed by C-46 Solar Contractors. Since my employer was a pioneer in the PV industry and had been sup-

plying battery systems starting in 1979 and solar panels in 1981, we understood that safety was critical to our growth and we had a deep respect for the skills and knowledge required to safely design and install solar and battery systems. We worked hard to properly educate contractors on the safe design and installation of these energy storage systems. Between 2007 and 2010, I built the largest solar training program for installing contractors that had ever existed to date. Despite the industry's growth over the next few years, I was very disappointed that C-10 electrical contractors and licensed electricians still had little-to-no interest in solar. It was only after the industry grew rapidly in 2010-2012 that C-10's started to get active, but we realized that C-10 contractors were poorly equipped to handle system design and installation for most solar projects as they had little experience with DC power systems.

Over the past twelve years, I have worked with many California C-46 contractors and find there is no lack of knowledge, skill or training needed to properly install. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. While not every C-46 contractor has the same levels of expertise, it is my assessment that on whole there are significantly more c-46 contractors that are capable of installing solar and storage safely when compared to C-10 contractors or licensed electricians.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Jeff Spies

—  
**Jeff Spies - President**  
[jeff.spies@planetplansets.com](mailto:jeff.spies@planetplansets.com)  
(866) 898-6886 office  
(714) 488-3790 mobile



**Planet Plan Sets**  
EASY SOLAR PERMITTING

Cc: David Fogt, Registrar



May 18, 2018

[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)  
Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

I have been a solar installer with Luminalt since March of 2013. I have worked on hundreds of solar installations and a number of solar installations paired with energy storage systems. I have worked on paired systems using traditional lead acid backup batteries as well as the newer advanced energy storage lithium ion batteries. I am excited to continue working in my field and to continue to train and expand my skills in this growing market.

**I oppose changes to the licensing classifications authorized to install solar and energy storage systems which would preclude me from being able to work on solar paired energy storage projects.**

My and my colleagues' safety, the safety of my customers and the public is critically important to me and Luminalt. My training in solar and storage as well as my OSHA, fall protection, and other safety training as well as the safety policies and procedures we follow here at Luminalt, are designed to keep us safe. I hold an OSHA 30 certification and am a NABCEP Associate. I have attended courses on solar and the National Electric Code through ISPQ accredited providers and local Community Colleges. I have taken fall protection and safety monitoring courses. I got my start in solar at Asian Neighborhood Design having graduated from their solar and green construction training program.

Solar and energy storage are multi-craft trades. My work covers many disciplines. Behind the meter solar and storage installations require mechanical work with metal racking, structural work, roofing, other general carpentry skills as well as electrical work.

There are a broad array of energy storage technologies on the market. Some, like Enphase's and JLM's, are mounted on individual solar panels and thus installed on a roof, carport or ground mount. Others are mounted like a solar inverter in the garage, mechanical room or on the side of a building. These devices are getting safer to install than the old lead acid batteries solar installers have been installing for decades.

Thank you for considering my comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Pamela Quan

Cc: David Fogt, Registrar



May 18, 2018

[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)  
Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jeanine Cotter, and I am co-founder and President of Luminalt Energy Corporation and the license qualifier for Luminalt's C-46 license.

Energy storage is rapidly becoming a necessary part of the grid-tied solar market in California. Eventually, it will not be possible for us to install solar without pairing it with energy storage. Over 30 people work at Luminalt. We have invested a significant amount of time and resources in training and developing a skilled professional workforce to do the different crafts that are required in the installation of solar and energy storage.

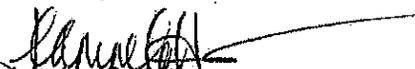
If only journeymen electricians were permitted to install energy storage with solar, the majority of my colleagues would no longer be able to work in a field they have specifically trained for and worked in for years. And installation of solar paired with energy storage would not be made safer because many individuals who have years of experience safely installing solar paired with energy storage would no longer be able to do that work.

C-46 contractors have installed solar paired energy storage systems since before the CSLB began the solar specialty classification. Off-grid solar systems require energy storage systems to function and the earliest grid-tied solar systems had energy storage systems. Today there are a broader range of energy storage systems that are designed to pair with solar systems. These newer systems have more safety features than the systems of old. They are increasingly paired with robust monitoring that allows the customer and manufacturer to see the performance of the energy storage system as well as the solar system.

That the work necessarily done by C-46 license includes the installation of energy storage paired with solar is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

Thank you for time and thoughtful consideration. I urge you to reject proposals to restrict solar paired energy storage installations so that my colleagues and I may continue to design and build safe well-constructed solar and energy storage systems. I welcome the opportunity to answer any questions.

Sincerely,

  
Jeanine Cotter

cc: David Fogt, Registrar

# LAND AND SEA SOLAR

May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## **RE: Opposition to limiting energy storage installation to C-10 license holders**

To whom it concerns:

I have been doing solar electric systems for over twenty five years and back then all the systems were battery based and the C-46 classification was geared towards solar water heating systems so at the time I used my B license. Eventually you shifted the C46 to be more solar electric oriented and I acquired that license. In all these years I have yet to meet a C-10 electrician that knows his way around battery based systems. It would be absurd for you to disallow C46s from installing these systems as we were the ones that started the whole ESS thing. By the way ESS is just some marketing hype cooked up to make it sound new and cool. Even the owner of the largest solar company in the US admitted to me they went back to calling them battery based systems as the public understands the word battery.

We C46s are also the ones that work every day with high voltage DC electricity, not your typical C10. I cant tell you how many times I've been called out to fix someone's battery system after the customer first hired some electrician to work on it and they didn't even understand what they were looking at. I am on the cutting edge in my county as far as installing battery based solar systems and have more energy storage experience under my belt around here than any electrician you could find so not only do I think its dangerous, but also poorly informed that you would only allow lesser qualified but perhaps politically stronger people to install these systems.

Look I know better than to set foot in some factory running on a huge three phase electric feed and think I would know my way around that type of installation but it would be equally crazy for some typical electrician to set foot in a battery room and know what he's doing. I have to wonder what started this whole notion of only letting C10s do this work. Is it some political move by their unions or what? Something doesn't smell right about why you'd even consider cutting us out.

Having operated under my B license for years I can tell you nothing changed for me once I got the C46 but these days solar is booming and all sorts of people want in and I usually point out that a person would have to be comfortable working with 400 volts of live dc power to do the work and I think it would be prudent to exclude the average general contractor from getting near dc electricity. So if it was up to me I would possibly exclude As and Bs. Having said that I know there are some smart and highly qualified people still operating under those licenses.

I will tell you this, if I get cut out of the very industry I helped to pioneer twenty five years ago I will retire or move to a less near-sided state and California will loose the money I pay for my license and permits and all the sales tax from my sales. I jumped the extra hoops to get my C46 because the County was going to exclude Bs, I'm not going to do that again over some poorly made ruling so for the sake of all of the solar industry I hope you choose carefully.

Carl Reuter  
Land and Sea Solar  
B and C46 524855



16 May, 2018

Ms. Heather Young  
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Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Enphase Energy, Incorporated, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

Enphase Energy is an industry leading manufacturer of microinverters for PV and Storage applications. Enphase has an installed base of over 16 Million microinverters installed globally. Enphase Energy specializes in plug and play solutions for residential and small commercial markets worldwide. We offer fully integrated energy storage solutions which package energy storage units, controls, communication and bi-directional power conversion into a single package.

Our system is characteristic of many of the integrated storage solutions being offered today from other leading suppliers such as Tesla and LG Chem. Energy storage units are rapidly becoming like any other appliance. From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are commonly UL listed as an engineered system, with multiple safeguards to prevent thermal events as well as other safety features that are designed for easy installation and widespread use. For example: Our integrated solution is fully UL Listed to UL 1973, UL 9540 and UL 1741. It is designed for ease of installation and avoids the installer being exposed to any energized terminals at any time. We have sold over 10,000 storage units to date into dozens of countries and have had zero reported cases of installer injury or property damage associated with our storage solutions.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce. We have ongoing installer training seminars for our global installer base who have systems installed in over 100 countries.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a leading manufacturer of solar and storage in the California market, we have worked with both C-10 and C-46 contractors for years and find C-46 contractors do not lack the



knowledge, skill or training needed to properly install our products. There has been significant rhetoric decrying the supposed dangers of energy storage from some parties. As one of the leading companies involved in solar and energy storage we are not aware of any safety issues associated with equipment which has been Listed to the relevant UL Standards, which are required under California Rule 21. As a 35 year veteran of the solar industry with over 20 years of experience in National and International Codes and Standards development I am personally unaware of any significant events related to the installation of energy storage events by C-46 contractors. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build. We strongly feel that both C-10 and C-46 contractors should be allowed to install energy storage systems which will become an increasingly common feature of solar systems.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read 'John Berdner'.

John Berdner

Senior Director of Regulatory Strategy  
Enphase Energy, Inc.

Cc: David Focht, Registrar



May 10, 2018

Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Karin Poelstra, and I am the Business Officer (CBO/VP/RMO) with CleanTech Energy Solutions Inc. I am a C-46 contractor with over 13 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required, and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Karin Poelstra, VP/CBO  
CleanTech Energy Solutions, Inc.

Cc: David Fogt, Registrar



1550 Dell Avenue, Suite K, Campbell, CA 95008  
408-883-7000 www.cinnamonsolar.com

May 16, 2018

Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I have been a C-46 contractor since 2002, and have installed over 10,000 photovoltaic systems -- many of which are coupled with battery storage. I am also a recent C-10 contractor. I had the honor to design the new C-46 test, so I am quite familiar with both the existing C-10 contractor test and the new C-46 test. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

At the April 26<sup>th</sup> ESS Hearing I listened to many earnest and heartfelt comments about safety and battery storage systems. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Moreover, at this hearing it was clear to me that the majority of the commentary about the hazards of energy storage systems did not relate to what has become by far the most common type of battery storage system: pre-packaged UL listed battery systems with internal battery management components and integrated circuit breakers. Tesla and LG Chem are two examples of these packaged battery systems.

Contractors making comments about the explosive or thermal runaway potential of these integrated systems clearly do not have experience with this equipment. Please do not be intimidated or swayed by these scare tactics.

I have great respect for specialized C-46 contractors, as well as general electrician C-10 contractors. I represent both. Currently 50% of my potential solar customers want energy storage with their systems. Eliminating C-46 contractors from serving this growing market would dramatically constrain California's ability to meet its energy and environment goals, and would have no impact on customer or contractor safety.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read 'Barry Cinnamon', is written over the word 'Sincerely,'.

Barry Cinnamon  
CEO, Cinnamon Energy Systems

Cc: David Fogt, Registrar



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Alexander Deeter, and I work for AMECO Solar Inc (C-46, #483280). I have 6 years of experience in the industry and AMECO has over 44 years of experience installing solar. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my continuing training and on-the-job experience reinforce that priority every day. Choosing the right technology, manufacturer, and installation method are key practices to satisfying a customer and having them refer future business to us. AMECO has only continued to be in business for so long because we do quality work and have continued to learn new technology and installation standards. When solar electricity was getting more popular in the 1980s, off-grid systems with batteries were the only ways to install solar, thus being required knowledge for a solar electric contractor. Over the last few decades, improvements in the designs of batteries have made them safer and easier to install.

“There was an 83 percent increase in the number of solar complaints filed with CSLB in 2017 as compared to 2016; 43 percent of these complaints were filed against 33 contractors. Further analysis revealed that 10 of these 33 contractors held the C-46 (Solar) classification as part of their licensure. The remaining 23 contractors held the following classifications: “B” General Building (11), C-10 Electrical (7), “B”/C-10 (3), and C-39 Roofing (2).”

-Solar Task Force Update, CSLB (P. 30)

During the April CSLB board meeting, I heard the reason for banning C-46 contractors from installing battery storage was to be pro-active rather than re-active. I believe the information from the Solar Task Force report shows issues exist for all license holders and the claim to be pro-active unjustifiably favors C-10 contractors.

Furthermore, the tests required for the CSLB licensing for battery storage is incomplete for C-10 licenses. The test for C-46 contractors always includes questions about energy storage systems but the C-10 license is so broad, the test does not always ask the applicant for proficiency in batteries, and yet the conclusion is to say C-46 are the unqualified ones. However, the CSLB is questioning the legitimacy of the C-46 contractor, but not C-10 contractor who has not necessarily been tested on battery systems.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Battery systems must be UL listed, with circuit breakers and sensors to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Alexander Deeter

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Fax (562) 426-8248

[www.amecosolar.com](http://www.amecosolar.com)



Cc: David Fogt, Registrar



May 7<sup>th</sup>, 2018  
Ms. Heather Young  
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Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

My name is Patrick Redgate. I am the licensee, President & CEO of Ameco Solar, a California Corporation. Our firm has been helping people & businesses go solar since 1974, acting first as Link & Sun Solar (CSLB 345310) and later as Ameco Solar (CSLB 483280). I am writing to express my strong opposition to changes to the C-46 licensing qualifications with regard to the installation of energy storage.

The safety of our employees as well as of our customers is of paramount importance to everyone at Ameco Solar. To imply otherwise or to suggest that our operations personnel are unable to install solar and energy storage systems safely is a falsehood, given our experience under the broad umbrella of the C46, its requisite skill base, and the plethora of applications that a C-46 may encounter. The C-46 contractor can and has installed solar and energy storage systems for many decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. I am not aware of any *evidence* that would indicate, for the sake of public health and safety or for any other legitimate public interest purpose, that the installation of solar and energy storage should be restricted to the C-10 license.

Before Net Metering (passed in 1996), batteries had almost *always been paired* with solar photovoltaic systems. The advent of net metering in 1996 made grid-tied solar photovoltaic systems possible without batteries, but the grid-tied technology did not mature until 2001, with the availability of high voltage (600V) inverters. Before that year, almost all installations were low voltage battery-based systems. Ironically, the safety issue that stimulated the safety arguments against a C-46 in those days was the higher voltage of the dc runs, not energy storage (lower voltage). That the C-46 license had been qualified to install *energy storage* was clearly proven *by 2001*. Additionally, the C-46 test currently contains more questions on energy storage *than any other licensing examination administered by the CSLB* and has been so for decades. Energy storage technologies have become more safe, self-contained, easier to install and have evolved in many cases to plug-and-play. Storage and the associated inverters today are UL listed, with circuit breakers or fusing to prevent any thermal event.

It is important to note that solar has become disruptive to the existing utility model. In my opinion, the recent concerns over safety issues have become a mask to the effort to slow down the momentum of distributed generation (DG) & energy storage (ES). Not only is utility management issuing this cry, but so is the utility workforce; Labor and Management are united in this effort. If solar is to continue to tip the scales against Green House Gases, you should not cut off the C-46 contractor, or the A or the B, from installing energy storage. This will effectively increase DG & ES costs and threaten the existing worker base when you cut those contractors off, contractors like myself, from the very business that we all have worked so hard to create and grow.

Patrick A. Redgate

CLSB 483280

7623 Somerset Blvd, Paramount CA 90723

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5/18/18

Ms. Heather Young

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Heather.Young@cslb.ca.gov

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Pritesh Sampat and I am a solar installer with AMECO Solar Inc (CSLB: #483280). I have over 11 years of experience in the industry working for a C46 contractor. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforce that priority every day. The work we do has stood the test of time and withstood the elements. I take great pride in having trained under a C46 to gain the experience I have in this field. That training and experience has prepared me to attain a C10 Lic# 1022634, NABCEP Lic# 100414-010526, and OSHA 10Hr and 30Hr cards.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Pritesh Sampat

Pritesh Sampat  
AMECO Solar  
562-633-4400

Cc: David Fogt, Registrar

5-17-18



Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a new C-46 contractor with over 14 years of experience in solar. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

After many years working for Pat Redgate, one of the longest standing C-46 contractors in California, I just recently obtained my own C-46 license from CSLB... thank you! I plan to make battery storage installation one of my specialties as this market is growing and needs more, not less, contractors to service it.

You know that until very recently, most of the many battery storage systems that were installed over the decades were done by C-46 contractors, not C-10s. Now that the market is expanding more of these system are being installed by C-10s. If you want to exclude C-10s from installing battery storage, I would say "No, don't do that", because we C-46 contractors can train them how to do it!

Excluding C-46s in favor of C-10s is like kicking Master Po out of the school and handing his job to Grasshopper (you remember "Kung Fu"). There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. WHERE is the problem that this purge claims to solve? This is so very obviously just a greedy power grab by the IBEW to control all the battery storage installation business in CA that they should really just be embarrassed. Please don't allow the CSLB to be manipulated into this baloney. Please stand up for the expertise, experience and rights of the C-46s!

Energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes decades ago. Net metering allowed grid-tied photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. Why would the CSLB excluded C-46s in favor of C-10s when the CSLB's own C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB?

Energy storage is a rapidly growing part of the grid-tied solar market. Cutting out C-46 or A & B contractors is an insult to those primary builders of this market. It is patently unfair and is without merit on any functional level. Please REJECT any proposals to restrict solar and energy storage installations.

Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Todd W. Fanady".

Todd W. Fanady License #1038737

Cc: David Fogt, Registrar



# ALL VALLEY SOLAR

Saving The Earth, One Solar System At A Time

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May 18, 2018

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RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems

Dear Ms. Young:

I am a C-46 Solar Contractor, first licensed in 1986 (32 years ago), with an additional 10 years of experience before that. I have assisted the CSLB as an industry expert in the updating of the C-46 licensing test many times over the last 10 years, and am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Our company employs around 20 people, with another 15 in our sister company. The safety of my workers and my customers is of the utmost importance to me. I was at the meeting where some were attempting to blind-side the solar industry with this exclusion, and frankly, was appalled by some of the things said there. To imply that solar contractors only know how to throw solar panels on a roof "and we certainly don't want those guys installing solar storage batteries" is totally ridiculous. It would be like saying that most electrical contractor employees only know how to install 120v outlets "and we certainly don't want those guys installing solar storage batteries". Clearly this was an attempt to both slow down the movement towards solar AND a power grab by C-10 license leaders.

No license EXCEPT the C46 requires questions on the licensing test regarding solar storage. No license EXCEPT the C46 has installed thousands of battery storage systems. In fact, I have never met an electrical contractor that knew anything about batteries and solar storage (unless they were also a solar contractor) ...and we have worked with many on new construction projects. The normal work of a C10 Electrical contractor involves Alternating Current (AC), which is why there are no Battery Storage Direct Current questions on their qualifying tests. The NORMAL work of a C46 is Direct Current (DC), so Battery Storage is part of the same training and language.

We should be trying to restrict the C10 license from installing Battery Storage systems...but while that would be an easier case to make, that would not be fair either. There are certainly C10's that can handle battery storage systems quite well. As was always emphasized in the test creation workshops, we license to an "entry level", so the test is to be sure that an "entry level" contractor can safely handle the basic trade. No newly licensed C46 nor C10 would be qualified to install a big commercial battery storage system, just like no entry level plumber would attempt to plumb a high rise office building.

It is the solar contractors that have been sailing this ship towards a sustainable, cleaner energy future. That has now become a tidal wave, of which energy storage is going to be a rapidly growing part. It is an absolutely ridiculous and insulting idea to now cut those out who made it happen AND who are the most qualified and experienced at making it happen from this huge part of solar: Energy Storage.

Thank you for your considering these comments. I urge you to reject any efforts to change the current licensing of solar and energy and storage installations.

Sincerely,  
ALL VALLEY SOLAR, INC.

Ted Bavin, President.  
818-489-7780

cc: David Fogt, Registrar



4526 Telephone Road #205 Ventura, CA 93003 • Phone (805) 676-1988 • Fax (805) 650-8223 •  
• A Division of Coastal Constructors, Inc. • License 913170 B & C10 •

5-22-18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Phil Riege, and I am the owner with Coastal Solar, div. of Coastal Constructors, Inc. I am a general and electrical contractor 913170 B / C-10 with over 30 of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. Solar PV requires the knowledge of many techniques and disciplines to install, and particularly retrofit, into a structure. Many

potentially problematic issues may not even be apparent, let alone resolved, by dedicated electrical workers not intuitively aware of the relationship, compatibility and fitness of material and hardware installations.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,  
Phil Riege, Pres.  
Coastal Solar  
div. of Coastal Constructors, Inc.

CC: David Fogt, Registrar

**Young, Heather@CSLB**

---

**From:** Robert Danielson  
**Sent:** Thursday, May 17, 2018 10:39 AM  
**To:** Young, Heather@CSLB; Bob  
**Subject:** C-46 lisense comment

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, Ca. 95827

Dear Ms. Young :

The recent issue of excluding the solar contractors currently holding a C-46 license from the installation of an electrical storage component with a solar PV system is under discussions by the CLS Board .

Storage systems have always been a part of solar PV , more so during the early years and was on the licensing test I told many years ago .. I see no reason to limit the installation of solar / storage systems ( battery or otherwise ) to the electrical ,C-10 , contractors .

Many solar contractors have spent countless hours in both training ( at their expense ) , hands on workshops and the installation of battery storage systems with very positive results .

I recommend to all trades qualified to install PV systems that if they are considering the addition of storage to their solar PV systems that they do the work to train with the makers/ suppliers of storage systems and become competent with their installation .

Please do not remove the C-46 license holders from installation of a crucial component in PV solar systems. We have being doing this since PV"s inception onto the energy market .

Sincerely,  
Robert Danielson  
Active Solar Co,

State License # 476422

Friday, May 4, 2018



Lic. # 508902 B-1 C-2 C-46

Ms Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

42622 7th Street East  
Lancaster, California 93535  
(661) 945-4545  
Fax: (661) 945-8145  
(888) 945-4345

Dear Ms. Young

My name is Stephen M. Jenkins CEO Advanced Conservation Systems Inc. CSLB #508902 B1, C2, C46.

We have been installing solar and energy saving systems in the rigorous CA High Desert since 1983. I am writing to oppose limiting the installation of solar and energy storage to C10 classification only.

As you probably know, the installation of solar and energy storage is a field, which was pioneered and is still being driven by the C46 license classification. In the early days of rooftop solar, before Net Energy Metering, we were installing solar PV with lead-acid battery energy storage, which, in those days, was much more dangerous than our modern lithium and salt batteries with the myriad of electronic safety features built into the charge controllers and inverters of today.

It appears that taking away the ability of the C46 to install energy storage is a solution that does not solve a problem.

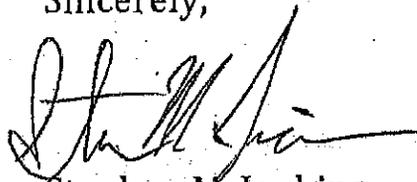
If the decision is made to restrict energy storage to C10 only it will most certainly create many problems. The entire C46 industry that was responsible for creating and nurturing a market will be removed from that market, causing an economic

collapse of that industry, leaving many clients of that industry as orphaned with no warranty for their solar installation.

In my opinion, the need for energy storage has been brought about by the arbitrage of the Electric utilities' Time of Use rate program. If you make solar exclusive to the C10 classification, you will increase the cost of solar, which has already been increased by the need for energy storage and will reduce the feasibility for many people to afford a solar energy system; which of course, is the goal of the Electric utilities.

I appreciate you taking the time to consider my point of view and I pray that you resist making rules that benefit those that have the gold.

Sincerely,



Stephen M. Jenkins  
CEO ACS Inc.



# Planet Plan Sets

EASY SOLAR PERMITTING

05-16-2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## **RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Planet Plan Sets, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

I have recently launched my new business Planet Plan Sets which is based in Southern California and offers engineering plan set services to residential PV installers. While my new venture has just started, I have worked in the field of PV training and codes/standards development for over 11 years.

I currently chair the committee on codes/standards for the California Solar and Storage Association where I also serve as a board member, and I serve as a UL 2703 standard technical panel member (the standard for rack mounted PV systems) where I lead the task group on Bonding and Grounding. As you would expect, the UL 2703 standard is focused on system safety, and much of the focus comes from system bonding/grounding.

In addition to these roles, I also serve as Secretary for the North American Board of Certified Energy Practitioners (the solar industry certification organization) where we certify solar installers, sales reps, and companies with the major focus on having competent quality installers that are trained to properly sell, design, and install PV and energy storage systems safely, to help consumers improve long term system performance. In summary, I have devoted my career to helping solar installations be done right, with safety as a core element of doing solar right.

From a safety perspective, energy storage technologies are safer, simpler to install, and more plug-and-play than battery systems from years past. UL listed equipment now exists with new UL safety standards for both the battery cells and the fully engineered Energy Storage Systems. Safety testing is at the heart of the UL listings and the safety systems include fusing/breakers that prevent thermal problems. These UL listed energy storage systems include many other safety features intended to improve easy installation and widespread use while preserving long term system safety.

When I first started working in the PV industry in 2007, I was the director of training for the second largest wholesale distributor, AEE Solar - which was originally founded as Alternative Energy Engineering in 1979. In the mid 2000's getting a C-10 contractor or licensed electrician interested

in installing solar was difficult to impossible, they simply had no interest in this technology. As a result, the significant majority of the solar and energy storage systems in California were installed by C-46 Solar Contractors.

Since my employer was a pioneer in the PV industry and had been supplying battery systems starting in 1979 and solar panels in 1981, we understood that safety was critical to our growth and we had a deep respect for the skills and knowledge required to safely design and install solar and battery systems. We worked hard to properly educate contractors on the safe design and installation of these energy storage systems. Between 2007 and 2010, I built the largest solar training program for installing contractors that had ever existed to date.

Despite the industry's growth over the next few years, I was very disappointed that C-10 electrical contractors and licensed electricians still had little-to-no interest in solar. It was only after the industry grew rapidly in 2010-2012 that C-10's started to get active, but we realized that C-10 contractors were poorly equipped to handle system design and installation for most solar projects as they had little experience with DC power systems.

Over the past twelve years, I have worked with many California C-46 contractors and find there is no lack of knowledge, skill or training needed to properly install. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. While not every C-46 contractor has the same levels of expertise, it is my assessment that on whole there are significantly more c-46 contractors that are capable of installing solar and storage safely when compared to C-10 contractors or licensed electricians.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Jeff Spies

—  
**Jeff Spies - President**  
[jeff.spies@planetplansets.com](mailto:jeff.spies@planetplansets.com)  
(866) 898-6886 office  
(714) 488-3790 mobile



**Planet Plan Sets**  
EASY SOLAR PERMITTING

Cc: David Fogt, Registrar [david.fogt@cslb.ca.gov](mailto:david.fogt@cslb.ca.gov)



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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Bond P. Mouch, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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4938 E. Ashlan  
Fresno, CA 93726

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Bakersfield, CA 93313

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Leonel Flores, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

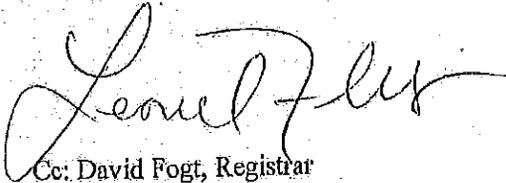
The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Cc: David Fogt, Registrar

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May 16, 2018

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CSLB Executive Office  
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[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Alejandro Neri, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Francisco J Lopez, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Juan Vese, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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Fresno, CA 93726

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Brandon Beach, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93720

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6901 McDowell, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ridley Villanueva, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4938 E. Ashlan  
Fresno, CA 93726

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is David Fogt, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

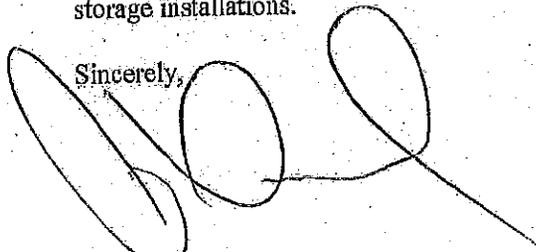
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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Cc: David Fogt, Registrar

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4936 E. Asfilar  
Fresno, CA 93726

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Bakersfield, CA 93313

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
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Sacramento, CA 95827  
[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is JOSEPH FLORES, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

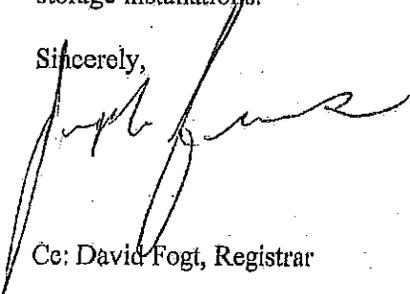
The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93726

BAKERSFIELD  
6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ismael Hidalgo, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93728

BAKERSFIELD  
6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

Ms. Heather Young  
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Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Chris Rios, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4930 E. Ashlan  
Fresno, CA 93726

BAKERSFIELD  
8901 McDivitt, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ruben Galaviz, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Richard Giamvitz, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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May 16, 2018

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Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Arnulfo Gonzalez Jr, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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Fresno, CA 93726

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6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

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9821 Business Park Drive  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jonathan Porter, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
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Fresno, CA 93726

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Chad Lockard, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read "Chad Lockard", written over a horizontal line.

Cc: David Fogt, Registrar

FRESNO  
4938 E. Ashlan  
Fresno, CA 93726

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is George Dean, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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4936 E. Ashlan  
Fresno, CA 93726

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Franklin Jones, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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4936 E. Ashlan  
Fresno, CA 93726

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6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Gary Delsid, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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Fresno, CA 93726

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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jeremy Buck, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Co: David Fogt, Registrar

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Fresno, CA 93726

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jason Garcia, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4938 E. Ashlan  
Fresno, CA 93726

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Bakersfield, CA 93313

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May 16, 2018

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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Adam Neves, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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May 16, 2018

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CSLB Executive Office  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Tyler Gilbert, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

*Tyler Gilbert*

Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93726

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May 16, 2018

Ms. Heather Young  
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[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Maurice Williams, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

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Fresno, CA 93726

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Bakersfield, CA 93313

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[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Daniel Neves, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93726

BAKERSFIELD  
8801 McDivitt, Ste. A  
Bakersfield, CA 93313

CASTROVILLE  
11485 Commercial Parkway, Ste. 10  
Castroville, CA 95012

SACRAMENTO  
1419 N. Market Blvd, Ste. 3  
Sacramento, CA 95834

Updated: 3/18/2019

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428



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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@csib.ca.gov](mailto:Heather.Young@csib.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Anthony D. Garcia, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4936 E. Ashlan  
Fresno, CA 93728

BAKERSFIELD  
6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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Updated: 3/18/2019



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May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@csfb.ca.gov](mailto:Heather.Young@csfb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Bryson Pugh, and I am a solar installer with Quality Home Services. I have several years of experience in the industry. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of the customers I serve is of the utmost importance and my training and on-the-job experience reinforces that priority every day.

It is also important to note that solar is a "multi-craft" trade entailing many different skills including site analysis, building structure suitability and reinforcements, roof penetrations and methods for walking on roofs to prevent damage, and many other skills. While the job encompasses electrical work, it is much broader.

Finally, energy storage technologies are getting safer, simpler, and easier to install. Many battery systems are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for plug-and-play installation and widespread use.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

FRESNO  
4938 E. Ashlan  
Fresno, CA 93726

BAKERSFIELD  
6901 McDivitt, Ste. A  
Bakersfield, CA 93313

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Sacramento, CA 95834



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May 15th, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Mark Dorman, and I am the Vice President of Customer Service with Quality Home Services. I am a License B contractor with over 35 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 250 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. In fact we are a Master Sun Power Dealer and recently earned an award for National Residential Dealer for providing exceptional customer service and complying with rigid installation protocols.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

**FRESNO**  
4936 E. Ashlan  
Fresno, CA 93726

**BAKERSFIELD**  
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Bakersfield, CA 93313

**CASTROVILLE**  
11485 Commercial Parkway, Ste. 10  
Castroville, CA 95012

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1419 N. Market Blvd, Ste. 3  
Sacramento, CA 95834



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Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Mark Dorman  
V.P. Customer Service

Col David Fogt, Registrar

**FRESNO**  
4936 E. Ashlan  
Fresno, CA 93726

**BAKERSFIELD**  
8901 McDivitt, Ste. A  
Bakersfield, CA 93313

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11485 Commercial Parkway, Ste. 10  
Castroville, CA 95012

**SACRAMENTO**  
1419 N. Market Blvd, Ste. 3  
Sacramento, CA 95834



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of Powertree Services Inc. ("Powertree"), I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

Powertree designs, manufactures and installs patented energy storage, solar and electric vehicle charging systems that are highly integrated to one another requiring specific training by our staff for installation. Our system is specifically designed for use in multi-family residential properties which continue to be under-served in the market.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. The newest generations now provide almost "plug and play" ease of installation intended to speed installations, lower costs and so reach a larger base of customers and thereby aiding in the effort on GHG reduction and local economic development.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

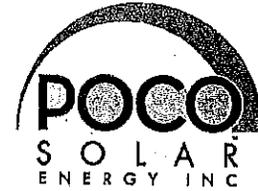
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Stacey Reineccius, CEO/Founder

Cc: David Fogt, Registrar



May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Gregory Cordero, and I am the President with POCO Solar Energy, Inc. I am a California contractor holding a B General Contractor license and a C46 specialty license with over 34 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 15 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems; ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Gregory A Cordero  
President

Cc: David Fogt, Registrar



5/16/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

My name is Gary Liardon and I am the President of PetersenDean's Consumer Division. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 2500 people work for our organization and the safety of our workers and customers is of the utmost importance. To imply otherwise or to suggest that our staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have a National Safety Director with dozens of direct reports across the States that work hand in hand to execute our safety program across all our vertical business segments. In PetersenDean's 34-year history we have received 7 Golden Gate Partnership awards from California/OSHA, more than any other roofing contractor. Any contractor that can weather 3 decades in the industry (installing over 1.4 million new construction roofs, the roof on the Miami Marlins stadium and Nasa's Johnson Space Center, over 100,000 solar systems, and several hundred energy storage systems) clearly has a track record of exemplary safety practices.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required, and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. It is important to note that we also carry a C-10 license and would be authorized to install under the proposed revision yet feel strongly that not only would it be unfair to C-46 holders it would create a more dangerous situation by taking them out of the mix given their expertise in this arena exceeds that of the typical C-10 holder.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. Energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy.

I appreciate you taking the time to review these comments and urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Gary Liardon  
President Consumer Division  
PetersenDean Roofing and Solar  
Cc: David Fogt, Registrar



5/3/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Cori Larsen, and I am the CEO with ParagonSun. Our company is a C-46 1025115 contractor with over 8 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 30 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read 'Cori Larsen'.

Cori Larsen

Cc: David Fogt, Registrar

15 May 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)



**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a B1 General and C46 Solar contractor with over 38 years of experience in the solar business. Today I am writing to express my strong opposition to proposed changes to the licensing classifications authorized to install solar and energy storage systems. This licensing was codified in State law many years ago.

More than 40 employees work for our company, and the safety of my workers and my customers has always been of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. I began installing battery-based systems in 1980, long before any thought of Grid connected solar, which did not happen until 1998.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only, particularly when they have not had the experience in it, except possibly when installing batteries in a Submarine for the Federal Government on a Union job, which is not residential nor exactly commercial.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s (implemented in 1998 in California) made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained many more questions on energy storage, and for many more years, than any other test administered by the CSLB. I personally have worked with Wendy Balfanz of the CSLB on at least three different rewrites of the C46 tests over the past 25 years. I have installed hundreds, if not thousands of battery-based and grid-tie with battery storage over the past 38 years.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

My question is, why are we not questioning the competence of a C10 contractor to install a battery based system, when they have actually not had much, if any exposure to the technology until it became fashionable in recent years?

My last comment is, why was I (and the hundreds of others) not legally notified at all of any proposed changes to the C46 license?

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,  
Harlan Ode'  
Oasis Air & Solar, Inc.  
1000 East Truxtun Avenue  
Bakersfield, CA 93305  
Office 661.322.COOL (2665)  
Cell 661.412.1672  
Fax 661.322.6889  
[harlan@322cool.com](mailto:harlan@322cool.com)

Cc: David Fogt, Registrar



**OutBack Power Technologies, Inc.**

17825 59th Avenue NE • Suite B • Arlington, WA 98223 • USA

Tel: 360 435 6030 Fax: 360 435 6019 [www.outbackpower.com](http://www.outbackpower.com)

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems

Dear Ms. Young:

On behalf of OutBack Power Technologies, I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. The C46 license was the original energy storage and solar installer in California; there is no reasonable justification for any proposal to limit the installation of energy storage systems to the C-10 license holder only, thereby cutting off the C-46 as well as the A and the B licenses from work they've safely and successfully performed for decades.

OutBack Power is the leading designer and manufacturer of advanced power electronics and energy storage for off-grid and grid-interactive solar + storage applications. With an emphasis on product performance, OutBack Power has forged a reputation as the product of choice in harsh environmental conditions and applications where product reliability is paramount. Whether the application is village micro-grids in Africa, rural electrification projects in Latin America, remote off-grid cabins in Alaska, or a suburban home in Southern California, OutBack Power has set the bar for delivering high quality resilient power solutions.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. OutBack Power has been an active participant in revising electrical, building and fire codes to address the needs of a growing industry, and UL Listed components, products and systems are now commonly available and prevalent to ensure even greater safety. In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce. OutBack Power offers extensive, hands-on NABCEP-registered Certificate Training Program covering all aspects of energy storage systems on a monthly basis, both at our Arlington, Washington offices and our Arizona training facility.

The C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer long active in the California market, we have worked with C-46 contractors for decades and find there is no lack of



**OutBack Power Technologies, Inc.**

17825 59th Avenue NE • Suite B • Arlington, WA 98223 • USA

Tel: 360 435 6030 Fax: 360 435 6019 [www.outbackpower.com](http://www.outbackpower.com)

knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors and their staff out from the very market they have worked to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

**Philip Undercuffler**  
**Director of Government and Industry Relations**

Direct: 360.618.4306 | Cell: 425.319.2821  
[pundercuffler@outbackpower.com](mailto:pundercuffler@outbackpower.com)

Cc: David Fogt, Registrar



5/18/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Kyle Bank, and I am the Chief Executive Officer of Meta Solar Technologies, LLC in Aliso Viejo, California. I am a C-46 ( # 1035650 ) contractor with over 7 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 10 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Kyle Bank-CEO  
Meta Solar  
92 Argonaut, Suite 130  
Aliso Viejo, CA 92656

Cc: David Fogt, Registrar



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

05/03/2018

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Michael Ingram, and I am the President of Michael & Sun Solar, Inc. I am a C46 contractor with over 10 of experience, and I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

I have 2 employees, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar



May 18, 2018

[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

I have been a solar installer with Luminalt since May of 2015. Prior to that I worked for other solar installation companies. I joined the solar industry following graduation from the solar and green construction training with Asian Neighborhood Design's Employment Training Center. For over 38 years, AND's ETC has successfully trained at-risk, low-income youth and young adults in the green construction field. That investment in me and my training made it possible for me to join a growing industry. Recently, I was promoted to crew lead. I am excited to continue working in my field and to continue to train and expand my skills in this growing market.

I have worked on hundreds of solar installations, and in the last year increasingly I have worked on systems paired with energy storage.

**I oppose changes to the licensing classifications authorized to install solar and energy storage systems which would preclude me from being able to work on solar paired energy storage projects.**

Solar and energy storage are multi-craft trades. My work covers many disciplines. Behind the meter solar and storage installations require mechanical work with metal racking, structural work, roofing, other general carpentry skills as well as electrical work.

Safety is critically important to me and Luminalt. My training in solar and storage as well as my OSHA, fall protection, and other safety training as well as the safety policies and procedures we follow here at Luminalt, are designed to keep us all safe. I hold an OSHA 10 certification, have attended courses on solar and the National Electric Code through ISPQ accredited providers and my local community college. I have taken advanced energy storage training. I have taken fall protection courses and am First Aid and CPR certified.

There are a broad array of energy storage technologies on the market. New devices are on the market and are being developed that are significantly safer to install than the old lead acid batteries solar installers have been installing off-grid and grid-tied for decades

Thank you for considering my comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Walter Morales

cc: David Fogt, Registrar



May 18, 2018

[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)  
Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

I have been a solar installer with Luminalt since June of 2014 and am currently a crew lead. I have worked on hundreds of solar installations and a number of solar installations paired with energy storage systems. I have worked on paired systems using traditional lead acid backup batteries as well as the newer advanced energy storage lithium ion batteries.

**I oppose changes to the licensing classifications authorized to install solar and energy storage systems which would preclude me from being able to work on solar paired energy storage projects.**

I am excited to continue working in my field and to continue to train and expand my skills in this growing market.

Solar and energy storage are multi-craft trades. My work covers many disciplines. Behind the meter solar and storage installations require mechanical work with metal racking, structural work, roofing, other general carpentry skills as well as electrical work.

The safety of my colleagues and I as well as the safety of our customers and the public is critically important to me and Luminalt. My training in solar and storage as well as my OSHA, fall protection, and other safety training as well as the safety policies and procedures we follow here at Luminalt, are designed to keep us all safe. I hold an OSHA 30 certification. I have attended courses on solar and the National Electric Code through ISPQ accredited providers. I have taken advanced energy storage training. I have taken fall protection courses and am First Aid and CPR certified.

There are a broad array of energy storage technologies on the market. Some, like Enphase's and JLM's, are mounted on individual solar panels and thus installed on a roof, carport or ground mount. Others are mounted like a solar inverter in the garage, mechanical room or on the side of a building. These devices are getting safer to install than the old lead acid batteries solar installers have been installing for decades.

Thank you for considering my comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read "Freddie DeVeyra". The signature is stylized and somewhat scribbled.

Freddie DeVeyra

Cc: David Fogt, Registrar



May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Eric Murphy, and I am the CEO of LetsGetSolar (CSLB Lic #1002782). I am a C-46 Solar contractor with over 12 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

The safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Eric Murphy  
CEO LetsGetSolar  
CSLB C-46 Lic #1002782

Cc: David Fogt, Registrar

Updated: 3/18/2019

445



May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Scott Siemer, and I am the President of Just Leaks, Inc. I am a General Building, Roofing Contractor (#712805 B, C39) with over 30 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 individuals work for me full time, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. Even though we perform industrial roofing – one of the most dangerous professions – this company has an exceptional safety record that has resulted in low insurance premiums. This is accomplished with training and awareness in partnership with our workers compensations insurance provider. Our employees know our number priority is safety and we pass much of the savings to them. This is done with all tasks – whether it is ladder/roof edge awareness or electrical lock-out procedures.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

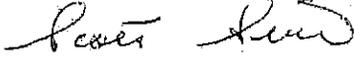
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From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build. Our clients appreciate that we provide all of our services "in house" without bringing in outside contractors.

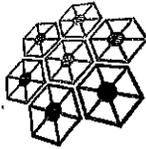
Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Scott Siemer

Cc: David Fogt, Registrar



HCI SOLAR

05/15/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jose Harb Jr , and I am the Chief Financial Officer with HCI SOLAR. I am a C-46 and B licensed contractor with over 24 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 25 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. Since our company's inception in 2007, we have had a flawless safety record installing both storage and photovoltaic systems. We continue to meet all Osha safety standards on the job.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off--contractors like myself--from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely

Jose O. Harb Jr. - C.F.O. - HCI SOLAR / Housing Construction Inc.

Cc: David Fogt, Registrar



27368 Via Industria Ave., Suite 101 | Temecula, CA 92590  
951.926.1176 | [HorizonSolarpower.com](http://HorizonSolarpower.com)

5/14/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ruben Ugarte, and I am the Sr. Business Development Director with Horizon Solar Power. We are General, C-46 and C-10 contractor with over 8 years of experience. I am writing to express our strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over five hundred people work for us, and the safety of our workers and customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We pride ourselves on safety and have a longstanding safety program in place to protect our workers and customer on every project.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Ruben Ugarte

Director of Business Development

O: 909-583-9550 | C: 626-252-6319 | [ruben.ugarte@horizonsolarpower.com](mailto:ruben.ugarte@horizonsolarpower.com)

Horizon Solar Power | [27368 Via Industria #101, Temecula, CA 92590](http://27368.Via.Industria.#101.Temecula.CA.92590) | [HorizonSolarPower.com](http://HorizonSolarPower.com)

For a **Brighter** Tomorrow.

5/14/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Daniel Tittmann, and I am the CTO / licensing officer of our company, Greenwired Inc. I am a C-46 Licensed solar contractor in the state of California and a Master Electrician EE-98 in the state of NM. I have over 14 years of experience in solar and energy storage. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have years of experience working with battery storage systems, with no record of any safety issues reported in the 12 years my company has been active in the energy storage market.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB. In my years of experience working with many C-10 licensed contractors I have found out firsthand the most C-10 contractors have little to no experience with energy storage technology or safety. Most of them can't even wrap their heads around variable DC voltages that we see in solar and battery systems. Of the countless systems that I have seen and serviced over the years, it is clear to me that contractors with the C-46 license install battery based systems safer, and with more skill and craftsmanship than I have ever seen from a C-10 Licensed contractor. In fact I have multiple C-10 licensed electricians use our company and experience with batteries and storage technology as their battery expert.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,  
Daniel Tittmann  
& greenwired renewable energy systems.  
Cc: David Fogt, Registrar



# ENVIRONMENTAL SOLAR DESIGN, INC.

11237 MAGNOLIA BLVD., NORTH HOLLYWOOD, CA 91801

P (818) 762-6624 • F (818) 762-2513

[www.esolardesign.com](http://www.esolardesign.com) • [environsolar@aol.com](mailto:environsolar@aol.com)

License # 402574 since 1979

May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Bob Ellis, and I am the Owner of Environmental Solar Design, Inc. I am a Class B, C-46 contractor with over 30 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 10 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

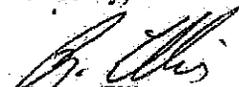
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Robert Ellis

Cc: David Fogt, Registrar



May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition regarding the limitation of storage installations to C-10 license holders**

Dear Ms. Young:

On behalf of ENGIE Storage I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

ENGIE Storage is a Santa Clara based energy storage company with a focus on providing schools and public sector customers energy bill savings with smart energy storage technology. ENGIE Storage is technology agnostic with most of our installations being lithium ion.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.

I urge you to reject any proposals to restrict solar and energy storage installations.

Regards, Walker Wright  
Head of Policy

# CORDA SOLAR

May 4, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

In business since 2007, Corda Solar is a residential installer of solar electric, solar thermal, and energy storage systems (CSLB lic. #1019424). Gary Corda (co-owner of our business) and I strongly oppose the changes to the licensing classifications authorized to install solar and energy storage systems.

Safety is of paramount importance to Corda Solar whether in regards to the immediate well-being of our employees, the protection of utility workers and first responders, or the security of our customers in their homes. We adhere carefully to the state's guidelines for safety and take every necessary precaution. We are skilled, knowledgeable and experienced with all the safety issues surrounding the design and installation of solar and storage systems and can be relied upon to consult outside experts whenever necessary.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. In recognition that the C-46 license installs energy storage, for many years, the C-46 test has contained more questions on energy storage than any other test administered by the CSLB.

Energy storage technologies are getting safer and easier to install. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use. Energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Courtney Corda  
President

Cc: David Fogt, Registrar

59 Silver Birch Lane, Danville, CA 94506  
www.cordasolar.com



ELECTRICAL CONTRACTORS & SOLAR ENERGY

Electrical Contractors & Service  
Solar Energy  
Ag Services

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

We are a B and C-10 contractor in business for nearly 60 years. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 80 people work for us, and the safety of my workers and my customers is of the utmost importance. Like the majority contractors in California, Chico Electric keeps safety on the top of our priorities by implementing certified electrical (including battery storage) and safety training everyday. There are many ways available for California contractors to obtain quality training.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

Even though we are a C-10 license holder, we believe discriminating against other related licenses is not proper and will hurt California and industry in general. This discriminating effort by special interests are only trying to artificially gain market share ... there are already many rules and regulations in place protecting the public, i.e. National Electric Code, local agency inspections, etc. This question does not need another layer of regulation.

The fact is, energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

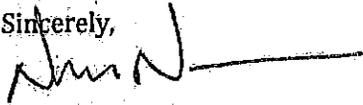
From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

[www.chicoelectric.com](http://www.chicoelectric.com)

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Norm Nielsen  
CEO

Cc: David Fogt, Registrar

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Nader Yarpezeshkan and I am the Sr. Director of Sales/ Corporate Development with Cenergy Power. We are a solar contractor Lic #922883 with over 10 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 40 work for Cenergy Power, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

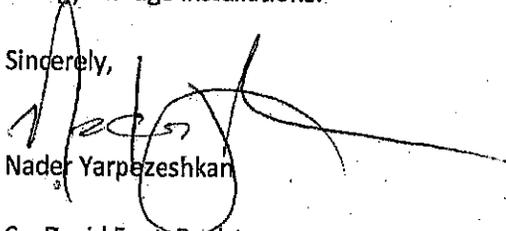
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Nader Yarpezeskhan

Cc: David Fogt, Registrar



5/18/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Jonathan Kane, and I am the Operations Manager with CED Greentech Santa Rosa. I am a Solar Distributor with over 10 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over a dozen work for me, and the safety of my installation customers is of the utmost importance. To imply otherwise or to suggest that my customers are unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Jonathan Kane  
Operations Manager  
CED Greentech Santa Rosa

Cc: David Fogt, Registrar



Solar. Design. Build.

5/18/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Yadydya Shahab Neman, and I am the President with California Solar Integrators, Inc. I am a CSLB#1004246 C-46 contractor with over 3 of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 15 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have a rigorous initial and ongoing safety training process that we are very proud of.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read "Yadydya", is written over a horizontal line.

Yadydya Shahab Neman

Cc: David Fogt, Registrar



# CalCom Solar

Solar for Agriculture and Water

5/17/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## **RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

On behalf of California Commercial Solar, Inc. (Calcom Solar), I am writing to express my strong opposition to any changes to the licensing classifications authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to the C-10 license holder only, cutting off the C-46 as well as the A and the B licenses.

As one of the leading installers of solar in California and the Central Valley, Calcom Solar is in a unique position to offer up opposition to the proposed licensing revision. Calcom Solar team members have installed over 100 megawatts of solar generating capacity, and close to a dozen proposed, designed, and installed energy storage systems while holding a C-46 license.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are becoming UL listed as an engineered system, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

In addition to making progress on simplifying designs, installation procedures and safety features, it is important to state that safety is of the utmost importance to our company. We go to great lengths to ensure that our products are installed by a trained workforce. We have site specific training to ensure all components of the system are installed without incident, and have had zero injury incidents related to our energy storage systems.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. As a manufacturer active in the California market, we have worked with C-46 contractors for years and find there is no lack of knowledge, skill or training needed to properly install our products. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off from the very market they have worked to build.



# CalCom Solar

Solar for Agriculture and Water

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Kevin Betz  
Site Development Manager  
California Commercial Solar, Inc.

Cc: David Fogt, Registrar



5/14/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Eric Stikes, and I am the Solar Program Manager with Byers Enterprises. I am a C46 (968280) contractor with over 18 years of experience in solar. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. I, personally, am NABCEP certified which is steeped in NFPA, NEC, and OSHA protocols and standards. My installation staff, including myself, attends regular training including OSHA, NABCEP, and specialized certification courses from our manufacturer, Sunpower.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only. In fact, my solar-specific experience has provided me with greater exposure to solar + battery storage systems than any of my C-10 peers, according to what they have to say about solar + storage.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes back when off-grid was the norm. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB. This should be evidence alone that a C-46 is more qualified to work on solar + storage systems than any other trade licensee.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more "plug-and-play". Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.



115 Idaho Maryland Road • Grass Valley, California 95945  
CA License# 518784 • 530.274.1750 • 800.977.5323 • ByersSolar.com

Updated: 3/18/2019



462



It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself--from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

**Eric A. Stikes**

Solar Program Manager, Byers Enterprises

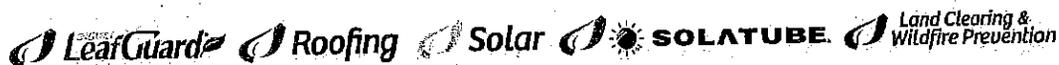
(530) 559-5023

C-46 Lic#968280 since 2011

NABCEP Pro Installer #PV-041115-004511 since 2015

Celebrating my 18th year in solar!

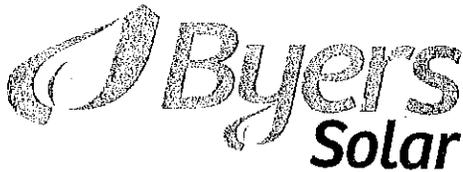
Cc: David Fogt, Registrar



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Updated: 3/18/2019





5/15/2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Brian Bookout, and I am the Solar Service Technician with Byers Enterprises. I am a C46 (1010480) contractor with over 10 years of experience in solar. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work with me, and the safety of my co-workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. I, personally, hold a NABCEP associate certification which is steeped in NFPA, NEC, and OSHA protocols and standards. I attend regular trainings including OSHA, NABCEP, and specialized certification courses from our manufacturer, Sunpower.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes back when off-grid was the norm. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB. This should be evidence alone that a C-46 is more qualified to work on solar + storage systems than any other trade licensee.

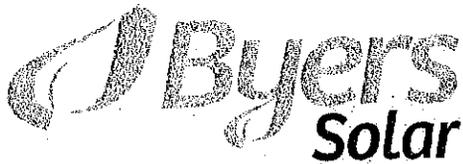
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115 Idaho Maryland Road • Grass Valley, California 95945  
CA License# 518784 • 530.274.1750 • 800.977.5323 • ByersSolar.com

Updated: 3/18/2019





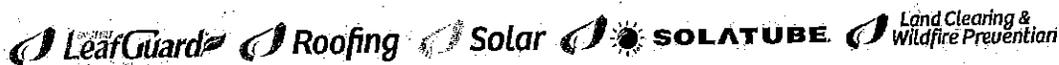
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

**Brian D. Bookout**  
Solar Service Technician, Byers Enterprises  
(530) 329 - 2464  
C-46 Lic#1010480 since 2016

Cc: David Fogt, Registrar



115 Idaho Maryland Road • Grass Valley, California 95945  
CA License# 518784 • 530.274.1750 • 800.977.5323 • ByersSolar.com

Updated: 3/18/2019





**Broadstreet Solar, Inc.**  
24330 McBean Pkwy  
Valencia, CA 91355  
Phone (818) 206-1464  
Fax (818) 638-5775  
[www.broadstreetsolar.com](http://www.broadstreetsolar.com)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Ahmad Yakub, and I am the CEO with Broadstreet Solar, Inc. I am a C-10 & a B License # 1009672 contractor with over 9 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 15 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Ahmad Yakub, CEO, Broadstreet Solar, Inc.  
Cc: David Fogt, Registrar



**BEARSOLAR**  
YOUR SOLAR DESTINATION

**Bear Solar Inc.**  
9274 Madison Ave, Orangevale CA 95662  
Phone: (916) 260-5913 | (888) 590-2327  
Fax: (916) 260-5913 Email: sales@bearsolar.com  
CSLB License # 1028222 | www.bearsolar.com

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

May 11, 2018

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Azim Ahmed, and I am the President/CEO with Bear Solar Inc. I am a C-46 contractor with over 19 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 20 people work for me directly and indirectly, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and have installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Azim Ahmed  
President/CEO  
Bear Solar Inc.

Cc: David Fogg, Registrar  
Updated: 3/18/2019

5-15-18

**B & B Solar**  
"25 Years Experience"

CL# 519561

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Bob Gumm, and I am the Owner with B&B Solar. I am a Licensed contractor with over 35 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 6 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

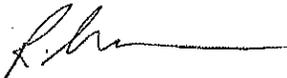
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From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,



Cc: David Fogt, Registrar



May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems**

Dear Ms. Young:

I am a C-46 and B license holder, number 550110 contractor with over 38 years of experience. I am also the President of California Solar and Storage Association. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

More than 30 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We are capable of installing batteries on both residential and commercial buildings safely.

As you are aware, a C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.



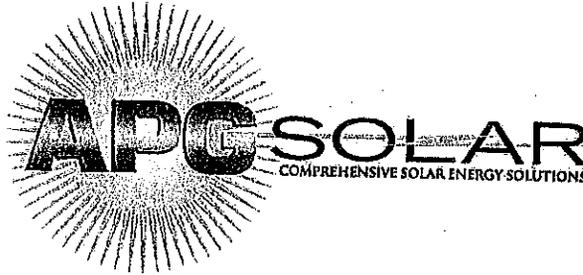
Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

*Edmond L. Murray*

Edmond L. Murray  
President

Cc: David Fogt, Registrar



5/17/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Brent Jerner, and I am the President with APG Solar. I am a B, C 10, C 46, C61/D21 859901 contractor with over 12 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 15 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

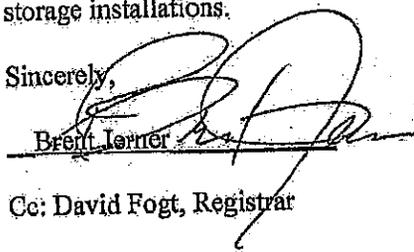
The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

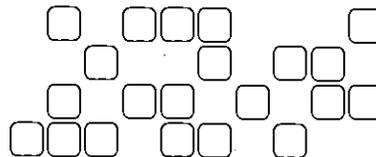
It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

  
Brent Lerner

Cc: David Fogt, Registrar



Alternative Energy & Energy Storage Solutions

E: adam@aliveindustries.com

T: +1 760 877 4759

5/3/2018

Ms. Heather Young
CSLB Executive Office
9821 Business Park Drive
Sacramento, CA 95827
Heather.Young@cslb.ca.gov

RE: Opposition to limiting energy storage installation to C-10 license holders

Dear Ms. Young:

My name is Adam Hammill, and I am the owner of ALIVE Industries, Inc. I am a B1 contractor with over 8 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 15 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. As a licensed general contractor, with a staff who have been in the construction industry for over two centuries, combined, we have the knowledge and skills to build entire homes, far less properly install, attach, wire and commission an energy storage system. We've all received specialized training and we have a 100% customer satisfaction rating. Not only do we install safely, but our installations look far better than others because of our attention to detail. Because of the vast growth of the solar and storage industries, many C10 contractors pay their employees very low wages to do work they're really not qualified for. I see it every day, and we often repair it for our customers. The solar and storage industries are quickly growing and changing, and when companies come and go, it is the reliable and trustworthy companies like us who end up cleaning up others messes.

I realize the industry needs regulation, but punishing more highly qualified companies by disallowing them to install energy storage is simply not an effective, or wise way to go about it.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more question on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Adam S. Hammill (handwritten signature)

Adam S. Hammill
President/CEO
ALIVE Industries, Inc.

Cc: David Fogt, Registrar



May 4<sup>th</sup> 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**RE: Opposition to limiting energy storage installation to C-10 license holders**

Dear Ms. Young:

My name is Al Rich, and I am the President of ACR Solar International Corp. I am a C46 solar contractor with over 39 years of experience. I am writing to express my strong opposition to changes to the licensing classifications authorized to install solar and energy storage systems.

Over 10 people work for me, and the safety of my workers and my customers is of the utmost importance. To imply otherwise or to suggest that my staff is unable to install solar and energy storage systems safely is, simply put, inaccurate. We have installed hundreds of solar electric PV systems over many years with an excellent safety record, in fact, we have never had an electrically related accident and have an excellent reputation with all county and city inspectors for excellent workmanship.

As you know, the C-46 contractor can and has installed solar and energy storage systems for decades. In addition, the General A contractor has been able to install energy storage when specialized engineering is required and the General B contractor has been able to do so in connection to a structure. There is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of solar and energy storage needs to be restricted to the C-10 license only.

The fact is energy storage has always been paired with solar photovoltaic systems, ever since the technology was first used in off-grid homes. The advent of net metering in the mid-1990s made grid-tied solar photovoltaic systems possible without batteries, but the pairing of these technologies nonetheless has never waned. That the C-46 license has been able to install energy storage is evidenced by the fact that the C-46 test has contained more questions on energy storage, and for many more years, than any other test administered by the CSLB.

From a safety point of view, energy storage technologies are getting safer, simpler to install, and more plug-and-play. Batteries today are UL listed, with circuit breakers to prevent thermal events, and other safety features that are designed for easy installation and widespread use.

It is important to note that energy storage is rapidly becoming a necessary part of the grid-tied solar market with the advent of Time-of-Use rates and the need to smooth out the intermittency of renewable energy. To cut off the C-46 contractor, or the A and the B, from installing energy storage would be to effectively cut those contractors off—contractors like myself—from the very market we've worked so hard to build and could put us out of business.

Thank you for considering these comments. I urge you to reject any proposals to restrict solar and energy storage installations.

Sincerely,

Cc: David Fogt, Registrar

# SUNPOWER®

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

## RE: Opposition to Revising Licensing Eligibility for Energy Storage Systems

Dear Ms. Young:

On behalf of SunPower Corporation, I am writing to express our strong opposition to any changes to the licensing classifications currently authorized to install solar and energy storage systems. There is no justification for any proposal to limit the installation of solar and energy storage systems to a C-10 license holder only.

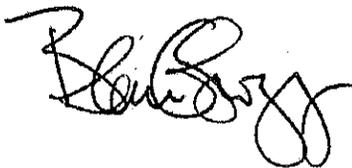
SunPower is a California-based manufacturer and installer of solar electric components and systems with 30 years of market experience providing complete solar solutions and services to a diverse group of customers: residential, businesses, governments, schools and utilities. SunPower has extensive experience with installing paired solar and energy storage systems.

Today's energy storage technologies are safer, simpler to install, and increasingly plug-and-play. The new generation of batteries are becoming UL-listed as an engineered system, with circuit breakers to prevent thermal events and other safety features that are designed for easy installation and widespread use.

Safety is of the utmost importance to our company and we go to great lengths to ensure that our systems are installed by a trained workforce. We have worked with C-46 contractors for many years in California and find there is no lack of knowledge, skill or training needed to properly install solar systems paired with energy storage. In short, there is no evidence that, for the sake of public health and safety or for any other legitimate public interest purpose, the installation of an energy storage system needs to be restricted to the C-10 license only.

Thank you for your consideration.

Sincerely,



Blair G. Swezey  
Senior Director

# ADVANCE: SOLAR, HYDRO, WIND, POWER CO. INC.

P. O. Box 23, Calpella, CA 95418  
6331 N. State St., Redwood Valley, CA 95470  
Solar & Electrical Contractor License #620243  
Energy Auditor License # 84325  
Since 1978

Phone 707-485-0588  
Fax 707-485-0831  
e-mail [pete@advancepower.net](mailto:pete@advancepower.net)

5/15/18

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Dr.  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)  
[David.Foght@CSLB.ca.gov](mailto:David.Foght@CSLB.ca.gov)

RE: C-10 Union (IBEW) bullying tactics of Energy storage qualifications of C-46

Dear CSLB:

I have filed formal complaints against 3 sitting board members mainly for their obvious IBEW bias. Mr. Schetter, Mr. Dias & Mr. Simpson all show not only contempt, bias, but also, in my opinion corruption. They should be removed from any further discussion on this matter.

CSLB meeting "handout" March 2, 2018:

Summary: Existing law defines a solar energy system as either: (1) any solar collector or other solar energy device, whose primary purpose is to provide for the collections, **STORAGE**, and distribution of solar energy for space heating, space cooling, electric generation, or water heating; (2) any structural design feature of a building, whose primary purpose is to provide for the collection, **STORAGE**, and distribution of

solar energy for electricity generation, space heating or cooling or for water heating.

Page, 60, 3/2/18

CSLB meeting "handout" 2/23/2018

Considerations for ESS Fire Safety

The main conclusion from the program is that installation of battery systems into buildings introduces risks, ***though these are manageable within existing building codes and fire fighting methods*** when appropriate conditions are met. Page iii

This illustrates that a smoldering Li-ion battery on a per kilogram basis can be treated with the same precautions ***as something like a sofa, mattress, or office fire*** in terms of toxicity, but during the most intense moments of the fire (during 2-3 minutes that the cells are igniting exothermically) precautions for toxicity and ventilation should be taken. Page 10

CSLB Committee meeting 4/25/2018

Many C-10 representatives extolled the virtues of C-10 contractors based on the incredible, lengthy and fully diversified training C-10 apprentices get. However all these, so called authority figures, instructors, never referred to the CEC (CA Electric Code) as a training guide and rule book. They all and many C-10s, continually sited, the NEC as the basis for their training. So, as CSLB members, do you stipulate we as CA contractors go by NEC or CEC? Just one of many problems with the assertion that C-10s are more qualified because of intense training. There were very, very few, in attendance, that day that had any knowledge of battery installations. Two C-10s came out and specifically mentioned Tesla, LG as very complicated, needing extensive training and the vulnerabilities of incorrect installation. Nothing could be further from the truth. I know both these manufacturers and products. They are TOTAL plug and play. They will absolutely not let you get inside the battery compartment. If there is a

problem you ship it back to the manufacturer. They are plug this wire into this socket, turn this switch on and look at the screen. The total ignorance of these people is astounding. Both these Li technologies are LMC (Lithium Manganese Cobalt). However, I doubt anyone in the room even understands, let alone knows, what this means and what inherent issues this creates. Plus both of these systems NEVER put cells in series above approx. 120 vdc. They install a DC to DC converter to boost the DC voltage up to 400. So why would they do that? BVD does not do that. We do not do that. Our Lipo4 systems are rated to 1000 vdc cell voltage. Again, the total incompetence and misinformation that these individuals espoused to was amazing. The culmination of this was when one of them asked for a show of hands of anyone in the room who has a energy storage system. Two hands raised up and I was one.

I have lived off grid for over 40 years. I have installed hundreds of thousands of battery systems. I have powered complete islands, businesses, homes. I have been manufacturing lead acid batteries for well over 10 years. I have been manufacturing Lipo4 systems for well over 7 years. Li systems, in my opinion are actually much, much safer & more inert than lead acid systems.

When C-10s talk about training people for battery installations I question their assertions. There is no training that can outpace years of installation knowledge. When you get to my level, there is NO TRAINING. It is all proprietary. Corp. secrets and getting or teaching these secrets will land you in court and possibly jail. I purchased a 1200 vdc Mitsubishi LI system with a 500 kW Eaton inverter, just so I could tear it apart and reverse engineer it. Actually, the system was very, very simple. Battery systems have very simple rules and guidelines to observe and follow.

In closing, I want to emphasize that energy storage systems, on the market today, are plug and play. They are AC coupled, utility support systems, that do not allow the customer, installer or anyone to get inside the battery system. It is virtually impossible for an installation to be installed improperly. Larger systems are stipulated under CA 2018 fire code to be fully engineered by a licensed electrical engineer. Once a system is fully engineered the only duty of the installation contractor is to follow the engineering and diagrams. Again, plug and play, in my opinion.

C-46 have ALWAYS installed battery banks. We invented home battery systems. We are the ones who changed the whole industry by utilizing MPPT circuits to increase the efficiency of off grid systems by close to 40% by utilizing the Lead acid battery required equalize voltage during normal bulk charge. This alone changed the whole grid tie world because now high voltage (600 vdc) inverters could be used for split phase 120/240. Not to mention it was the solar industry that totally changed the inverter industry by initially inserting a time pulse at the 0 point of the wave form. Does not sound like much now, but 40 years ago this was revolutionary. And, again, it was the solar industry that gave birth to the present inverter technology. And lastly, C-46 work with DC all the time. 600 vdc, 1200 vdc and now even 1500 vdc is common.

Thank you for your consideration  
Pete Gregson  
Advance Power Inc.

**LETTERS RECEIVED ON BEHALF OF THE  
ELECTRICAL CONTRACTOR (C-10) INDUSTRY**



CALIFORNIA PROFESSIONAL FIREFIGHTERS



March 5, 2019  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827



**RE: Clarification of Regulations for Battery Energy Storage System Installation**

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery **transforms** electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *“install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose.”*

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system.** CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only specialty contractors who hold a valid C-10 electrical contractors license.

Sincerely,



Brian K. Rice, President  
**California Professional Firefighters**

Tom Dalzell, Chairman  
**Coalition of California Utility Employees**

Matthew Hargrove, Senior Vice President,  
Government Affairs  
**California Business Properties Association**

William "Bill" Kelly, Liaison  
**County Building Officials Association of California**

Gary Passmore, President  
**Congress of California Seniors**

Daniel V. Fross, Executive Director  
**Building Safety Alliance**

Shawn Lewis, Policy Director  
**NFIB California**

The Honorable Leticia Perez  
**Fifth District Supervisor, Kern County**

The Honorable Joan Hartmann  
**Third District Supervisor, Santa Barbara County**

The Honorable Al Austin II, Councilmember  
**City of Long Beach**

The Honorable Willie Rivera, Councilmember  
**City of Bakersfield**

Jesse Urquidi, Boardmember  
**Norwalk La Mirada Unified School District**

Yolanda Rodriguez-Pena, Vice – President  
**Azusa Unified School District**

Laura Santos, Trustee  
**Mt. San Antonio College**

Natalie M. Ybarra, Vice President, Board of Education  
**Bassett Unified School District**

Julie Lind, Executive Secretary/Treasurer  
**San Mateo Labor Council**

Mike Shrout, President  
**California State Firefighters Association**

Richard Samaniego, Secretary/Treasurer  
**California State Association of Electrical Workers**

Robbie Hunter, President  
**State Building & Construction Trades Council**

Dion Abril, Executive Administrator  
**Western States Council of Sheet Metal, Air, Rail and Transportation Workers**

Matthew Hargrove, Statewide Administrator  
**Building Owners and Managers Association (BOMA) California**

John M. Bozeman, Director, Government & Industry Affairs  
**BOMA – San Francisco**

Aaron Taxy, Director of Government & Public Affairs  
**BOMA – Greater Los Angeles**

Eddie Bernacchi, Legislative and Regulatory Advocate  
**NECA – California**

James Willson, Executive Director  
**NECA – Los Angeles Chapter**

Greg Armstrong, Executive Director  
**NECA – Northern California Chapter**

Andy Berg, Executive Manager  
**NECA – San Diego Chapter**

Fran McDermott, Executive Director  
**NECA – Great Sacramento Chapter**

Michael Geller, Manager  
**NECA – Contra Costa Chapter**

Anisa Thomsen, Manager  
**NECA – Redwood Empire Chapter**

Jerri Champlin, Executive Manager  
**NECA – Monterey Bay Chapter**

Cody Brooks, Executive Director  
**NECA – Kern County Chapter**



Dan Rodriguez, Business Manager  
**IBEW Local 332**

Doug Lung, Executive Director  
**NECA – Santa Clara Chapter**

Joel Barton, Business Manager  
**IBEW Local 11**

Peggy M. Brown, Chapter Manager  
**NECA – Orange County Chapter**



Nicolaj Svoboda, Business Agent  
**IBEW Local 684**

Shari J. Brunner, Executive Manager  
**NECA – Central Coast Chapter**



Daniel O. Chivello, Business Manager  
**IBEW Local 595**

David Shankle, Executive Vice President  
**NECA – Southern Sierra Chapter**



Chris Huston, Business Representative  
**IBEW Local 952**

Robert Meadows, President  
**Morrow-Meadows Corporation**



Steve Booker, Business Representative  
**IBEW Local 617**

Bernard M. Kotlier, Executive Director  
**Sustainable Energy Solutions**



John P. McEntagart, Business Manager  
**IBEW Local 551**

Anthony Hernandez, President  
**Electrical Workers Minority Caucus - San Jose Chapter**



Nicholas J. Segura, Jr., Business Manager/  
Financial Secretary  
**IBEW Local 569**

Thomas Coleman, Executive Manager  
**San Francisco Electrical Contractors Association**



Richard Samaniego, Business Manager  
**IBEW Local 441**

Frank Reardon, Business Agent  
**United Association of Journeymen and Apprentices Local 38**



John J. Doherty, Business Manager/  
Financial Secretary  
**IBEW Local 6**

Alex Lantsberg, Director of Research and Advocacy  
**San Francisco Electrical Construction Industry**

Dave Clark, Director of Membership  
Development  
**IBEW Local 100**

Mike Garner, VP Sales  
**Cupertino Electric, Inc.**



Marc Flynn, Business Manager/  
Financial Secretary  
**IBEW Local 40**

Jeff Neubauer, Manager  
**Neubauer Electric, Inc.**



James S. Elrod, Business Manager/  
Financial Secretary  
**IBEW Local 428**

Shelley Keltner, CEO  
**Pacific Data Electric Inc.**



David Iloff, Business Agent  
**IBEW Local 180**

Robert Hayes, President  
**R.I.S. Electrical Contractors Inc.**



Andy Hartmann, Business Manager  
**IBEW Local 234**

Jack Paulson, Training Director  
**Solano & Napa Counties Electrical JATC**



Jason Eshelman, Business Manager  
**IBEW Local 477**

Cliff Thompson, Senior Vice President  
of Field Operations  
**Rosendin Electric, Inc.**

Earnest Brown, President  
**International Line Builders SoCal**



Tom Hansen, Business Manager  
**IBEW Local 302**

Mikail Hussein, President/CEO  
**United Taxi Workers of San Diego**



*Telenet VoIP Inc.*

Robert Ward, Business Manager  
**IBEW Local 340**

Collin Weiner, President  
**CalEnergy Electrical Corporation**



**Chula Vista Electric Co.**  
Innovative Electrical Contracting & Network Systems

Chuck Huddleston, Business Manager/  
Financial Secretary  
**IBEW Local 413**

Jim Marsh, President/CEO  
**Taft Electric Company**



VMax Electric, Inc.

Matt Furrer, Vice President,  
Branch Manager  
**Contra Costa Electric, Inc.**

Earl Restine Jr., President  
**Rod Fuller Electric Corporation**

Douglas Woodruff, CFO  
**Advanced Cable Systems**

Jon Treder, President/CEO  
**Electricraft, Inc.**



Craig Gini, Vice President  
**Collins Electrical Company, Inc.**

James Young, CEO  
**Young Electric Co. Inc**

Jeff Davis, VP Construction  
**CSI Electrical Contractors**

William Musgrave, President/CEO  
**McMillan Electric**

Tara Hammond, Director of  
Community Development  
**Sullivan Solar Power**

Brad Kirk, President  
**Sac Valley Electric, Inc.**



Diana Limon, Training Director  
**Electrical Training Institute**

Jack Bellows, President  
**Vmax Electric Inc.**

Jeff Perry, President  
**Briggs Electric, Inc.**

James Reed, Owner  
**Century Electric**



William Delucchi, President  
**Delucchi Electric, Inc.**

Michael Brannon, President  
**Brannon Inc. DBA Smith Electric Service**

Larry Strohm, Co-Owner  
**Big Sky Electric Inc.**

Jim Robinson, President  
**Artkos Incorporated**



**ROSSI & CARR  
ELECTRICAL, INC.**

6440 Monterey Rd.  
Paso Robles, Ca 93446  
805 238 3502  
C10 438266

Robert Davies, President  
**Davies Electric Co, Inc.**

Barry Frain, President  
**Con J. Franke Electric, Inc.**

Travis Becker, President  
**Becker Electric, Inc.**

Asghar Ghassemy, President  
**Telenet VoIP, Inc.**

Tim Daniels, President  
**TDN Electric, Inc.**

Ernie B. Ulibarri, President  
**Barri Electric Company, Inc.**

Andrew Ferrari, Chairman of the Board  
**A.S.F Electric, Inc.**

David Studebaker, President  
**Studebaker Brown Electric, Inc.**



San Diego, California

SINCE 1962

9085 Kenamar Drive, San Diego, Ca 92121  
(858) 578-7454

Ben Smith, President  
**Advanced Cable Solutions, Inc.**

Manny Ayala, President  
**Solar Motion Green Energy Services LLC**

Stephen Mussell, President  
**Santa Maria Electric, Inc.**



Ryan Cross, General Partner  
**Cross Price Electric**

Patrick McMillan, President  
**Victory Electric**

Yuriy Fox, President  
**Absolut Electric, Inc.**

Ted Kristensen, President  
**Enterprise Electric**

Robert W. Friar, President  
**Chula Vista Electric**

Timothy McBride, CEO  
**Southern Contracting Company**

Russell Sterner, President  
**Rossi Carr Electrical Inc.**

James Hart, President  
**DAB Innovations, LLC**

Vic Giacalone, CEO  
**Best Electrical Co., Inc.**

Walt Zacharias, President/Owner  
**Elite Power, Inc.**

Brian Jacoway, President  
**Valley Pacific Electric, Inc.**

Richard Nogleberg, President  
**PEI Placer Electric, Inc.**

Shane Cox, President  
**The Mike Cox Electric, Inc.**

Richard Reed, President  
**Renewable Gateway**

Katrina Kincaid, Owner  
**American Electric Company**

Scott Kingsmill, President  
**Gilbert & Stearns, Inc.**

Michael Outerbridge, President  
**Outerbridge Electric**

Troy Wilhite, President  
**Wilhite Electric Inc.**

Mark H. Olson, President  
**Mark Olson Electric, Inc.**

Kevin Carsey, President  
**David Stone Electrical Contractors, Inc.**

Sean Holland, Owner  
**HS Electric, Inc.**

Louis Angelos, President/Owner  
**Betaray Inc. (dba) Sage Electric**

Louis Buhler, Owner  
**Buhler Construction Co**

John Pegram, President  
**Integrated Security Controls, Inc.**

Pete Spencer, CEO  
**Audio Associates**

Rebecca Anderson, Owner  
**Beci Electric, Inc.**

Brian Iwashita, CEO/President  
**Palmer Electric, Inc.**

Kevin Baxter, President  
**Baxter Electric, Inc.**

Gregory Olson, President  
**Olson Electric Services**

Thomas Ispas, President  
**Daniel's Electrical Construction**

Greg James, President  
**Direct Digital Controls, Inc.**

Richard Beard, Owner  
**Beard Electric, Inc.**

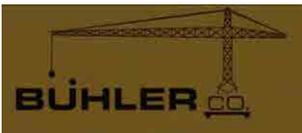
Keith Orum, Owner  
**Halco Testing Services**

Michael Espinoza, President  
**Calsouth Electric, Inc.**

Julio Guillen, President  
**Guillen Electric Company, Inc.**



American Electric Company





Jeff Bernardino, President  
**Integrated Power & Lighting, Inc.**

Patrick Grafton, President  
**Grafton Electric, Inc.**

Nicholas McDaid, Owner/Manager  
**N2 Electric, Inc.**

Kevin Miller, Owner  
**Alden Electric Co.**

Leanne Peterson, President  
**Southland Electric, Inc.**

Dylan Lecair, CEO  
**Lecair Electric Inc.**

Matthew Sellars, Owner  
**Matthew Sellars Electrical Services**

Basri Ismail, Owner  
**Buzz Electric, Inc.**



February 6, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: Clarification of Regulations for Battery Energy Storage System Installation

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to "install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.





We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

Eric M. Tonnesen  
Branch Manager  
Collins Electrical Company, Inc.



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

6998 Sierra Court  
Dublin, CA 94568  
PH: 925-829-6000  
FX: 925-829-6033

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

I am writing to you out of concern that Energy Storage Systems (ESS) are being installed by contractors with C-46 licenses. These systems are larger and more complex than those that have been installed by C-46 contractors in the past as part of small residential photo-voltaic systems; thus, they pose a greater risk to the safety of any unqualified personnel that come in contact with the system.

These ESS systems can produce as much as 10 MW of power and the potential danger to the installer, future maintenance workers, and the public at large dictate that these systems should be installed by licensed C-10 electrical contractors that have a trained workforce of electricians that have had years of on the job and classroom training and must be certified to work in the State of California. Many of the workers of C-46 PV Contractors are unskilled workers with little or no technical training. It is a public safety risk to allow these contractors and their unskilled workforce to install intricate and highly powerful ESS Systems that have the potential to produce large amounts of electrical energy.

As a part owner of Del Monte Electric, a firm that has been in business since 1938, I understand the inherent dangerous nature of these systems and the training required for our staff to install every component, connection point, and safety label correctly to protect all that come in contact or utilize an ESS System. Please make safety a priority and only allow Energy Storage Systems to be installed by C-10 licensed contractors that hire properly trained and certified electricians.

Thank you very much for your consideration.

Best regards,  
Del Monte Electric Co., Inc.



Scott Mullins  
Vice President



May 16, 2018

Nicolaj Svoboda

California State Licensing Board  
9821 Business Park Dr.  
Sacramento, CA 95827

CSLB Hearing on Energy Storage Licensing

To whom it may concern from the CSLB:

I spoke at the hearing that you held in April about my personal experiences working for a C46 contractor, before I got into an apprenticeship, graduated and became a State Certified Electrician. At the hearing we were informed there that if we had anything else to say, to write a letter and that is exactly what I am doing. I didn't really have too much to say, until the people that were speaking from the C-46 side, went up to the podium and spoke half-truths.

I was astonished that some of the diversions, those few, such as Bernadette del Chiaro threw out at the hearing on Wednesday. Bernadette stated, "That the C-46 License Test has a higher percentage of questions on energy storage, than that of the C-10 Test." She is, absolutely correct, but she left out one huge factor. That factor being that the C-10 Test takers know, and deal with a wide range of subjects. Not just DC, Energy Storage Devices and the tying in. C-10 contractors deal with AC, DC, Transformers, Capacitors, Fire Alarm, Communications, Fiber, the list goes on and on. Secondly, Bernadette stated, "Their safety rating or incident ratings are perfect." That again, is true. But sadly, it's because there isn't anyone out there that is accumulating data for the C-46 Projects out there. These two instances, are part of the myriad of ammunition the C-46 proponents are using to persuade the Board to rule in their favor.

I am sure you are swamped with letters, videos, and such; meaning I will cut short this letter. I really appreciate the board's time and consideration in this letter and hearing, as well, to help determine the best determinations on Construction and making every site and job, as safe as possible.

Best Regards,



Nicolaj Svoboda  
CA State General Electrician #163593

RECEIVED  
MAY 18 2018  
MR #6



May 16, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Classifications Authorized to Install Energy Storage Systems

My name is Ted Kristensen and I am the President of Enterprise Electric Company. We have been performing electrical installations in Southern California for over thirty years, a number of which are now combined with PV Solar and Energy Storage systems.

It has recently come to our attention that there may be some consideration to allow C-46 Contractors to perform Energy Storage installations. It is our opinion given our many years of electrical experience that these installations present a much more complicated and hazardous environment and as such should be left to the expertise of C-10 Electrical Contractors. With this rapidly expanding technology, Energy Storage systems vary widely in type, size, and power. As such, these Energy Storage installations are more complicated and require more skill and knowledge than the installation of PV Solar systems.

Energy Storage systems (ESS) - including residential systems - are rapidly increasing in size. Some commercial systems exceed 10 megawatts. Improperly installed Energy Storage systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

There is a clear difference between C-46 contractors and C-10 contractors in that C-46 contractors can, and do, hire workers with no formal training. According to data collected by UC Berkeley, these same untrained workers are paid as little as \$10 to \$11 per hour. Putting these low wage, uncertified workers to work on energy storage systems - which if installed improperly are extremely dangerous - puts workers and end consumers at risk. In contrast, C-10 contractors are required to employ state certified electricians who have secured at least 8,000

hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections.

While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe in a residential installation are much different.

Furthermore, Energy storage and PV are completely different and separate systems. The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system.

In conclusion, there is much to consider when dealing with any electrical or Energy Storage system, the foremost of which should be life/safety concerns. It is our experienced opinion that the State should insist on the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California.

Thank you for your kind consideration,

Ted M. Kristensen  
President  
Enterprise Electric



Electrical Contractor and Service Provider  
CA State License No. 994305  
6830 Fair Oaks Blvd., Carmichael CA 95608  
Tel (916)735-3144

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Dylan Lecair, I represent Lecair Electric, Inc.

Dear Members of the Contractors State Licensing Board:

I really appreciate that you are taking comments on this subject.

My understanding is that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is

having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

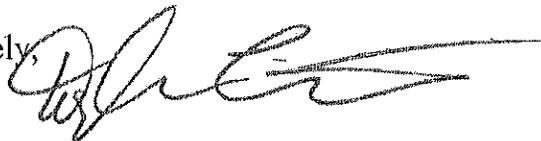
Even a small home energy storage wall unit is much bigger and a lot more dangerous than a portable consumer device. What's even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

I know the difference between an electrician and a solar contractor and there is a huge difference in electrical understanding and experience. Electrical contractors (c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer. Insurance companies have long said that electrical problems are the #1 cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate. Who would know how much training that solar worker has, if any at all? That's not a safety risk that average citizens should have to take.

The CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,

A handwritten signature in black ink, appearing to be "John E.", written over the word "Sincerely,".



Electrical Contractor and Service Provider  
CA State License No. 994305  
6830 Fair Oaks Blvd., Carmichael CA 95608  
Tel (916)735-3144

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

We, the undersigned California state certified general electricians are writing to you about a very important electrical safety issue, and we appreciate the opportunity to make these comments to the California Contractors State Licensing Board (CSLB).

The issue and important safety question facing the CSLB is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

We want to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

We believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be challenged:

1. **C-46 statement or inference:** This is a union or IBEW issue.

**Counter:** In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the test - whether you are union or not.

2. **C-46 statement or inference:** C-46 contractors are capable of doing energy storage work because they pass a test.

**Counter:** Any contractor of significant size must spend their time running their business. Employees do the installations. So it is the qualifications of the employee installers that

really matters. The difference in worker qualifications is vast. **There is NO minimum California state certification requirement for electrical education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors.** In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

3. **C-46 statement or inference:** Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the public.

**Counter:** Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

4. **C-46 statement or inference:** There is "no evidence" that there are problems or complaints with C-46 contractors.

**Counter:** According to CSLB data:

- Number of C-10 contractors: 24,391 active; 6,068 inactive  
In 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors - **a 5.6% complaint rate.**
- Number of C-46 contractors: 1,167 active; 174 inactive.  
In 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-146 contractors - **a 32.2% complaint rate.**

5. **C-46 statement or inference:** If C-46 contractors are not allowed to install ESS, the market will be disrupted or harmed.

**Counter:** A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!

**Additional counter:** While 367 out of 1152 C-46's have dual licenses (32%), 482 C-46's have no worker's comp and claim no employees. That means that 670 C-46s do have employees. Therefore, the 367 dual license holders (who are in good standing) represent 54% (367/670) of the C-46s who have employees. With more than half of C-46s (who have employees) already seeing the benefits of having a C-10 license and utilizing state certified electricians, the market will not be harmed or disrupted.

6. **C-46 statement or inference:** Residential "plug and play" ESS are safe.

**Counter:** So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. The way to make residential ESS safer is to have qualified, certified personnel install and maintain it.

7. **C-46 statement or inference:** The power, danger, and risk of PV and energy storage work are similar. (If I can work on PV, I can work on energy storage.) A spokesperson from Sunrun commented at the CSLB on April 25<sup>th</sup> and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar.

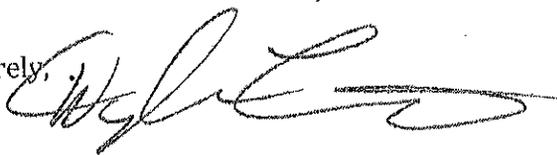
**Counter:** The C-46 representative who indicated this does not understand energy storage, or potential energy. PV produces a stream of electrons that can be likened to a stream of water. In contrast, ESS store a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

**In summary, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.**

**We strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems - whether they are paired with a PV system or not.**

Thank you for considering our comments.

Sincerely,



Name

Dylan Lecair

Address

6830 Fair Oaks Blvd., Carmichael CA 95608

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

6998 Sierra Court  
Dublin, CA 94568  
PH: 925-829-6000  
FX: 925-829-6033

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

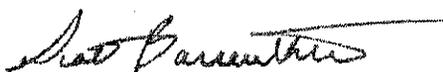
I am concerned that Energy Storage Systems (ESS) are being installed by contractors with C-46 licenses and not by certified electricians that work for C-10 contractors. The installation of these systems and the connections to the electrical distribution system require an understanding of the entire electrical system. I spent 5 years of my life acquiring the knowledge and skills to safely install electrical systems such as ESS and I am acutely aware of the potential dangers inherent in these systems. They should not be allowed to be installed by less skilled photo-voltaic workers that are not certified and are not required to be trained on the entire electrical system.

These ESS systems can produce as much as 10 MW of power and the potential danger to the installer, future maintenance workers, and the public at large dictate that these systems should be installed by licensed C-10 electrical contractors that have a trained workforce of electricians that have had years of on the job and classroom training and must be certified to work in the State of California. Many of the workers of C-46 PV Contractors are unskilled workers with little or no technical training. It is a public safety risk to allow these contractors and their unskilled workforce to install intricate and highly powerful ESS Systems that have the potential to produce large amounts of electrical energy.

Part of my responsibility with Del Monte Electric is to ensure that our electricians are properly trained and informed for each project that they work on. We also are constantly providing safety training so that our electricians not only work safely, but also ensure the safety of the final installation. In my tenure at Del Monte Electric, I have overseen many large scale PV Projects where we have worked hand in hand with the workforce of C-46 contractors. Many times, these workers are unskilled and lack the training to understand the dangers of the systems that they install. I believe that the complexity of ESS Systems mandate that they be installed by C-10 electrical contractors that hire properly trained and certified electricians.

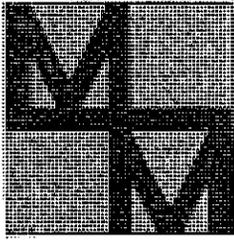
Please contact me should you wish to discuss my concerns any further. Thank you for your time.

Sincerely,  
Del Monte Electric Co., Inc.



Scott Barreuther  
General Superintendent and safe certified electrician





## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
231 Benton Court, City of Industry, CA 91789 - Tel: 909.598.7700 / Fax: 909.839.8186

May 16, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Written Comments -Classifications Authorized to Install Energy Storage Systems

My name is Rick Jarvis, I am the Executive Vice President of Morrow-Meadows Corporation. I am also a Certified General Electrician #100656. I have held various field and office positions over the past 34 years at Morrow-Meadows Corporation and have 37 years in the electrical construction industry.

Thank you for the opportunity to comment on the Boards decision regarding license classification for installation of commercial battery storage installations. My 37 years of experience installing, managing, and maintaining various electrical installations has always considered 1st public safety as it relates to installations. I have no concern with C-46 contractors safely installing solar PV installations. Commercial energy storage systems, however are a separate and distinct more complicated system that requires the skill and training of State Certified General Electricians and C-10 Licensed Contractors, to ensure the safe installation of these potentially dangerous systems.

Our firm currently has B, C10, and a C7 licenses. Energy Storage installations are more complicated and require more skill and knowledge than PV Solar systems: You can compare this current issue with what the State has done with Electrical Installations (require C10) and their complexity and danger to Low Voltage installations (require a C7). Low Voltage installations are much less complex and less dangerous so the State wisely separated the two types of work for safety reasons. The State should follow the same protocol on this issue and side with caution and require a higher level of skill and training under the C10 license. Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

MEMBER OF THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

- Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.
- These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.
- C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for energy storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are invalid because:
  - C-46 contractors could and often do obtain a C-10 license to install and maintain energy storage (whether it is paired with PV or not). According to Ms. Del Chiaro of the CA Solar and Storage Association, approximately 1/3 of C-46 contractors already also hold a C-10 license. C-46 contractors who do not have a C-10 license have the option of obtaining one. This would not be an unreasonable/onerous/unusually difficult requirement to meet.
  - In this way the same contractor could install PV solar under their C-46 license, and also install energy storage under their C-10 license with no disruption, warranty issues, or delay to their customers. Far from burdening contractors, with the addition of a C-10 license, C-46 contractors would also be able to install energy storage not paired with PV, and expand their businesses.
  - As for the claim of market disruption, that does not make sense. According to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!
  - Finally, it is important to address cost. A contractor that holds both a C-46 and C-10 license will be very competitive in the marketplace when competing with other dual license or with C-10 only contractors. The cost to consumers will remain very competitive because of continued strong competition in the market.
  - The only cost issue for contractors installing ESS would be when and if a C-46 has been employing low or unskilled workers at very low pay with few or no benefits. Those contractors would be required to employ electricians to install ESS on the energy storage portion of a project where PV is paired with energy storage. Electricians are paid more than unskilled workers because they have a certification that reflects substantial electrical training, knowledge, and experience which provides workers and the public with much greater safety. Utilizing low paid, low or unskilled workers as a trade-off for safety cannot be justified.

As a solar contractor, we are very familiar with what it takes to do solar PV work, and I also know what knowledge, skills and abilities (KSAs) are required to do energy storage system (ESS) projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the KSAs of a C-46 contractor and especially C-46 employees are not adequate to safely install ESS systems.

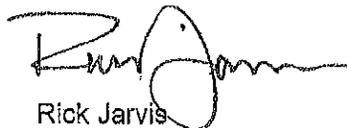
The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. Again, similar to what the State has previously implemented in the C10 versus C7 licensing.

In concluding, this is as much a safety issue and when dealing with any electrical or energy storage system, the State should side with the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California as stringently as possible.

Thank you for considering our input and experience.

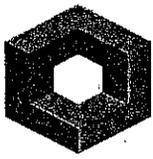
Sincerely

MORROW-MEADOWS CORPORATION

A handwritten signature in black ink, appearing to read "Rick Jarvis". The signature is stylized with a large, looped "R" and "J".

Rick Jarvis  
Executive Vice President

MORROW-MEADOWS CORPORATION



**PDE**  
Total Energy Solutions  
Electrical Contractors  
& Engineers

www.pdeinc.com CA Lic. No. C10 620473

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Dear Ms. Young,

My name is Shelley Keltner and I appreciate the time you are taking to review this issue. As electrical contractor and business owner, safety is my highest priority. Our company is known as a leader in battery energy storage and DC power systems. PDE installed its first battery energy storage system (BESS) for a large telecom installation over 25 years ago. Our deep knowledge in designing, installing and maintaining DC power systems enabled PDE to leverage its experience into the new market for large, grid-connected battery energy storage systems.

The battery energy storage market is changing and expanding. Applying existing rules to this new market is not appropriate and potentially dangerous. The BESS market is dynamic and its growth is actually outpacing many of the groups working to develop safety standards. Nationally, the DOE is working on an energy storage roadmap and coordinating the efforts of code setting agencies such as the NFPA, the International Code Council and IEEE. The National Fire Protection Association has recently completed a draft version of NFPA 855, Standard for the Installation of Stationary Energy Storage Systems. The release of NFPA 855 in 2020 will create more stringent requirements. Based on the actions taken by code setting agencies, it is clear, the BESS systems in this new market are not the systems paired with smaller PV systems. These new systems are much more complex, requiring expanded knowledge of installation means and methods for varied electrical components and systems.

Safety of the workers, safety of the end-users and safety of our first responders are at stake. The C-10 electrical contractor has broader experience in electrical systems installation and training, which makes the C-10 licensee better suited to safely install BESS systems.

Please feel free to contact me with any question.

Respectfully,

Shelley G.  
Keltner

Digitally signed by Shelley G.  
Keltner  
DN: cn=Shelley G. Keltner, o=PDE  
Total Energy Solutions, ou,  
email=skeltner@pdeinc.com,  
c=US  
Date: 2018.05.16 17:36:28 -0700

Shelley Keltner  
CEO

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9970 Bell Ranch Drive #109  
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O: 562.204.3550  
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PDE San Francisco Office  
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F: 510.614.0662



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: Heather.Young@cslb.ca.gov

Re: Classifications Authorized to Install Energy Storage Systems

As a General Contractor here in the San Francisco Bay Area I felt compelled to weigh in on the issue of who is qualified to install Energy Storage Systems for 2 reasons:

1) When it comes to the installation of anything over 12v we always use C-10 contractors. Why would you not? There is no amount of cost savings that a C-46 contractor can bring that I would risk my electrical scope of work to one.

2) As a long time proponent of new technologies that reduce our carbon footprint, I believe it is important that to not forget the importance of deploying technologies that will not increase public risk, real or perceived, no matter what the benefit. If new technologies are deployed without the highest regard for public safety, we not only fail those that are injured, but we create the circumstances to disrupt the adoption of that technology. Energy Storage Systems in particular are vulnerable to this. Imagine one or more Exploding Energy Storage Systems due to less than rigorous installation standards would do the adoption of this critical step in our planets future.

In addition to the fact they are separate systems with unique installation requirements, energy storage systems also pose unique and heightened fire and life safety risks to occupants, building officials, and emergency responders. Energy storage systems can overheat, explode, catch fire, and pose significant electrocution risks. The intensity of these risks is far greater than those posed by PV solar. It is critical that energy storage systems are installed by workers with the proper expertise and training. Accordingly, it would be a serious mistake to treat energy storage systems as mere incidental components of PV systems.

I urge the CSLB to clarify that only qualified C-10 electrical contractors, utilizing workers who are trained, experienced, and certified, be authorized to install and maintain energy storage systems regardless of whether or not they are paired with a solar PV system.

Sincerely,

Mauricio Mejia  
Vice President

8 N San Pedro Street San Jose CA 95110  
[www.CalPacificContractors.com](http://www.CalPacificContractors.com)

**BAKER ELECTRIC  
HOME ENERGY**

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May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young,

Thank you for taking the time to accept and read my written comments regarding the workers that should be authorized to install Energy Storage Systems. It is my belief that only State Certified General Electricians should be authorized to install these systems.

Baker Electric Home Energy has been installing Energy Storage Systems for a couple of years now and we have completed over (60) systems for residential customers. We have installed over (8,000) Solar PV Systems since 2012 as well. It has been and will remain our policy to have all Energy Storage Systems installed by qualified State Certified General Electricians.

There are currently several different types and brands of Energy Storage Systems available for the residential market. Some are AC coupled while others are DC coupled. The technology for this market is rapidly evolving and manufacturers are constantly changing their products adding new features and requirements. Just because an Energy Storage System is being installed into a residence does not make it inherently safe. There are many installation techniques that need to be followed in order for the installation and ongoing operation of the system to be safe.

The size and power capacity of an Energy Storage System is only limited by the electrical service it is being connected to. One manufacturer (DC coupled system) just made their "B or slave" battery available this month which allows more storage capacity on the same electrical service. Multiple Energy Storage Systems can be connected to the same service allowing for larger Energy Storage Systems (20 kW plus) powering homes. Often times the addition of these systems requires a Main Service Panel Upgrade which requires a State Certified General Electrician to perform the work. Without the proper electrical theory, wiring and safety training a worker installing these systems is putting themselves, co-workers and the host customer at risk.

It is our belief that State Certified General Electricians should be installing these systems. They have thousands of hours of experience and have proper training that will result in the appropriate level of safety for all stakeholders.

Sincerely,

  
Jay Miller  
Director of Operations

---

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877.578.8080  
www.BakerHomeEnergy.com  
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You've got Baker.™



March 23, 2018

Contractors State License Board  
PO Box 26000  
9821 Business Park Drive  
Sacramento, CA 95827

Attention: Board Members

Reference: Energy Storage Systems

Dear Board Member:

My name is Eric Tonnesen, first I would like to thank you in advance for the opportunity to write this letter concerning the installation and maintenance of Energy Storage Systems (EES).

I have been in the electrical industry for 43 years and I am currently Branch Manager for Collins Electrical Company in Marina CA. Collins Electrical Company has six offices throughout the state of California making us one of the largest electrical construction companies in the state and we have been in business for over 90 years

My concern is the EES systems are becoming more and more technical and requires a completely different set of skills. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe in a residential installation are much different. So much so that the National Fire Protection Association, NFPA are adopting new Codes and Standards, specifically for the installation of stationary energy storage system. They have now adopted a new standard NFPA 855 which address these installations.

Just to have common safety knowledge, relying on Cal/OSHA general safety training, to install and maintain ESS puts workers and the public at great risk. ESS systems are rapidly increasing in size. Improperly installed energy storage systems pose risk to workers, emergency responders and the general public. Where connected to the grid, these systems can also pose risks to utility infrastructures and utility workers.

C-10 Contractors unlike C-46 Contractors hire workers that are formally trained, and C-10 Contractors are required to employ state certified electricians who have secured at least 8,000 hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections.

Using only C-10 Contractors for the installation and maintenance of ESS installation, makes for a better installation. They are well-trained and use only certified electricians.

Again, thank you for allowing me to express my concerns.

Sincerely,

Eric M. Tonnesen  
Branch Manager  
Collins Electrical – Marina Branch





March 4, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: Clarification of Regulations for Battery Energy Storage System Installation

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *"install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."*

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical license.

Sincerely,

Mike Garner



Vice President of Sales  
CUPERTINO ELECTRIC, INC.

**Headquarters**  
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Gilbert, Arizona 85233  
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May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Ed Tait Jr. I represent Collins Electrical Company Inc.

I have over 25 years' experience as a state certified general electrician & 15 year as a senior electrical estimator. My experience includes commercial, industrial, residential & renewable energy installations.

I appreciate this opportunity to comment.

I understand that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB). The issue is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

First, we would like to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

We believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be corrected:

- A. C-46 claim: C-46 contractors are capable of doing energy storage work because they pass a test.

Response: Any contractor of significant size must spend their time running their business. Employees do the installations. So, it is the qualifications of the employee installers that really matters. The difference in worker qualifications is vast. There is NO minimum California state certification requirement for electrical education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors. In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.





- B. C-46 claim: Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the general public.

Response: Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

- C. C-46 claim: There is "no evidence" that there are problems or complaints with C-46 contractors.

Response: According to CSLB data:

Number of C-10 contractors: 24,391 active; 6,068 inactive  
In 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors – a 5.6% *complaint rate*.

Number of C-46 contractors: 1,167 active; 174 inactive.  
In 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-46 contractors – a 32.2% *complaint rate*.

- D. C-46 claim: If C-46 contractors are not allowed to install ESS, the market will be disrupted or harmed.

Response: A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%.

Additional response: While 367 out of 1152 C-46's have dual licenses (32%), 482 C-46's have no worker's comp and claim no employees. That means that 670 C-46s do have employees. Therefore, the 367 dual license holders (who are in good standing) represent 54% (367/670) of the C-46s who have employees. With more than half of C-46s (who have employees) already seeing the benefits of having a C-10 license and utilizing state certified electricians, the market will not be harmed or disrupted.

- E. C-46 claim: Residential "plug and play" ESS are safe.

Response: So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. The way to make residential ESS safer is to have qualified, certified personnel install and maintain it.





- F. C-46 claim: The power, danger, and risk of PV and energy storage work are similar. (If I can work on PV, I can work on energy storage.) A spokesperson from Sunrun commented at the CSLB on April 25<sup>th</sup> and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar.

Response: The C-46 representative who indicated this does not understand energy storage, or potential energy. PV produces a stream of electrons that can be likened to a stream of water. In contrast, ESS store a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

- G. C-46 claim: This is a union or IBEW issue.

Response: In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician, you must pass the test - whether you are union or not.

C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.

I strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems – whether they are paired with a PV system or not.

Sincerely,





May 18, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Rick Henry, I am the Dublin Branch Manager of Collins Electrical Company, Inc. I have held various field and office positions over the past 5 years at our company and have 29 years in the electrical construction industry.

Thank you for the opportunity to comment on the Boards decision regarding license classification for installation of commercial battery storage installations.

During my many years of experience installing, managing, and maintaining various electrical installations I have always considered worker and public safety the highest priority.

I will not be commenting about C-46 contractors installing solar PV installations. Installing energy storage systems of any size, however, is a separate and distinctly more dangerous process than PV. Installing energy storage systems requires the skill and training of State Certified General Electricians and C-10 Licensed Contractors.

Energy Storage installations are more complicated and require much more skill and knowledge than PV Solar systems. You can compare this current issue with what the State has done with electrical installations - which require C10 - and their complexity and danger, to low voltage installations - which require a C7 license. Low voltage installations are much less complex and less dangerous so the State wisely separated the two types of work for safety reasons. The State should follow the same protocol with energy storage systems: side with caution and require the higher level of skill, training and safety that comes with the C10 license.





Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems

requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

- C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for energy storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are invalid because:
  - C-46 contractors could and often do obtain a C-10 license to install and maintain energy storage (whether it is paired with PV or not). According to Ms. Del Chiaro of the CA Solar and Storage Association, approximately 1/3 of C-46 contractors already also hold a C-10 license. C-46 contractors who do not have a C-10 license have the option of obtaining one. This would not be an unreasonable or unusually difficult requirement to meet.
  - In this way the same contractor could install PV solar under their C-46 license, and also install energy storage under their C-10 license with no disruption, warranty issues, or delay to their customers. Far from burdening contractors, with the addition of a C-10 license, C-46 contractors would also be able to install energy storage not paired with PV, and expand their businesses.
  - As for the claim of market disruption, that does not make sense. According to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are





- o subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%.
- o Finally, it is important to address cost. A contractor that holds both a C-46 and C-10 license will be very competitive in the marketplace when competing with other dual license or with C-10 only contractors. The cost to consumers will remain very competitive because of continued strong competition in the market.
- o The only cost issue for contractors installing ESS would be when and if a C-46 has been employing low or unskilled workers at very low pay with few or no benefits. Those contractors would be required to employ electricians to install ESS on the energy storage portion of a project where PV is paired with energy storage. Electricians are paid more than unskilled workers because they have a certification that reflects substantial electrical training, knowledge, and experience which provides workers and the public with much greater safety. Utilizing low paid, low or unskilled workers as a trade-off for safety cannot be justified.

As a solar contractor, we are very familiar with what it takes to do solar PV work, and I also know what knowledge, skills and abilities (KSAs) are required to do energy storage system (ESS) projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the KSAs of a C-46 contractor and especially C-46 employees are not adequate to safely install ESS systems.

The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. Again, similar to what the State has previously implemented in the C10 versus C7 licensing.





**In conclusion, this is a serious safety issue for all concerned. When dealing with energy storage systems, the State should recognize and acknowledge the much better trained and more stringent license requirements to protect the interests of the people of the State of California as stringently as possible. The C-10 license will do that, the C-46 will not.**

We appreciate your consideration of our input and our experience.

Sincerely,

Rick Henry  
Dublin Branch Manager  
COLLINS ELECTRICAL COMPANY, INC. | CA License No. 115427  
6761 Sierra Court, Suite D | Dublin, CA 94568  
T: (925) 392-0134 | F: (925) 248-2572 | C: (925) 260-0519  
[rhenry@collinselectric.com](mailto:rhenry@collinselectric.com) | [www.collinselectric.com](http://www.collinselectric.com)





Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Hello,

My name is Joe Ory and I would like to thank the board for taking the time to read my letter. I am writing today to put forward my opinions on the public safety issues of Energy Storage Systems. I have worked in the electrical field for the last 23 years and have been a state certified general electrician since 2003. I am a 3<sup>rd</sup> generation electrician who truly believes electrical work above all other trades is dangerous and occasionally deadly. I think we can all agree that changing out a toilet or tiling a countertop may be frustrating for us but we are never afraid for our safety to try. The same cannot be said for electricity. People have a fear of electricity and for very good reason, it can kill you and others instantly.

I was present on day 2 of the hearings and I listened to everyone speak of their reasons for or against ESS installs by C-46 contractors. Unfortunately I did not speak that day but I feel many others did that expressed feelings similar to mine on this subject. There are small residential units that are simple plugs and play units like demonstrated at the hearing. Although I must say at the hearing and that particular demonstration on the plug and play unit they never addressed the electrical service tie in for that unit. They merely showed where the DC connections land and didn't address entering into the live panel board for interconnection. Anytime somebody is working in an electrical panel they should be trained for that install. And when that install is in somebodies home or business I feel that training should be documented and certified somehow. C-10 contractors are regulated by this documentation and certification. Unfortunately there is nothing in place ensuring the C-46 contractors are properly trained or even trained at all in the electrical trade. I am not claiming all of C-46 installers are not trained I am just stating that there is no way to tell whether or not they have the necessary training for the install they are working on.

There are so many ways you can put a similar situation to this. When I go to Les Schwab to get a new set of tires there is no way I would also ask them to rebuild my motor since I am already there getting work done on my car. This being the simple fact that they are not trained for this type of work. It would put me and my family in possible danger. Now move this concern over to a much more complicated and complex installation of a 500kw ESS and the potential danger is terrifying to me. I have been trained through thousands of hours of on the job training and countless hours of classroom time and these systems still concern me.

In conclusion I can understand how they want to install these systems to help their business grow however this cannot come at the cost of safety. I feel that takes precedence above all else in this life. I hope you understand my point of view on this topic without getting into all of the technical aspects of the systems. C-10 contractors are trained and certified through continuing education protocol and should be the installers of these energy storage systems.

Thank you for your time!!  
Joe Ory

---

Sincerely,

*Joe Ory*  
*Renewables Superintendent*  
Collins Electric Co Inc.

Date: May 17, 2018

Attention: Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Subject: **Written Comments - Classifications Authorized to Install Energy Storage Systems**

Dear Ms. Young,

Baker Electric, Inc. is providing this letter regarding C-46 contractors installing and maintaining electrical energy storage systems (ESS) Paired with Photovoltaic (PV) systems. Our primary concern is public and worker safety. Energy Storage Systems come in a wide range of type including electro-chemical, thermal, pumped hydro, mechanical and compressed air with electro-chemical currently most prevalent. From our direct experience commercial and industrial system sizes range from 30kW/40kWh to 5MW/10MWh. These systems typically employ Li-Ion chemistries operating at 800-1000VDC with DC fault currents, in many cases, far exceeding 100,000 Amps. These systems typically feed a facility, building or campus Main Switch Board interconnecting at voltages ranging from 480/277V to 12kV and in many cases require service upgrades, line side taps or new main Switch Boards to be installed. In the case of 12kV (medium voltage) a whole new level of qualification, certification and safety must be employed that is not typical of a C-46 contractor. Our strong opinion is that improperly installed Energy Storage System pose a significant Fire, Life and Safety risk. Following is a brief list of safety concerns:

- a. Arc Flash, Proper PPE (it is critical that workers are properly trained and wear the correct Personal Protective Equipment for the task)
- b. Device coordination (insure that the nearest protective device quickly detects and clears the fault – protects downstream wire mitigating fire risk)
- c. Improper termination of conductors can lead to conductor failure and result in a Fire life Safety hazard.
  - i. Dissimilar metals, improper torque, unmatched current and or temp ratings, bend radiuses all compound this risk.
- d. Improper crimps/splices of conductors can lead to a thermal event/arc and result in a Fire life Safety hazard.
  - i. Use proper and calibrated crimping/splicing tools per manufacturer recommendations.
- e. DC Voltage and Amps Interrupting Rating (AIR). Incorrectly rated switches, circuit breakers, fuses, load centers can lead failure (arcing/overheating, fault not being cleared, and in some cases cause an arc when operating a switch) and result in a Fire, life, and Safety hazard.
  - i. Multiple strings of batteries in parallel can supply high fault currents – in large commercial projects and utility scale this fault current can be much greater than standard AIR ratings of the overcurrent device used to protect individual battery strings.
- f. Improperly grounded Battery energy storage system pose a sock hazard and risk of electrocution.

Baker Electric, Inc. is a licensed C-10 contractor that also has a C-46 license and has been in continuous operation since 1938. We have substantial experience in PV and Energy Storage Systems and have installed more than 153 commercial solar projects (100MW), more than 48 large utility scale solar projects (2GW), more than 5 commercial



# Baker Electric

Established 1938

1298 Pacific Oaks Place  
Escondido, CA 92029  
760.745.2001 Tel  
760.745.3610 Fax

Battery Energy Storage projects (1.1MW/1.7MWh), and have installed more than 5 utility scale Battery Energy Storage projects (51.2MW/73.4MWh). In all cases we routinely work with potentially lethal systems and take painstaking efforts to insure public and worker safety. These efforts include:

- g. Use of State Certified General Electricians.
- h. Continued training for General Electricians.
- i. Robust safety programs for our workers such as:
  - i. CPR
  - ii. Electrical Work Safety
  - iii. OSHA 30
  - iv. Specialty Tools (as required)
  - v. Lift Equipment
  - vi. Fall Protection
  - vii. Rigging
- j. Use of proper test equipment/procedures on all circuits, conductors, switchgear, etc. to confirm proper installation prior to being energized.
- k. Close adherence to all AHJ, NEC (CEC), NFPA, Utility, UL, IEEE standards as required.

In contrast a typical C-46 Contractor relies on the knowledge of the qualifier and work on smaller, less complex low voltage systems most likely utilizing technicians that are not licensed electricians to perform or even oversee the work. In the formative days of our industry this was acceptable as most energy storage systems encountered by a C-46 contractor were smaller Valve Regulated Lead-Acid or Flooded Lead-Acid batteries operating at 12, 24 or 48VDC. Vastly different from today's large Energy Storage Systems that can operate up to 1000-VDC and interconnect at high voltage.

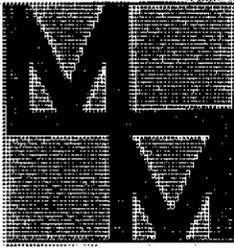
For the above reasons it is our opinion that Energy Storage Systems weather paired with PV or stand-alone should only be installed by qualified contractors utilizing State General Electricians such as C-10 Electrical Contractors.

Sincerely,



Troy Strand  
Director, Renewable Energy Solutions  
Baker Electric, Inc.





## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
231 Benton Court, City of Industry, CA 91789 - Tel: 909.598.7700 / Fax: 909.839.8186

May 14, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Written Comments -Classifications Authorized to Install Energy Storage Systems

My name is Robert Meadows and I am the President and an owner of Morrow-Meadows Corporation. We are headquartered in Los Angeles and the largest electrical contractor in Southern California and have been in business for 53 years while employing over 2000 employees and performing over half a billion dollars annually.

I would like to thank the Board for its public service, no easy job today, and for the opportunity to share my companies and my 35 plus years of experience to this important issue before us. It is important to emphasize that our concerns are not related to C-46 Contractors and their ability to install solar installations, rather than the importance and safety related to the much more complicated and potentially dangerous industry of Energy Storage installations.

Our firm currently has B, C10, and a C7 licenses. Energy Storage installations are more complicated and require more skill and knowledge than PV Solar systems. You can compare this current issue with what the State has done with Electrical installations (require C10) and their complexity and danger to Low Voltage installations (require a C7). Low Voltage installations are much less complex and less dangerous so the State wisely separated the two types of work for safety reasons. The State should follow the same protocol on this issue and side with caution and require a higher level of skill and training under the C10 license. Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

- Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the public. When connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

MEMBER OF THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

- These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.
- C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for energy storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are invalid because:
  - C-46 contractors could and often do obtain a C-10 license to install and maintain energy storage (whether it is paired with PV or not). According to Ms. Del Chiaro of the CA Solar and Storage Association, approximately 1/3 of C-46 contractors already also hold a C-10 license. C-46 contractors who do not have a C-10 license have the option of obtaining one. This would not be an unreasonable/onerous/unusually difficult requirement to meet.
  - In this way the same contractor could install PV solar under their C-46 license, and also install energy storage under their C-10 license with no disruption, warranty issues, or delay to their customers. Far from burdening contractors, with the addition of a C-10 license, C-46 contractors would also be able to install energy storage not paired with PV, and expand their businesses.
  - As for the claim of market disruption, that does not make sense. According to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!
  - Finally, it is important to address cost. A contractor that holds both a C-46 and C-10 license will be very competitive in the marketplace when completing with other dual license or with C-10 only contractors. The cost to consumers will remain very competitive because of continued strong competition in the market.
  - The only cost issue for contractors installing ESS would be when and if a C-46 has been employing low or unskilled workers at very low pay with few or no benefits. Those contractors would be required to employ electricians to install ESS on the energy storage portion of a project where PV is paired with energy storage. Electricians are paid more than unskilled workers because they have a certification that reflects substantial electrical training, knowledge, and experience which provides workers and the public with much greater safety. Utilizing low paid, low or unskilled workers as a trade-off for safety cannot be justified.

As a solar contractor, we are very familiar with what it takes to do solar PV work, and I also know what knowledge, skills and abilities (KSAs) are required to do energy storage system (ESS) projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the KSAs of a C-46 contractor and especially C-46 employees are not adequate to safely install ESS systems.

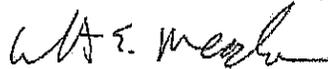
The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. Again, similar to what the State has previously implemented in the C10 versus C7 licensing.

In concluding, this is a much a safety issue and when dealing with any electrical or energy storage system, the State should side with the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California as stringently as possible.

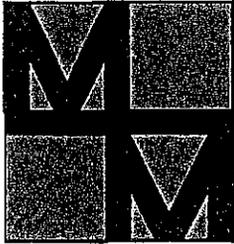
Thank you for considering our input and experience.

Sincerely

MORROW-MEADOWS CORPORATION



Robert E. Meadows  
President



## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
231 Benton Court, City of Industry, CA 91789 - Tel: 909.598.7700 / Fax: 909.839.8186

May 16, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Written Comments -Classifications Authorized to Install Energy Storage Systems

My name is Randy Olmos, I am the Vice President of Field Construction and General Field Superintendent for Morrow-Meadows Corporation. I am also a Certified General Electrician #D690780. I have held various field and office positions over the past 28 years at Morrow-Meadows Corporation and have 36 years in the electrical construction industry.

Thank you for the opportunity to comment on the Boards decision regarding license classification for installation of commercial battery storage installations. My 36 years of experience installing, managing, and maintaining various electrical installations has always considered public safety first as it relates to installations. I have no concern with C-46 contractors safely installing solar PV installations. Commercial energy storage systems, however are a separate and distinct more complicated system that requires the skill and training of State Certified General Electricians and C-10 Licensed Contractors, to ensure the safe installation of these potentially dangerous systems.

Our firm currently has B, C10, and a C7 licenses. Energy Storage installations are more complicated and require more skill and knowledge than PV Solar systems. You can compare this current issue with what the State has done with Electrical installations (require C10) and their complexity and danger to Low Voltage installations (require a C7). Low Voltage installations are much less complex and less dangerous so the State wisely separated the two types of work for safety reasons. The State should follow the same protocol on this issue and side with caution and require a higher level of skill and training under the C10 license. Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

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- Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.
- These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.
- C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for energy storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are invalid because:
  - C-46 contractors could and often do obtain a C-10 license to install and maintain energy storage (whether it is paired with PV or not). According to Ms. Del Chiaro of the CA Solar and Storage Association, approximately 1/3 of C-46 contractors already also hold a C-10 license. C-46 contractors who do not have a C-10 license have the option of obtaining one. This would not be an unreasonable/onerous/unusually difficult requirement to meet.
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In concluding, this is as much a safety issue and when dealing with any electrical or energy storage system, the State should side with the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California as stringently as possible.

Thank you for considering our input and experience.

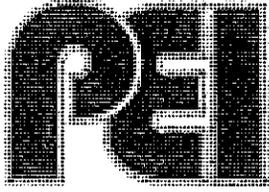
Sincerely

MORROW-MEADOWS CORPORATION



Randy Olmos  
Vice President of Field Construction  
& General Field Superintendent





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## CONTRACTING and ENGINEERING

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Richard Nogleberg and I am the president of PEI Placer Electric Inc

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my personal position that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

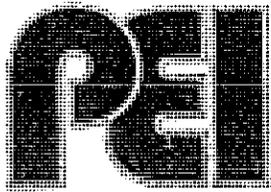
I am particularly concerned that workers who install for C-46 contractors have no state requirements for electrical training and experience. While they may have Cal/OSHA training, that is general safety training and does not address the need for those workers to have the electrical knowledge and experience to safely and effectively install energy storage systems.

While energy storage systems may be paired with solar photovoltaic systems and connected in a variety of configurations, they are separate systems. Energy storage systems have different functions and characteristics than photovoltaic systems and are subject to distinct California Building Standards Code requirements.

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## CONTRACTING and ENGINEERING

In addition to the fact they are separate systems with unique installation requirements, energy storage systems also pose unique and heightened fire and life safety risks to occupants, building officials, and emergency responders. Energy storage systems can overheat, explode, catch fire, and pose significant electrocution risks. The intensity of these risks is far greater than those posed by PV solar. It is critical that energy storage systems are installed by workers with the proper expertise and training. Accordingly, it would be a serious mistake to treat energy storage systems as mere incidental components of PV systems.

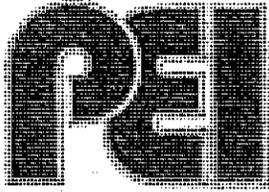
For example, the California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirement for battery systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems. The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems. Adding to the complexity of energy storage systems is the requirement of California Fire Code section 608.13 that permit applications for certain systems must include a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis.

Battery storage system permits must also provide specific storage room design information and details on hourly fire-rated assemblies, fire suppression, smoke detection and ventilation systems. None of which is required for PV systems. Energy storage and PV systems are very different, and they have much different electrical safety and fire requirements, risks, and hazards.

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It is my concern that buildings are safe to ensure safe building construction, and a safe built environment for the public. As California moves toward zero net energy buildings, and new residence are required to have PV solar power, commercial and residential energy storage systems will become more and more common. It is imperative that we ensure that these systems are installed safely and correctly, and we are mindful of the fire and life safety risks of these systems. I treat(s) the addition of energy storage system to a solar PV system as a significant and substantive addition to the project, not a mere incidental add-on.

I urge the CSLB to clarify that only qualified C-10 electrical contractors, utilizing workers who are trained, experienced, and certified, be authorized to install and maintain energy storage systems regardless of whether or not they are paired with a solar PV system.

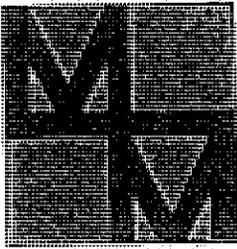
Thank you I appreciate the Board's consideration of these comments.

Sincerely,

A handwritten signature in black ink, appearing to read 'Richard J. Nogleberg'.

Richard J. Nogleberg  
President





## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
620 Reyes Drive, Walnut, CA 91789 - Tel: 909.594.4161 / Fax: 909.468.0593

*Celebrating 50 years*

Dear California State License Board,

Thank you for allowing me to write to you on such an important subject that will affect the safety of many, outline how we move into the future with back-up power and distribution to homes, healthcare facilities, commercial and industrial buildings, workplaces, and many other types of facilities. My name is Ed Santos and I am currently a Vice President for Morrow Meadows Corporation, one of the largest electrical contractors in the State of California. We currently perform work in nearly every sector of the construction industry including industrial, power plants, healthcare, film studios, commercial buildings, data centers, museums, hospitality, sports arenas and stadiums, we provide on call service, instrumentation installations, calibrations and control panel fabrication in our UL listed panel shop, and of course, alternative energy, more specifically Photovoltaic Systems and Energy Storage Systems.

We currently have over 2,200 employees, the majority of which are State Certified Electricians. The balance of our field team is comprised of apprentices who are learning the craft by being taught electrical theory, electrical codes and are mentored on installations over a 5-year period. They are supplemented with administration and support staff. While our business is electrical contracting and engineering, at the core of every installation is safety. It is with great pride that I am also able to share with you our safety record. Our current EMR is .46, which also makes us one of the safest electrical contractors in the nation.

I have spent the past 30 years of my career in the electrical industry and I'm very familiar with the physical installation of electrical infrastructures including PV systems and Energy Storage Systems. I began my career in California as an apprentice. After many years of classroom study, exams and field mentoring, I progressed to working as an electrician, field supervisor, then as an estimator, a project manager, our service manager, group manager and currently oversee 5 different divisions of the company as a Vice President.

Among my responsibilities, is overseeing our Alternative Energy Group. This group focuses on Photovoltaic System installations as well as Energy Storage System installations which include fuel cells, hydro generation and battery storage. Being familiar with the different types of systems also allows us to clearly understand the different levels of knowledge and capability necessary to install them correctly and safely. We have successfully completed many PV, power generation and battery storage projects for well-known companies. We have partnered with battery manufacturers in a multitude of different types of end user facilities. All without any injuries or compromise to safety. I attribute most of the success of these projects to our State Certified Electricians and their knowledge and understanding of electrical theory, their training in methods of installation and ability to understand and correctly interpret the National Electrical Code, The National Fire Protection Code, The California Code and local ordinances. Ironically this experience primarily comes as a direct result of State Certified Electricians working for C-10 contractors. I also believe these successes are largely attributed to my company qualifying for and retaining a C-10 license and the support staff typical of a C-10 contractor. A C-10 license requires my company to be much more familiar and well versed in

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many types of electrical theory and installation methods to complete these projects in a safe and successful manner. This knowledge is consistent with the knowledge required to install Energy Storage systems and specifically battery storage.

California is consistently the leader in establishing the technology footprint in creating a greener world and sustainable environment. Alternative energy is a part of that footprint and how and who performs battery storage in this state will have legacy for many years to come. The decisions made for the type of contractor's license required to perform this work will dictate the personnel used and the knowledge and skills of those individuals. This of course directly affects the safety of those installing these systems as well as people in and around these systems long after they are installed. Battery storage projects are much more complex than photovoltaic systems, as they provide functions far beyond back up of the utility distribution system. These systems can include high voltage cables, inverters and up to 1000 volts of direct current. They can be installed in combination with a PV system or without one. They can be installed to operate independent of PV systems and independent of the utility grid. In other words, power stored in batteries can operate much like grid furnished power. Morrow Meadows is not the only company to recognize the differences between PV systems and battery storage systems. Besides engineering and construction companies, The National Electrical Code also recognizes the substantial differences between PV Systems and Energy Storage Systems as they have created an entirely separate code article pertaining specifically to energy storage; It is identified as article 706 in the NEC. Another example is the California Fire Code who has also recognized these differences as they also regulate battery storage differently than solar PV systems. Not a surprise considering they pose very different fire and life safety risks than those associated with PV systems.

Such differences in code applications became necessary because of the inherent differences in systems and to quote the National Electrical Code- "To safeguard persons and property from hazards arising from the use of electricity". Some of the risks associated with battery storage include electric shock, explosion, fire, flash burns, and exposure to hazardous chemicals and gasses. How are these risks apparent? A battery storage system is composed of banks of batteries that can operate at high levels of voltage and potential therefore capable of delivering deadly electrical shock and burn. The flammable electrolyte in lithium ion batteries makes them prone to thermal escape if they are incorrectly installed which can lead to overheating thru overcharging therefore producing large volumes of toxic and flammable gasses. Lead acid batteries generate hydrogen and oxygen when charging and need adequate ventilation to avoid an explosion. While there are many benefits for the utilization of battery storage systems, they pose a serious safety risk for installers and occupants of facilities if they are installed incorrectly, improperly operated and maintained. C-10 contractors and state licensed electricians hold the qualifications required necessary to install these systems correctly and with less potential for incident. Not only do State Certified Electricians hold these qualifications, they have been installing battery systems for years in a slightly different format such as an Uninterruptable Power Supplies commonly referred to as a UPS.

Because we are a full service electrical contractor with a fleet of service vehicles we are also subject to emergency call outs. On many occasions my company has received after hours emergency calls to respond to power outages because of an electrical explosion. Some of these explosions have resulted in arc blasts that have killed, severely injured and burned people working on and in vicinity the equipment. I have personally made visits to these emergency calls and the smell of burned flesh is not something that is easily erased from my memory.

While we were not called out to perform a forensic study on the cause of failure it was apparent that the workers that were both injured and working on the equipment were not State Certified Electricians nor working for C-10 contractors. It was also apparent the methods and procedures utilized were not those typical of a C-10 contractor or certified electricians. There were no precautions for Arc Flash concerns or use of PPE. My concern with C-46 contractors performing installations for Energy Storage Systems including those that use batteries, is the great potential for injury. Considering that C-46 contractors are not required to use licensed electricians there would be a considerable lack of knowledge and understanding from installers that will put them and others around them at risk. This risk continues into the occupancy of facilities long after the work has been completed. I often say just because the light bulb turns on does not mean that it was installed properly or safely. Unfortunately, in the electrical construction industry, most of the inadequate installations are not clearly identified by the device not operating properly.

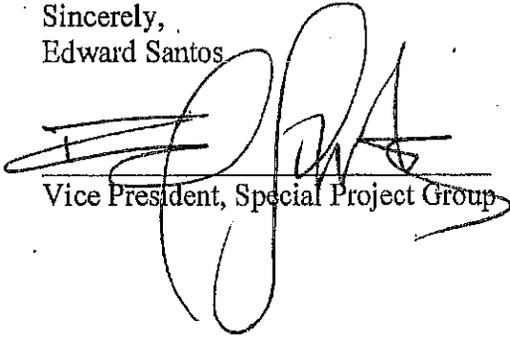
The California Code of Regulations is very clear on what work a C-46 "Solar Contractor" may work on. This code reads that "A solar contractor installs, modifies and repairs thermal and photovoltaic solar energy systems". Furthermore, it states, "a licensee classified in this section shall not undertake or perform building or construction trades, crafts, or skills, except when required to install a thermal or photovoltaic solar energy system". At no point is the installation of energy storage a "requirement" for the installation of a PV system. If an energy storage system is installed adjacent to a PV system it is a separately derived system working independent of the PV system. The two may complement each other but it is clear they are two separate systems and either can be constructed and/or operate without the other.

It would be extremely risky and technically improper to try and treat energy storage systems as a subsystem of a photovoltaic energy system. The differences between PV systems and Energy Storage Systems begins with the handling of this equipment. Batteries cannot be handled, moved or installed without a greater level of care and understanding in comparison to Photovoltaic equipment. Batteries connected in series pose a great danger to unqualified personnel but single batteries which are mishandled are also capable of explosion and burn on their own. We have also been witness to single battery explosion due to mishandling while being moved by an individual that was not a State Certified Electrician. If I were to walk you thru one of our completed Battery Storage projects you would see every aspect of an electrical installation including small and large conduit, small and large wire gauges, electrical distribution switchgear, inverters, transformers, control power and power furnished to other devices to create a functioning system. All this equipment, the method of installation, the knowledge of code, is consistent with the same type of equipment you would see in commercial building installations that do not have a battery storage system associated with it. What this means is that to install a battery storage system, not only do you have to be familiar with the National Electrical Code article for battery storage, you would also have to be familiar with the code book for all the articles outside of the battery storage section. This also applies to the qualifications of the installer and contractor; essentially, we are defining a State Certified Electrician and the work of a C-10 Contractor.

Thank you again for taking the time to identify the proper licensing and I hope that in this process I have contributed to your decisions in keeping this work with State Certified Electricians and contractors that possess a C-10 license. I know that by requiring both the certification and this license we will help save many lives and set examples of how systems are properly installed and maintained. Clearly this decision should be based on safety and

qualification and not on the availability of unqualified contractors trying to increase their market share.

Sincerely,  
Edward Santos



Vice President, Special Project Group

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Ray Robertson, I would like to thank you and the board for considering my comments on this subject. I am a registered electrical engineer in the State of California and Vice President of Renewable Energy and Engineering for a very large Electrical Contractor in California employing over 600 State Certified Electricians. With over 35 years of engineering and construction experience I have been involved with Energy Storage and Renewable energy projects for many years.

My concerns with the subject above are both Safety and Technical.

With more than three decades of experience in both Design and technical aspects as well as the installation and maintenance of Energy Storage Systems and having supervised the Electrical installation of roughly 400 Megawatts of PV installations I can ensure the board that the hazards associated with ESS systems are numerous and very extreme. Even small battery storage units are capable of producing Arc Faults and shock hazards many magnitudes as powerful and damaging as a small residential PV system.

Understanding the hazards, analyzing them and safely addressing these hazards takes extensive training and application of hazard mitigation equipment that most C10 contractors own and have training on such as 40 Calorie flash gear. Very few contractors that do not employ Licensed electricians have this type of gear. The many types of batteries on the market and under development all require understanding the charging requirements, Discharge characteristics, and fault potentials available to prevent overcharging, faults, explosions and fires and only



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qualified, trained and properly certified electricians understand these issues as well as the NEC requirements. The NEC is an electrical code, not a PV code although it addresses PV systems it states in the very first paragraph article 90.1A ---“ This Code is not intended as a design specification or an instruction manual for untrained persons” This is exactly the point of this letter, C46 contractors although they may have PV training are not trained or licensed Electricians and do not have the Knowledge and training required to install energy storage systems of any size. C10 Contractors on the other hand have been installing ESS systems, UPS systems, large power switchgear battery backup systems such as in Data Centers, Power plants and Communication installations for decades and are trained and experienced at this work.

“In conclusion, I would recommend against authorizing the work C46 contractors are eligible to perform to include energy storage systems and leave the work to licensed Electrical contractors, employing skilled and trained Electricians.”

*Ray Robertson*

Ray Robertson, P.E., LEED A.P.  
Vice President, Engineering and Renewables  
Contra Costa Electric, Inc. an EMCOR Company  
Off. (925) 335-2861, Fax (925) 228-4817  
email: rrobertson@emcor.net





May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Ms. Young,

Thank you for the opportunity to address the Board and offer my informed insights regarding C-46 contractors being allowed to perform battery/electrical storage work under their license. These comments are about C-46 contractors doing energy storage work, not about C-46 contractors doing PV work.

I have worked on both solar energy projects and projects that included battery energy storage. I am a California State Certified Electrician and have worked in the electrical construction industry since August 1981.

Battery storage is not an integral part of a renewable energy project any more than high-voltage line work is part of a commercial facility project. They may exist in harmony but each comes with its own required skill set necessary for safe and efficient installation and operation, and each poses completely different challenges, risks, and dangers.

Energy storage systems may be employed as a method of enhancing a renewable energy storage project but often come as an add-on rather than a necessary part. In fact, battery storage systems have been installed in many other electrical systems with no renewable component at all for decades! Emergency power, uninterrupted power sources for computer and data-collection, life-safety systems found in hospitals, and breaker and switchgear actuation systems all use battery energy storage.

Many C-10 Contractors, including our company, have been doing this type of DC electrical work for well over 50 years. As such, we have developed protocols and safety procedures - many required and reviewed by owners and public entities - before we are allowed to work on their projects. This electrical training, knowledge and experience safeguards the workers installing the battery systems as well as the occupants or members of the public who may find themselves in close proximity to these battery systems when they are in use.

As for the batteries themselves, this is a constantly evolving technology. The battery systems we install today are very different from the systems we installed even a few years ago - in both design and componentry. State Certified Electricians are trained in DC

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electrical theory, and in the maintenance and installation of these systems across a broad category of applications and power storage requirements.

For example, a 7kW solar array produces 7000 watts. A battery energy storage system stores the energy produced by the PV array. If there is no load and if there is 8 hours of sunlight, the battery system will store 56,000 watts of power. The dangers are not just different, they are 8 times different. The solar array can only deliver what it is generating at that moment in time. Battery-storage, under a direct-short fault condition, can deliver at one time, all of its stored electrical energy. That 8 times difference can be deadly.

This dramatically increased power and danger dramatically raises the need for electrical expertise. It sharply increases the need for worker training, experience, and adherence to the National Electrical Code's requirement for qualified persons, and for established best safety practices and protocols.

The C-46 license was initially developed for solar thermal installations, and expanded into residential rooftop "renewable" energy systems. The workers who do these installations know one unrelated, repetitive, narrow task, and little more about electricity.

Wisely, the scope of work for C-46 contractors was expressly limited to "install, modify, maintain, and repair thermal and photovoltaic solar energy systems". Adding "battery storage systems" to this list would defeat and degrade California's commitment to quality construction performed by a workforce verifiably trained in skills, knowledge, and safety. But most critically, permitting C-46 contractors and their uncertified workers to install and maintain electrical energy storage systems would put workers, first responders, and the public in harm's way.

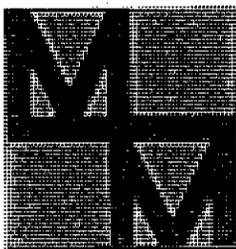
Only C-10 contractors should be permitted to install energy storage systems for any residential or commercial application.

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Sincerely,



Rebecca Van Fossan  
Card # D699338



## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
231 Benton Court, City of Industry, CA 91789 - Tel: 909.598.7700 / Fax: 909.839.8186

May 16, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Written Comments -Classifications Authorized to Install Energy Storage Systems

My name is Larry Garcia, I am a General Field Superintendent at Morrow-Meadows Corporation. I am also a Certified General Electrician #D730162. I have been employed for 13 years at Morrow-Meadows Corporation and have 33 years in the electrical construction industry.

Thank you for the opportunity to comment on the Boards decision regarding license classification for installation of commercial battery storage installations. My 33 years of experience installing, managing, and overseeing Industrial Projects that include Code Compliance, QA/ QC , and craft distribution has always considered public safety first as it relates to installations. I have no concern with C-46 contractors safely installing solar PV installations. Commercial energy storage systems, however are a separate and distinct more complicated system that requires the skill and training of State Certified General Electricians and C-10 Licensed Contractors, to ensure the safe installation of these potentially dangerous systems.

Our firm currently has B, C10, and a C7 licenses. Energy Storage installations are more complicated and require more skill and knowledge than PV Solar systems. You can compare this current issue with what the State has done with Electrical installations (require C10) and their complexity and danger to Low Voltage installations (require a C7). Low Voltage installations and much less complex and less dangerous so the State wisely separated the two types of work for safety reasons. The State should follow the same protocol on this issue and side with caution and require a higher level of skill and training under the C10 license. Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

MEMBER OF THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

- Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.
- These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.
- C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for energy storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are invalid because:
  - C-46 contractors could and often do obtain a C-10 license to install and maintain energy storage (whether it is paired with PV or not). According to Ms. Del Chiaro of the CA Solar and Storage Association, approximately 1/3 of C-46 contractors already also hold a C-10 license. C-46 contractors who do not have a C-10 license have the option of obtaining one. This would not be an unreasonable/onerous/unusually difficult requirement to meet.
  - In this way the same contractor could install PV solar under their C-46 license, and also install energy storage under their C-10 license with no disruption, warranty issues, or delay to their customers. Far from burdening contractors, with the addition of a C-10 license, C-46 contractors would also be able to install energy storage not paired with PV, and expand their businesses.
  - As for the claim of market disruption, that does not make sense. According to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!
  - Finally, it is important to address cost. A contractor that holds both a C-46 and C-10 license will be very competitive in the marketplace when competing with other dual license or with C-10 only contractors. The cost to consumers will remain very competitive because of continued strong competition in the market.
  - The only cost issue for contractors installing ESS would be when and if a C-46 has been employing low or unskilled workers at very low pay with few or no benefits. Those contractors would be required to employ electricians to install ESS on the energy storage portion of a project where PV is paired with energy storage. Electricians are paid more than unskilled workers because they have a certification that reflects substantial electrical training, knowledge, and experience which provides workers and the public with much greater safety. Utilizing low paid, low or unskilled workers as a trade-off for safety cannot be justified.

As a solar contractor, we are very familiar with what it takes to do solar PV work, and I also know what knowledge, skills and abilities (KSAs) are required to do energy storage system (ESS) projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the KSAs of a C-46 contractor and especially C-46 employees are not adequate to safely install ESS systems.

The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. Again, similar to what the State has previously implemented in the C10 versus C7 licensing.

In concluding, this is as much a safety issue and when dealing with any electrical or energy storage system, the State should side with the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California as stringently as possible.

Thank you for considering our input and experience.

Sincerely

MORROW-MEADOWS CORPORATION



Larry Garcia  
General Field Superintendent

MORROW-MEADOWS CORPORATION





May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Steve Larsen. I represent Collins Electrical Co. Inc. construction department.

I have 35 years of experience as an Apprentice, JW Electrician, Foreman, and the last 19 years as Superintendent. My experience includes all types of electrical installation including residential, commercial, industrial, and renewable resources. In addition, I have supervised installation of many battery storage systems.

My department appreciates this opportunity to comment on the contractor classifications authorized to install energy storage systems.

First, please note that my comments are only focused on the contractor classifications authorized to install energy storage systems. I am not addressing C-46 contractors installing PV solar, that is not the issue.

I attended the hearings in April and was surprised and disappointed by some of the testimony offered at that time. I approached the hearings with the belief that the C-46 contractors were merely misinformed. After listening to C-46 representatives it became clear that I had misjudged the situation.

I heard advocates for C-46 contractors claim that they (and their workers) had all the skills necessary to install battery energy-storage systems in a safe and professional manner. But they did not describe the industry-standard Personal Protective Equipment (PPE) necessary to hook up and service a modern battery energy-storage system. They did not describe the challenges inherent in these systems. And they did not describe any real electrical training offered to their workers to perform their tasks in a safe and efficient manner. Instead, a C-46 representative said that Cal/OSHA training was sufficient.



That was very unfortunate because Cal/OSHA training is totally inadequate to prepare and protect C-46 installation employees and the public: Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

A C-46 representative also claimed that there is little difference in the dangers posed by a solar energy generating system versus a battery energy storage system - that the risks and challenges were basically the same. To suggest or infer that PV systems have the same or similar risks and dangers as modern Lithium Ion battery systems shows complete ignorance. We have all seen videos of exploding cell phones, laptop computers, hoverboards and fiery endings to a faulting lithium ion battery. The truth is that, the "cutting edge" of technology is on a double-edged sword.

The fact is that a 7kW (7000 watts) solar array produces ... 7000 watts. A battery STORAGE system STORES the energy produced by these arrays. If we assume that there is no consumptive load and eight hours of sunlight, the battery system will store 56,000 WATTS of power! The dangers are not just dissimilar, they are vastly different. The solar array can only deliver what it is producing AT THAT MOMENT IN TIME. Battery-storage, under a direct-short fault condition, can deliver ALL OF ITS STORED ENERGY AT ONE TIME! That huge difference can be a deadly difference.

Also astonishing was the claim that C-46s are really the DC energy experts, that they are better qualified to install and maintain energy storage systems than state certified general electricians. That is not just misinformed, it is false.

Hundreds of California C-10 contractors, including our company, have installed battery-back-up systems since the 1950's and 60's - in Uninterrupted Power Sources (UPS), switchgear back-up. (Yes, battery-banks supply the DC power to operate the large circuit breakers for much of the industrial switchgear!), hospital back-up systems, computer systems, and data-storage systems which cannot afford to have even a moment without power for system and life safety reasons. We have been installing and servicing them long before solar panels migrated from satellites to the homes of early adopters.

For decades, C-10 contractors have installed DC battery back-up banks of all sizes - some the size of a computer, some as big as a room. Apparently, C-46 contractors who primarily install residential solar systems, may not be aware of all the DC power work C-10 contractors have done for so many years. (Or is it to their advantage to misrepresent it?)

C-46s also claimed that they had so much battery storage experience. Yes, they did install some lead acid batteries before grid tied systems made them mostly obsolete. But that was years ago. For many years, now, virtually all solar panels installed are not paired with a



battery storage system - except for the one that powers the transfer switches and the odd computer monitoring system. Furthermore that limited battery experience years ago was a few people who installed lead acid batteries -- not Lithium Ion.

Batteries are becoming more and more pervasive -- not just on solar projects, but in large data centers and in industry, which has nothing to do with photovoltaic energy generation. There is no more "similarity" between battery energy storage and solar PV than there is between a lighting system and a motor-driven assembly line in a manufacturing plant. Both may be in the same building, but they have very different goals, challenges, and dangers.

When C-46 contractors make so many false claims it becomes clear what is going on. A group of contractors are attempting to use their current scope of work to enter into a highly-technical, constantly-evolving, and expanding market. Frankly, one where they do not belong. In fact, one where they either do not realize, or do not care to realize, the perils for their workers, first responders, and the public.

C-10 contractors do not don "Bee-Keeper" suits and take great precautions to guard their workforce because of some romantic notion of machismo. They do it to comply with thoughtful industry principals developed over decades to guard their most prized assets -- their workers.

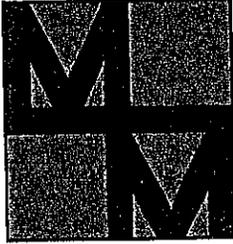
To C-46 contractors I say: "just because it looks easy doesn't mean it is". I have seen countless electrical installations in a myriad of industries. There is one thought that enters my mind every time: "With electricity, everything looks so calm until it isn't. Then all hell breaks loose!"

I think the message is obvious; the CSLB should clearly limit the installation and maintenance of electrical energy storage system only to C-10 contractors.

Sincerely,

A handwritten signature in black ink, appearing to be 'Steve L.', written in a cursive style.





## MORROW-MEADOWS CORPORATION

Electrical/Datacom Contractors and Engineers - License No. 230813-C10  
231 Benton Court, City of Industry, CA 91789 - Tel: 909.598.7700 / Fax: 909.839.8186

May 16, 2018

Ms. Heather Young  
CSLB EXECUTIVE OFFICE  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

Re: Written Comments -Classifications Authorized to Install Energy Storage Systems

My name is Rick Lane I am the Vice President of Project Development for Morrow-Meadows Corporation, one of the largest Electrical Construction and Engineering Organization's in Southern California. I have been in the business of designing and constructing electrical systems for 45 years.

I would like to thank the Board for the opportunity to share my experience on this important issue. It is important to emphasize that our concerns are not related to C-46 Contractors and their ability to install solar installations, we are concerned with the importance and safety related to the much more complicated and potentially dangerous industry of Energy Storage Installations.

Energy Storage Installations are more complicated and operate at far greater voltage combinations requiring a higher level of skill, knowledge and safety measures than PV Solar System Installations.

You may compare this current issue to what the State has done for Electrical Installations with their level of complexity and danger requiring a C10 License and State Certified Electricians to less complex, less dangerous Low Voltage Installations requiring a C7 License and Low Voltage Installers.

Low Voltage installations are less complex and less dangerous, so the State has separated the two types of work for safety reasons. The State should follow the same protocol on this issue and require the higher level of skill and training provided by the C10 license with State Certified Electricians for the Energy Storage System Installations.

Energy Storage Systems vary widely in type, size, and power requiring a broader base of electrical knowledge and safety. In addition, the installation of Energy Storage Systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located.

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Energy Storage Systems - including residential systems - are rapidly increasing in size with Commercial systems being designed up to 200 Megawatts and 1,500 Volts. These batteries are live right out of the box with no switch to turn them off, they are connected Hot in series making every connection potentially more dangerous than the previous one.

Improperly installed Energy Storage Systems pose risks to workers, emergency responders and the public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

As a Solar Contractor, we are very familiar with what it takes to do Solar PV work, and we also know what knowledge, skills and abilities are required to do Energy Storage System projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the abilities of a C-46 contractor and C-46 employees are not adequate to safely install Energy Storage Systems.

The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While Energy Storage Systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An Energy Storage System is not incidental to a PV system, it is a separate system. Again, like what the State has previously implemented in the C10 versus C7 licensing.

In concluding, this is safety issue and when dealing with any Electrical or Energy Storage System, the State should side with the more stringent C10 license requirements and the additional training of the State Certified Electricians.

Thank you for consideration.

Sincerely

MORROW-MEADOWS CORPORATION



Rick Lane  
Vice President of Project Development



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P: 562-946-0700 F: 562-946-0701  
csielectric.com

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

RE: Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

CSI Electrical Contractors, Inc. submitting this letter regarding C-46 contractors installing and maintaining electrical energy storage systems (ESS) paired with Photovoltaic (PV) systems. Our overriding concern is the safety of the public, first responders, and of course our employees.

ESS are available in a wide range of types including electro-chemical, thermal, pumped hydro, mechanical and compressed air with electro-chemical currently most prevalent. From our direct experience, commercial and industrial system sizes range from 30kW/40kWh to 5MW/10MWh. These systems typically utilize Li-ion chemistries operating at 800-1000VDC with DC fault currents, in many cases, far exceeding 100,000 Amps. These systems usually feed a facility, building or campus Main Switch Board interconnecting at voltages ranging from 480/277V to 34.5kV and in many cases require service upgrades, line side taps or new main Switch Boards to be installed.

In the case of energy storage, C-46 contractors do not possess the level of qualification, certification and safety that must be employed to be safe. Our strong professional opinion is that improperly installed Energy Storage System pose a significant Fire, Life and Safety risk. Following is a brief list of safety concerns:

- Arc Flash, Proper PPE (it is critical that workers are properly trained and wear the correct Personal Protective Equipment for the task)
- Device coordination (insure that the nearest protective device quickly detects and clears the fault – protects downstream wire mitigating fire risk)
- Improper termination of conductors can lead to conductor failure and result in a Fire life Safety hazard.
- Dissimilar metals, improper torque, unmatched current and or temp ratings, bend radiuses all compound this risk.
- Improper crimps/splices of conductors can lead to a thermal event/arcing and result in a Fire life Safety hazard.

CA License # 617804 AZ License # 287743

- Use proper and calibrated crimping/splicing tools per manufacturer recommendations.
- DC Voltage and Amps Interrupting Rating (AIR). Incorrectly rated switches, circuit breakers, fuses, load centers can lead failure (arcing/overheating, fault not being cleared, and in some cases cause an arc when operating a switch) and result in a Fire, life, and Safety hazard.
- Multiple strings of batteries in parallel can supply high fault currents – in large commercial projects and utility scale this fault current can be much greater than standard AIR ratings of the overcurrent device used to protect individual battery strings.
- Improperly grounded Battery energy storage system pose a shock hazard and risk of electrocution.

CSI Electrical Contractors, Inc is a licensed C-10 contractor and has been in continuous operation since 1992. We have substantial experience in Photovoltaic and Energy Storage Systems and have installed more than 200 commercial solar projects over 200MW) more than 1.3 Gigawatts of large utility scale solar projects, more than 40 commercial Battery Energy Storage projects totaling 18MW and have installed at total of 12 MW of utility scale Battery Energy Storage. In all cases we routinely work with potentially lethal systems and take painstaking efforts to insure public and worker safety. These efforts include:

- Use of State Certified General Electricians with a minimum of 8000 hours of training and experience
- Continued training for General Electricians.
- Robust safety programs for our workers such as:
  - CPR
  - Electrical Work Safety
  - OSHA 30
  - Specialty Tools (as required)
  - Lift Equipment
  - Fall Protection
  - Rigging
- Use of proper test equipment/procedures on all circuits, conductors, switchgear, etc. to confirm proper installation prior to being energized.
- Close adherence to all AHJ, NEC (CEC), NFPA, Utility, UL, IEEE standards as required.

In contrast, a typical C-46 Contractor works on smaller, less complex, low voltage systems most likely utilizing uncertified workers that are not licensed electricians to perform or even oversee the work. In the formative days of our industry that was done because most energy storage systems encountered by a C-46 contractor were smaller Valve Regulated Lead-Acid or Flooded Lead-Acid batteries operating at 12, 24 or 48VDC. Vastly

different from today's large Energy Storage Systems that can operate up to 1000-VDC and interconnect at high voltage.

It is also important that we do not overlook the dangers and risks presented by modern residential energy storage systems. They are no longer primarily lead acid battery systems as lithium ion is now the predominant chemistry. While these systems are smaller, they still represent considerable electrical and chemical dangers when not installed by qualified persons as defined by the National Electrical Code. C-46 workers have some electrical knowledge relative to PV, but are not equipped to properly and safely install and maintain residential energy storage systems.

For the above reasons it is our professional recommendation that all Electrical Energy Storage Systems, whether paired with PV or stand-alone, commercial or residential, should only be installed by C-10 contractors utilizing State Certified General Electricians.

Respectfully submitted,  
CSI Electrical Contractors, Inc.



Gene Acosta, LEED AP  
Energy Solutions



Ladies and Gentlemen of the CSLB,

Thank you for the opportunity to write this letter and share my opinion on the types of battery being installed today, code requirements, public safety, and voltage ranges in the C46 debate. My Name is Carl Price and I am Vice President of HMT renewable energy a C-10 contractor based out of San Diego. I am also a highly skilled electrician with over 18 years of experience and training in AC, DC Solar, maintenance, battery, and UPS systems.

With HMT I have led and managed over 200 solar installations ranging in size from 50kw to 12mw. And we have completed over 50 Energy Storage installations ranging in size from 18kw to 2MW. HMT has supervised over 500,000 labor hours in the field and over 130MW of renewable installations between solar and energy storage. Each project we have completed required a detailed interconnection scope where we had to connect our power to the existing electrical equipment and in some cases directly to the utility grid. We have completed interconnections from 208v AC all the way up to 35,000v AC and have worked with DC voltages from 48v to 1000v. With these varying voltages and currents safety is always at the core of our planning and we always ensure we have an OSHA-30, NFPA 70E, state certified electricians onsite to manage these installations on both the AC and DC side.

Many of our installations have been at schools, airports, hospitals, and various other public facilities where we simply could not connect our wires until off hours. This means we have spent a lot of late nights in electrical rooms under immense pressure to complete our work in a timely manner so we can reenergize the facility before everybody returned to work or school the next day. The Shutdown I remember the most was our project at the San Diego Airport. We had to connect a 1 MW rooftop solar installation to the airport main electrical equipment which required (2) 4-hour shutdowns on back to back nights. If you want to know what pressure feels like shutdown an airport in the middle of the night and put yourself on a very tight timeline to get your work done. This outage took five of our top state certified electricians who all had over 20 years' experience each. It took this kind of training and talent to complete this work safely and timely which we did successfully. We are also looking at a very similar energy storage project at the San Diego Airport which will require the same type of shutdown and interconnection.

The question I ask you is do you really think this work should be completed by anybody who does not have a CA state electrical certification and proper training? I hope you would answer no because that question will be a lot harder to answer after something goes wrong when a non-certified installer performs this work and gets hurt. Some of the recent C46 presenters stated they had training, but, when you have a large body of contractors without mandated training requirements for the field workers you can rest assured not everybody will be trained. With the expansion of energy storage into today's market it will force C46 contractors to cut corners and hire non-trained / non-certified installers to keep up with demand. With no requirements for training and certification you can be assured non-trained workers will be hired to do this work. It is currently a C10 requirement to train all workers and we already have trained electricians working for us. This should be considered heavily when making this decision.

Further, I have heard a couple other comments during the speeches I would like to address. One comment from a C46 representative was solar and battery storage share the same risk level. I find this to be a very scary assumption. For instance, a 1MW rooftop solar array is spread out over 70,000 square feet which means the power is spread out over a large area. On the other hand, a 1MW energy storage system can be placed in less than 500 square feet. 70,000 vs 500 is a big difference. The reason I bring this up is because danger in our industry is often measured by potential and when you take 70,000 square feet of power and cram it into 500 square feet you increase the power potential exponentially.

The next comment I would like to address came from Mr. Cinnamon a C46 representative. He stated Energy storage was very simple and that you cannot get arc flash when you wire battery units. Mr. Cinnamon used the most basic LG home battery system to generalize all battery storage and to downplay all battery storage was this simple to install. These comments are very concerning because he did not explain what happens when you connect a battery to the homes electrical panel. The battery itself may be protected but you still have arc flash concerns at the main electrical panel, which can create fire and serious injury or death if improperly wired. In Mr. Cinnamon's speech he also left out the details on how larger commercial energy storage is wired and connected. These larger systems do not come prefabricated like the LG home battery he used to describe all battery installs. In commercial systems you often load and wire batteries by hand putting the workers at surface level danger for faults. To generalize all battery storage is easy and share the same risk as solar is just not true and the C46 contractors are trying to downplay the seriousness of this work. If we as a state allow non-certified installers to perform this work we are willingly allowing untrained workers to access extremely dangerous situations, which could cause serious physical and property damage.

When problems happen with electrical you often end up with an arc flash. An arc flash is the ionization of the air and molten metal capable of exploding like a bomb when you have an electrical short or failure. The temperature of the arc flash can reach 35,000 degrees Fahrenheit, which is hotter than the surface of the sun. I can tell you right now with that type of danger in our industry I would only trust my life with C-10 trained electricians.

To conclude my letter, I would like to note even though it is becoming more and more common for energy storage and solar to be part of the same projects they are not required to be installed together to operate. Energy Storage is covered under separate NEC and fire codes than solar, each solar and energy storage systems operate independently and should be treated as separate systems. To ensure proper installations I have only installed energy storage systems under a C10 license, and I feel our training is 100% necessary to complete energy storage installations safely and effectively per all codes and standards. Our community, our schools, our families and friends all deserve to know we take this business very serious, with safety is our top concern.

I truly appreciate you reading my letter today, and hope my experience and stories can help you make your final decision in this matter. Thank you.

**Carl Price**

VP of Renewable Energy



2340 Meyers Ave.

Escondido, CA 92029

Business (858) 458-9771 Ext:2012

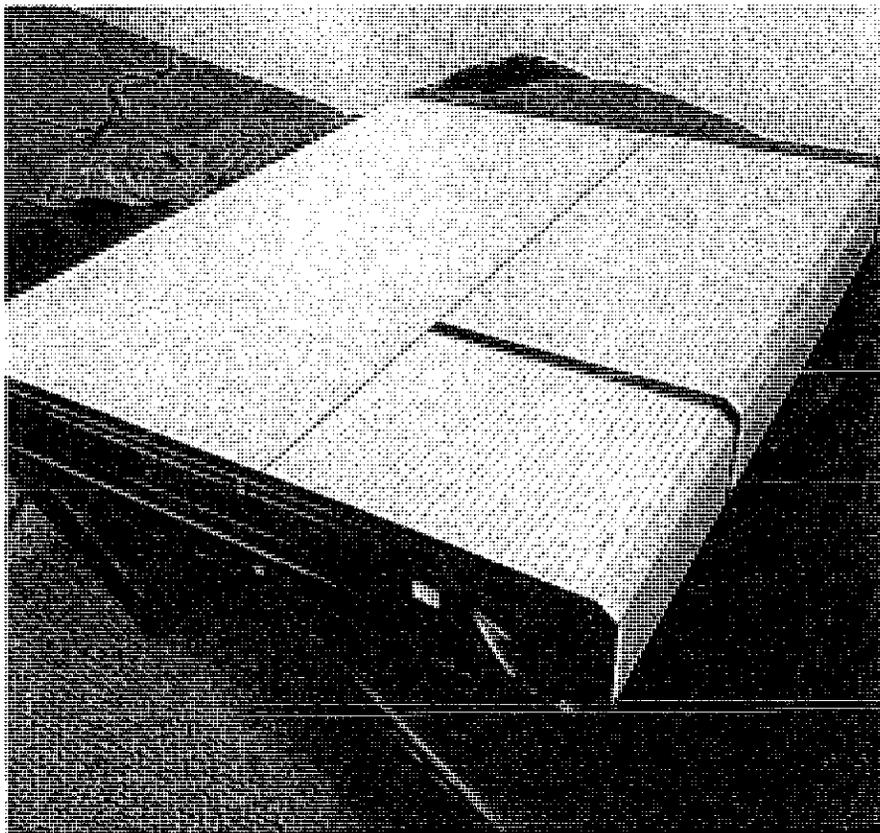
Mobile (858) 336-8722

Fax (858) 458-9775

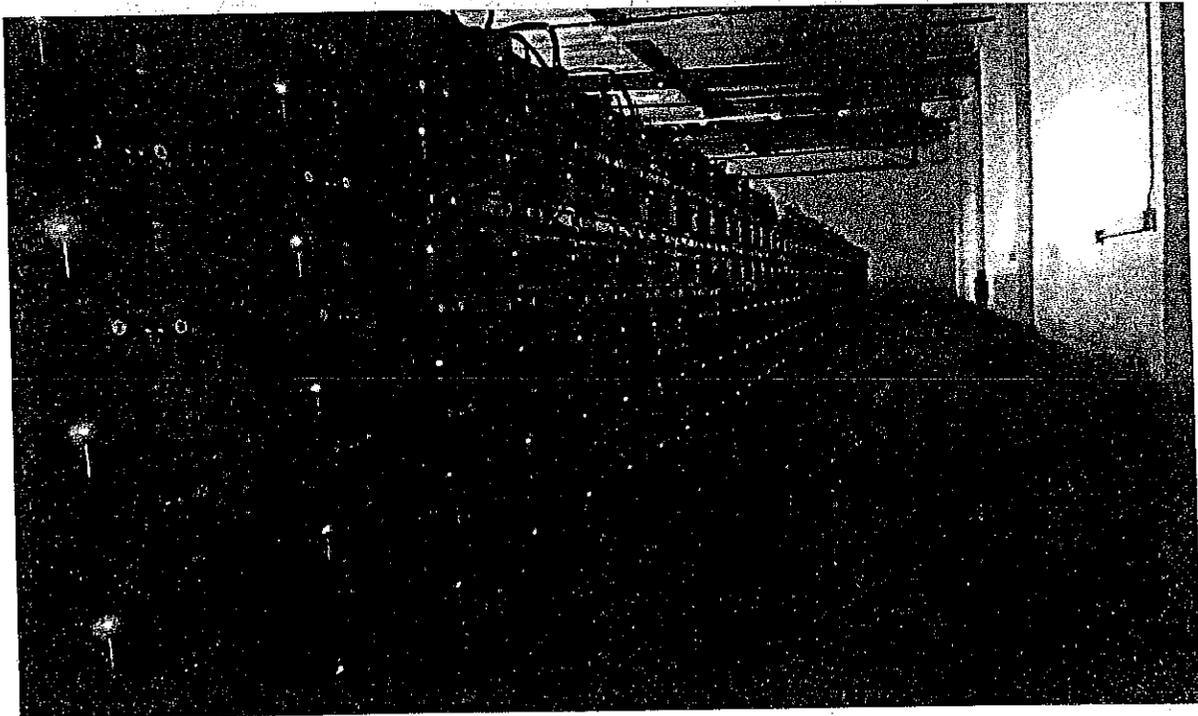
[CarlP@HMTElectric.com](mailto:CarlP@HMTElectric.com)

Battery used by Mr. Cinnamon to explain the following statements.

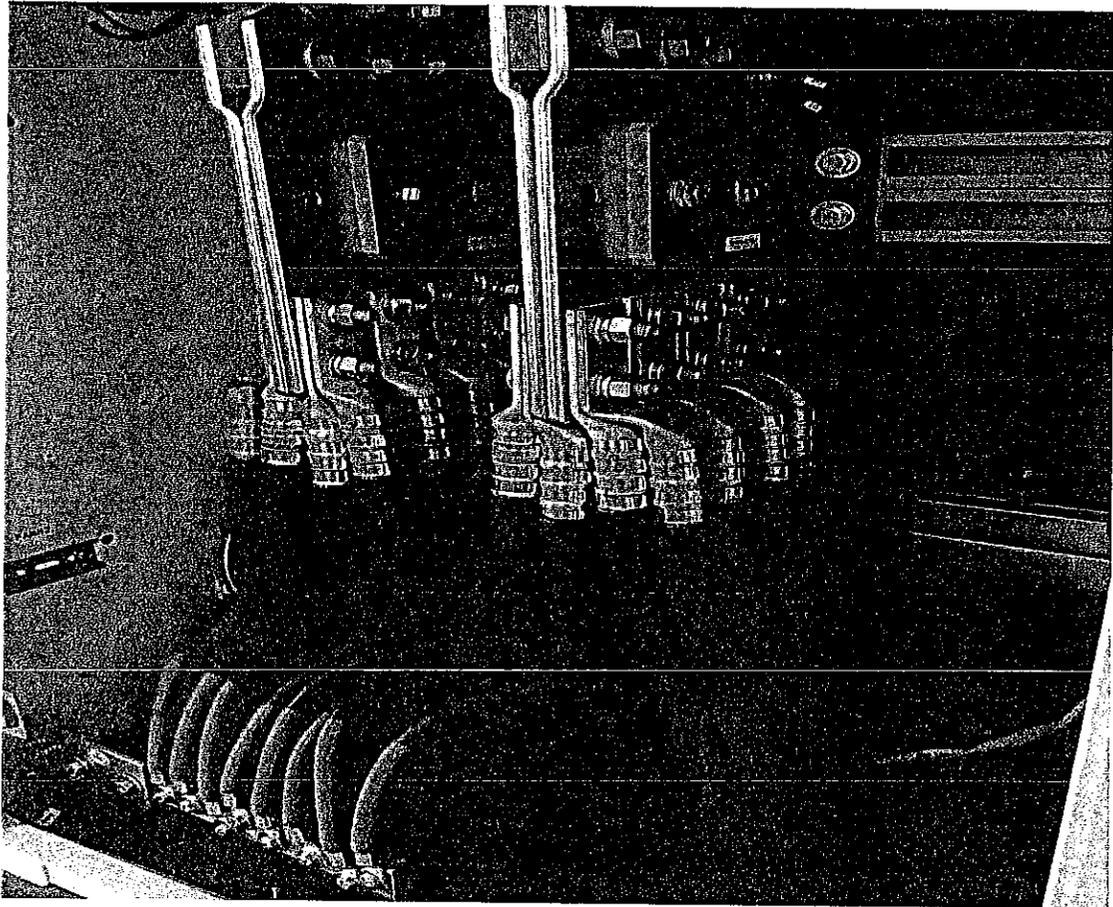
1. "Batteries are very easy to wire; they only take 3 wires to connect." This only depicts one type of battery and generalizes all batteries are easy - which is simply not true. Many battery systems do not come prefabricated like the one used in the presentatoin and require hand wiring. I recommend the CSLB look into all wiring methods for all energy storage systems.
2. "This unit is UL listed and you cannot get thermal run off or Arc flash." This statement is false. Even though this particular prefabricated LG battery may come with UL certification you can still create an arc flash in the main electrical panel if you improperly wire the AC connection to the homes electrical panel.



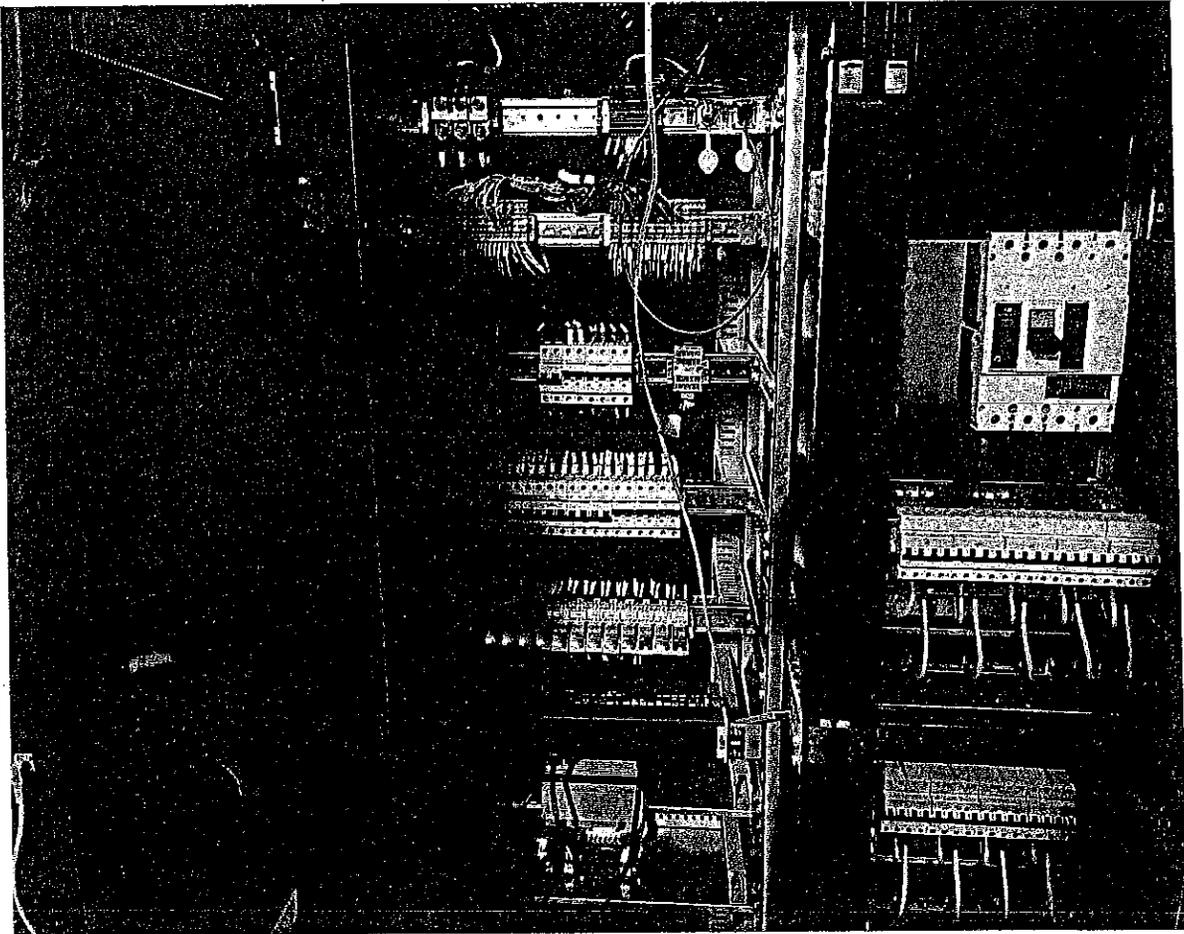
Example of non prefabricated energy storage system installed by HMT



Example of DC wiring connections on a non prefabricated system



Example of live DC / AC parts on a non prefabricated energy storage system







May 15 2018

## Written Comments - Classifications Authorized to Install Energy Storage Systems

Contractors State License Board (CSLB),

I am writing to address the request for public input regarding the possibility of allowing the C-46 contractor classification the ability to perform work related to the installation of Energy Storage Systems (ESS).

I would like to address the question by highlighting several concerns related to electrical Code requirements and principally, the issue of safety as expressed by the National Fire Protection Association and inspector criteria.

I have been in the electrical industry for over 20 years. Having graduated from a State recognized electrical apprenticeship, I went on to work as a foreman for a very large electrical contractor. I received my certification as a General Electrician from the Department of Industrial Relations (CA). I was happy to meet that challenge as I recognized the importance of training and the "proof of knowledge" that the certification examination qualified. I believe that it helped me to work more safely and helped to ensure that any electrical installation I was responsible for was done to Code®. What is more, it allowed me to have a better sense of the qualifications of those that worked for and alongside me. If they were "certified", I knew that they had met the same rigorous requirements I had fulfilled as an electrical worker. In my opinion, it has proved to be a qualitative barometer in assessing the basic skill and understanding of the electrical worker.

In time, I became an inspector for the City of San Jose's Building Department. I have acquired inspector certifications through the International Association of Electrical Inspectors, the International Code Council, and the Office of Statewide Health Planning and Development (OSHPD). As an inspector, I was asked to inspect residential solar installations performed by C-46 classifications. It became apparent to me that many of these contractors did not have sufficient training or access to information. So, I worked with the City of San Jose to help develop a list of solar installation requirements for residential properties. What motivated me more than anything else was the fact that often I was having to explain installation requirements not to the contractor, but to their workers. The majority of these workers were not electricians, they were simply installers performing a function; installers that did not fully comprehend the inherent dangers related to an electrical system. What concerned me, above all, was the fact that they were performing work that had to conform to the National Electrical Code®, a Code that many of them were not familiar with. I did not understand how this could be acceptable from a safety perspective. An installation conforming to the Code is a legal requirement once that Code has been adopted by the State or a municipality, yet many of these installers had not been trained in that regard. I have been and remain perplexed at the permissions afforded the C-46 classification that are not afforded to the electrical contractor C-10 classification.

The term "qualified person" is found in both the National Electrical Code® and NFPA's Standard for Electrical Safety in the Workplace®. Both publications are recognized in the electrical industry because of their impact on safety. One, an installation standard meant to "safeguard" people and property; the other, a safety standard meant to provide a proven methodology of protecting the worker from the risks and hazards associated with electrical work. Each of these standards highlight the importance of being "qualified". They speak of the importance of knowledge, training, and experience, as each relates to electrical risks and hazards. The term "qualified" is applicable to solar installation as any other form of electrical work. How, then, does the C-46 classification demonstrate compliance to these Standards regarding the "qualified" person? Is there some barometer used to determine the "qualified" status of the worker? For the C-10 classification, this is achieved, in part, through the DIR's certification requirement.



The logo for Sprig Electric, featuring the word "Sprig" in a stylized, handwritten-style font.

In my opinion, it seems that the question being asked is “Should the C-46 classification be allowed to install Energy Storage Systems because they currently install solar systems?” Is it not better posed: “What *justification* is there to permit this classification to perform work in ESS installations?” We are talking about two distinct systems. The ESS installation can be considerably more complex and what is more...dangerous. Many of these systems rated at nominal voltages and currents considerably higher than the average home based solar installation. In my opinion, simply because an ESS may work in conjunction with a solar system is not a valid justification. A receptacle may be installed in the same electrical room as a set of medium voltage switchgear, but each require considerably distinct levels of skill and experience; and each pose considerably distinct risks and hazards.

A residential solar installation must conform to certain Articles found within the National Electrical Code®, among them Article 690, Solar Photovoltaic (PV) Systems and Article 110, General Installation Requirements, among others. An ESS installation must conform to more than simply the NEC®. It is impacted by the requirements found in NFPA 1-Fire Code (Chapter 52), NFPA 70- National Electrical Code (various Articles), NFPA 110- Standard for Emergency and Standby power Systems, and NFPA 111- Stored Electrical Energy Emergency and Standby Power Systems. The installation of these systems (ESS) and relevant safety concerns have been the focus of both the Department of Energy and the National Fire Protection Association for some time. Many of these concerns are delineated in the DOE’s *Energy Storage Safety Strategic Plan* of December 2014. The goal of said Plan was “to lay the groundwork necessary to ensure the safety of energy storage deployments and instill confidence in the community stakeholders...”. The National Fire Protection Association, as well, has expressed tremendous concern regarding safety of these systems. This has been one of the motivating factors behind the development of a new Standard expressly for these systems. This Standard, NFPA 855- Standard for the Installation of Stationary Energy Storage Systems should soon be available. Once completed, we are sure to see considerably more stringent installation requirements that will, once again, challenge the knowledge, training and experience of the installer.

Then, of course, there is the challenge of inspection. Because of budget constraints, as well as other issues, many municipalities have moved to a combination inspector classification. The combination inspector may not have a profound electrical background but now will be asked to inspect an ESS to ensure that it is installed correctly. The issue is: What real-world electrical knowledge will many combination inspectors have in the inspection of these systems? Any hands-on experience? In my opinion, this complicates the situation even more as it means, effectively, we are drawing increasingly further from the premise as set forth by the National Fire Protection Association, one of qualification, knowledge, training, experience, and most importantly, safety.

Currently, I work as the Training Director for Sprig Electric. I am responsible for coordinating training for over 150 field foremen, as well as office personnel. When it comes to training, my chief concern is the same as it was more than 20 years ago...safety; safety for the worker, the installation, and the end-user. As it relates to the question confronting the Board, it is, as well, my chief concern.

Thank you for your consideration in this matter.

Respectfully submitted,

Andrew G. Rogers



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

May 17, 2018

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Earnest L Brown , I am the Vice President of International Line Builders and ILB Electric. We are a long-standing Electrical Contractor that performs all phases of High (500Kv to 69KV), Medium (34.5KV to 5KV), and Low Voltage (600V and less) power systems (both AC and DC) throughout the West. I appreciate the opportunity to write to you in regards to the public safety concern related to the installation of Energy Storage Systems (ESS).

International Line Builders/ ILB Electric has been in the power business for over 40 years. We hold not only a C10, but a C7, an A, and B license as well. Due to the complexity and safety concerns of many of the electrical markets we serve (including ESS systems), we feel compelled to submit this correspondence in support of requiring C10 contractors to perform this work.

Modern energy storage systems can produce over 10 megawatts of power. These systems can be of a commercial, residential, and utility based nature and in a variety of locations. Incorrectly installed, these voltages pose a very serious risk to both installer, property, and the general public. These systems require a very skilled electrical worker to help ensure these risks are mitigated and controlled. As a large Commercial, Utility, and Solar installation contractor, ILB has extensive experience with these projects and extensively train our employees to produce a broad-based foundation of electrical safety and knowledge. Just as the State has requirements for typical electrical installers. The State should follow the same protocol on this issue and side with caution and require a higher level of skill and training as required under the C10 license.

C-46 contractors have claimed that if the CSLB decides that a C-10 contractor's license is required for Energy Storage, it could interfere with the market, burden contractors, harm consumers, and/or raise prices. These claims are simply invalid. The only cost issue for contractors installing ESS would be when and if a C-46 has been employing low or unskilled workers at very low pay with few or no benefits. Those contractors would be required to employ electricians to install ESS on the Energy Storage portion of a project where PV is paired with Energy Storage. Electricians are paid more than unskilled workers because they have a

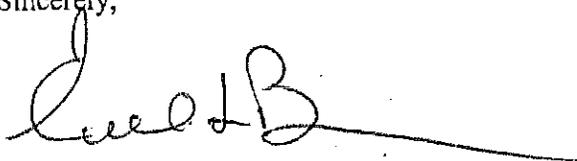
certification that reflects substantial electrical training, knowledge, and experience which provides workers and the public with much greater safety. Utilizing low paid, low or unskilled workers as a trade-off for safety cannot be justified.

The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While Energy Storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an Energy Storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. Again, similar to what the State has previously implemented in the C10 versus C7 licensing.

In concluding, this is not just an installation issue but a major safety issue, when dealing with any electrical or Energy Storage system, the State should side with the better trained and more stringent license requirements of the C10 Contractors and protect the interests of the people of the State of California as stringently as possible.

I would like to thank the Board for its public service, It is important to emphasize that our concerns are not related to C-46 Contractors and their ability to install solar installations, rather than the importance and safety related to the much more complicated and more hazardous industry of Energy Storage installations.

Sincerely,

A handwritten signature in black ink, appearing to read "Earnest L Brown". The signature is written in a cursive style with a long horizontal line extending to the right.

Earnest L Brown  
*Vice President*  
International Line Builders / ILB Electric Inc.



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Heather,

My name is Craig Gini and I am the Renewables General Manager and Vice President of Collins Electrical Company, Inc. I would first like to thank you for the opportunity to express my views surrounding the issue of competency regarding the C10 versus C-46 debate. As a point of reference, I was one of the speakers during the open forum and was able to listen to both sides of the issue.

Clearly, the most critical aspect of the entire issue is the safety of all involved. This would include the persons installing the Energy Storage Systems (ESS) as well as the public at large who will knowingly and unknowingly be exposed to them. I don't mean, in any way to try to create a hysterical scenario but the simple truth of the matter is that ESS's can be complex and require the knowledge and skill of a trained person for their installation. Even the so called "plug and play" units are suspect to safety issues if not installed properly. If the safety of the public at large is at stake, does it not make sense to insure that the installation of such technology be installed by those who have been exposed to rigorous training both in a lab setting as well as in the actual field?

The C-46 contractors will claim that they have just as much experience as the C-10 contractors when it comes to PV and PV is just the same as ESS. That claim could not be further than the truth. PV has its own unique simplicity as well as its own unique complexities. A 15-20KW residential or even 100KW commercial PV system is relatively simple compared to a 1 MW PV system installed at a waste water treatment plant. The coordination, electrical theory, and experience of interconnecting a system such as this requires electrical construction experience. Something that the C-46 contractors not only don't have but are not even allow to participate in due to the limits of their classification. Such is the same with EES. True, some systems will be simple in nature however, with the reclassification of the C-46 contractors, they would then have the ability to participate in larger more complex systems that are far outside of their capabilities. That to me is very concerning! C-10 contractors clearly have the training





required to safely install all manners and sizes of these ESS's; from the simple residential installation to the 100 MW installations that are already in the midst of being installed. Would you truly trust a C-46 contractor, who has no state certified training, to install something that complex?

I know that this will not be an easy decision for you. However, it is clear to me that to allow a segment of contractors to participate in a sector of work that is far outside of their trained capabilities is not only dangerous but borders on insanity.

Thank you for your time.

Could you kindly provide a receipt acknowledging your confirmation that you have received my letter, via email? My email address is [cgini@collinselectric.com](mailto:cgini@collinselectric.com).

Sincerely,

A handwritten signature in cursive script that reads 'Craig Gini'.

Craig Gini,  
Renewables General Manager  
Vice President





5/22/2018

California State License Board

Sacramento, Ca.

Hello My Name is Edward Thoma. I would like to thank the board for an opportunity to write about licensing for the installation of Energy Storage Systems (ESS). I spoke to the panel held in Sacramento on April 26<sup>th</sup>.

I am writing to you about Public Safety concerns that I have for these systems.

I was Vice President of Thoma Electric, Inc. I was an owner, estimator, project manager and safety officer for our company before my retirement. I now work part time for Thoma Electric, working on the Company Safety program.

As you may know ESS's are constantly evolving. From battery racks filled with lead and acid in AT&T facilities, to UPS's (uninterruptable Power Systems) in computer centers, and now in residential application like those developed by Tesla. The one undeniable fact about these systems is once the energy is stored in these various systems, there is potential for the release of all that energy in just a few seconds if certain safety precautions and protocols are not properly followed by knowledge and trained personnel.

C10 workers are trained in best construction practices, and installation techniques. All of my electricians have received formal electrical training in theory, and installation techniques. They have all received Osha 10 and Osha 30 training. Safety is stressed at our company, and we have a .89 Worker comp EMR as a result of our commitment to safety. Even though our workers have these osha certifications, they are just general safety training, and don't necessarily address that specific dangers of the installation of ESS's, specific training and understanding of the theory behind how these systems work is necessary to provide a safe work environment for the installer and the end user.

ESS's if not installed properly can lead to injuries and possible electrocution if not installed by competently trained electrical workers. The evolving technology of these ESS's is using new battery technology. Lithium Ion batteries while more efficient also possess one trait that the older lead acid technology, and that is thermal runaway.

While C46 contractors have a license to install Photo Voltaic systems, that doesn't guarantee that the installers working for C46 contractor have the necessary training to install these systems. Install an ESS if far different work than installing PV panels and plugging them together. These workers by and large have not received the formal technical training that Certified General Electricians have received. This work if not done properly is a danger to the electrical worker and anyone in the general public working with, or in and around ESS equipment.

ESS's are a separate system from PV systems. If requires electrical work which C46 contractor are not otherwise licensed to perform. Why would be allow untrained worker install these systems? It is dangerous for the installer and for the end user.

Thank you for your time,  
Edward C. Thoma

VP Thoma Electric, Inc.

ELECTRICAL ENGINEERING - ELECTRICAL CONSTRUCTION - DATA COMMUNICATIONS - SERVICE 225/22/2018  
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INTERNET - THOMAELEC@THOMAELEC.COM



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Thank you for the opportunity to address the Board and offer my informed insights regarding C-46 contractors being allowed to perform battery/electrical storage work under their license. These comments are about C-46 contractors doing energy storage work, not about C-46 contractors doing PV work.

I have worked on both solar energy projects and projects that included battery energy storage. I am a California State Certified Electrician and have worked in the electrical construction industry since 1995.

Battery storage is not an integral part of a renewable energy project any more than high-voltage line work is part of a commercial facility project. They may exist in harmony but each comes with its own required skill set necessary for safe and efficient installation and operation, and each poses completely different challenges, risks, and dangers.

Energy storage systems may be employed as a method of enhancing a renewable energy storage project but often come as an add-on rather than a necessary part. In fact, battery storage systems have been installed in many other electrical systems with no renewable component at all for decades! Emergency power, uninterrupted power sources for computer and data-collection, life-safety systems found in hospitals, and breaker and switchgear actuation systems all use battery energy storage.

Many C-10 Contractors, including our company, have been doing this type of DC electrical work for well over 50 years. As such, we have developed protocols and safety procedures - many required and reviewed by owners and public entities - before we are allowed to work on their projects. This electrical training, knowledge and experience safeguards the workers installing the battery systems as well as the occupants or members of the public who may find themselves in close proximity to these battery systems when they are in use.

As for the batteries themselves, this is a constantly evolving technology. The battery systems we install today are very different from the systems we installed even a few years ago - in both design and componentry. State Certified Electricians are trained in DC

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P: 408-641-2500 F: 408-451-9452

[cselectric.com](http://cselectric.com)

electrical theory, and in the maintenance and installation of these systems across a broad category of applications and power storage requirements.

For example, a 7kW solar array produces 7000 watts. A battery energy storage system stores the energy produced by the PV array. If there is no load and if there is 8 hours of sunlight, the battery system will store 56,000 watts of power. The dangers are not just different, they are 8 times different. The solar array can only deliver what it is generating at that moment in time. Battery-storage, under a direct-short fault condition, can deliver at one time, all of its stored electrical energy. That 8 times difference can be deadly.

This dramatically increased power and danger dramatically raises the need for electrical expertise. It sharply increases the need for worker training, experience, and adherence to the National Electrical Code's requirement for qualified persons, and for established best safety practices and protocols.

The C-46 license was initially developed for solar thermal installations, and expanded into residential rooftop "renewable" energy systems. The workers who do these installations know one unrelated, repetitive, narrow task, and little more about electricity.

Wisely, the scope of work for C-46 contractors was expressly limited to "install, modify, maintain, and repair thermal and photovoltaic solar energy systems". Adding "battery storage systems" to this list would defeat and degrade California's commitment to quality construction performed by a workforce verifiably trained in skills, knowledge, and safety. But most critically, permitting C-46 contractors and their uncertified workers to install and maintain electrical energy storage systems would put workers, first responders, and the public in harm's way.

Only C-10 contractors should be permitted to install energy storage systems for any residential or commercial application.

Sincerely,



Eduardo Rubalcava  
CSI Electrical Contractors, Inc.



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

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Only C-10 contractors should be permitted to install energy storage systems for any residential or commercial application.

Sincerely,

Jerry Esparza  
CSI Electrical Contractors, Inc.

Ms. Heather Young  
CSLB Executive Office  
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Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Brandon Malone

*(I am a private citizen who is concerned about safety.)*

Dear Members of the Contractors State Licensing Board:

I really appreciate that you are taking comments on this subject.

My understanding is that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is

having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

Even a small home energy storage wall unit is much bigger and a lot more dangerous than a portable consumer device. What's even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

I know the difference between an electrician and a solar contractor and there is a huge difference in electrical understanding and experience. Electrical contractors (c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer. Insurance companies have long said that electrical problems are the #1 cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate. Who would know how much training that solar worker has, if any at all? That's not a safety risk that average citizens should have to take.

The CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,



Brandon Malone

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Jeff Petrini and I am Energy Manager at A-C Electric Company. I have been with A-C for 18 years and have 32 years in the electrical construction business. Thank you for the opportunity to comment regarding installation and maintenance of energy storage systems.

With the variety of storage systems, it requires more knowledge of the electrical portion as well as possible safety issues. Along with that, there are many variables: additional hazards, ability to identify problems, and have the experience to fix them if. Installing Solar PV panels is a simplistic process in comparison to that of installation of storage systems and maintenance of said systems. If not properly connected, larger systems pose an even bigger threat as the size of the system puts untrained workers, and others, at risk of physical danger. A well trained and licensed professional, for storage installation would ensure proper installation in the beginning and knowledge to be able to confront any future problems.

As you know, C-46 licenses are restricted to work specifically to the "install of thermal or photovoltaic solar energy systems". PV solar systems can and are often sold together. But their process of permits, codes, and installation are very different and require different skill sets, as well as licensing. They pose different risks even when it comes to fire and safety. Again, they are two different types of systems that individually required specialized attention.

A C-10 contractor has the training for all aspects of electrical construction including PV solar and Energy Storage Systems. We have certified electricians who have undergone at least 8,000 hours of training and have hands on field experience. They have been trained how to work on systems in both the electrical and safety aspect. C-46 contractors have no minimum standard and are able to hire anyone whether they have experience or not.

California law requires that a person performing work as an electrician, under a C-10 licensed contractor, be certified to the standard of the Division of Labor Standards Enforcement. "Electricians" is all those who engage in the connection of electrical devices for electrical contractors licensed pursuant code 7058 of the Business and Profession Code.

I feel that allowing a C-46 contractor to act in the place of a C-10 contractor by not having certified electricians or proper training put themselves and their projects in danger. They also would lack any longer term trouble shooting if the system fails and inability to maintain those systems, possibly leaving customers in the dark.

I would like to maintain that I am not here to say that C46 contractors cannot install PV solar.

Thank you for your time in reviewing our information.

Sincerely,

Jeff Petrini  
Energy Manager  
A-C Electric Company

May 18, 2018

Ms. Heather Young  
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Sacramento, CA 95827  
Via Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

Thank you for the opportunity to comment on the CSLB debate concerning C-46 vs C-10 licenses on Energy Storage Systems (ESS). Please share my letter and comments regarding ESS public safety concerns with the CSLB.

I am a California State Certified Electrician with 18 years of electrical experience and I am a graduate of a state approved electrical apprenticeship program. Throughout my career, I have participated in the installation process, maintenance, and operation of multiple ESS and battery storage units. I have also witnessed ESS installations done by an unskilled and untrained workforce under C46 contractors wherein the workforce didn't know how to use tools and didn't know the difference between AC and DC, which resulted in damaged equipment and easily could have resulted in electrocution.

Just recently at the Naval Air Force Base in El Centro, there was a project to change the lighting and street light system to run off of solar derived battery storage, but the project failed because the project manager and workforce was not knowledgeable on temperature control and conversion theory and electrical best practices. When temperatures began to rise in El Centro, the system failed and the Naval Air Force Base has brought in a C10 contractor to re-wire and re-install the system with a skilled and trained workforce.

C10 contractors are required by law and regulation to ensure that electrical work is performed properly trained workforce with certified as electricians. Conversely, C46 contractors do not have this requirement for ESS and this puts the public and the electrical industry at risk.

To protect public safety and prevent workforce hazards, C10 contractors should be the only license type allowed to perform battery storage installations.

Thank you for your time and consideration of this matter and my views.

Sincerely,

Josh Nunez

# GREG BONATO

May 17, 2018

Ms. Heather Young  
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Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

As a state certified general electrician in the State of California since 2003, I would like to share a few thoughts on the need to have qualified C-10 contractors, that employ California State Certified General Electricians, perform the installation of Energy Storage Systems (ESS).

These are the reasons why California State Certified General Electricians who work for C-10 contractors meet or exceed the NEC definition of a "qualified person":

- They have received the minimum essential safety training required including compliance with Federal OSHA 1910 for General Industry, Federal OSHA 1926 for Construction, and NFPA 70E standard for Electrical Safety in the Workplace. Those without this training won't be able to recognize the hazards involved.
- The 2017 NEC provides references from Article 690 and 691 to Article 706 covering energy storage systems.
- Energy storage systems include much more than batteries. There are multiple types of energy storage systems that include sources such as ultra (super) capacitors, flow batteries (large scale), fuel cells, hydro-generation, and so forth. All of these systems are separate from PV systems, but could be installed and interconnected with a PV system. Installing, commissioning, and maintaining these systems requires specific training that electrical contractors and electricians possess. To expose unqualified persons to such risk is not responsible and will result in injuries and fatalities.
- The capacity of energy storage system can be huge and brings significant amounts of incident energy in calories per centimeter squared. Exposing workers that are untrained to these amounts of energy is high risk and will definitely result in severe injuries or fatalities. This can be avoided by placing clear limits on the scope of licenses that were never intended to expand into areas where the licensee is not trained.
- Licensed electrical contractors are qualified to manage construction and installation of energy storage systems, of all scales. They also have the necessary electrical safety training in recognizing and protecting workers from arc-flash, arc-blast, and electrical shock hazards, covered by NFPA 70E.
- They have the minimum necessary skills and training attained through apprenticeship programs that meet the requirements of the Department of Labor. The training and skillsets align with Division 2600 of the

Heather Young  
CSLB Executive Offices  
Page 2

Construction Specification Institute's Master Format for project specification. PV systems, Wind, Fuel Cells, and Generators are all power sources that energy storage systems are interconnected to.

I have 25 years of experience in the electrical industry, 15 of those years installing battery storage systems. I understand the potential dangers of these systems and the need to have a "qualified person" perform the installation of these systems.

The only way to ensure that Energy Storage Systems (ESS) are installed properly, safely, and by qualified State Certified General Electricians is to require that they are only installed by C-10 contractors that are required by law to employ California State Certified Electricians.

Sincerely,



Greg Bonato

Ca State General Electrician #E-101650-G

**Young, Heather@CSLB**

---

**From:**  
**Sent:** Tuesday, May 15, 2018 11:41 AM  
**To:** Young, Heather@CSLB  
**Subject:** energy storage systems

May 15, 2018

Ms. Heather Young

CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Dave Thomas. State license number 101855 General electrician. Thank you for taking the time to hear my concerns. I have been an electrician for almost 40 years and have been teaching electrical apprentices for almost 10 years.

Allowing C46 contractors and their minimally qualified employees to install battery systems is asking for a disaster. The difference between a solar panel and a battery is potential incident energy. Shorting out a solar panel the available fault current is limited by the wattage of the panel. Shorting out a storage battery is only limited to the internal resistance of the battery. Laymen's terms it is the difference of a few amps or 10s of thousands of amps. You also don't have a cascading thermal break down on panels. We've all seen the laptop battery and hover board battery melt downs, and these are fractions of what an energy storage system holds.

Installing energy storage systems on solar systems allows the solar system to work when the utility power fails. This is good for the homeowner but deadly for the lineman called out to work on a downed power line if the system is installed incorrectly. Ask the utility worker if he wants "solar dudes" to have his life in their hands. The reason I used the term "solar dudes" is that a significant number of these installers know just enough to put up a solar panel. The consequences and technical aspects of interconnecting a storage unit is beyond them. By allowing these minimally qualified people to install storage systems is like boiling frogs. You turn the heat up on a frog slowly and it will sit there and slowly boil to death. You give minimally qualified people more and more technical and dangerous sources of power and you are asking for a dead lineman.

Real electricians, electricians who have had training in both safe handling and the technical aspects of storage systems as well as training in both AC and DC systems should be the only ones allowed to installer anything with this much potential for catastrophic failure. Ask a fireman, ask a lineman ask any first responder what they think of storage batteries and then make your decision. It's their lives.

Sincerely Yours,  
David B Thomas  
SL# 101855 General Electrician

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Steve Earhart,

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Steve Earhart

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Brian Holt, I am a California State Certified Electrician from Bakersfield, California. I have worked in the trade for 22 years and have completed a State Indentured 5 year apprenticeship program which included the requisite 960 classroom hours and 8000 on the job hours. I am honored to now sit as 1 of 6 committee members who oversee that apprenticeship and have done so for the last six years.

I am in strong opposition of allowing C-46 contractors, and in turn, non-certified workers, to install and maintain energy storage systems, regardless of their location. To be clear, these are separate, stand-alone systems that are complex in nature. To assume that a "solar" contractor can install such a system based solely on the fact that it is adjacent to a solar facility is ludicrous. Solar systems are adjacent to many types of facilities, but that doesn't mean those contractors should be allowed to build and maintain those, does it? If a cement mason can finish the concrete dome around a nuclear reactor, does that mean he can build and maintain the nuclear reactor?

There's been talk in the industry here lately of possibly going back to all the "peaker" plants that were built during the power crunch of the late '90's and installing energy storage systems using technology very similar to that found in today's hybrid vehicles. Most of these are gas fired power plants with very large turbines—your quintessential industrial type facilities with smoke billowing out of the smoke stacks. Should these systems be installed by a company whose workers are not required to be State Certified? Should workers trained only in installing PV modules on residential roof tops be expected to perform this work correctly and safely? As an industry tradesman I say no.

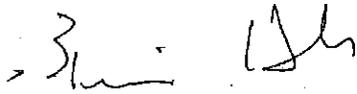
A few years back I was the lead electrician at a new data center being built for NASA at Edwards Air Force Base. As you can imagine, it was incredibly complex and the power systems feeding the building were redundant, meaning it had multiple, alternative sources in case of emergency. Included in this system was a very large UPS (uninterrupted power supply) which is a fancy term for a "battery backup". By design, I would say that it is no different than the very systems we are talking about here today.

One day, towards the end of the project, the owner had a testing company on site working through the systems whose workers were not required to be certified or prove any kind of training—much like that of the C-46 contractors. Not understanding

the system, one of these workers went to reach into a piece of gear that he thought was de-energized, when in fact it was being fed by the UPS system (battery storage) I mentioned earlier. Without even thinking, I grabbed him by the shirt collar and pulled him back to safety before he made contact. Luckily, it was classified as a "near miss" but could have easily been a very serious injury or worse. I think this is a very good example of what can and does happen when unqualified, untrained individuals are allowed to work on systems that they do not understand.

I strongly urge you to vote no on allowing C-46 contractors to install energy storage systems.

Sincerely,

A handwritten signature in black ink, appearing to read "Brian Holt". The signature is written in a cursive style with a large initial "B" and "H".

*Brian Holt*  
California Certification #105329

May 14, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems, "ESS"

Ms. Young;

My name is David Lawhorn and I appreciate and would like to thank the Board for the opportunity to comment on whether C-46 Contractors should install and maintain energy storage.

I have many concerns with C-46 Contractors being able to install ESS but I would like to focus on Safety issues. The dangers and risks of working with energy storage is something I have worked on as a California State Certified Electrician. These systems aren't nothing like Solar PV systems which are almost like plug and play systems or units. I have over 30 years' experience in the Electrical field with 4 years of that going through a state registered electrical apprenticeship program to learn all facets of the electrical industry including battery storage systems. These systems are posing safety issues with arc flash, arc blast and DC electric shock which the training I have received protects workers and the public from these dangers. I believe allowing C-46 Contractors to install these systems will cause risk to workers and lead to public safety

Licensed C-10 electrical contractors are qualified to manage construction and installation of energy storage systems, of all scales. They also have the necessary electrical safety training in recognizing and protecting workers from arc-flash, arc-blast, and electrical shock hazards, covered by NFPA 70E.

I urge you to keep this installation work under the C-10 Contractors scope of work.

Sincerely,

*David Lawhorn*  
*State Certified General Electrician*  
#123617

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Jeff Bode

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Jeff Bode

**Young, Heather@CSLB**

---

**From:** Mark Swain <  
**Sent:** Thursday, May 17, 2018 2:57 PM  
**To:** Young, Heather@CSLB  
**Cc:**  
**Subject:** Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Please except my opinion letter pertaining to Classifications Authorized to Install Energy Storage Systems. Please send a confirmation of receipt of this e-mail.

My name is Mark Swain

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,

*Mark Swain*



Mark Swain  
TAFT ELECTRIC COMPANY  
805-833-0716 - Cell

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Thank you for this opportunity to voice my side of this argument. I am a state certified General Electrician. To earn the GE Certification in California, one needs a minimum of 8,000 verifiable hours of on the job training from a C-10 contractor and to pass a state test which, last statistic I saw, had a pass rate of 46%. I graduated from a five year training program. I have worked in mines with MSHA, industrial, commercial, residential, solar, battery backup systems, and for the past four years, hospitals with OSHPD.

I would like to talk about an incident that happened a couple weeks ago and how it would relate to allowing C-46 contractors to perform additional work from Photo Voltaic installs.

One of the biggest arguments I have heard from C-46 contractors and installers is, the systems are professionally engineered and the inspectors catch the rest of the mistakes. This is simply a weak argument; we are all human and make mistakes. I have fixed countless mistakes made by engineers and pointed out many more that inspectors missed. For example:

I was tasked to take over a project from a previous electrical contractor who had difficulties passing inspections and did not show up on the job for over a month. Come to find out, the job was run by trainees and were not state certified electricians.

I walked the job with the general contractor and the OSHPD inspector to get a better understanding of the job before we started work. We walked an area that had been previously passed by the inspector. I pointed out the California Electric Code (CEC) and National Electric Code (NEC) specifies a disconnecting means was needed next to the transformer; which the OSHPD inspector who had eidetic memory recalled the exact location in the code book and turned white in the face. In addition, the location was on top of a roof which is considered a wet location according to CEC/NEC and the transformer was a dry location transformer.

Note: the stamped drawings, (which the electrical engineer created, the owner approved it, city approved it, and the State of California approved it; a requirement of OSHPD) failed to specify a disconnecting means and specifically called for that specific transformer; again each passed the stringent OSHPD inspections.

It took a California State Certified General Electrician to catch these two major mistakes; solar and battery backup systems do not have nearly as much oversight as OSHPD work sites. If that transformer needed maintenance, the technician would need to pray no one else turns on the circuit because that voltage and amperage would kill a person instantaneously. The bigger issue was the dry location transformer being in a wet location. If water got into the transformer, it could have blown a hole in the roof killing/injuring any patients in their beds below that portion of the roof.

We cannot rely on engineers to be perfect in a cut and paste field; it takes less time & money to cut and paste from a previously engineered system than to start from scratch every time. In addition, inspectors are human and make mistakes. It is stomach churning thinking about taking out such a skilled and knowledgeable force just to save money for the C-46 contractors; which is what it boils down to, money.

Why are C-46 contractors not willing to have general electricians install the battery back-up systems? It must be due to state certified General Electricians demand a higher pay than the non-trained, non-state certified workforce the C-46 contractors grew to love. They are putting their profits ahead of the safety of the stakeholders of the great state of California.

I suggest the CSLB conduct a study on the amount of experience from the C-46 installers versus the amount of experience the C-10 General Electricians have.

I also suggest the CSLB conduct a study on fire safety of C-46 versus C-10.

Information is key in making the best possible decision. I have seen firsthand the poor quality of workers the C-46 contractors prefer to use. It is a huge safety risk to any of the stakeholders of their projects.

Sincerely,



Sean L. Swoboda  
California State Certified General Electrician

# Daniel O. Chivello

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May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments – Classifications Authorized to Install Energy Storage Systems

As a state certified general electrician in the State of California since 2004, I would like to share some thoughts on the need to have qualified C-10 contractors perform the installation of energy storage systems (ESS).

My comments are focused on whether C-46 contractors should install and maintain energy storage. My comments are not about C-46 contractors installing PV solar. These are separate systems that pose different risks, require different expertise, and have different permitting and code requirements.

The energy storage unit that was demonstrated at the CSLB on April 26th, and other similar so-called “plug and play” ESS are not as simple, easy and safe as claimed. A UL listing means that equipment samples have been tested for safety but it is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused.

When not installed correctly, even small residential ESS units can start a fire which could engulf a residence. While commercial ESS present even greater risks, there is no such thing as a safe “plug and play” ESS. What makes any size ESS safer, is proper installation and maintenance which is a result of training, experience and certification.

A spokesperson from Sunrun commented at the CSLB on April 25th and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar. This is not correct.

The misinformed claim from the Sunrun representative demonstrates a lack of critical technical knowledge and a dangerous misunderstanding of the risks to worker and public safety.

These are different systems, different tech, different skills, and different risks. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe in a residential installation are much different. In my 35 years, I have installed multiple systems. Article 706 of the National Electric Code provides specific, separate installation standards for all energy storage

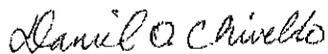
Ms. Heather Young  
CLSB Executive Office  
Page 2

systems operating at over 50 volts ac or 60 volts dc. In contrast, car batteries, which have been used, are around 12 volts dc and are not even subject to these standards.

There have been numerous comments about the test questions on the C-46 contractor exam compared to those on a C-10 contractor exam. This discussion misses the critical issue for worker and public safety. Contractors are the business owners; their employees install the energy storage systems. It is the knowledge, skills and experience of the employees who do the installations that matters most. The state of California requires that the employees of C-10 contractors who install and/or maintain electrical equipment must be state certified general electricians. The workers who install energy storage and PV systems for C-46 contractors have no minimum California state certification requirement for education, training, skills, and experience. That puts worker and public safety at risk.

The best way to ensure that energy storage systems are installed properly, safely, and by qualified, state certified electricians is to ensure that they are only installed by C-10 contractors that are required by law to employ them.

Sincerely,



Daniel O. Chivello  
CA State General Certification # E-107218-G

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Joel Cerda

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

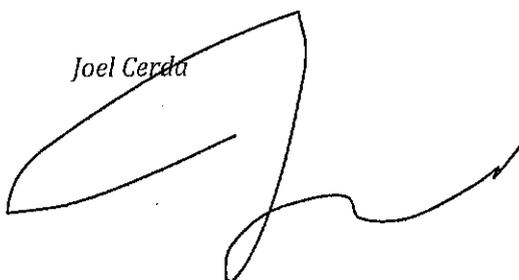
As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,

Joel Cerda



## Young, Heather@CSLB

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**From:** Jason Gumataotao  
**Sent:** Thursday, May 17, 2018 6:32 AM  
**To:** Young, Heather@CSLB  
**Subject:** Written comments-Classifications Authorized to Install Energy Storage Systems

Good morning, Ms. Young.

Thank you for doing the work you do and thank you for the opportunity to comment on the installation of Energy Storage Systems.

My name is Jason Gumataotao and I am addressing the questions around public safety concerns related to ESS. I have been working in the electrical construction industry since 2001 and in that time I have worked with teams of electricians building projects for school districts, research and science facilities and utility scale photovoltaic (PV) energy systems. I have worked as a California State Certified General Electrician since 2006, Card # E122018G, and as an electrical apprenticeship instructor since 2015.

Regarding safety, citing OSHA 1910.399 which specifically defines a "qualified person" as "One who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved." I served an apprenticeship between 2001-2006 and I have continued to work in the electrical construction industry. I agree with the above OSHA regulation and I am very concerned that there will be untrained or improperly trained workers building ESS. While in my apprenticeship I learned how to safely build electrical systems. We started with electrical theory, then moved along with industry appropriate curriculum that included our first look at NFPA 70E in early 2006. I share this because without associated hands-on and classroom training to connect the work we all did in the field we would just be "working a job" rather than developing into skilled craftsmen and women.

It would be a highly risky and technically improper for the CSLB to treat energy storage systems as a subsystem of a solar photovoltaic (PV) energy system. While these systems can and will be increasingly paired together, they are highly distinctive and separate systems - subject to their own inherent risks, technical specification, codes, installation and fire safety standards. Most energy storage systems are battery-based and pose very different fire and life safety risks such as, fire, arc blast, thermal runaway, explosion and/or exposure to released gases and hazardous chemicals. Some commonly characterized risks include:

- Banks of battery cells can operate at critically hazardous voltages and must be electrically isolated while any work is being performed on the bank, individual cells, groups of cells, or electrical equipment that constitute upstream or downstream parts of the system.

- A battery storage system can cause an arc flash if it suffers a short circuit or fault. An arc flash can have temperatures above 12,000° C, capable of melting metal and/or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures unless the fault currents are removed quickly by correctly rated and correctly installed electrical protective devices.
- Lead-acid batteries generate hydrogen and oxygen when charging and need adequate ventilation to avoid an explosion, fire or risk to occupants. Lithium-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault. Moreover, the chemistry of lithium-ion batteries makes them prone to 'thermal runaway' if they are damaged or overheated by overcharging. While some brands of lithium-ion batteries have superior features intended to prevent the uncontrolled rupture of cells under runaway conditions, technologies vary widely.
- Any one, or a combination, of these risks may cause serious injury or death to a worker, or member of the public who may be too close to an energy storage system when there is an accident.

It is the knowledge, skills and experience of the electricians who build the systems that matter most. The state of California requires that employees of C-10 contractors who install and/or maintain electrical equipment must be state certified general electricians.

The workers who install energy storage and PV systems for C-46 contractors have no minimum California state certification requirement for education, training, skills and experience.

Without demonstrating the knowledge and proving the experience, which is required for certified electricians, the safety of the public and workers alike will be at risk.

With regards.

Jason Gumataotao

Dear Ms Young:

Re: Written Comments- C46 License Authorization to Install Energy Storage Systems

My name is Doug Mangione and I am a certified electrician license number 105151. I have over 40 years in the electrical industry and have worked on many different systems.

I am writing to oppose the inclusion of installation and maintenance of Energy Storage Systems into the C46 license.

I would like to thank the board for the opportunity to comment on this very important issue.

The National Electrical Code NFPA 70 in the first section 90.1 states

“The Purpose of this code is the practical safeguarding of persons and property from the hazards arising from the use of electricity”

When state certification of electricians in the state of California was adopted many electricians were unprepared for taking the test. We attended classes and realized that some did not keep up with all the code changes that occurred every 3 years, such as derating the ampacity of conductors for conduit fill or when computers became prevalent in the workplace we had to increase the size of the neutral conductor because of the inductive load that computers put on the line. Some relied on the AHJs to bring up these changes at the time of inspections but inspectors should not be instructors.

Now that electrical certification rules are in place all electricians working for C10 contractors must take 32hrs of education in the electrical field to maintain their license and most electricians take code upgrade or new systems classes such as ESS or the new title 24 rules. You must have 8000 hours of practical experience just to be eligible to take the test and majority of the questions require knowledge of the code book. My point is, this electrical code book is our bible to protect life and property. Others want to take excerpts out of the code and say “that’s all we want to do” but the systems being installed are all encompassing. If

you install a battery system is it ok to install new panels or switch gear that may be required with that system, new underground for feeders ,lighting and ventilation that might be required. Where does this encroachment into certified electricians scope stop.

Many C46 contractors also have C10 licenses so that their certified electricians can do the work that is in the scope of the C10 license. C46 PV installers do not have any requirements for education or license to work on these systems. Rather than weakening the electrical certification law you should strengthen them by requiring C10 license and certified electricians install these potentially dangerous system.

Thank you for consideration

Douglas Mangione

Anthony Ausbie

Hello, my name is Anthony Ausbie and I would like to thank you for accepting my comments regarding energy storage system. I am a state certified general electrician and an instructor at an electrical apprenticeship. I would like to address two topics in particular, safety and the evolving technology.

My primary concern is safety. Not only am I concerned for the safety of the individuals installing the systems, but also for others who may be affected if mistakes were made during the installation process. Energy storage systems are dangerous and require trained electricians to install them. When not installed correctly, energy storage systems can start a fire, cause an arc fault event, or expose someone to electric shock. I believe the only way to protect workers and the public from these dangers, is to ensure the work is done by a C-10 contractor. It is my opinion that they are better trained in all areas of the electrical industry and better suited to keep up with the evolving technology than a C-46 contractor. A C-10 contractor hires skilled state certified electricians and often employs highly skilled apprentices. Every apprentice that graduates from our program has a state certification, many years of experience with the National Electrical Code, and is trained on the job by C-10 contractors. They also receive extensive training in the NFPA 70E where they learn all about the inherent dangers of electricity and how to protect against them.

In closing I would simply like to say that a technology as new as energy storage systems should be investigated carefully. The components are constantly changing and we are far from the point where anyone can do it. It is my personal opinion that a C-10 contractor is the most qualified to perform this work.

Sincerely,

Anthony Ausbie  
Instructor

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Gene Hansmeier

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Gene Hansmeier

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Chris Huston

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

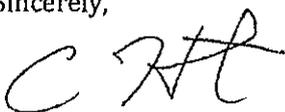
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As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

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I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Chris Huston

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Tony Skinner

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

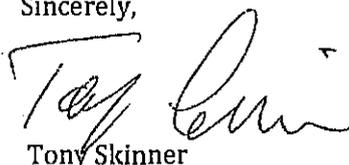
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As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Tony Skinner

Mark Buck I would like to thank the board for the opportunity to speak about Public safety concerns regarding Electrical storage systems.

I'm a state certified general electrician with 22 years' experience, I helped installed the PV Solar system at the FAA Tower at the Oakland airport, I have great concern for safety when it comes to these commercial ESS systems. There are many types of storage units that can be used (batteries, fuel cells, ect.) Some type of batteries such as lead acid and nickel cadmium can experience thermal failure when overcharged. Improperly installed ESS pose risks to workers, emergency responders and the general public. These systems also pose a risk to utility workers when these systems are connected to the grid. That is why these types of installation should be done by qualified State certified general electricians.

ESS systems include much more than batteries .there are many types of energy storage systems that include sources such as ultra (supper) capacitors, flow batteries (large scale) Hydro- generation. All these systems are separate from PV systems but could be installed and interconnected to a PV system. This is why it is important to have these systems installed, commissioned, and maintained by state certified electricians and electrical contractors. To expose unqualified persons to such risk is not responsible and will result in injuries and fatalities.

As for other safety issues you can look at NFPA 70E article 320 it deals with safety requirements related to batteries and battery rooms which is part of our training, being a state certified general electrician.

Thank You

Mark Buck

Card #101581

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Dan Smith

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code (NEC), the California Electrical Code, and NFPA 70E are critical to safety of persons and property. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,

*Daniel A. Smith*

Dan Smith

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Hi Ms. Young,

My name is Ray Wenner and I want to thank you for allowing me to express my concern to why I feel C-46 contractors should not be allowed to perform Energy Storage work.

The prerequisite knowledge to safely perform Energy Storage installations and maintenance is vast. The individual tasked with performing this work must know and understand how to recognize and mitigate the lethal hazards present. They include chemical hazards, electrical hazards and more. Knowledge of electrical meter usage along with PPE appropriate for the given hazard is critical. These are areas which electricians are very familiar and actually study to be in compliance with NFPA 70E and OSHA. C-46 contractors nor their employees are equipped to deal with these hazards and that poses a risk to people and property. Only licensed C-10 contractors are trained to perform work of this nature. Please consider this my strongest recommendation to not allow untrained C-46 contractors and their unskilled workforce to perform this potentially dangerous work.

Sincerely,



Ray Wenner  
California State Certified General Electrician  
No.113453

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

Thank you for the opportunity to share my safety concerns and personal views on the CSLB matter regarding C-10 vs C-46 licenses on Energy Storage Systems (ESS).

Please note that my comments are focused on whether C-46 contractors should install and maintain energy storage. My comments are not about C-46 contractors installing PV solar. These are separate systems that pose different risks, require different expertise, and have different code requirements.

I studied electricity in high school and then received electrical training while in the United States Navy where I learned how to understand solar, chemical, nuclear, hydro, pizio and others sources of electricity. After my service in the Navy, I sought to become a career electrician and successfully graduated from a five year apprenticeship program while receiving on-the-job experience with battery storage, solar arrays, and power plant construction and maintenance. It was my apprenticeship program that provided me with the formal training required to be successful as an electrician while also preserving public safety against electrical hazards.

Presently, I act as a career counselor for electricians in San Diego and Imperial Counties. I advise apprentices and persons interested in becoming an electrician and encourage them to keep focus on their studies and to be life-long learners with our apprenticeship and Electrical Training Center. It is significant that only C10 contractors ensure electrical work is being done by skilled and trained General Certified Electricians while also providing a living wage career to the workforce.

I encourage you to declare that only C10 contractors are allowed to perform battery storage installations - for the sake of the consumer that seeks a quality installation, and the public's safety that must be protected, and for those, like me, that have invested our careers and training with a California state general electrical certification. We should not dilute our standards of training and public safety so that C46 contractors are allowed to utilize a low-wage workforce with no training requirements.

Thank you for your time and consideration of this matter.

Sincerely,

Kevin Alvin

# Brian R Gregory

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

Dear Members of the Contractors State Licensing Board:

My name is Brian Gregory. I am an electrician and a trustee on the Santa Barbara County Electrical Joint Apprenticeship Training Committee. Electrical Safe Work Practices based on NFPA 70E are woven into the entire fabric of our 5-year electrical training program. The thought of anyone without such training and without proper electrical certification working on energy storage systems is very scary to me.

C10 contractors are required by law to use properly certified electricians as an assurance to protect persons and property. Having a lower, or no standard, for what is extremely dangerous electrical work, flies in the face of logic. The available short circuit current on PV systems is inherently limited. That is not the case with associated or stand-alone energy storage systems. The need for utility scale energy storage is in its infancy and putting safety first now will prevent a misstep with tragic consequences in the future.

Thank you for your consideration,



Brian R Gregory

## Young, Heather@CSLB

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**From:** Jeremy Floth >  
**Sent:** Friday, May 18, 2018 9:24 AM  
**To:** Young, Heather@CSLB  
**Subject:** Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Jeremy W. Floth and I am an Electrical Safety, Electrical Training and Energy Storage System Instructor, as well as a California State Certified General Electrician. I would like to thank you in advance for taking the time to read my letter and allowing me to comment on some of the issues I have on the "Classifications Authorized to Install Energy Storage Systems". There are many points to be made on the Energy Storage topic, I will try to focus on some Public Safety Concerns I have.

I have personally worked both union & non-union throughout my electrical career, this is not an issue of who the actual employer is. My concern is with proper training, knowledge & safe work practices. During my apprenticeship to become a State Certified Electrician I had an opportunity to take, and pass, courses in both AC and DC Theory, a luxury those not participating in an apprenticeship do not experience. AC and DC systems function differently and pose individual risks. Without a basic understanding of both power sources, and the dangers associated with each & combined, the end results could be Catastrophic.

Energy storage systems (ESS) come in many different forms, each with their own dangerous elements. I will begin with describing Battery Systems. Storage Batteries must be constantly maintained by monitoring fluid levels ( Lead Acid type), toxic gas sensors & alarms, charge rate, discharge rate, ventilation systems and temperature sensing monitors. There are fire and explosive dangers associated with each type of Battery. For example Lithium batteries react violently if introduced to water, which poses great dangers if trying to extinguish a fire with no knowledge of the type of Battery System. There are numerous attributes associated with each kind of Battery Storage to include different types of fire prevention and restrictions to each. Skilled labor is needed to install & maintain these systems. Basic OSHA 10 or extensive OSHA 30 are not enough to protect the workers from the Dangers of ESS ( I train both OSHA 10 & 30 as well as NFPA 70E). It is more extensive than stacking & carrying batteries or simply plugging in a few wires. A solar panel can be plugged into itself with little to no damage, whereas if you short a battery it will EXPLODE. The misconception that its only DC or just a Battery is a huge error. When working with more than 50 volts live the NFPA 70E & the NEC require certain types of training, protective gear & insulated tools to work on equipment. Unless properly educated we are not only risking human lives, damage to property, equipment, THE POWER GRID ITSELF & the environment could range in the millions of dollars.

Uncertified, untrained Individuals in the electrical field are dangerous. Certifications & proper training is imperative. To my knowledge no special training is required for this work classification. I was informed that there was a demonstration performed on April 26th to give a false sense of safety on Battery Storage. Was a demonstration of all the possible dangers also provided? Please don't let one example relax the standards on the DANGERS associated with these systems. I will close with this ,recall from recent news of the electronic cigarette batteries exploding in peoples pockets, cell phone batteries catching fire on airplanes, laptops batteries imploding from over charging, hover board batteries melting down. These are very minor compared to something large enough to power a house, a building or an entire city.

There is so much to add on this subject, so many different components to these systems, safety concerns & procedures that need to be implemented on every level. Public Safety & Fire need our cooperation for joint

training with the hazards of ESS. In the wrong hands Energy Storage Systems can be extremely destructive to human life, the power grid itself, property & the environment. Not just anyone can build & maintain these properly. Just because it works today doesn't mean it wont become a danger tomorrow with the wrong type of personnel assembling these systems.

Sincerely,

Jeremy W. Floth

Electrical Safety, Electrical Training & Energy Storage Instructor

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: For the CSLB - Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Daniel Fross. I am commenting personally on the proceedings to determine the appropriate license classifications authorized to install energy storage systems when paired with solar PV systems.

I have over 40 years of experience in the Electrical industry. My experience includes Apprenticeship, Journeyman, Foreman as an Inside Wireman, and 25 years as a San Francisco Electrical Inspector. I have expertise in the National Electrical Code, California Electrical Code, NFPA, and the San Francisco Electrical Code. I have continued to remain deeply involved in issues of electrical safety as a Founding Board member of Building Safety Alliance.

Thank you for this opportunity to comment.

As an electrical inspector, I understood that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB) regarding the installation and maintenance of electrical energy storage systems (ESS): Which category of contractor should be licensed to install and maintain electrical energy storage components and systems when they are paired with PV solar systems (PV).

The CSLB decision will involve a number of very serious electrical safety concerns. As an inspector it was my duty and responsibility to keep workers, inspectors, first responders, and the public at large as safe as possible from many types of hazards and risks.

The area of energy storage is of special concern because it is relatively new to many, and it presents particular hazards and risks that are different and substantially more serious than those posed by PV. Energy storage systems vary widely in type, size, and power requiring a broad base of electrical theory and safety knowledge. The installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current

battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe are much different.

Current ESS present far greater electrical hazards to workers, first responders, and the public such as arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

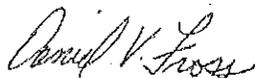
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As a former electrical inspector, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage systems to C-10 contractors, only.

Sincerely,



Daniel V. Fross

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: For the CSLB - Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is James Hansmeier. I am commenting personally on the license classifications authorized to install energy storage systems when paired with solar PV systems.

I have 4 years of experience as combination building inspector with a specialty as an electrical inspector. My experience includes electrical plan check and inspection of electrical systems. I have expertise in solar photovoltaics and battery energy storage systems. I am a IBEW/NECA apprenticeship instructor and I am also a CA state certified journeyman electrician.

Thank you for this opportunity to comment.

I understand that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB) regarding the installation and maintenance of electrical energy storage systems (ESS): Which category of contractor should be licensed to install and maintain electrical energy storage components and systems when they are paired with PV solar systems (PV).

The CSLB decision will involve a number of very serious electrical safety concerns. As a building official it is my duty and responsibility to keep workers, inspectors, first responders, and the public at large as safe as possible from many types of hazards and risks.

The area of energy storage is of special concern because it is relatively new to many, and it presents particular hazards and risks that are different and substantially more serious than those posed by PV. Energy storage systems vary widely in type, size, and power requiring a broad base of electrical theory and safety knowledge. The installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe are much different.

Current ESS present far greater electrical hazards to workers, first responders, and the public such as arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

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I strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,

James Hansmeier  
Building Inspector III, Electrical Specialist

My Name is Chuck Vella and I thank the Board for the opportunity to speak.

I am speaking on Public safety concerns related to Energy Storage Systems (ESS).

I am a California state certified Voice, Data & Video and Life/Fire Safety Electrician and have been an instructor for the electrical trades for over 8 years and hold the title of Master Instructor, I have been in the electrical trades for over 29 years and considered a subject matter expert in my field by the state of California, I have helped with the development of the California Electrician Certification exam.

In all my years performing electrical trade work for C-10 contractors I have never installed an Energy Storage System because I am not qualified to do so, but because of my training, experience and knowledge I know that C-10 contractors and state certified general electricians are qualified to safely and effectively install and maintain energy storage systems.

It would be a mistake for the CSLB to treat energy storage systems as merely a subsystem of a solar photovoltaic (PV) energy system. While these systems can be paired together, they are separate systems – subject to their own code, installation and fire safety standards. Moreover, they pose very different fire and life safety risks. These risks include electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

California State Certified General Electricians who work for C-10 contractor meet or exceed the NEC definition of a “qualified person”.

It would be a highly risky and technically improper for the CSLB to treat energy storage systems as a subsystem of a solar photovoltaic (PV) energy system. While these systems can and will be increasingly paired together, they are highly distinctive and separate systems – subject to their own inherent risks, technical specification, codes, installation and fire safety standards. Most energy storage systems are battery-based and pose very different fire and life safety risks such as, fire, arc blast, thermal runaway, explosion and/or exposure to released gases and hazardous chemicals.

I recommend that all aspects of energy storage system installations should be undertaken with the involvement of a properly licensed professional electrical contractor, employing trained and qualified electrical workers, for a number of reasons, including **Electrical Expertise**.

The workers for C-10 contractors - have a great deal of electrical expertise, take a very tough exam, and can only work as certified general electricians if they pass.

Let's compare that expertise to the requirements for the workers employed by C-46 contractors.

Some consumers and businesses often confuse a contractor with an installer. For example, some think that because a C-46 contractor has to be licensed that their workers are also licensed. That is not the case and it is a very important distinction.

**There is NO minimum California state requirement for education, training, skills, or certification of the WORKERS who install PV systems for C-46 contractors. That means that if C-46 contractors are permitted to install energy storage systems, those same workers – with no minimum requirements for education, training, skills, or certification would be installing and maintaining these high-powered systems and putting worker and public safety at risk.**

**Considering the dangers related to energy storage systems, and the critical importance of proper and safe installation and maintenance, allowing C-46 contractors and their workers to install energy storage systems is a worker and public safety risk that should not be taken.**

I trust that the CLSB will make the right determination and award C-10 contractors with energy storage systems for the protection of life and property for its residents of California.

Thank You.

Chuck Vella

## Public Safety Concerns Related to Energy Storage Systems

I would like to thank you for taking the time to read my letter and allowing me an opportunity to voice my concerns on this issue. My name is Paul B. Smith and I am an electrical training instructor at the Sacramento Area Electrical Apprenticeship.

My comments are focused on whether C-46 contractors should install and maintain energy storage. My comments are not about C-46 contractors installing PV solar systems. These are separate systems that pose different risks, require different expertise, and have different permitting and code requirements.

Essential in doing any electrical work has always been and will continue to be safety. In addition to 8,000 hours of on the job training, I have completed 1,000 hours of classroom training which includes subjects such as DC and AC theory, electrical safety, blueprint reading, codes & practices, motor controls and other theory and skills based subjects that gave me the understanding of how to safely install electrical systems in accordance with the National Electrical Code (NEC), OSHA-10, OSHA-30, EM-385, NFPA 70E, along with certification in First Aid and CPR. The main goal is to be able to safely install systems to avoid fire hazards and shock hazards to myself and the public. And, now, as a state-certified general electrician, I am recognized as a "qualified person" by the NEC to work on energy storage systems. Contrast that with no state training, education, and experience certification requirements for C-46 installer employees.

The state of California requires the employees of C-10 contractors who install and/or maintain electrical equipment to be state certified general electricians. The workers for C-46 contractors who install energy storage and PV systems have no minimum California state certification requirement for education, training, skills, and experience. That puts workers and public safety at risk.

Cal/OSHA training alone is totally inadequate to prepare and protect C-46 installation employees and the public from the stark hazards of energy storage systems. Cal/OSHA trainings are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. While helpful for basic electrical safety tips, the Cal/OSHA trainings can never be considered adequate for installing or maintaining energy storage systems

Early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. Today's energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe in a residential installation are much more complex and hazardous. Even at the national level, the National Electric Code Article 706 provides specific, separate installation standards for energy storage systems operating at over 50 volts ac or 60 volts dc. In contrast, car batteries, which have been used, are around 12 volts dc and are not even subject to these standards.

Energy storage systems (ESS) may be linked with PV systems but they are separate standalone systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. When not installed correctly, even small residential ESS units can start a fire which could engulf a residence. While commercial ESS present even greater risks, there is no such thing as a safe "plug and play" ESS.

Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where

the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers. These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

I recognize that energy storage systems have become an integral component of our industry but have increased the danger of potentially fatal hazards through arc flash, electrical shock, chemical spills and explosions, and other associated fire and life safety risks. An untrained, unqualified person installing these systems not only put themselves at risk, but also their nearby co-workers and the public these systems will serve.

I strongly recommend these systems are installed only by state certified general electricians working for C10 contractors who are qualified to safely and effectively install and maintain energy storage systems.

Sincerely,

Paul B. Smith  
Electrical Training Instructor  
Sacramento Area Electrical Apprenticeship

May 18, 2018

From: Bernie Kotlier  
CA & NV LMCC  
San Jose, CA

To: Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Bernie Kotlier and I work with a number of energy industry organizations including as a member of the boards of directors of the California Clean Energy Fund / CalCEF, CalCharge, and NAATBatt. For the last 11 years I have worked on sustainable energy projects, education, and training for electrical contractors who are members of the National Electrical Contractors Association and for IBEW electricians in California. I have served as a member of the California Public Utilities Commission (CPUC) Advisory Committee on Energy Efficiency Workforce Development, the CPUC Working Group on Lighting, the State of California Schools of the Future Initiative Advisory Committee, and the California Air Resources Board advisory committee on Zero Emission Buses. I have also worked on the development of numerous electrical industry energy training programs including those focused on energy storage and micro-grids.

This opportunity to comment is appreciated.

I understand that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB). The issue is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

First, I would like to emphasize that I am not commenting on C-46 contractors installing PV solar, I am only commenting on whether C-46 contractors should be installing ESS.

Electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be corrected:

First and foremost, C-46 representatives claimed that C-46 contractors should be permitted to install and maintain ESS (when paired with PV) because they are the DC power experts who

have done so much PV and ESS for so many years that they do it best. Additionally they claimed that only a few C-10 contractors did PV or energy storage work and that generally C-10 contractors did not work with, or understand, DC power. One C-46 representative summed it up by indicating that they (C-46s) were the DC people, and C-10s are the AC people.

These are completely false claims. The truth is that C-10 contractors and the state certified electricians who work for them have so much experience, training and expertise in DC power that such a comparison is upside down:

### 1. Experience

A 2018 recent survey of C-10 contractors on DC energy work produced 33 responses. Just those 33 generated the following data points:

- DC battery energy storage installed: **1,600,150KW**
- Average number of years installing DC ESS: **31.04** years
- Number of DC PV residential installations: **170,335** homes
- Number of DC PV commercial installations: **1,706** projects
- Power generated by commercial DC PV installations: **791.4** Megawatts
- Number of DC PV utility scale installations: **205**
- Power generated by DC PV utility scale installations: **8,688** Megawatts
- Average number of years contractors have been installing PV: **13.74** years  
(A number of C-10 contractors have been installing PV for 20 – 30 years)

That's right, all these projects done by just 33 C-10's, and there are thousands of C-10 contractors in California. While these numbers represent only a fraction of the C-10 totals, they completely contradict the false and misleading assertions made by C-46 representatives.

### 2. Training

Electrician electrical safety training such as NFPA 70E, Electrical Safety in the workplace, and applied knowledge of the National Electrical Code is not only taught and reinforced but is constantly reviewed and applied throughout an electrician's entire working career.

As for the issue of DC versus AC electrical training, DC is the foundation upon which all electrical theory is based. DC theory is akin to learning the letters of the alphabet for an electrician. OHMs law where voltage = current multiplied by resistance is the most basic electrical equation and something that is taught to first year students. During the second year of the electrical training program, students are exposed to training, both in the classroom and related hands on applications, on DC solar photovoltaic systems. This training includes the full gamut of solar PV systems to include all related electrical equipment such as solar inverters, where the DC (direct current) that solar panels produce when activated by the sun needs to be converted to AC (alternating current)

that is compatible with the utilities electric grid that supplies electrical energy to buildings.

In the following years of training students learn about DC semi-conductors and electronics with multiple power sources, as well as variable frequency drives (VFDs) - including hands-on experience. VFDs reduce energy use by converting AC to pulsating DC and then lowering the frequency to achieve significant energy savings.

Throughout their training - a program consisting of over 1,000 hours of related classroom instruction and a minimum of 8,000 hours of on the job training - the National Electrical Code (NEC) is taught and reviewed to ensure the proper and safe installation of electrical systems – both DC and AC. Some real world examples of electrical work performed by state certified general electricians are DC motors, solar PV systems, battery storage, and UPS or uninterruptible power supply battery back-up systems.

Anyone who would say that C-10 contractors and electricians do not know, or work with, DC power clearly knows nothing about the electrical industry.

### 3. Expertise that is certified

C-10 electrical contractors and qualified workers have the knowledge and qualifications to effectively perform all necessary aspects of energy storage system installation that will ensure customers the greatest degree of reliability and safety from such systems. C-10 electrical contractors and electricians are trained in the science of this technology as well as all applicable safety codes and standards that have specific application to these systems.

California law requires that persons performing work as an electrician under a C-10 licensed contractor be certified pursuant to certification standards established by the Division of Labor Standards Enforcement. "Electricians" is defined as all persons who engage in the connection of electrical devices for electrical contractors licensed pursuant to Section 7058 of the Business and Profession Code, specifically, contractors classified as electrical contractors in the Contractors State License Board Rules and Regulations [Labor Code § 108 (c)].

Before a candidate can take the exam to become a California State Certified Electrician, the candidate must complete a minimum of 8000 hours of work for an electrical contractor installing, constructing or maintaining electrical systems covered by the National Electrical Code.

Prospective electricians must have 8000 hours just to take the exam, and it is very demanding test. How do we know? According to the California Department of Industrial Relations:

CA State Certified Electrician Exams taken to date	121,943
Exams passed to date	68,478
Exams failed to date	53,465
So, 43.8% fail!	

The workers for C-10 contractors have a great deal of electrical expertise, take a very tough exam, and can only work as certified general electricians if they pass.

**What about C-46 contractors and their employees?**

Let's compare C-10 and electrician expertise to the requirements for the workers employed by C-46 contractors, but first a point of information: Some consumers and businesses often confuse or conflate a contractor with an installer. For example, some think that because a C-46 contractor has to be licensed that their workers are also licensed. That is not the case and it is a very important distinction.

**There is NO minimum California state certification requirement for education, training, skills and experience of the workers who install PV systems for C-46 contractors. That means that if C-46 contractors are permitted to install energy storage systems, those same workers – with no minimum certification requirements for education, training, skills, and experience - would be installing and maintaining high powered systems, and putting worker, first responder, and public safety at risk.**

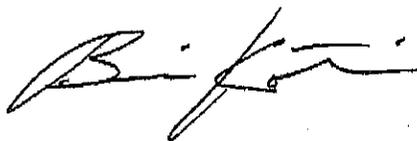
There is another claim that C-46 representatives have made: That this is a union or IBEW issue. In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the test - whether you are union or not.

In conclusion, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.

Based on my years of professional energy industry experience, I strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems – whether they are paired with a PV system or not.

Thank you.

Sincerely,



Bernie Kotlier

David R MacLean  
City of Los Angeles Building and Safety  
Principal Inspection Retired  
Electrical Inspection Division

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: For the CSLB - Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is David R. MacLean. I am commenting personally / on the license classifications authorized to install energy storage systems when paired with solar PV systems.

I have over 30 years of experience as an electrical inspector and 26 years of teaching in the electrical trades and a member of several U.L. standards panel related to solar. My experience includes Installation and inspection of commercial, Industrial and residential electrical system include small solar system on single family dwelling to large commercial solar instatallions with battery systems

Thank you for this opportunity to comment.

I understands that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB) regarding the installation and maintenance of electrical energy storage systems (ESS): Which category of contractor should be licensed to install and maintain electrical energy storage components and systems when they are paired with PV solar systems (PV).

The CSLB decision will involve a number of very serious electrical safety concerns. As an inspector, it is my duty and responsibility to keep workers, inspectors, first responders, and the public at large as safe as possible from many types of hazards and risks.

The area of energy storage is of special concern because it is relatively new to many, and it presents particular hazards and risks that are different and substantially more serious than those posed by PV. Energy storage systems vary widely in type, size, and power requiring a broad base of electrical theory and safety knowledge. The installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and

hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills, and experience required to be safe are much different.

Current ESS present far greater electrical hazards to workers, first responders, and the public such as arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver a severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As an inspector, it is evident to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too severe and substantial to allow C-46 contractors and their workers to handle energy storage components and systems.

I would strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,  
David R MacLean  
Principal Inspector

Joseph Sullivan  
LBCCEWG & NECA

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Hello, I am a member of the Long Beach Community Choice Energy Working group and work for the National Electrical Contractors Association (NECA) of greater Los Angeles. NECA LA represents approximately 350 licensed C10 Electrical Contractors who employ approximately 10,000 electricians. I am writing to express concern about the safety of C46 Electrical Contractors installing energy storage systems (EES). My concerns include the following:

- C46 Contractors do not have the necessary electrical safety training to install energy storage systems. C46 contractors are not trained in NFPA 70E which covers critical safety topics like arc-flash, arc-blast and electrical shock hazard.
- ESS are not simple plug and play systems. These can be quite complex. There are multiple types of EES: ultra-capacitors, flow batteries, fuel cells, hydro-generation, lead acid, etc. Some of these systems can bring significant amount of incident energy and require special training for installing, commissioning, and maintaining.
- The employees of C46 contractors are frequently not trained or qualified. Licensed C10 electrical contractors are required to employ state certified electricians who have completed at least 8000 hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections. C46 contractors can and do hire workers with no formal training.
- EES is frequently becoming grid connected which means the work of C46 contractors is putting at risk utility workers and our grid. Unskilled contractors and workers should not be tying into our grid.

Energy storage systems are complex, can vary significantly and pose great safety risks to installers, utility workers and the grid. This type of work requires training and licensed, experienced professionals which C46 contractors lack.

Sincerely,

Joseph Sullivan

Sincerely,

*(Name)*

*(Title if applicable)*

*(In your cover email, please remember to ask for a confirmation of receipt of your letter.)*

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments on Classifications Authorized to Install Energy Storage Systems (ESS)

Dear CSLB Chair and Members:

My name is Mike Farmer and I am a professional Firefighter / I am commenting personally re. license classifications authorized to install energy storage systems (ESS).

I am a 23 year veteran of the Fire Service and a current member of a full time professional fire department in the State of California. My experience in energy storage systems comes from my time spent in the United States Navy as a shipboard electrician and then 12 years spent working for C-10 licensed contractors as an electrician.

In my opinion as a fire fighting professional, treating energy storage systems as a subsystem of a solar photovoltaic (PV) energy system would be a mistake that the CSLB would not want to make.

While these systems may be paired together, they are separate systems subject to their own code, installation and fire safety standards. In addition, they pose very different fire and life safety risks such as electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

Battery cells in banks can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system.

If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures.

Unlike lead-acid batteries (which produce oxygen and hydrogen and need to be ventilated to avoid risk to persons), lithium-ion batteries do not produce exhaust gases during normal operation. However, an electrical fault can cause them to produce flammable and toxic gases. Also, the lithium-ion battery chemistry makes them prone to "thermal runaway" if they are damaged or overheated by overcharging. While some brands of lithium-ion batteries have features intended to

prevent uncontrolled cell rupture under runaway conditions, there is wide variation in battery technologies and safety technologies, and their effectiveness.

Battery casings can rupture as a result of pressure generated from a change in chemical reaction from over-charging or following an electrical short circuit. Electrolyte fluid or gel can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion. Some of these leaking compounds can be extremely toxic.

Therefore, energy storage systems present a serious safety risk for occupants and installers if incorrectly installed and/or operated. The type of risk and the measures needed to be taken to reduce these risks vary depending on the battery type. Accordingly, it is important that these systems are installed by contractors and workers that have the competency to understand the varying technologies and electrical configurations that may be encountered. Contractors and especially installation workers must be well-versed in electrical theory and electrical risk assessment methodologies. Workers must be qualified persons as required by the National Electrical Code (NEC).

To be clear, I am not just talking about large commercial energy storage systems. Relatively small UL listed ESSs connected to a residential circuit breaker box can also be a serious safety hazard to the public and to first responders. As firefighters, we rely on UL certification to reduce the risk of fire. Even so, unfortunately, UL certification does not eliminate it. Incorrect wiring, improper grounding, poor electrical isolation, and other factors can contribute to creating dangerous situations. There is also a misunderstanding about the effectiveness of circuit breakers. If an ESS is located too far from a breaker, the wrong size wire is used, or the breaker is beyond its recommended lifecycle, a fire can start before the circuit is broken. One of the least understood dangers is thermal runaway. It can happen in any size energy storage device – even a residential wall pack – and once it is underway a circuit breaker will have no impact on containing it. Proper installation by a qualified person is the first and most important line of defense.

My recommendation is that the CSLB follow the practice of the California Fire Code in regulating energy storage systems differently, and separately, from solar PV systems. The California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirements for battery systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems. The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems.

The California Fire Code requirements for battery systems are substantially different from what is required for solar PV systems and that is for very good reason – they are different systems with very different levels of risk that must be treated differently.

As energy storage system technology continues to advance and change, the building standard codes are constantly playing a game of catch up. Accordingly, it is critical that a contractor has the skill, knowledge, and experience necessary to ensure safe and proper installation of these systems beyond mere compliance with minimum code standards. It should also be recognized that to a great extent, the requisite skill, knowledge, and experience of a contractor is based on having state certified electricians performing the installations.

Once again, in my opinion as a fire fighting professional, treating an energy storage systems – of any size – as a subsystem of a solar photovoltaic (PV) energy system would be a mistake that the CSLB would not want to make. Energy storage systems do not become less dangerous or less complicated when paired with a particular electrical power source. It is irrelevant whether the energy storage system is powered by a solar PV system, a wind energy system, or the electric power grid. Because of the specialized skill and knowledge needed to install energy storage systems safely, only contractors that are licensed to install these systems as stand-alone systems should be allowed to install these systems.

In conclusion I strongly urge you to only allow C-10 contractors to install and maintain energy storage systems which are paired with PV systems.

If you have questions and or concerns please feel free to contact me.

Sincerely,

Mike Farmer

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear CSLB Chair and Members:

My name is Jeff Griffith and I am a 30 year veteran and second generation firefighter and current Fire Captain in Riverside County.

In my opinion as a fire fighting professional, it would be an error for the CSLB to treat an energy storage system as a subsystem of a solar photovoltaic (PV) energy system. It would create safety and risk exposure that the CSLB would not want. While these systems may be paired together, they are separate systems subject to their own code, installation and fire safety standards. In addition, they pose very different fire and life safety risks such as electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

Banks of battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures.

Unlike lead-acid batteries (which produce oxygen and hydrogen and need to be ventilated to avoid risk to individuals), lithium-ion batteries do not produce exhaust gases during normal operation. However, an electrical fault can cause them to produce flammable and toxic gases. Also, the lithium-ion battery chemistry makes them prone to “thermal runaway” if they are damaged or overheated by overcharging. Although some brands of lithium-ion batteries have features intended to prevent uncontrolled cell rupture under runaway conditions, there is wide variation in battery technologies and safety technologies, and their effectiveness. Battery casings can rupture as a result of pressure generated from a change in chemical reaction from over-charging or following an electrical short circuit. Electrolyte fluid or gel can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion. Some of these leaking compounds can be extremely toxic.

Because of these risks, energy storage systems pose a serious safety hazard potential for occupants and workers if incorrectly installed and/or operated. The type of risk and the measures needed to be taken to reduce these risks vary depending on the battery type and chemistry. Therefore, it is important that these systems are installed by contractors and workers who have the training, skills, and experience to understand the varying technologies and electrical configurations that may be encountered. Contractors and especially installation workers must be well-versed in electrical theory and electrical risk assessment methodologies. Workers must be qualified persons as required by the National Electrical Code (NEC). That means that they must have considerable electrical knowledge, training, and experience.

These concerns do not just apply to commercial energy storage systems. Small UL listed energy storage systems connected to a residential circuit breaker box can also be a serious safety hazard to the public and to first responders. As firefighters, we rely on UL certification to reduce the risk of fire. Unfortunately, UL certification does not eliminate it. Incorrect wiring, improper grounding, poor electrical isolation, and other factors can contribute to creating dangerous situations.

The effectiveness of circuit breakers is also misunderstood. If an energy storage system is located too far from a breaker, the wrong size wire is used, or the breaker is beyond its recommended lifecycle, a fire can start before the circuit is broken.

Thermal runaway is one of the least understood dangers. It can happen in any size energy storage device, even in a residential wall pack. Once it is underway a circuit breaker will have no impact on containing it. When thermal runaway ignites a structure fire, fire professionals will be mobilized to contain the blaze. Proper installation by a qualified person is the first, the most important, and the best line of defense. It is much easier, less expensive, and far safer to have qualified persons install residential or commercial energy storage devices than to fight fires.

As a fire fighting professional, my recommendation is that the CSLB follow the practice of the California Fire Code in regulating energy storage systems differently, and separately, from solar PV systems. The California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirements for battery systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems.

The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems.

The California Fire Code requirements for battery systems are substantially different from what is required for solar PV systems and that is for very good reason – they are different systems with very different levels of risk that must be treated differently.

As energy storage system technology continues to advance and change, the building standard codes are constantly playing a game of catch up. Accordingly, it is critical that a contractor has the skill, knowledge, and experience necessary to ensure safe and proper installation of these systems beyond mere compliance with minimum code standards. It should also be recognized that, to a great extent, the requisite skill, knowledge, and experience of a contractor is based on having state certified electricians performing the installations.

In summary, my opinion as a fire fighting professional is that treating energy storage systems of any size as subsystems of a solar photovoltaic (PV) energy system would be an error, and a serious one. It would be a mistake that the CSLB would not want to make. Energy storage systems do not become less dangerous or less complicated when paired with a particular electrical power source. It is irrelevant whether the energy storage system is powered by a solar PV system, a wind energy system, or the electric power grid.

Because of the specialized skill and knowledge needed to safely install energy storage systems, only contractors that are licensed to install these systems as stand-alone systems should be allowed to install energy storage systems. Another key safety factor is that contractor employees who do the installations must meet the NEC Code requirements that they are qualified persons. Solar PV contractor installation employees do not have the electrical knowledge, training, and experience to meet this safety requirement.

I strongly urge you to only allow C-10 contractors to install and maintain energy storage systems which are paired with PV systems.

Sincerely,

Jeff Griffith

Fire Captain/Paramedic Riverside County  
Vice-Chair, Palomar Health Board of Directors

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Erika Sherer

*(I am a private citizen who is concerned about safety.)*

Dear Members of the Contractors State Licensing Board:

I really appreciate that you are taking comments on this subject.

My understanding is that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is

having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

Even a small home energy storage wall unit is much bigger and a lot more dangerous than a portable consumer device. What's even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

I know the difference between an electrician and a solar contractor and there is a huge difference in electrical understanding and experience. Electrical contractors (c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer. Insurance companies have long said that electrical problems are the #1 cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate. Who would know how much training that solar worker has, if any at all? That's not a safety risk that average citizens should have to take.

The CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Ericka Her", followed by a long horizontal line extending to the right.

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Brandon Malone

*(I am a private citizen who is concerned about safety.)*

Dear Members of the Contractors State Licensing Board:

I really appreciate that you are taking comments on this subject.

My understanding is that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is

having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

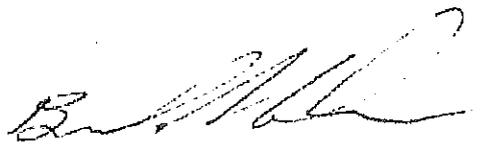
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The CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,



Brandon Malone

## Gretchen K. Newsom

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May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

Dear Members of the Contractors State Licensing Board (CSLB):

Thank you for taking comments on this important public safety topic and subject matter.

My understanding is that you will soon make a decision about which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (C46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the workforce who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

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Thank you.

Sincerely,

**EDWARD T. MASCK**

---

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

I am an electrical inspector, but writing as an individual and not on behalf of my employer. I have worked as an electrical inspector for the past 3-1/2 years, during which I have performed perhaps 9000 inspections, including my share of mostly residential solar. Starting almost a year ago, I have been seeing Tesla Powerwall systems, in both new and existing solar installations. Powerwalls in single family homes are the easiest and least demanding energy storage installations.

The Powerwalls themselves are a self-contained battery system with a built-in inverter, with the only connections a 30 amp circuit and a low voltage cable. You never see the batteries. A solar energy system and a Tesla Powerwall both supply AC from an inverter output to the building wiring, but their functions are different. The solar system is an instantaneous second source of power; the Powerwall's function is time-shifting that second source of power.

Tying a solar installation into the building wiring often means only installing a back-fed breaker into a panel to accept the inverter output. The same is true for a Powerwall. The complete Powerwall installation however, requires a Tesla Gateway grid-isolating contactor panel installed either as a service disconnect or in a feeder, often to a new critical load panel. Powerwall installation is therefore more difficult and is often much more like commercial work than residential solar. It may mean relocating a full panel of branch circuits and reconfiguring and reworking panel feeders, often in EMT. It often requires the installation of at least one additional panel. This is very much commercial, C-10 type electrical work, where this otherwise would not occur in a residential setting.

An important consideration in this matter is the solar contracting business model. Obviously, like anywhere, there are better and worse contractors. But in solar, I see this huge low end that is often fragmented by subcontracting and is all about using cheap, inexperienced labor on all levels. Even the contractors that I consider to be the best and enjoy working with the most, still have to play by these low-end rules whether they want to or not. Their field workers may be more experienced and longer tenured but still they are not the electricians I would expect to see on say a commercial project. These top end contractors may also have thoroughly competent degreed engineers in the office. But they are a small minority. They all have C-10 licenses. These contractors are competent to install Powerwalls.

From what I can tell if the low end solar contracting business model, subcontracting plays a large role. A larger firm may sell and design a system, and then subcontract or sell the job to a local solar installation firm. That local firm then may subcontract the electrical portion to an inexperienced "electrician." There are problems throughout the process. The design is done cheaply. The information for the roof installation comes from Google Earth. The take-off of the existing electrical situation is error-prone. The drawing have boilerplate language about code requirements, but none of it is read or followed in the field. This business model is lacking on all levels. They struggle with solar. How can they install Powerwalls?

As an electrical inspector, my first responsibility is to judge electrical installations for code compliance; a close second is to interact with electrical installers or their representatives. I have inspected many solar installations, and each one comes with an interaction with a solar contractor. Through my work I have concluded that in general, solar contractors, and most of those that I deal with have C-10s in addition to C-46s, represent the lowest level of the electrical installation business. Their workers in general are the least qualified and most poorly trained of any category of contracting that I deal with. Some of the workers even have years of experience, but they haven't learned from it; they keep making the same mistakes over and over. I also believe this often applies at job levels above the roof installer.

For the most part I inspect basic residential solar installations. The jobs have two aspects: the roof and the electrical wiring from the roof down. There are fewer problems on the roof, where the task is mainly the installation of the racking and panels. The errors mostly occur with the more traditional electrical work below. The common theme for my solar inspections is the general lack of installer experience and being easily tripped up by relatively minor situations. There is no sophistication or breath of experience. The job is new and a struggle; or old and still a struggle. It is the same old thing in a different house, but too often still a challenge.

I enjoy my second responsibility as an electrical inspector: working with people and helping them understand the situation and get the job done. But with some of these solar contractors, it can be a slog. The tasks are the same one job after another but the errors repeat job after job. Plan check corrections are disregarded. For example: on a routine solar installation, the homeowner told me on my eighth and final inspection, "You're like family you've been here so much." Often with multiple inspections, I'm dealing with a new face every time. There is no responsible party; the organization is dysfunctional; the lack of experience extends into management. This business model adopted by a substantial portion of the solar contracting industry is the reality that all parties must deal with.

Powerwalls are a category of inspection that has emerged only in the last year and only with one major and one minor contractor for me so far. Both of them are competent contractors and have C-10s in addition to other licenses. Some jobs pass on the first inspection and some require correction. These contractors are up to the task.

In addition to the Powerwalls, which would be Code-classified as an "Energy Storage System, Self-Contained," I did inspect a built in place system. It was in a net-positive energy "Nanogrid" condominium building. In addition to three Powerwalls for each unit, it had battery racks and separate inverters for each of the three house power phases. The main house load was a commercial elevator. The one-line drawing for this system was quite involved. The job was competently installed by a C-10 contractor. I would consider this to be medium difficulty commercial work. A low end solar contractor would not know where to begin on this job, but it is energy storage work just the same.

I think that it would be fair to say that of any category of those who may comment on this issue, the group I belong to, inspectors of residential solar and energy storage systems, has by far the most direct, first-hand and intense exposure to this matter. We perform these inspections frequently. We inspect the installations and we interact with the contractor's representative. We judge the work and we size up the people. This comes from direct experience. This is what we do for a living.

If electrical licensing standards are to be relaxed, it should be where that category of work is populated by the thoroughly qualified. With solar, it is just the opposite. If C-46 contractors want to do the more demanding and traditionally electrical category of energy storage work, let them take what should be an easy step and get a C-10.

Thank you,

Edward Masck  
Electrical Inspector

**Young, Heather@CSLB**

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**From:** Andrew Hallam  
**Sent:** Thursday, May 17, 2018 8:32 PM  
**To:** Young, Heather@CSLB  
**Subject:** Classifications Authorized to Install Energy Storage Systems

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Members of the Contractors State Licensing Board.

My name is Andrew Hallam, I am a lifelong resident of California who is writing to you because I am concerned about the safety of the citizens of this State.

I really appreciate that you are taking comments on this subject.

My understanding it that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be really dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have ignited in flames. Now imagine the potential hazard that could exist in solar panels that have far greater potential energy within them when strung together in a series of circuits atop some unassuming homeowners rooftop. I am aware that the future of energy storage is in renewables, and I am a big supporter of that. I believe in the mandate to make renewable energy a sustainable source of energy production on the building of the future of this state. However, I would feel much safer knowing that it was being done in a safe and sustainable way, that means electricians doing work that involves any and all electricity.

I know that the state has the well being of all of us at heart, I just hope that it thinks through the potential risks of allowing someone who is not state certified to handle electrical work to be doing that work. If I want to get my house painted I call up a painter, not a plumber. And if my sewer line gets clogged I call a plumber, not a carpenter. The analogy is simple, and might seem overtly uncomplicated. But that's the way we get things done and it works. Why change the rules of the game now. I mean otherwise, we might as well just get rid of license contractors all together and just hire "handymen" to do everything for us. I know a pretty good one that works under the table, but doesn't any taxes, and doesn't carry any insurance. So buyer beware!

In all seriousness, though, the CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sur

that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors, and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,

Andrew Hallam

David Mauro  
Concerned Citizen of California

Ms. Heather Young  
CLSB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email [Heather.Young@clsb.ca.gov](mailto:Heather.Young@clsb.ca.gov)

Re: Written Comments – Public Safety Concerns Related to Energy Storage Systems.

My name is David Mauro and I thank the board for the opportunity to submit my written comments.

I am addressing Public Safety concerns related to Energy Storage Systems (ESS).

I am a California state certified General Electrician and have been in the electrical trades for over 30 years and have completed a 5-year state approved apprenticeship for an Electrician. Because of my training, experience and knowledge I know that C-10 contractors and state certified General Electricians are qualified to safely and effectively install and maintain energy storage systems.

It would be a highly risky and technically improper for the CSLB to treat energy storage systems as a subsystem of a solar photovoltaic (PV) energy system. While these systems can and will be increasingly paired together, they are highly distinctive and separate systems – subject to their own inherent risks, technical specification, codes, installation and fire safety standards. Most energy storage systems are battery-based and pose very different fire and life safety risks such as, fire, arc blast, thermal runaway, explosion and/or exposure to released gases and hazardous chemicals. Some commonly characterized risks include:

- Banks of battery cells can operate at critically hazardous voltages and must be electrically isolated while any work is being performed on the bank, individual cells, groups of cells, or electrical equipment that constitute upstream or downstream parts of the system.
- A battery storage system can cause an arc flash if it suffers a short circuit or fault. An arc flash can have temperatures above 12,000°C, capable of melting metal and/or causing fires and explosions. Generally higher battery energy

storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures unless the fault currents are removed quickly by correctly rated and correctly installed electrical protective devices.

- Lead-acid batteries generate hydrogen and oxygen when charging and need adequate ventilation to avoid an explosion, fire or risk to occupants. Lithium-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault. Moreover, the chemistry of lithium-ion batteries makes them prone to 'thermal runaway' if they are damaged or overheated by overcharging. While some brands of lithium-ion batteries have superior features intended to prevent the uncontrolled rupture of cells under runaway conditions, technologies vary widely.
- Any one, or a combination, of these risks may cause serious injury or death to a worker, or member of the public who may be too close to an energy storage system when there is an accident.

I recommend that all aspects of energy storage system installations should be undertaken with the involvement of a properly licensed professional electrical contractor(s), employing trained and qualified electrical workers, for a number of reasons, including **Electrical Expertise**.

C-10 electrical contractors and qualified workers have the knowledge and qualifications to effectively perform all necessary aspects of energy storage system installation that will ensure customers the greatest degree of reliability and safety from such systems. C-10 electrical contractors and electricians are trained in the science of this technology as well as all applicable safety codes and standards that have specific application to these systems.

Sincerely,

David Mauro

*Stephanie G. Croce*

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

Dear Members of the Contractors State Licensing Board:

My name is Stephanie Croce and I really appreciate that you are taking comments on this subject. My understanding is that you will soon be making a decision about a very important safety issue: determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have strong feelings about it.

Although solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work.

It's hard to believe that our state would even consider that!

Those who have been paying attention over the last few years know that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, and hover boards have just ignited in flames. That has been bad, but what would be much worse is having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the risk of an explosion or fire.

A small home energy storage wall unit is still much bigger and a lot more dangerous than a portable consumer device. What's even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

The difference between an electrician and a solar contractor is sizable, and there is a huge difference in electrical understanding and experience. Electrical contractors (c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer.

Insurance companies have long said that electrical problems are the number one cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate. How would the average person know how much training and experience a solar worker has, if he or she has any at all? That's not a safety risk that average citizens should be expected to take, or suffer.

CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do what is right and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,

*Stephanie G. Croce*

Stephanie G. Croce

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

Dear Members of the Contractors State Licensing Board:

My name is Lukas Curry and I am a Project Management Professional (certified PMP) who frequent works in the renewable energy industry. While working within renewables, I frequently have had to deal with PV solar and energy storage systems of many technologies and various sizes.

I would like to present my two sense regarding the ongoing discussion with C46 contractors who wish to install energy storage.

My understanding is that you will soon be deciding upon an important safety issue, that is determining which contractors are licensed to install energy storage systems.

While solar contractors (c46) may be able to install solar, they do not have the electrical skills and experience to install these types of dangerous electrical systems. According to what I've researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. It's hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. Thousands of laptop computers, cell phones, hover boards, etc. have just ignited in flames. That has been bad, but what would be much worse is having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

Even a small home energy storage wall unit is much bigger and a lot more dangerous than a portable consumer device. What's even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

I know the difference between an electrician and a solar contractor and there is a huge difference in electrical understanding and experience. Electrical contractors (c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer. Insurance companies have long said that electrical problems are the #1 cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate. Who would know how much training that solar worker has, if any at all? That's not a safety risk that average citizens should have to take.

The CSLB has the authority to decide what type of contractors install energy storage. With all due respect, you also have the responsibility of keeping us safe. Please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state certificate should be allowed to do these installations.

Thank you.

Sincerely,  
Lukas Curry  
Project Management Professional

May 17<sup>th</sup> 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Email: Heather.Young@cslb.ca.gov

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Heather, CSLB chair and members:

My name is Eduardo Hierro, I want to express my gratitude for the opportunity given to voice my concerns with the safety issues that will arise if Energy Storage System (ESS) are allowed to be installed by other than Electrical Contractors that do not hold a C10 license because the state of California, rightly so, requires that the employees of C-10 contractors who install and/or maintain electrical equipment must be state certified general electricians, while C-46 contractors have no minimum California state certification requirements for education, training, skills, and experience. That puts worker and public safety at risk. A State Certified Electrician is required to complete 8000 hours on the job training and 900 hours in classroom training before he can become State Certified. I am a seven-year California State Certified Electrician veteran (12 years in the profession) that works during the day for Cupertino Electric and a five-year instructor that trains State Certified Electricians and apprentices at the NetZero Energy in San Leandro California during the evenings. In my opinion as a professional State Certified Electrician I believe that it will be a grave mistake to consider that an Energy Storage System (ESS) can be considered a subsystem of a solar Photovoltaic system and therefore installed by workers that are unaware, untrained, and unqualified to deal with the dangers of Shock, Arc Faults, and the complexity and interconnectivity of the electrical systems, such as the consequences of hysteresis caused by the PWM (Pulse width modulator) as an intrinsic component of ESS. Also, understanding voltage drops, or ampacity de-rating due to temperature adjustments or number of conductors in a raceway, that if not properly considered can cause a fire. So, understanding the interconnectivity of these electrical systems is imperative if we do not want to expose the public or untrained workers to the dangers inherited to the electricity.

I will like to clarify that my intent is to focus on whether C-46 contractors should install and maintain energy storage systems (ESS). My comments are not about C-46 contractors installing PV solar. ESS are separate systems that pose different risks, require different expertise, and have different permitting and code requirements. It requires five years of training to understand functionality, safety design considerations, and proper construction of electrical systems that are interconnected. The complexity, hazards, and operation of this systems poses some intrinsic hazards that are such that there is a push to create the NFPA 855, Installation of Stationary Energy Storage Systems. It will include guidance for a wide range of battery and chemistry types on thorny issues such as installation, ventilation, maintenance, operation, decommissioning, and fire prevention. The draft also includes an appendix of best practices for system hazards. The first edition of NFPA 855 could be published as soon as early 2019.

Updated: 3/18/2019

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During an Arc Fault temperatures of 35000 °F are reached, at such temperatures the copper expands at a rate of 1 to 64,000 parts when it transforms from solid to gas sending shrapnel at speeds exceeding 750 miles per hour hence the importance of understanding that switch gear and electrical rooms need to be design to withstand such energies to reduce hazards. Understanding how to mitigate this hazards through the mandates of the NFPA 70E are crucial to provide a safe working system and environment for the public and the workers that are constructing it or operating it. The understanding of the National Electrical code (NEC) publication NFPA 70 allows us State Certified Electricians to understand the electrical systems design and construction that will remove and mitigate this dangers. Understanding the proper selection of Over Current Protection Devices (OCPDs) reduces the exposure of the energy available to create an Arc Fault. Furthermore, a PWM is an intrinsic component of ESSs and are responsible for harmonics that add current to the grounded conductors of the system increasing the risk of fires. Electricians through the study of publications like the NEC, the NFPA 70E, the NFPA 70B, and through the understanding of electrical systems designs and construction know how to compensate and remove these risks from the systems. Moreover, another crucial part of our training resides in understanding the process of removing the hazards of shock, fire, and arc fault through the mandates of the NFPA 70E. More important, the contents of the NFPA 70E are based on two very important facts: First, the electrical system has to be properly installed as per the NFPA 70 (NEC). Second, the system has to be properly maintained as per the NFPA 70B. As professionals and Certified Electricians, we understand the benefits for customers and workers alike of not working energized because we understand the negative consequences to the public and worker can range from life crippling to fatal. In the rare occasion that work has to be performed energized, we receive extensive training as how to mitigate the hazards by the understanding and analyzing the NFPA 70E we learn how to determine Approaching Boundaries, Arc Flash boundaries, on what consists an incident energy hazard analysis, determine the arc flash category and the PPE required to performed the work with the hazards present. Energized work has to be approved by all involved customers, owners, contractors, and workers and can only be performed if a hot work permit is signed by all mentioned above. Most important we educate owners, customers, and general contractors of the fatal consequences to personnel and catastrophic ones to equipment and from this perspective we instigate in the customer the value of working de energized. Again, I recommend against allowing untrained personnel to install ESS. The need to have qualified workers, State Certified Electricians, installing ESS is essential and it will be irresponsible not to convey to the Contractors holding the C-46 to consider obtaining a C-10 license rather than placing workers, public, and equipment at risk of fatal and catastrophic failures if they want to expand their scope of work. I firmly believe that lives will be lost if unqualified workers are allowed to install ESS directly as the installation is being build or indirectly to the public caused by poor installations not build according to code, resulting in fires, in an Arc Blast, or worse death.

It can be argued that these unqualified workers can install ESS because they receive safety training through OSHA 10 and 30. But, OSHA does not even begins to mention the intrinsic hazards to the electrical profession, the few references made in OSHA are based on the NFPA 70E the portion that deals with de energizing. If OSHA covered these hazards there would be no need or references made to the NFPA 70E. It also can be argued that PV and ESS are interconnected but not understanding the workings, and hazards involved in the installation and required maintenance can lead to fatalities and improper installation of the electrical system. Furthermore, as mentioned before State Certified Electricians receive training on the electrical systems complexity, interconnectivity, and how it affects the whole system in terms of functionality, fire, shock, and Arc Fault. We have publications that we study to help us remove and mitigate these issues like NFPA 70, 70E, 70B, along with an electrical understanding of issues arising from poor installations and maintenances procedures. We spend five

years receiving on the job training and technical training at our training facilities because the complexity, regulations of proper installation, and the safety associated with our profession. All this training and the constant training and upgrading we receive makes us the qualified workers needed to install Electrical systems that are safe, functional, and effective for the workers and the public. The consequences of not understanding the hazards associated with the electrical industry leads to fatalities and catastrophic failures. Do we really want to run that risk?

At our electrical training facility, apprentices, we form future State Certified Electricians, we spend two semesters learning about the inherent dangers of our profession related to Arc Faults and electrical shock. We learn how to mitigate these hazards through safety procedures and regulatory mandates of the NFPA 70E publication.

In our program, we learn how to mitigate these hazards among many other considerations that affect them directly and indirectly. Emphasis is placed in the removal of the hazard. In the case of an ESS is more elaborated because it contains stored electrical energy and added steps are needed to reach such state. This requires the understanding and implementing the mandates of article 120 in the NFPA 70E, such as the 6 steps of Lock out and tag out procedure and the removal of potential energies, but safety regulations and mandates are not the only aspects that contribute in establishing electrical safety related work practices. We also study in depth the following aspects of our industry that contribute to mitigate and avoid the Electrical Shock and Arc Fault hazards that are part of the electrical systems that we install, maintain, and troubleshoot. These disciplines are:

- Electrical Safety Culture
- Electrical Hazard Awareness
- NFPA 70E
  - Safety Related Work Practices
  - Safety Related Maintenance Requirements
  - Safety Requirements for Special Equipment (i.e., Batteries and battery rooms, Electrolytic cell, etc.)
- Lockout, Tagging, and the Control of Hazardous Energy
- Fundamentals of 3 Phase Bolted Fault Currents.
- Justification, Assessment, and Implementation of Energized Work
- Bolted and Arcing Fault Current and Reading Time-Current Curves
- Methods to Accomplish the Arc Flash Risk Assessment
- Maintenance Considerations and OCPD Work Practices
- Electrical Systems Design and Upgrade Considerations

Some of the important points to highlight here are that in order to familiarize a contractor to the dangers of the electrical profession it takes training that it is regulated, mandated, and constantly changing. There are MOPs that need to be developed, they need to be written filed and available to all employees. They need to be audited and reviewed. The employer, contractor, is responsible to train its employees on the hazards of the job and to keep them in a safe work environment free from any hazards. Training has to occur at a minimum of every three years or retrain in new equipment or systems that the worker is unfamiliar with. This is what defines a qualified person. She/he should be able to understand and mitigate the dangers present in a particular system or job. Furthermore, the NFPA 70 E requires the electrical installations to have been installed as per the NFPA 70 (NEC) and to have been properly maintained as per the NFPA 70B. We also spend a great deal of the safety

curriculum understanding the importance of Short Currents (bolted currents) and how it relates to the incident energy of an Arc Fault. It also helps to determine the IR (interrupting Rating) of the overcurrent protection devices (OCPDs) critical to the safely functionality of an electrical system. We also stress on the importance of maintenance (NFPA 70B and Chapter 2 of the NFPA 70E) and how if an OCPD is not properly maintained, it can have a failure rate of 50%. We determine the value of the Arc Rated PPE through the NFPA 70E. I want to remind you that working energized is the last resource and the NFPA 70E states the three instances when this permitted. We understand that Arc Rated PPE does not protect the worker fully because it only protects the worker 50% of the time from second-degree burns. We also stress that a 40Cal/cm<sup>2</sup> is only there to provide you with an open casket funeral. Most important, we spend part of the curriculum learning how to ground electrical systems, or deal with battery backup systems, as many ESS have, to remove the store electrical energies that pose a hazard.

Concluding, we all agree that safety is a serious consideration. It requires knowledge of the construction of the electrical system as per the NEC, its efficient and safe functionality, its proper maintenance as per NFPA 70B, and receiving the training to recognize and avoid the hazards involved, NFPA 70E. The statement earlier defines a qualified worker from one that is not. It is not only the mandates of the NFPA 70E that help us mitigate these hazards, but understanding the systems at play, their maintenance, their construction, their design considerations of rating and OCPD along with establishing an infrastructure that emphasizes a safety culture through training and established MOPs(Method of Procedure). I sincerely urge you to reconsider the safety aspects that involves the installation of ESS and who better to handle it that a contractor that understands the regulations, mandates, and procedures set in place to provide its workers and the public with a safe environment from the aspect of regulation, installation, and proper maintenance of the equipment. I cannot see a better candidate than a qualified C-10 Contractor that is mandated by the State to use State Certified Workers, who receive a minimum of five years on the job training and a minimum of 900 hours of schooling. Last, Solar PV contractor installation employees do not have the electrical knowledge, training, and experience to meet this safety requirement, thus, I strongly urge you to only allow C-10 contractors to install and maintain ESS.

Sincerely yours

Eduardo Hierro

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: For the CSLB - Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Bernie Ruffenach. I am commenting personally on the license classifications authorized to install energy storage systems when paired with solar PV systems.

I have 50 years of experience as an electrician. My experience includes all types of wiring, inspections, plus teaching the technical, code, and safety aspects. I have expertise in NEC, NFPA 70E and OSHA standards. Subject matter expert on high voltage and high power systems.

Thank you for this opportunity to comment.

I understand that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB) regarding the installation and maintenance of electrical energy storage systems (ESS): Which category of contractor should be licensed to install and maintain electrical energy storage components and systems when they are paired with PV solar systems (PV).

The CSLB decision will involve a number of very serious electrical safety concerns. As an inspector and teacher, it is my/our duty and responsibility to keep workers, inspectors, first responders, and the public at large as safe as possible from many types of hazards and risks.

The area of energy storage is of special concern because it is relatively new to many, and it presents particular hazards and risks that are different and substantially more serious than those posed by PV. Energy storage systems vary widely in type, size, and power requiring a broad base of electrical theory and safety knowledge. The installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process. While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe are much different.

Current ESS present far greater electrical hazards to workers, first responders, and the public such as arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As an inspector and teacher, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,

Bernie Ruffenach  
California General Electrician License  
Colorado Master Electrician License  
IAEI Certified, Commercial Electrical Inspection  
IAEI Certified, Commercial Electrical Plan Review  
ICC Certified, Commercial Electrical Inspection  
ICC Certified, Commercial Electrical Plan Review  
INPO Certified Electrical Instructor  
UL, Standards Technical Panel Member, STP67

## Nicholas J. Segura

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Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

Thank you for the opportunity to comment on the CSLB debate concerning C-46 vs C-10 licenses on Energy Storage Systems (ESS). Please share my letter and comments regarding ESS public safety concerns with the CSLB.

I am a Navy Veteran with over 20 years of experience as a California State Certified General Electrician, and I serve my community as a Board Member for Sweetwater Union High School District - the largest secondary school district in California. I graduated from a state approved Inside Wireman Apprenticeship program and received my Journeyman Wireman Electrician Certificate from Palomar College, and I have been trained on AC/DC theory, electrical safety and best practices.

I have worked for a C-10 contractor for over 24 years and installed many complex DC battery back-up systems including uninterrupted power supplies for UC Data Centers, AT&T switch sites, and Kaiser Permanente Hospitals. Each one of these systems are very different in installation technique and operation, and all require expertise and technical training to ensure proper installation and sound public safety.

Only C-10 contractors are required to certify and employ a skilled and trained workforce by utilizing State Certified General Electricians and Apprentices - this protects the public's safety and ensures that workforce has a strong education of the fundamentals of electricity (DC/AC) in order to work on the wide variety of battery systems.

To elaborate further, C-46 contractors can, and do, hire workers with no formal training. According to data collected by UC Berkeley, these same untrained workers are paid as little as \$10 to \$11 per hour. Putting these low wage, uncertified workers to work on energy storage systems - which if installed improperly are extremely dangerous - puts workers and end consumers at risk. Again, and in contrast, C-10 contractors are required to employ state certified

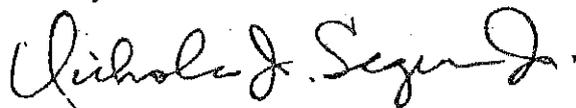
electricians who have secured at least 8,000 hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections.

Pertaining to the energy storage unit that was demonstrated at the CSLB on April 26, 2018, and other "plug and play" items - these energy storage systems are not as simple, easy and safe as claimed. A UL listing means that equipment samples have been tested for safety but it is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused.

When not installed correctly, even small residential ESS units can start a fire which could engulf a residence. While commercial or larger energy storage systems present even greater risks, there is no such thing as a safe "plug and play" ESS. What makes any size ESS safer, is proper installation and maintenance - which is a direct result of quality training, experience and certification.

As an electrician, veteran, and school board member, I ask that the CSLB place public safety as a top priority and ensure that Energy Storage Systems are installed and operated by a skilled and trained workforce, one that can only be guaranteed by a C-10 contractor. Thank you for your time and consideration of this matter.

Sincerely,



Nicholas J. Segura  
Board Member, Sweetwater Union High School District  
California State Certified Electrician with over 20 years of experience  
Navy Veteran

**Young, Heather@CSLB**

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**From:** joseph estrada  
**Sent:** Friday, May 18, 2018 11:13 AM  
**To:** Young, Heather@CSLB  
**Subject:** Energy Storage System classification

Hello Ms. Young,

Thank you for presenting my comments to the Board on my behalf. I have been an electrician for almost 30 years and have been a California State certified general electrician since 2004. I was present at the recent hearings and I heard a few things that I feel urged to respond to.

The first issue is regarding the C46 contractors considering themselves the "experts" at DC energy while portraying the C10 contractors as experts in AC energy. I live and work in the Central Valley and C10 contractors have installed at least a gigawatt of solar energy systems in the past few years. There is currently over 2 gigawatts of solar systems to be installed in the next handful of years that will also be done by qualified and competent C10 contractors. I'm not implying that C46 contractors are unqualified or incompetent, but rather stating that C10 contractors are energy experts in ALL aspects of electricity.

Secondly, by the CSLB's own definition of a C46 contractor, "Solar contractors install, modify, maintain, and repair thermal and photovoltaic solar energy systems.. A licensee classified in this section **shall not** undertake or perform building or construction trades, crafts, or skills, **except when required to install a thermal or photovoltaic solar energy system.**" Neither of these systems are required to be installed with one another. In fact, the National Electrical Code even has separate articles relating to the proper and safe installation of each system that is not reliant upon one another. (Art. 690 and 706) The National Fire Protection Association sees this technology as so important that they highlighted it on their website:

**"With the present growth of the energy storage industry, NFPA is actively engaged in a number of diverse initiatives including standards development, training, and research projects aimed at promoting the continued safe and sustainable expansion of this renewable technology."**

Lastly, and most importantly in my opinion, is in regards to a comment that was made by a C46 contractor/advocate at the hearing. He stated that they've been doing this work before any certifications were required, such as the NABCEP certification, and that they "learned on the fly". I'm sure he meant that as a testament to his ingenuity and resourcefulness, but the fact of the matter is this.....with the inherent dangers associated with the highly condensed power in these Energy Storage Systems, we **CAN NOT** afford to "learn on the fly." Only state certified general electricians, such as those employed by C10 contractors, that are well versed in ALL aspects of the electrical industry should be the ones installing these critical and transformative systems.

Thank you for your time and attention to this extremely important issue. Good luck with your deliberations.

Respectfully,  
Joseph Estrada, General Electrician

Updated: 3/18/2019

654

Concerned citizen

May 16<sup>th</sup>

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: C-10 / C-46 Contractor Scope of work inclusion of battery storage

I appreciate the opportunity to address the Board and offer my informed insights regarding C-46 contractors being allowed to perform battery/ electrical storage work under their license.

I am a California State Certified Electrician and have worked in the electrical construction industry since 1972. I have worked on both solar energy projects and projects that included battery storage.

Battery storage is not an integral part of a renewable energy project any more than high-voltage line work is part of a commercial facility project. They may exist in harmony but each comes with its own required skill set necessary for safe and efficient installation and operation, and each poses completely different challenges.

Battery storage is sometimes employed as a method of enhancing a renewable energy storage project but it comes as an add-on rather than a necessary part. In fact, battery storage systems have been installed in many other electrical systems with no renewable component at all for years! Emergency power, uninterrupted power source for computer and data-collection, life-safety systems found in hospitals, and breaker and switchgear actuation systems all use battery storage.

Our company and other C-10 Contractors have been doing this type of work for well over 50 years. As such, we have developed protocols and safety procedures - many required and reviewed by owners and public entities - before we are allowed to work on their projects.

This safeguards the workers installing the battery systems as well as the occupants or members of the public who may find themselves in close proximity to these battery systems when they are in use.

As for the batteries themselves, this is a constantly evolving technology. The battery systems we install today are very different from the systems we installed even a few years ago – in both design and componentry. State Certified Electricians are trained in the maintenance and installation of these systems across a broad category of applications and power storage requirements.

Large solar projects, such as at the 240 Megawatt Centinela Project in Calexico, CA completed by our company a few years ago, typically deliver power at 480 volts (By the way, a kilowatt is 1000 watts, a megawatt is a *million watts*!). Even a typical parking lot array at a local school provides power at 480 volts! This is a far cry from the 220 volt, 7 kilowatt systems found on residential rooftops.

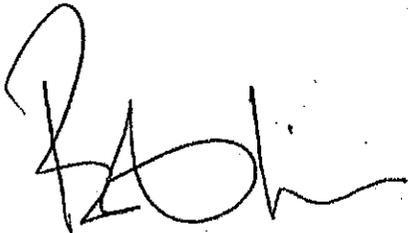
This dramatically-increased power and voltage increases the need for worker training and adherence to established best safety practices.

The C-46 license was initially developed to serve the expected demand for residential rooftop "renewable" energy systems. Wisely, the scope of work for these contractors was expressly limited to "install, modify, maintain, and repair thermal and photovoltaic solar energy systems".

To add "battery storage systems" to this list defeats and degrades California's commitment to quality construction performed by a workforce verifiably trained in skills, knowledge, and safety.

As these and other electrical construction technologies move rapidly ahead, it makes sense that the C-10 contractors and their workers that are familiar, efficient, safe, and well-trained maintain California's high standard of construction quality and safety, rather than add it to the scope of those who are intentionally limited to one unrelated, repetitive, and narrow task.

Sincerely,

A handwritten signature in black ink, appearing to read 'Bob Lilley', with a large, stylized initial 'B' and a long horizontal flourish at the end.

**Bob Lilley**  
*Business Development Director*

*Contra Costa Electric, Inc.*  
*925.229.4250 office*  
*925.335.2860 direct*

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# EARL HAMPTON

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May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Good morning Ms. Young,

I'd like to first thank you for the work you do and thank you for the opportunity to comment on the installation of Energy Storage Systems (ESS).

My name is Earl Hampton and I'll be addressing concerns around public safety with regards to ESS. My comments are focused on whether C-46 contractors should install and maintain energy storage. My comments are not about C-46 contractors installing PV solar. These are separate systems that pose different risks, require different expertise, and have different permitting and code requirements.

I have been working in the electrical construction industry since 1993 and have been a California State Certified since 2003. In that time, I have worked extensively with teams of electricians on large and small scale commercial projects.

The energy storage unit that was demonstrated at the CSLB on April 26<sup>th</sup>, and other similar purported "plug and play" ESS are not as simple, easy and safe as claimed. A UL listing is no guarantee of safety. It only means that equipment samples have been tested for safety but it is not a guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, the load may be too far from the breaker, wire sizes may be wrong, or the breaker may be too old or have been overused. When not installed correctly, even small residential ESS units can start a fire which could engulf a residence. Commercial ESS present even greater risks. There is no such thing as a safe "plug and play" ESS. What makes any size ESS safer, is proper installation and maintenance which is a result of training, experience and certification.

Cal/OSHA training is totally inadequate to prepare and protect C-46 installation employees and the public. Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a

May 17, 2018  
CSLB Executive Office  
Page 2

*Guide to Electrical Safety* (attached as a reference) which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems: Relying on Cal/OSHA general safety training, or the attached guide, to install and maintain ESS puts workers and the public at great risk.

Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

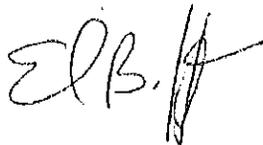
Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

A key distinction between C-46 contractors and C-10 contractors is that C-46 contractors can, and do, hire workers off the street with no formal training and put them to work for as little as \$10 to \$11 per hour. Putting these low wage, uncertified workers to work on energy storage systems - which if installed improperly are extremely dangerous - puts both workers and end consumers at risk. In contrast, C-10 contractors are required to employ state certified electricians who have secured at least 8,000 hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections.

The only to ensure that ESS systems are safely and properly installed by qualified State certified General Electricians is to require that they are only installed by C-10 contractors required by law to employ California State Certified Electricians.

Respectfully,



Earl Hampton

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

As a state certified general electrician in the State of California since 2006, I would like to share a few thoughts on the need to have qualified C-10 contractors perform the installation of Energy storage systems (ESS).

Energy storage and PV are separate systems. The C-46 license expressly restricts the scope of work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system.

Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a different and much more predictable process.

Energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. When connected to the grid, these systems can also pose risks to utility infrastructure and utility workers.

These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

Another key difference between C-46 contractors and C-10 contractors is that C-46 contractors can, and do, hire people off the street for as low as \$11 per hour and put them to work with little to no training. C-10 Contractors, in contrast, are required to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

Data on safety/quality of C-46 work ("no evidence"): C-46 leadership used the same wording in at least two comments to claim that there is "no evidence" of problems with C-46 installations and maintenance. Their words were chosen carefully because that does not mean there were no problems. According to the County of Los Angeles, there is no comprehensive county, nor statewide reporting system to collect data on electrical problems related to C-46 contractor installation or maintenance work.

Cal/OSHA training is totally inadequate to prepare and protect C-46 installation employees and the public: Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* (attached as a reference) which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

The best way to ensure that Energy storage systems are installed properly, safely, and by qualified, State certified electricians is to ensure that they are only installed by C-10 contractors that are required by law to employ them.

Sincerely,

*Samir I. Kharufeh*  
CA. State General Certification # E-113260-G

Benjamin Souza  
-Certified General Electrician-  
Card # 158489

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Ms. Young

*Please take into account these facts when considering what classification of contractor can be allowed to install and maintain Energy Storage Systems. The National Fire Protection Association(NFPA) has spent the last few years conducting hazard assessments associated with Energy Storage Systems<sup>1</sup> and the batteries that go with them. The NFPA completed studies into the hazards of Lithium ion batteries in 2011, 2014, and 2016 and Energy Storage Systems(ESS) in 2016. The studies were an attempt to understand the dangers these systems pose and how current codes and standards for manufacture, installation, maintenance, and incident response will influence the implementation of ESS in our society.*

*Due to the lack of knowledge and understanding related to the enabling technology as well as the Moore's law pace of advancement with the technology; the installation and maintenance of Energy Storage Systems needs to have a rigorous prerequisite list for anyone considering the task. The continued increase of battery storage on a global scale will soon become exponential. Current estimates from 2017 have a total of 11 Gigawatt hours(GWh) for battery storage systems currently installed. This number is expected to rise to somewhere between 100-167 GWh by 2030<sup>1</sup>. This fact alone should be a clear indicator that diligence must be taken when considering what type of workers and contractors will be allowed to perform installation or maintenance of an ESS.*

*Any person who wishes to install or maintain Energy Storage Systems needs to have an understanding of the science behind the system as well as how any type of variable involved in the installation or maintenance can effect that stability or safety of the system. In December 2014 by the US Department of Energy, Office of Electricity Delivery and Energy Reliability issued a report called "Energy Storage Safety Strategic Plan", in their executive summary of the report, it is called out that owners, regulators,*

and responders need to understand codes and standards for the installation of ESS. Also, parties responsible for the oversight, regulations, and incident response need to be clearly identified<sup>2</sup>.

For a C-10 contractor to employ workers to perform electrical work, their workers must be either registered with the state as an electrician trainee, or have taken a certification test that proves amount of hours spent performing electrical work and a understanding of the National Electrical Code. For a C-46 contractors, by definition from the CSLB, can only "install, modify, maintain, and repair thermal and photovoltaic solar energy systems. A licensee in this classification shall not undertake or perform building or construction trades, crafts or skills, except when required to install a thermal or photovoltaic solar energy system."<sup>3</sup> In comparison to a C-10 contractor that "places, installs, erects or connects any electrical wires, fixtures, appliances, apparatus, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."<sup>3</sup>

The Department of Energy's report for Energy Storage Safety Strategic Plan focuses on four key elements, ESS Safety Technology, Risk Assessment and Management, Incident Response, and Codes-Standards-Regulations.<sup>2</sup> ESS Safety Technology is still developing as the science behind the technology is continuing to change and evolve. Manufacturers of batteries used within ESS are still developing different ways to simulate short circuits within batteries and other various means of failures to better their manufacturing quality and safety for the end user.

In a report issued by the Fire Protection Research Foundation covering the lithium-ion battery hazards and uses, it is stated that battery failures can result from multiple ways. Some of the factors that can lead to a failure within an Energy Storage System include Thermal Abuse, Mechanical Abuse, Electrical Abuse, poorly designed electrochemical cells, and internal cell faults due to poor manufacturing.<sup>4</sup> Thermal Abuse events can induce a thermal runaway event in a single battery cell. If diligence in design is not taken, the thermal runaway can transfer from cell to cell in multi-cell battery packs and turn into a catastrophic runaway. Thermal Runaway events can result in temperatures of 1,110°F from a fully charged battery cell.<sup>4</sup> With an increase in temperature, internal pressures within the cell increase to upwards of 200psi before venting. Upon venting, flammable gases are released from the battery and create the potential of ignition due to the temperature of the battery. These factors can result in a cell being ejected from their containers or housing and create a large surface area for a fire to develop from and spread the thermal runaway event to other cells within the system.

For a Lithium-ion battery fire to be suppressed, incident responders need to be properly prepared for the special circumstances created by the presence of batteries. In a third phase report issued the Fire Protection Research Foundation on the hazards and uses of lithium ion batteries, sprinklered fire tests were performed in various ways for a storage facility environment<sup>5</sup>. The lack of knowledge involved in the testing factors of associated hazards with the main component of an ESS is a clear indication that those work install or maintain these systems need to be well versed in the science of the

technology and the applicable codes and regulations. It is concluded at the end of the third phase report that possible future work related to the subject include "Make final protection system recommendations and fire service overhaul guidelines."<sup>1</sup>

In February of 2016, the Fire Protection Research Foundation issued a report of the hazard assessment of Lithium Ion Battery ESS<sup>16</sup> and at the conclusion of testing results for external and internal ignition of Tesla Powerpacks, it was identified that there were several gaps in the electrical, fire and building codes related to ESS'. It is also indicated that real world experience with Lithium Ion ESS fire incidents are very limited.

It must also be noted that the NFPA is currently pushing for the creation and implementation of "NFPA 855, Installation of Stationary Energy Storage Systems" with the first edition estimated to be published in 2019. With the standard for how responders deal with an incident involving an ESS still being developed<sup>7</sup>, to move forward with C-46 contractors installing or maintaining ESS systems would create a large concern for the safety and effectiveness of responders across the state if the CSLB allows for workers without any type of training or certification to be allowed to install and maintain ESS systems. A recent incident involving a Tesla Model X crashing in Mountain View, CA that ripped open the battery compartment of vehicle resulted in 3 lanes of freeway being closed for 6 hours while responders dealt with a scene that was a fire, HAZMAT incident, and electrocution hazard. The issue of responder preparedness for the multifaceted threat created by ESS or Lithium Ion batteries needs to be considered heavily when deciding on the argument of who can install and maintain an ESS.

In conclusion, the associated risk factor involved with the installation and maintenance of an ESS by a contractor or contractor's employee who is not fully vested in the Electrical Industry with either training or certification is too large to overlook. The NFPA is still studying the technology and revising or writing new codes and regulations for an ESS, understanding of the technology is still in its infancy and responders are still developing training on how to deal with an incident involving ESS. To act in the best interest of public safety, for not only customers, but for contractors, workers, and also responders; a C-10 contractor along with their certified and trained employees should be the only persons engaged in the installation and maintenance of any ESS operating in California.

Sincerely,

Benjamin Souza  
-Certified General Electrician-  
Card # 158489

## *Sources Cited*

- 1 *Technical University of Munich, Department of Electrical and Computer Engineering "Lithium-Ion Battery Storage for the Grid – A Review of Stationary Battery Storage System Design Tailored for Applications in Modern Power Grids"*
- 2 *Department of Energy, Office of Electricity Delivery and Energy Reliability Energy Storage and Safety Strategic Plan*
- 3 *California Code of Regulations Title 16, Division 8, Article 3. Classifications*
- 4 *NFPA Lithium-Ion Batteries Hazard and Use Assessment  
NFPA Lithium Ion Batteries Hazard and Use Assessment Phase IIB*
- 5 *NFPA Lithium Ion Batteries Hazard and Use Assessment Phase III*
- 6 *NFPA Hazard Assessment of Lithium Ion Battery Energy Storage Systems Report*
- 7 *NFPA Journal "Rapid Advance" An update from the evolving world of energy storage systems, including the development of NFPA 855, Installation of Stationary Energy Storage Systems.*

Citizens in Support of this letter

Name: Katelyn Rubio  
City:

Name: Thomas Boylan  
City:

Name: Saku Fowler  
City:

Name: Sean Boylan  
City:

Name: Alice Marshall  
City:

Name: Jack Buckhorn  
City:

Name: Madly Hirschfield  
City:

Name:  
City:

Name:  
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Name:  
City:

May 15, 2018

Ms. Heather Young

CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Hello, my name is Raymond Dodge and I would like to thank you for allowing me the opportunity to voice my concerns on the topic of energy storage systems. I am not concerned with the viability of this emerging technology, but I am concerned with the competency of the contractors and electricians installing them. I am also concerned with the level of training that these individuals should have as it relates to the National Electrical Code.

First and foremost, I believe that energy storage systems are something that will be necessary for California's photovoltaic needs. I also believe that the level of training that goes into battery storage systems and energy storage systems is much more than the average photovoltaic or C-46 contractor's capabilities. I have been an electrician for 20 years and an electrical instructor for over 3 years, and I also teach an energy storage course about these systems. The installation of these systems requires proper training in all facets of the electrical industry, not just photovoltaic. C-10 contractor's hire trained state certified electricians to perform their work. These state certified electricians have to get 8,000 hours of training in the electrical industry in areas such as, Industrial, commercial, residential, and much more. These requirements are just for the workers of C-10 electrical contractors. C-46 contractors and their workers do not the extensive training of the National Electrical Code, the NFPA 70E Standard for Electrical Safety in the workplace or have the state certification for electricians that proves they are competent to perform work on energy storage systems.

The bottom line is that C-10 electrical contractors have well trained, state certified, competent electricians who are aware of the electrical code and safe work practices that are necessary to perform safe installations of energy storage systems. Unfortunately, I believe that the C-46 photovoltaic and their workers are much more suited to perform solar work only. The difference between solar and energy storage is too vast to just allow anyone to do this work. Honestly, you wouldn't want a plumber to install your electrical. So, it comes to reason that you wouldn't want someone who only does solar work to do work which requires a much higher standard of training.

Sincerely,  
Raymond Dodge

Paul Rodgers

Dear Contractors State Licensing Board,

I am an electrician working for a C-10 contractor. I am writing this letter emphasizing that Energy Storage(ESS) installation and maintenance is not the same as Photovoltaic Solar Systems. Energy Storage have a different array of technical, safety, and code requirements. The parameters of ESS are much more stringent with considerable more risk.

Although on the surface it appears that installing an UL listed ESS system is relatively risk free without a great deal to consider, I can assure you that this is no the case. It is quite dangerous, requiring technical expertise, to avoid adverse incidents. Improper installations can lead to fire, arc flash, and shock. These incidents are the results of old, faulty, or improperly-sized breakers. Sometimes the load was improperly distanced from the breaker, paralyzing from its proper function. Despite the fact that equipment is labelled "Plug and Play," arc flash hazards still exists and can occur.

I have years of training and applying the National Electrical Code for ESS. The requirements are much more stringent than those for Photovoltaic systems and are much more difficult to apply for

installation and maintenance. A C-10 contractor hires electricians that properly adhere to the Code requirements.

In addition to the National Electrical Code, there are also NFPA 70E Safety Requirements. NFPA 70E is designed to protect the installer from safety risks. My contractor, as do all C-10s, stresses to us (as I was trained) to follow the protocols to avoid injury.

There is a great deal of variety in ESS and my C-10 contractor trains for each one we encounter. ESS vary widely in how energy or load they handle, size, and form.

A C-46 contractor will not have training for their installers. They will not have the stringent documentation of safety and technical adherence. A C-46 will not have the knowledge themselves for the rules and regulations for this type of work.

Please protect the workers, the public, and the consumer from faulty installation and inadequate maintenance of ESS that result from a hapless C-46 performance.

Yours Sincerely,

A handwritten signature in black ink, appearing to read "Paul Rodgers, Jr.", written in a cursive style.

Paul Rodgers, Jr

Bob Barber,

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Hello,

Thank you for allowing me to write to you regarding this matter on Energy Storage Systems. I am an electrician and I am concerned with the possibility that C-46 contractors are trying to become electricians and installing battery energy storage systems. As an electrician I have installed battery storage racks. I know what training I received to be able to perform this work, safely and I don't believe that C-46 contractors can provide that training to their employees, as it stands in this moment.

When installing an ESS you are going from AC to DC voltage. Many people are not aware that AC voltage has less potential to hurt you than DC voltage. DC voltage being a direct current system, once it grabs you there is no letting it go.

I have trained for 50 years and my electrical and safety knowledge is extensive, and this is what is required for installing ESS. This is not the same as a car battery, which can be dangers if done improperly. With the growing market in PV, where C-46 are trained to deliver this system, there is more demand for ESS, and that means a well-trained electrician. These are different systems, with different technology and requires different skills and safety training to remove the risks.

If a C-46 contractor is relying on OSHA to protect them and their employees, they will find that OSHA is inadequate. OSHA is a book on standards and not a training manual. You must go through training to understand OSHA and as an electrician I have done the minimum 10 hours plus another 20 hours to understand the standards.

Also, for me to perform electrical work in the State of California I need a state certification that is required of all people working under a C-10 license. I don't believe that is the same requirement for C-46 contractors or their employees.

Bob Barber, :

I know that I can handle the installation of an ESS because of my training, experience, certification and work history of doing these systems. Can a C-46 employee provide the same expertise?

Thanks for reading my letter. I know the Contractors board will make the right decision.

Very truly yours,

A handwritten signature in cursive script that reads "Robert Barber". The signature is written in black ink and is positioned above the typed name.

Robert Barber  
Electrician  
Confirmation mail

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
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Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: For the CSLB - Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

My name is Dennis Nielsen. I am a California licensed Electrical C-10, General B, and Engineering A Contractor and registered Professional Electrical Engineer. I am employed as the resident Electrical AHJ for safe Installations at the Lawrence Berkeley National Laboratory.

I am commenting personally on the certifications/license classifications that authorize to install energy storage systems when paired with solar PV systems.

I have 28 + years of experience in the electrical installations field for industrial, commercial and residential wiring. I am currently a member of the NFPA National Electrical Code on Code Panel 6 representing the IEEE, and since 2000 was on code Panel 7. My experience includes electrical premises wiring and electrical safety in applying NFPA 70, and NFPA 70E as a Certified Electrical Safety Compliance Professional.

Thank you for this opportunity to comment. I understand that there is a current and important safety question facing the California Contractors State Licensing Board (CSLB) regarding the installation and maintenance of electrical energy storage systems (ESS): i.e. the category of contractor licensing to install and maintain electrical energy storage components and systems when they are pair with PV solar systems (PV).

The CSLB decision will involve a number of very serious electrical safety concerns. As a consumer and a responsible individual for safe electrical installations including the safety involved with service, operation and maintenance, the responsibility to minimize and or avoid the risk of hazards involved with electrical shock and arc-flash for workers, occupants, public and property damage including first inspectors.

The area of energy storage is of special concern because it is relatively new to many, and it presents particular hazards and risks that are different and substantially more serious than those posed by PV. Energy storage systems vary widely in type, size, and power requiring a broad base of electrical theory and safety knowledge.

The installation of energy storage systems requires the ability to assess and adapt to the field conditions that a trained installer may encounter in or around a building where the system is located. There may be other unexpected events and hazards as well if work performed or the installation is not correct. In contrast, the installation of Solar PV panels is a much more predictable process. While early solar PV systems were often paired with lead acid car batteries, those early battery systems have some similar characteristics but are also different than modern energy storage systems. The current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe are much different.

Current ESS present far greater electrical hazards to workers, first responders, and the public such as arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

It is very clear to me that C-10 contractors and their electrical workers meet these Code requirements by the State of California because they are required to demonstrate and test to show they have this knowledge and experience. The C-10s have a state license and the workers have a state certification that means they meet the qualifications.

C-46 workers who lack technical competency without a state certification to show qualified do not possess the knowledge, skills, and experience to safely and effectively install and maintain ESS in the areas of industrial, commercial and residential. C-46 workers who install PV systems for C-46 contractors that do not have a minimum California state certification requirement for electrical education, training, skills, and experience lack the technical competency. The prospective dangers to workers, building and residential occupants, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to install, and service energy storage components and systems without proper training and a California state certified qualification that equates to the state certification requirements for Qualified Electrical Workers employed by C-10s.

I strongly urge the CSLB to continue the installation and maintenance of electrical energy storage systems by C-10 contractors with California State certified electricians only.

Sincerely,  
Dennis Nielsen

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments – Classifications Authorized to Install Energy Storage Systems

My name is Glenn Dolph and I appreciate this opportunity to write on this subject. I am a California state certified electrician. I started my electrical career in 1979 with a four-year apprenticeship and for sixteen years worked on housing, commercial buildings, hospitals, oil fields, oil refineries, industrial plants and both fossil and nuclear power plants. Many of these facilities had “energy storage systems” in the form of Uninterrupted Power Supply or battery back up systems that I installed, serviced or maintained. Some of those units used something other than batteries to store energy such as compressed air or steam. For the following sixteen years I was the Kern County Sheriff’s Department’s lead electrician where I installed, operated and maintained electrical systems for it’s numerous facilities. Many of these facilities had “energy storage systems” that I helped install, maintain or dismantle. After that I spent four years helping construct six commercial solar power plants from twenty to one hundred twenty megawatts in size. Concurrently in the middle of all that I was an apprenticeship instructor for over ten years teaching evening classes.

It has been my experience that the majority of energy storage systems that most C-46 contractors install are for housing and light commercial applications. They are battery systems designed to be simplistic and inherently safer compared to the large systems I have worked on in the past. The majority of “installers” employed by C-46 contractors are poorly trained compared to the certified electricians employed by C-10 contractors and as a group they are far less regulated. It takes a great deal of training to become a certified electrician and then in requires continual education to maintain that status. The argument that solar installers are more familiar with DC electricity than certified electricians is based on ignorance or disinformation. In training electrical apprentices must master DC electrical systems before moving on to AC systems. I first worked on a DC battery energy storage system in 1980 under supervision as an apprentice.

Having worked on both large solar projects and large battery systems there are some similarities between the two that are different from most AC power systems. However, there are a number of differences between the two that make energy storage systems more dangerous. For instance, solar panels generally do not produce choking, poisonous, or explosive off gassing like energy storage systems can. Generally solar panels do not create the explosion hazard energy storage systems can. Energy storage systems can be drained of energy and recharge themselves to dangerous potentials if not properly made safe. Because of internal differences between batteries and solar panels, accidental arcing of the output of a battery bank of the same voltage as a solar array can produce a much more powerful arc. Because of these greater dangers the National Electrical Code covers DC electrical systems and battery storage systems extensively. Certified electricians are trained in these systems and codes and must take continuing education on the code to remain current.

It is generally considered that energy storage has been the least advanced portion of the electrical industry up to the recent past. With the new focus on energy storage a tremendous amount of experimentation and change is occurring in this segment of the industry and will continue for the foreseeable future. In my opinion anyone who has not gone through a comprehensive training program

and certification process cannot be qualified to do any of this work. Further more I do not see how anyone who does not maintain a continual training process can maintain that qualification. In my opinion it is clear that the Certified Electricians used by the C-10 Electrical Contractors meet those requirements while the Solar Installers used by the C-46 contractors do not.

Sincerely,

Glenn Dolph

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9821 Business Park Drive  
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Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dr Ms. Young and CSLB Executive Office,

I am writing on behalf of the important decision that the CSLB will have in determining if a C-10 contractor will install Energy storage systems or allow C-46 contractors to install them, or both. Recently, I heard of the complaints filed to CSLB regarding C-10 contractors which are 5.6% out of 24,000 contractors and 32.2% out of 12,000 C-46 contractors. This staggering statistic highlights the importance of safety, skill, quality and prevention. If C-46 contractors already have, a staggering 32.2% complaints filed against them with the work they are already doing, can we imagine allowing them to install energy storage systems will do? Will the complaints against c-46 contractors increase? It most definitely will. I have thirteen years in the electrical industry working for C-10 contractors. I fortunately still have great health, all ten fingers and have not been injured on the job causing me to lose work. C-10 Contractors preach and practice safety. C-10 contractors install quality electrical work from start to finish. Also, in my career none of the C-10 Contractors I have worked for have had complaints filed against them. Several of the contractors that I have worked for also have installed major solar systems and energy storage systems. C-10 contractors by nature hire CA state certified electricians, electrical trainees and apprentices to install electrical work. Having skilled labor goes a long way. This is where the quality and quantity comes into

play. To obtain a CA state cert one would have to show the Department of Industrial Relations that they have 8,000 hours of experience documented. Then after being accepted to take the exam one would have to pass the exam. The CA State Exam is very intensive and challenging. For someone to pass the CA State General Electrician Exam, one would have to be more than familiar with the code book, one would have to 'know' the NEC(National Electrical Code) Book. The purpose of the, '**National Electrical Code 90.1 Purpose:** (A) Practical Safeguarding. The **purpose** of this **Code** is the practical safeguarding of persons and property from hazards arising from the use of electricity.' The NEC is the national safeguarding standard that inspectors, c-10 contractors of the electrical industry live by to ensure safety to people, property and prevention of Hazards. Apprentices are learning the code book through their state accredited apprenticeship. Electrical trainees take courses that teach them aspects of the code book.

Are energy storage systems dangerous? Energy Storage Systems are dangerous. Anything related to electricity can kill any electrician if they are not trained and know the NEC. Would I rather hire a CA General State Certified Electrician that takes safety for the public, property and prevention of electrical hazards than someone that doesn't to install Energy Storage Systems? My decision would be, 'any day of the week and twice on Sunday.' But I don't have this major decision before me as the CSLB that will affect the public, property and prevention of electrical hazards. I do have a voice, as a Ca State Certified Electrician, and citizen of this wonderful country.

I am grateful to live in America, where we have a great process like this to establish standards in construction to protect everyone. This decision, to some may seem miniscule in the big picture of things, but, 'it is by the small and simple things do great things come to pass.' This decision will have a great impact as the future turns to

energy storage systems, that will require more workers to install these potential dangerous electrical storage systems. May we choose the best decision which is, to only allow C-10 contractors to install energy storage systems, that will employ trained Ca State Certified electricians that 'know' the NEC. There are double the amount of C-10 Contractors in California than C-46 contractors and the complaint ration difference between this is astronomical, 5.6% for C-10 and 32.2% for C-46 contractors. Which of the two could hand this important task of installing energy storage systems? I trust that you will make the right decision for the public, property and prevent hazards and most importantly for our future.

Sincerely,

*Kasitalea A Talakai Jr.*  
*California State Certified Electrician*  
*Concerned Citizen of America*

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Via Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

Thank you for the opportunity to address the matter regarding C-10 vs C-46 licenses on Energy Storage Systems (ESS). I have nearly 20 years of experience as a California State Certified Electrician, and I am concerned about public safety and the hazards associated with installing and operating ESS without proper training, skills, or knowledge.

I have personally installed energy storage systems – with a wide array of size, voltage, and use (commercial vs. residential) – and high-quality training and electrical knowledge was and should be required for all work, which can only be guaranteed by the workforce requirements of a C10 contractor.

I worked with Eaton and Siemens at power plants for C-10 contractors to install massive battery banks to back up Norwalk's power system. I have also worked in Rancho Cucamonga on their battery storage systems. Without my training and education I would have been unable to perform this work properly, and there would be no way to know how these systems - including everything from transformer to rectifiers - should be installed safely and correctly.

The C-46 license is for a completely different type of work – solar installation. It is one thing to be in the field working on solar, but quite another to contain and harness the massive power that solar systems create, and a person working on ESS must have the pertinent electrical knowledge and training to work safely around massive power. High voltage power associated with ESS is not forgiving and it takes less than a second to kill you and everyone around you if you make a mistake. My training and education as a California State Certified Electrician ensures that the work will be done properly and safely, as opposed to unskilled workers.

Further, PV and ESS are dissimilar in many ways. ESS and battery storage control massive amounts of power, while PV is a way to make power on a much smaller scale. The storage of that power can be very dangerous and difficult to do because of the

scale of power. If the storage of this power is done incorrectly, the public can and will be put unknowingly in danger. It is a requirement of C10 contractors to employ a skilled and trained workforce and California State Certified Electricians – hence ESS work should only be done by C10 contractors.

Again, to protect public safety and prevent workforce hazards, C10 contractors should be the only license type allowed to perform battery storage installations.

Thank you for your time and consideration of this matter and my views.

Sincerely,

Nick Guth

Betony Jones

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young,

I am an independent consultant specializing in the design and evaluation of the energy sector's workforce, employment, and training policies and programs in California and nationwide. The rapid transformation and growth of energy storage systems (ESS) from traditional lead-acid batteries presents significant public and worker safety challenges. It is incumbent upon the Contractors State License Board to take precautionary measures to protect public safety and limit the installation of photovoltaic (PV) paired energy storage systems to C-10 licensed contractors.

Please note that I am writing to the Board as an expression of my concerns and am not being compensated for these comments.

**Please also note that while my comments here reference shortcomings of the solar PV industry, which I have studied extensively, I am not commenting on whether a C-46 contractor should be installing PV systems. Rather, I am concerned about how those shortcomings would translate to battery energy storage.**

Previously, as a research specialist at the UC Berkeley Center for Labor Research and Education, and today as an independent policy advisor and research consultant, I have extensively studied California's renewable energy policies, the skills required for their implementation, and their outcomes for those working in the sector. In my research on the renewable energy industry, which is dominated by solar, I have come upon three issues that all have impact on public safety relative to C-46 contractors installing electrical energy storage:

- Many contractors in the residential and small commercial segment of the solar PV industry fail to invest in comprehensive occupational training of their workforce;
- There are inherent risks for both workers and the general public associated with the installation of energy storage systems;
- When public policy fails to identify and establish skill standards for emerging technologies, the work created by the adoption of new technologies follows the employment patterns typical of general construction work, in which significant numbers of workers operate in the underground economy

First, despite significant growth aided by public subsidies through renewable net metering and tax credits, the rooftop solar industry has fallen behind the rest of the construction industry in wage growth.<sup>1</sup> Even as demand and policy support (most recently the solar home mandate) has soared and the complexity of its projects has increased, California has failed to establish any skill standards for solar PV workers. PV work remains a dead-end job, even according to the solar industry's own National Solar Jobs Census, which states that rooftop installer occupations currently lack "a distinct career progression". Because the C-46 solar contractors use the same installer workforce for energy storage, these issues concern me. Without career progression opportunities, there is little incentive to invest in training and engage experienced workers.

Second, research – my own and others' – has consistently shown the link between wages, training, and workplace safety. As you are aware, C-10 electrical contractors are required to employ state certified general electricians with at least 8,000 hours of experience, while C-46 contractors are not required to employ installers with a minimum level of training, skill, and experience. According to data collected by UC Berkeley<sup>2</sup> and independent journalists,<sup>3</sup> C-46 contractors routinely hire workers with no formal training and, these same untrained workers are paid as little as \$10 to \$15 per hour. Contractor strategies that emphasize benefits and training contributions lead to safer work lives and greater public safety. Employing low wage, uncertified workers on the new generation of ESS is dangerous. As ESS technology is already becoming more complex and batteries are storing greater amounts of energy, the safety risk to the public, workers, and emergency responders is increasing. It's important to get the qualifications right.

Finally, for years, CSLB has targeted issues of wage theft, workers compensation, and the underground economy. The precarious nature of solar work, piece-rate payment, and an under-resourced enforcement system increase the risk of the underground economy making inroads into the ESS sector. In a research interview, one contractor told me, "Contractors are cowboys. We'll do whatever we can get away with." Low wage and undertrained workers are often victimized by this cowboy mindset and the resulting expansion of the underground economy.

In summary, I believe it is vital for the CSLB to protect public safety by ensuring the rapidly growing ESS sector be anchored on a trained workforce, employed by contractors with affirmative skill workforce certification requirements. Restricting ESS work to C-10 contractors can help achieve those goals.

Thank you for your attention to this matter,  
Betony Jones

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<sup>1</sup> Occupational Employment Survey, California Employment Development Department.

<sup>2</sup> The Link Between Good Jobs and a Low Carbon Future: Evidence from California's Renewable Portfolio Standard, 2002–2015

<sup>3</sup> Solarcoaster: The Promise and Pitfalls of Rooftop Solar Jobs, Capital & Main, April 13, 2017

Kathleen A. Barber.

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

I am writing to you as a Training Director for an electrical JATC. The installation of solar panels is under the C-46 licensing process; however, the installation of energy storage is not. The training requirements for training in energy storage are not covered under the licensing of C-46 contractors. Relying on OSHA to protect C-46 employees in the installation of energy storage is shortsighted. OSHA is not training, OSHA is compilation of standards regarding safety and is not safety classes.

The installation of PV systems is entirely different than the installation of energy storage. They are separate systems as defined by Article 706 of the National Electric Code (NEC). The energy storage systems for PV are not car batteries. Because these are separate systems, C-46 license restricts the scope of work that is required for the installation of thermal or photovoltaic solar energy systems. These systems may be paired with solar, but they are separate.

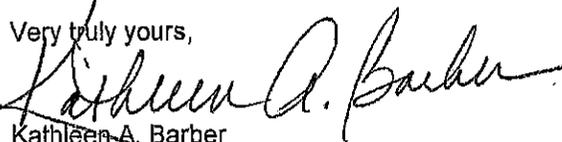
Energy storage systems (ESS) covers both residential and commercial applications. These systems vary in storage and size requiring a broader base of electrical and safety knowledge and training. Within our JATC, an apprentice attends 1050 hours of related classroom instruction coupled with 5 years of on-the-job training. At the end of their apprenticeship they are required to take the State of California Certification Examination to perform work in the electrical industry. I do not believe these requirements are covered under a C-46 license.

When an ESS is not installed correctly, the results can be catastrophic. If you have ever witnessed a bank of batteries short circuiting, you know the results of an explosion with acid spewing all over, not to mention the fire that follows.

Every apprentice is trained in NFPA 70E standards which addresses working with energized circuits. As you well know, solar panels are energized the moment light comes in contact with a photovoltaic panel. Inclusive in the NFPA 70E training is the proper Personal Protective Equipment (PPE) necessary to work on energized components of varying sizes and capacity.

In conclusion, I would eager the CSLB to consider the risk of having an untrained person installing and ESS. The liability to the contractor and the licensing board for consenting to allowing untrained personnel is unimaginable.

Very truly yours,



Kathleen A. Barber  
Training Director  
Confirmation Mail

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

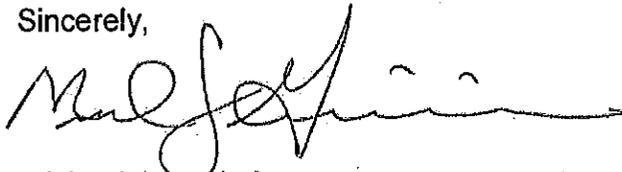
Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Ms. Young,

My name is Michael Guarnieri and I am an instructor of Industrial Electricity. I would like to express my opinion and concern about C-46 solar contractors performing Energy Storage installations. This work is highly technical and hazardous and should only be performed by C-10 electrical contractors whose employees have been trained to perform this work in a safe manner. I can't stress how dangerous this work can be and using unqualified installers can only end in disaster. Our electricians who work for C-10 contractors receive five years of training in the electrical safety based on OSHA and NFPA 70E as well as all the technical areas that make these installations safe. Thank you for considering my opinion

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Guarnieri", written in a cursive style.

Michael Guarnieri

May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear CSLB Chair and Members:

My name is Andrew Gardanier and I am a 12 year veteran Firefighter here in Northern California and I am commenting personally re. license classifications authorized to install energy storage systems.

In my opinion as a fire fighting professional, it would be an error for the CSLB to treat an energy storage system as a subsystem of a solar photovoltaic (PV) energy system. It would create safety and risk exposure that the CSLB would not want. While these systems may be paired together, they are separate systems subject to their own code, installation and fire safety standards. In addition, they pose very different fire and life safety risks such as electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

Banks of battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures.

Unlike lead-acid batteries (which produce oxygen and hydrogen and need to be ventilated to avoid risk to individuals), lithium-ion batteries do not produce exhaust gases during normal operation. However, an electrical fault can cause them to produce flammable and toxic gases. Also, the lithium-ion battery chemistry makes them prone to "thermal runaway" if they are damaged or overheated by overcharging. Although some brands of lithium-ion batteries have features intended to prevent uncontrolled cell rupture under runaway conditions, there is wide variation in battery technologies and safety technologies, and their effectiveness. Battery casings can rupture as a result of pressure generated from a change in chemical reaction from over-charging or following an electrical short circuit. Electrolyte fluid or gel can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion. Some of these leaking compounds can be extremely toxic.

Because of these risks, energy storage systems pose a serious safety hazard potential for occupants and workers if incorrectly installed and/or operated. The type of risk and the measures needed to be taken to

reduce these risks vary depending on the battery type and chemistry. Therefore, it is important that these systems are installed by contractors and workers who have the training, skills, and experience to understand the varying technologies and electrical configurations that may be encountered. Contractors and especially installation workers must be well-versed in electrical theory and electrical risk assessment methodologies. Workers must be qualified persons as required by the National Electrical Code (NEC). That means that they must have considerable electrical knowledge, training, and experience.

These concerns do not just apply to commercial energy storage systems. Small UL listed energy storage systems connected to a residential circuit breaker box can also be a serious safety hazard to the public and to first responders. As firefighters, we rely on UL certification to reduce the risk of fire. Unfortunately, UL certification does not eliminate it. Incorrect wiring, improper grounding, poor electrical isolation, and other factors can contribute to creating dangerous situations.

The effectiveness of circuit breakers is also misunderstood. If an energy storage system is located too far from a breaker, the wrong size wire is used, or the breaker is beyond its recommended lifecycle, a fire can start before the circuit is broken.

Thermal runaway is one of the least understood dangers. It can happen in any size energy storage device, even in a residential wall pack. Once it is underway a circuit breaker will have no impact on containing it. When thermal runaway ignites a structure fire, fire professionals will be mobilized to contain the blaze. Proper installation by a qualified person is the first, the most important, and the best line of defense. It is much easier, less expensive, and far safer to have qualified persons install residential or commercial energy storage devices than to fight fires.

As a fire fighting professional, my recommendation is that the CSLB follow the practice of the California Fire Code in regulating energy storage systems differently, and separately, from solar PV systems. The California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirements for battery systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems.

The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems.

The California Fire Code requirements for battery systems are substantially different from what is required for solar PV systems and that is for very good reason – they are different systems with very different levels of risk that must be treated differently.

As energy storage system technology continues to advance and change, the building standard codes are constantly playing a game of catch up. Accordingly, it is critical that a contractor has the skill, knowledge, and experience necessary to ensure safe and proper installation of these systems beyond mere compliance with minimum code standards. It should also be recognized that, to a great extent, the requisite skill, knowledge, and experience of a contractor is based on having state certified electricians performing the installations.

In summary, my opinion as a fire fighting professional is that treating energy storage systems of any size as subsystems of a solar photovoltaic (PV) energy system would be an error, and a serious one. It would be a mistake that the CSLB would not want to make. Energy storage systems do not become less dangerous or less complicated when paired with a particular electrical power source. It is irrelevant whether the energy storage system is powered by a solar PV system, a wind energy system, or the electric power grid.

Because of the specialized skill and knowledge needed to safely install energy storage systems, only contractors that are licensed to install these systems as stand-alone systems should be allowed to install energy storage systems. Another key safety factor is that contractor employees who do the installations must meet the NEC Code requirements that they are qualified persons. Solar PV contractor installation employees do not have the electrical knowledge, training, and experience to meet this safety requirement.

I strongly urge you to only allow C-10 contractors to install and maintain energy storage systems which are paired with PV systems.

Sincerely,

**Young, Heather@CSLB**

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**From:** David Green  
**Sent:** Sunday, May 20, 2018 1:19 PM  
**To:** Young, Heather@CSLB  
**Subject:** Energy Storage Systems Public Participation Hearing

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
[Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

RE:

**Energy Storage Systems Public Participation Hearing**

CSLB Headquarters, Sacramento  
*April 25-26, 2018, 9 a.m. - Noon*

Ms. Young,

I understand that this comment is not in time for the April 25-26 hearing

I submit this comment on the chance that the CSLB is continuing to consider action on energy storage systems.

I have been working in the electrical industry for 46 years, including a 4 year apprenticeship, 11 yeas as an electrician foreman and estimator, and 26 years as an inspector and senior inspector.

As a Senior Electrical Inspector for the City and County of San Francisco,

my duties included plan review of small and large solar PV systems, and inspection of both solar pv systems and small and large battery systems.

I currently work part time performing electrical plan review for the San Francisco International Airport, and teaching electrical and related codes to electricians.

During my work as an inspector I observed a wide range of contractors and electrical workers abilities, ranging from incompetent to highly skilled.

Workers and contractors with more experience and training generally perform at a higher level.

Electrical workers employed by C10 contractors are required to be certified electricians and generally have more skill and knowledge than workers that are not required to be certified.

The stored energy in battery systems present an additional fire hazard in addition to the shock and fire hazards of utility supplied electrical wiring.

Safe electrical installations depend on a team of designers, manufacturers, contractors, electrical workers, and finally inspectors. No one group can ensure a safe installation. All groups are needed. During my career I inspected electrical fires and electrocutions, and realized that inspection cannot completely guard against lesser skilled and unknowledgeable workers.

I believe it is in California's best interest to not expand the scope of C46 Solar contractors to include installation of battery systems. At this time C46 contractors are not required to use certified electricians and do not have the level of experience required to install safe reliable electrical storage necessary for a reliable electrical grid, as California relies more on solar power in the future. We should be utilizing the experienced contractors and trained electrical workers that are doing this work already.

Sincerely,

David Green

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

My name is Joshua Medrano

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position as a California State Certified Electrician that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

Considering the severe nature of these risks, contractor and worker knowledge and mastery of the National Electric Code, (NEC) and NFPA 70E are critical to safety. The National Electrical Code (NEC) addresses the issue of qualified personnel this way: "The installation of equipment and all associated wiring and interconnections shall be performed by qualified persons". The NEC defines a "Qualified Person" as one who has the skills and knowledge related to the construction and operation of the electrical equipment and installation and has received electrical safety training to recognize and avoid the hazards involved. This language is in the current California 2014 Electrical Code which is a legal requirement.

As a certified electrician with the state of California, it is very clear to me that C-10 contractors and their electrical workers meet these Code requirements because they are required by the State of California to have this knowledge and experience. They also have a state certification which means they can be identified as a person who meets those qualifications.

C-46 workers do not have the knowledge, skills, and experience to safely and effectively install and maintain ESS. C-46 workers who install energy storage (and PV systems as well) for C-46 contractors have no minimum California state certification requirement for electrical education, training, skills, and experience. The prospective dangers to workers, inspectors, first responders, and the general public are too substantial and serious to allow C-46 contractors and their workers to handle energy storage components and systems.

I/we strongly urge the CSLB to clearly limit the installation and maintenance of electrical energy storage system to C-10 contractors, only.

Sincerely,



Joshua Medrano 5-17-18

## Young, Heather@CSLB

---

**From:** Roque Viernes  
**Sent:** Thursday, May 17, 2018 11:01 PM  
**To:** Young, Heather@CSLB  
**Subject:** Classification Authorized to install energy storage systems

My name is Roque Viernes I am a private citizen that is concerned about safety.

Dear members of the Contractors State Licensing Board:

I really appreciate that you are taking comments on this subject.

My understanding is that you will soon be making a decision about a very important safety issue, that is determining which contractors are licensed to install energy storage systems. I have done considerable research and reading on this subject and have very strong feelings about it.

well solar contractors (c46) may be able to install solar they do not have the electrical skills and experience to install these types of solar and electrical systems. according to what i have researched and read, the people who work for solar contractors are not required to have a state certificate that proves to the public that they have an adequate level of electrical training to do energy storage work. Its hard to believe that our state would even consider that!

Anyone who's been paying attention over the last few years knows that energy storage products can be dangerous. They've caught fire and exploded and people have been hurt, or worse. thousands of laptop computers, cell phones, hover boards, etc. Have just ignited in flames. that has been bad, but what would be much worse is having solar workers, with little or no training, incorrectly installing an energy storage device and increasing the likelihood of an explosion or a fire.

Even a small home energy storage wall unit is much bigger and a lot more dangerous than a portable consumer device. Whats even more threatening is that these energy wall packs are attached to our houses and garages and if they flare up, our homes will catch fire. This is serious, it could not only threaten our homes, but our lives.

I know the difference between an electrician and a solar contractor and there is a huge difference in electrical understanding and experience. Electrical contractors(c10) and their electricians must have a lot of electrical training and experience to get a state certificate. That means that they know what they're doing with electricity and that they can keep us much safer. Insurance companies have long said that electrical problems are the #1 cause of fires. I would trust an electrician with a certificate to install energy storage, but would not trust a solar worker, with no state certificate who would know how much training that solar worker has, if any at all? Thats not a safety risk that average citizens should have to take.

The CSLB has the authority to decide what type of contractors install energy storage. with all due respect, you also have the responsibility of keeping us safe. please do the right thing and make sure that solar C46 contractors and their low skilled or unskilled workers are not allowed to install energy storage systems. Only c10 contractors and electricians with a state should be allowed to do these installations

Thank you.

International Brotherhood of Electrical Workers  
Local Union No. 413

100 THOMAS RD.  
BUELLTON, CA 93427



PHONE: 805/688-8088  
FAX: 805/688-7144

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Classifications Authorized to Install Energy Storage Systems

Ms. Young,

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems whether they are connected or not connected to solar photovoltaic systems.

I possess a unique experience having been a firefighter, an emergency medical technician (EMT), an electrician, an electrical apprenticeship instructor, a training director and currently business manager. I know what is at risk regarding public safety. It's my opinion, based on my experience, that C-46 contractors are not qualified to install energy storage systems.

Why would the CSLB want to unnecessarily risk workers safety and the public's safety by allowing C-46 solar contractors to do energy storage work they're not qualified to do? As a former fireman and an emergency medical technician, I went to the aid of the public for fire and medical emergencies. It's my duty to continue to advocate in the public's best interests.

**The public trusts the California State License Board to ensure its safety by protecting it.**

Thank you for your time and consideration.

A handwritten signature in black ink that reads "Chuck Huddleston".

Chuck Huddleston  
Business Manager/ Financial Secretary

# *International Brotherhood of Electrical Workers*

## LOCAL UNION

10300 Merritt Street  
Castroville, CA 95012  
www.ibew234.org



NO. 234

(800) 499-4239

(831) 633-2311

Fax (831) 633-0570

The Electrician's Union for Monterey, San Benito, and Santa Cruz County

May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

SENT VIA EMAIL TO: [HEATHER.YOUNG@CSLB.CA.GOV](mailto:HEATHER.YOUNG@CSLB.CA.GOV)

RE: WRITTEN COMMENTS - CLASSIFICATIONS AUTHORIZED TO INSTALL ENERGY STORAGE SYSTEMS

Dear Ms. Young:

I am writing to express my vehement objection over C-46 contractors being allowed to install and maintain energy storage systems. This is a training and safety issue. Only C-10 contractors should be allowed to install and maintain energy storage systems.

C-46 contractors are claiming that OSHA 10 and OSHA 30 are adequate training classes in regards to energy storage systems. This is entirely inadequate as OSHA 10 and 30 are general safety classes for the construction industry. While these classes include some references to electrical safety, they are not electrical safety classes. NFPA 70E Standard for Electrical Safety in the Workplace is an electrical safety class. Training on NFPA 70E in addition to the National Electrical Code (NEC) would be a better claim for the basis of installing energy storage systems.

C-46 contractors should not be allowed to install and maintain energy storage systems. The C-10 classification, utilizing State Certified General Electricians, is the only classification that should be authorized to install and maintain energy storage systems.

Thank you in advance for your time and consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Andy Hartmann", is written over a horizontal line.

Andy Hartmann  
Business Manager



**Southern Sierras Chapter**

P. O. Box 12149 • San Bernardino, CA 92423  
Tele: (909) 792-0387 Fax: (909) 792-4314 e-mail: vronica@ssneca.org

February 5, 2019  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Clarification of Regulations for Battery Energy Storage System Installation**

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are willing to urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical license may install battery energy storage systems.

The use of battery storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by a highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *"install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."*

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.**

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

David A. Shankle  
Executive Vice President  
DAS: vmc



MONTEREY BAY CALIFORNIA CHAPTER  
NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION  
P.O. Box 2175  
Salinas, CA 93902  
E-mail: JLChampIn@gmail.com

Cell: (831) 236-1363

February 5, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: Clarification of Regulations for Battery Energy Storage System Installation

To whom it may concern:

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to "install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."

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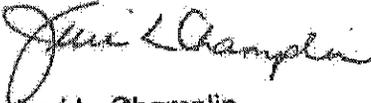
FEB 15 2019

their installing employees have no training nor certification requirements.

We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,



Jerri L. Champlin  
Executive Manager  
Monterey Bay CA Chapter, NECA

CC: Board of Directors

RECEIVED BY CSLB MR #5

FEB 15 2019



## Sacramento Electrical Training Center

2836 El Centro Road • Sacramento, CA 95833 • (916) 646-8888 • FAX (916) 646-0289

- Equal Opportunity
- State Registered

May 16, 2018

Contractors State Licensing Board  
9821 Business Park Dr,  
Sacramento, CA 95827

I would like to thank you for taking the time to read my letter and allowing me the opportunity to voice my concerns on this issue. My name is Dennis Morin and I am a Director of electrical training center. I would like to address the public safety concerns related to energy storage systems.

My comments are focused on whether C-46 contractors should install and maintain energy storage. **My comments are not about C-46 contractors installing PV solar systems.** These are separate systems that pose different risks, require different expertise, and have different permitting and code requirements.

My top priority in doing electrical work has always been and will continue to be safety. In addition to 8,000 hours of on the job training, I have completed 1,000 hours of classroom training which includes subjects such as DC and AC theory, electrical safety, blueprint reading, codes & practices, motor controls and other theory and skills based subjects that gave me the understanding of how to safely install electrical systems in accordance with the National Electrical Code (NEC), OSHA-10, OSHA-30, EM-385, NFPA 70E, along with certification in First Aid and CPR. The primary goal is to be able to safely install systems to avoid fire hazards and shock hazards to myself and the public. And, now, as a state-certified general electrician, I am recognized as a "qualified person" by the NEC to work on energy storage systems. Contrast that with NO state training, education, and experience certification requirements for C-46 installer employees.

Please note that the state of California requires the employees of C-10 contractors who install and/or maintain electrical equipment to be state certified general electricians. The workers for C-46 contractors who install energy storage and PV systems have no minimum California state certification requirement for education, training, skills, and experience. That puts workers and public safety at risk.

Cal/OSHA training alone is totally inadequate to prepare and protect C-46 installation employees and the public from the stark hazards of energy storage systems. Cal/OSHA trainings are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. While helpful for basic electrical safety tips, the Cal/OSHA trainings can never be considered adequate for installing or maintaining energy storage systems.

While early solar PV systems were often paired with lead acid car batteries, those early battery systems were much smaller and less dangerous than modern energy storage systems. Today's energy storage systems (ESS) - including residential systems - are rapidly increasing in size. Some behind-the-meter commercial systems exceed 10 megawatts. And, the current battery chemistry and technology is different, the safety risks are different, and the knowledge, skills and experience required to be safe in a residential installation are much more complex and hazardous. Even at the national level, the National Electric Code Article 706 provides specific, separate installation standards for energy storage systems operating at over 50 volts ac or 60 volts dc. In contrast, car batteries, which have been used, are around 12 volts dc and are not even subject to these standards.

While energy storage systems (ESS) may be paired with PV systems, they are separate systems. They perform different functions and are subject to different installation, permitting, fire, and code standards. These systems also present different fire and life safety risks. The claim that an energy storage system is required to install a photovoltaic solar energy system improperly conflates two separate systems - they are separate and independent systems. Just because they may be connected to work in conjunction with each other does not mean they are one system. An ESS is not incidental to a PV system, it is a separate system. When not installed correctly, even small residential ESS units can start a fire which could engulf a residence. While commercial ESS presents even greater risks, there is no such thing as a safe "plug and play" ESS. What makes any size ESS safer is proper installation and maintenance which is a result of training, experience and certification.

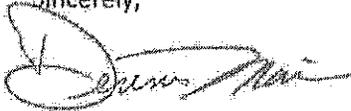
Energy storage systems vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. In addition, the installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well. In contrast, the installation of Solar PV panels is a much more predictable process.

Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. When connected to the grid, these systems can also pose risks to utility infrastructure and utility workers. These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

I recognize that energy storage systems have become an integral component of our industry but have increased the danger of potentially fatal hazards through arc flash, electrical shock, chemical spills and explosions, and other associated fire and life safety risks. An untrained, unqualified person installing these systems not only put themselves at risk, but also their nearby co-workers and the public these systems will serve.

I strongly recommend these systems are installed only by state certified general electricians working for C10 contractors who are qualified to safely and effectively install and maintain energy storage systems.

Sincerely,



Dennis Morin  
Director, Electrical Training Center

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MAY 18 2018



February 20, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Clarification of Regulations for Battery Energy Storage System Installation**

To Whom It May Concern:

The Western States Council of Sheet Metal, Air, Rail and Transportation Workers would like to thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery **transforms** electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *"install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."*



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**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.**

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

Dion Abril, Executive Administrator  
Western States Council of  
Sheet Metal, Air Rail and Transportation Workers

CALIFORNIA STATE ASSOCIATION OF ELECTRICAL WORKERS

Affiliated With



A.F.L. - C.I.O.

*International Brotherhood of Electrical Workers*

February 21, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: Clarification of Regulations for Battery Energy Storage System Installation**

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.

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Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to "install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

308 N. Rampart Street, Suite M, Orange, CA 92668  
Phone (714) 939-3131 • Fax (714) 939-3132

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system.** CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

A handwritten signature in cursive script that reads "Richard Samaniego". The signature is written in black ink and is positioned above the printed name and title.

Richard Samaniego  
Secretary/Treasurer



**CALIFORNIA STATE  
PIPE TRADES COUNCIL**  
PUBLIC, LABOR AND GOVERNMENTAL RELATIONS

1121 L Street, Suite 207  
Sacramento, CA 95814  
T: 916.446.7311 F: 916.446.3520  
www.calpipes.org

February 21, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

***RE: Clarification of Regulations for Battery Energy Storage System Installation***

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery **transforms** electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *"install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."*

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.**

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,



Gregory A. Partch  
Executive Director





May 16, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments on Classifications Authorized to Install Energy Storage Systems (ESS)

Dear CSLB Chair and Members:

My name is Tyler Gilliam and I represent the Santa Barbara County Firefighters Association. I am commenting personally re. license classifications authorized to install energy storage systems (ESS).

I am a sixteen year veteran of the Fire Department.

In my opinion as a fire fighting professional, treating energy storage systems as a subsystem of a solar photovoltaic (PV) energy system would be a mistake that the CSLB would not want to make.

While these systems may be paired together, they are separate systems subject to their own code, installation and fire safety standards. In addition, they pose very different fire and life safety risks such as electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

Battery cells in banks can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system.

If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures.

Unlike lead-acid batteries (which produce oxygen and hydrogen and need to be ventilated to avoid risk to persons), lithium-ion batteries do not produce exhaust gases during normal operation. However, an electrical fault can cause them to produce flammable and toxic gases. Also, the lithium-ion battery chemistry makes them prone to "thermal runaway" if they are damaged or overheated by overcharging. While some brands of lithium-ion batteries have features intended to prevent uncontrolled cell rupture under runaway conditions, there is wide variation in battery technologies and safety technologies, and their effectiveness.

Battery casings can rupture as a result of pressure generated from a change in chemical reaction from over-charging or following an electrical short circuit. Electrolyte fluid or gel can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion. Some of these leaking compounds can be extremely toxic.

Therefore, energy storage systems present a serious safety risk for occupants and installers if incorrectly installed and/or operated. The type of risk and the measures needed to be taken to reduce these risks vary depending on the battery type. Accordingly, it is important that these systems are installed by contractors and workers that have the competency to understand the varying technologies and electrical configurations that may be encountered. Contractors and especially installation workers must be well-versed in electrical theory and electrical risk assessment methodologies. Workers must be qualified persons as required by the National Electrical Code (NEC).

To be clear, I am not just talking about large commercial energy storage systems. Relatively small UL listed ESSs connected to a residential circuit breaker box can also be a serious safety hazard to the public and to first responders. As firefighters, we rely on UL certification to reduce the risk of fire. Even so, unfortunately, UL certification does not eliminate it. Incorrect wiring, improper grounding, poor electrical isolation, and other factors can contribute to creating dangerous situations. There is also a misunderstanding about the effectiveness of circuit breakers. If an ESS is located too far from a breaker, the wrong size wire is used, or the breaker is beyond its recommended lifecycle, a fire can start before the circuit is broken. One of the least understood dangers is thermal runaway. It can happen in any size energy storage device – even a residential wall pack – and once it is underway a circuit breaker will have no impact on containing it. Proper installation by a qualified person is the first and most important line of defense.

My recommendation is that the CSLB follow the practice of the California Fire Code in regulating energy storage systems differently, and separately, from solar PV systems. The California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirement for battery

systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems. The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems.

The California Fire Code requirements for battery systems are substantially different from what is required for solar PV systems and that is for very good reason – they are different systems with very different levels of risk that must be treated differently.

As energy storage system technology continues to advance and change, the building standard codes are constantly playing a game of catch up. Accordingly, it is critical that a contractor has the skill, knowledge, and experience necessary to ensure safe and proper installation of these systems beyond mere compliance with minimum code standards. It should also be recognized that to a great extent, the requisite skill, knowledge, and experience of a contractor is based on having state certified electricians performing the installations.

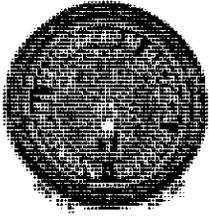
Once again, in my opinion as a fire fighting professional, treating an energy storage systems – of any size – as a subsystem of a solar photovoltaic (PV) energy system would be a mistake that the CSLB would not want to make. Energy storage systems do not become less dangerous or less complicated when paired with a particular electrical power source. It is irrelevant whether the energy storage system is powered by a solar PV system, a wind energy system, or the electric power grid. Because of the specialized skill and knowledge needed to install energy storage systems safely, only contractors that are licensed to install these systems as stand-alone systems should be allowed to install these systems.

In conclusion I strongly urge you to only allow C-10 contractors to install and maintain energy storage systems which are paired with PV systems.

Sincerely,

Tyler Gilliam  
President  
Santa Barbara County Firefighters  
Local 2046





**SAN FRANCISCO ELECTRICAL CONSTRUCTION INDUSTRY  
Labor-Management Office of Business Development**

55 Fillmore Street, Suite 100 • San Francisco • CA 94117  
Tel. 415.241.0126 • Fax 415.241.0129



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Dear Heather,

I'm writing you today to express my written concern for the fact that our already well functioning electrical industry is on the verge of being compromised and fractured by allowing solar contractors to perform the work of a C-10 Electrical Contractor.

I spoke at you hearing a couple weeks ago, but wanted to also submit my written comments to back up my verbal statements about public safety concerns related to ESS.

Our industry prides itself on training, and the education of our manpower to understand the potential threats to life and safety on a regular basis. Anything less than properly skilled and trained electricians, that are certified by the State of California, should not be allowed to perform energy storage work. This work is highly volatile, and possesses more dangerous, higher voltages of direct current electricity, that should not be underestimated under any circumstances.

Besides working for the SF Electrical Construction Industry, I also sit as a member of the SF Planning Commission, appointed by our late Mayor, Ed Lee.

I earned this appointment because I was able to demonstrate that I have the public's best interest in mind when dealing with responsible development, contracting practices and reading blueprints and drawings. I also make the public safety of nearby residents a large priority when looking at perspective construction projects.

I view allowing solar contractors to perform energy storage work as a concession to the solar contractors, and a take-away from the contractors that have historically performed this work in the past.

Energy storage is electrical storage.

Electrical storage is electrical work..

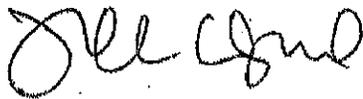
Electrical work is performed by C-10 electrical contractors.

NOT ANY OTHER LICENSE #

I've worked in the industry for 18 years now, and am OSHA 30 trained, NFPA70E trained for arc flash and fire safety. These topics should be taken very seriously, and I believe that if another contractor is allowed to install energy storage work, this would lead to more accidents, electrical injuries, and possibly more fires that could potentially damage persons and properties.

To summarize, it is my strong opinion that energy storage work should only be installed by a C-10 electrical contractor.

Sincerely,



Joel Koppel  
Director, SF Planning Commissioner

IBEW Local 441  
309 N. Rampart  
Orange, Ca. 92868

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

I represent over 1,100 California state certified general electricians and am writing to you about a very important electrical safety issue, and I appreciate the opportunity to make these comments to the California Contractors State Licensing Board (CSLB).

The issue and important safety question facing the CSLB is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

I want to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

I believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be challenged:

1. **C-46 statement or inference:** This is a union or IBEW issue.

**Counter:** In Orange County, Ca. there are hundreds of C-10 contractors who do not employ any union electricians. Orange County has over 1,700 California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the safety oriented test - whether you are union or not.

2. **C-46 statement or inference:** C-46 contractors are capable of doing energy storage work because they pass a test.

**Counter:** Any contractor of significant size must spend their time running their business. Employees do the installations. So it is the qualifications of the employee installers that

really matters. The difference in worker qualifications is vast. **There is NO minimum California state certification requirement for electrical education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors.** In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

3. **C-46 statement or inference:** Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the public.

**Counter:** Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems. Cal/OSHA includes in their field inspection report to check on General Electrician Certification for electrical workers. They know the hazards of untrained electricians to life and property.

4. **C-46 statement or inference:** There is "no evidence" that there are problems or complaints with C-46 contractors.

**Counter:** According to CSLB data:

- o Number of C-10 contractors: 24,391 active; 6,068 inactive  
In 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors - **a 5.6% complaint rate.**
- o Number of C-46 contractors: 1,167 active; 174 inactive.  
In 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-46 contractors - **a 32.2% complaint rate.**

5. **C-46 statement or inference:** If C-46 contractors are not allowed to install ESS, the market will be disrupted or harmed.

**Counter:** A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!

**Additional counter:** While 367 out of 1152 C-46's have dual licenses (32%), 482 C-46's have no worker's comp and claim no employees. That means that 670 C-46's do have employees. Therefore, the 367 dual license holders (who are in good standing) represent 54% (367/670) of the C-46s who have employees. With more than half of C-46s (who have employees) already seeing the benefits of having a C-10 license and utilizing state certified electricians, the market will not be harmed or disrupted.

6. **C-46 statement or inference:** Residential "plug and play" ESS are safe.

**Counter:** So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. The way to make residential ESS safer is to have qualified, certified personnel install and maintain it.

7. **C-46 statement or inference:** The power, danger, and risk of PV and energy storage work are similar. (If I can work on PV, I can work on energy storage.) A spokesperson from Sunrun commented at the CSLB on April 25<sup>th</sup> and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar.

**Counter:** The C-46 representative who indicated this does not understand energy storage, or potential energy. PV produces a stream of electrons that can be likened to a stream of water. In contrast, ESS store a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

**In summary, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.**

**We strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems – whether they are paired with a PV system or not.**

Thank you for considering our comments.

Sincerely,  
Rick Hecht – Business Development  
IBEW Local 441



May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

We, the undersigned California residents trained in the Electrical profession are writing to you about a very important electrical safety issue, and we appreciate the opportunity to make these comments to the California Contractors State Licensing Board (CSLB).

The issue and important safety question facing the CSLB is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

We want to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

We believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be challenged:

1. **C-46 statement or inference:** This is a union or IBEW issue.

**Counter:** In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the test - whether you are union or not.

2. **C-46 statement or inference:** C-46 contractors are capable of doing energy storage work because they pass a test.

**Counter:** Any contractor of significant size must spend their time running their business. Employees do the installations. So it is the qualifications of the employee installers that really matters. The difference in worker qualifications is vast. **There is NO minimum California state certification requirement for education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors.** In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

3. **C-46 statement or inference:** Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the public.

**Counter:** Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

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**Counter:** A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services?  
It is only 3%!

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6. **C-46 statement or inference:** Residential "plug and play" ESS are safe.

**Counter:** So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the

breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. They way to make residential ESS safer is to have qualified, certified personnel install and maintain it.

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**Counter:** The C-46 representative who indicated this does not understand energy storage, or potential energy. PV produces a stream of electrons that can be likened to a stream of water. Energy storage stores a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

**In summary, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.**

**We strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems - whether they are paired with a PV system or not.**

Thank you for considering our comments.

Sincerely,

(Please see following attached pages, Thank you)

Name:

Cody Cass  
Darryl Dragon  
Martin Aguilar  
Timothy Hines  
Anthony Gutierrez  
Tim Anaz  
Christian Cavanah  
Manuel Gonzalez  
Thomas Scholl  
Justin Collins  
Joe Messner  
Robert Peraza  
Joseph Medina  
Edgar Ramirez  
Chris Watson  
Cameron Garcia  
Salvador Vasquez  
Abel Guadarrama  
Vernon Black  
JOHN DEAKINS  
Kyle Buckson  
MARISA SOTO  
Julio Rojas  
Nicholas Krosch  
Dorovan Jester  
Jonathan Kanard  
Jonathan Kanard  
Stefan Bucke  
Elyssa A GARCIA  
Darryl Cass  
Illian Loude  
GILBERT SALAZAR  
Daniel Martinez  
Rick Hockworth  
Manuel Osmond

Kenneth Myers  
 Randy Cochran  
 Brian College  
 Sam King  
 Patrick Anderson  
 DAVID ALMADA  
 Victor Arico  
 Fernando Arlan  
 Ruben Silva  
 Adam Lane  
 Dominic Betancur  
 Austin Aguilar  
 Trevor Hancock  
 Samuel Prochard  
 Austin Drick  
 Andrew Hallam  
 Jason Pachter  
 Anthony Smith  
 BRANDON LABOQUE  
 Brian Adelman  
 Jose Reynoso  
 Jacob Ardaca  
 Art Lane  
 Anthony Pava  
 Rodolfo Solorzano  
 Technician  
 Danny Mendelva  
 Alex Marauri  
 Paul Pacheco  
 Francisco Lomas  
 Eric Martinez  
 Joseph Ramirez  
 Kyle Smith  
 Ryan Pasore  
 Jack Zeit  
 Matthew R. Everedadas

JOSE J. LOPEZ JR.  
Chris Grimes  
Ruben Masagossay  
Kellen Kikner  
DOLAN RICHARD  
DAVID ALVA  
Victor Diaz  
Ben Aton  
Brandon Smith  
Andy Anderson  
Paul Rider  
Victor F. Rodriguez  
Mark Traylor  
LAWAN J VERGUES  
Kristen Rintoul  
JASON MILLER  
MATTHEW SMITH  
JERAMIAH GOWE  
FRANK WOOD  
LIME WOOD  
DANIEL SEVERAL



Los Angeles County Chapter

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May 16, 2018

Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Ms. Young,

On behalf of The Los Angeles Chapter of the National Electrical Contractors Association (NECA) which represents over 300 electrical contracting companies who employ over 8,000 electricians throughout Los Angeles and Ventura Counties, I would like to provide the following written comments regarding the appropriate classification(s) to install an ESS in a standalone contract or when included in the installation of a solar system. These comments are supplemental to my oral testimony given at the April 25, 2018 CSLB hearing on this issue.

My written comments are not intended to supplement my oral testimony but to respond to the misleading and incomplete testimony provided to the Board by the C-46 contractors and their representatives at the hearing. To preface my remarks, I would like to make the observation "when you don't have the evidence, you just start making stuff up". The following are just a few of the misleading statements and misrepresentations made at the hearing by the C-46 contractors and their representatives.

**Comment:**

**C-46 contractors' employees are equally trained and qualified as C-10 contractors certified electricians because they go through OSHA training.**

**Response:**

**OSHA 10 and OSHA 30 are general safety training classes that include a certification if passed. These general safety classes are for all tradespeople including painters, roofers, carpenters etc. While these classes include some references to electrical safety; they are not classes on proper and safe electrical installations, National Electric Code requirements, Fire Code requirements, proper testing and**

Over 75 Years of Service to the Electrical Industry



protective equipment to be utilized. CAL/OSHA does publish a Guide to Electrical Safety which is not a class nor provides a certification but only is intended as a general guideline.

In contrast, C-10 contractors are required to employ state certified electricians who have 8,000 hours of job experience performing various aspects of electrical work and passed a rigorous state examination. There is no reasonable way these two criteria can be considered equivalent and do so would create a tremendous public safety risk.

**Comment:**

These battery energy systems do not pose a safety risk because they are basically small plug and play systems. At CSLB hearings, the C-46 contractors have brought in examples of these battery systems which is a misleading type of "show and tell" demonstration.

**Response:**

These residential ESS can be dangerous and cause fires if not installed properly. More importantly, the C-46 contractors are advocating no limitations on the size of ESS they can install. A microgrid can have several megawatts of battery energy storage.

At the hearing, only the C-10 contractors provided relevant testimony on the larger ESS that their companies have installed and detailed the potential catastrophic safety dangers (i.e. thermal runaway, arc flash-arc blast) that can occur when these systems are not installed properly.

These omissions and lack of credible testimony that C-46 contractors and their employees have the qualifications to install all sizes of ESS should raise "red flags" to the Board.

**Comment:**

The C-46 contractors representative stated there were only ten C-10 contractors without a C-46 license that installs PV systems.

**Response:**

This is just one of many statistics that was put on the record that was not only verifiable but also a blatant falsehood. The raw numbers tell a completely different story of which license performs the vast majority of electrical work, including PV and battery systems, in the state. According to a 2017 CSLB report there were 24,391 C-10 contractors and 1,167 C-46 contractors in California. When the 382 dual license holders are subtracted from the 1,167, there are only 770 C-46 only contractors.

Furthermore in 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors. Comparatively in 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-46 contractors.

C-10 contractors with their state certified workforce perform the preponderance of all electrical work in the state. To testify in a public hearing quoting false and misleading statements should weigh heavily on the Boards decision.

Finally, there has been considerable feed back and comments since the hearing that the C-10 contractors want to eliminate the C-46 license. This is not the case and the testimony at the hearing was clearly not about restricting C-46 contractors installing PV solar. Energy storage systems are separate systems that pose different risks, require different expertise, and have different permitting and code requirements.

In closing, when one group or entity relies on incomplete facts, deception, and misleading statements versus another group that provides credible evidence, expert witnesses and testimony, as well as, verifiable facts – I believe, in the interest of public safety, the right decision is self-evident.



James M. Willson  
Executive Director  
Los Angeles County N.E.C.A.





*International  
Brotherhood of  
Electrical  
Workers*

**Local Union 441**  
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**Richard Samoniego**  
Business Manager

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*Los Angeles/Orange Counties  
Building and Construction  
Trades Council*

*State Building and Construction  
Trades Council of California*

*California State Association of  
Electrical Workers*

*California Labor Federation*

*American Federation of Labor*

*Congress of Industrial  
Organizations*

*Orange County Federation  
of Labor, AFL-CIO*

May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827  
Heather.Young@cslb.ca.gov

**Re: Comments on Classifications Authorized to Install Energy Storage Systems**

Dear Ms. Young:

On behalf of the International Brotherhood of Electrical Workers Local Union 441, I am writing to you about a very important electrical safety issue, and appreciate the opportunity to make these comments to the California Contractors State Licensing Board (CSLB).

The issue and important safety question facing the CSLB is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

We want to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

We believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be challenged:

1. **C-46 statement or inference:** This is a union or IBEW issue.

**Counter:** In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the test - whether you are union or not.

2. **C-46 statement or inference:** C-46 contractors are capable of doing energy storage work because they pass a test.

**Counter:** Any contractor of significant size must spend their time running their business. Employees do the installations. So it is the qualifications of the employee installers that really matters. The difference in worker qualifications is vast. There is NO minimum California state certification requirement for electrical education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors. In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

3. **C-46 statement or inference:** Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the public.

**Counter:** Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

4. **C-46 statement or inference:** There is "no evidence" that there are problems or complaints with C-46 contractors.

**Counter:** According to CSLB data:

- Number of C-10 contractors: 24,391 active; 6,068 inactive  
In 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors – a 5.6% complaint rate.
- Number of C-46 contractors: 1,167 active; 174 inactive.  
In 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-46 contractors – a 32.2% complaint rate.

5. **C-46 statement or inference:** If C-46 contractors are not allowed to install ESS, the market will be disrupted or harmed.

**Counter:** A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!

**Additional counter:** While 367 out of 1152 C-46's have dual licenses (32%), 482 C-46's have no worker's comp and claim no employees. That means that 670 C-46's do have employees. Therefore, the 367 dual license holders (who are in good standing) represent 54% (367/670) of the C-46s who have employees. With more than half of C-46s (who have employees) already seeing the benefits of having a C-10 license and utilizing state certified electricians, the market will not be harmed or disrupted.

6. **C-46 statement or inference:** Residential "plug and play" ESS are safe.

**Counter:** So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. The way to make residential ESS safer is to have qualified, certified personnel install and maintain it.

7. **C-46 statement or inference:** The power, danger, and risk of PV and energy storage work are similar. (If I can work on PV, I can work on energy storage.) A spokesperson from Sunrun commented at the CSLB on April 25<sup>th</sup> and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar.

**Counter:** The C-46 representative who indicated this does not understand energy storage, or potential energy, PV produces a stream of electrons that can be likened to a stream of water. In contrast, ESS store a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

In summary, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.

We strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems – whether they are paired with a PV system or not.

Thank you for considering our comments.

Sincerely,

  
Richard Samaniego  
Business Manager





Pacific Gas and  
Electric Company

Mark Krausse  
Director  
State Agency Relations

1415 L Street, Suite 280  
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February 20, 2018

Mr. David Fogt  
Registrar of Contractors  
Department of Consumer Affairs, Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: C-46 Energy Storage Jurisdiction

Dear Mr. Fogt:

Pacific Gas and Electric Company (PG&E) understands that the Contractors State License Board is considering the issuance of a formal determination to clarify whether C-46 solar contractors will be permitted to install energy storage systems that are paired with solar PV systems. We understand C-46 solar contractors are not allowed to install stand-alone energy storage systems. PG&E would like to express our support for the proposal that would require only contractors qualified to install energy storage systems as stand-alone projects to install those same units paired with PV systems.

Energy storage systems can pose unique and potentially hazardous safety risks if not properly installed or operated. PG&E believes that as this relatively new technology comes into full maturity, installations of energy storage systems in residential and commercial settings should require a skilled, highly-trained workforce to ensure the long-term safety of customers, workers and the public.

PG&E's top priority is always the safety and reliability of the services we provide to our customers. It is with this in mind that we ask the board to adopt eligibility clarifications for contractors that will put safety first.

Respectfully,

Mark Krausse



David L. Geier  
Senior Vice President  
Electric Operations

8330 Century Park Court  
San Diego, CA 92123-1530

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February 20, 2018

Dean R. Grafilo, Director  
Contractors State License Board  
**Department of Consumer Affairs**  
**Consumer Information Division**  
**1625 North Market Blvd., Suite N 112**  
**Sacramento, CA 95834**

**RE: Utility C-46 Energy Storage Jurisdiction Letter**

It has come to our attention that the CSLB has been asked to issue a formal determination clarifying whether C-46 solar contractors will be allowed to install energy storage systems that are paired with solar PV systems. It is our understanding that C-46 contractors are not currently allowed to install energy storage systems as stand-alone projects due to the fact energy storage systems have unique attributes that are vastly different from solar PV systems. A solar PV system generates and exports energy, while an energy storage system has two functionalities: the charge and discharge mode. Energy storage systems also vary widely in type, size and technology. Energy storage encompasses a diverse range of categories, including mechanical, thermal and chemical storage. Energy storage systems can also include the use of flywheels, ultracapacitors, superconducting magnetic energy storage, molten salt, synthetic oil or compressed air and varies wildly in size, with some large commercial systems now hitting the 10 to 20 MW level.

Because of these factors it is our opinion that energy storage systems have their own separate installation and safety standards and codes requirements that must be followed. Requiring appropriately trained and licensed contractors for electrical energy storage installation is necessary to ensure that these systems are installed properly and safely.

The safety and performance of energy storage systems is a particular concern to California utilities because these systems are increasingly interconnected with utilities' own distribution systems. Over the past few years, numerous legislative and regulatory requirements have been adopted that direct California's investor-owned utilities to procure significant energy storage capacity, including distributed, customer-side, behind-the-meter storage. California's Self-Generation Incentive Program (SGIP) was reauthorized with increased funding and an emphasis on distributed energy storage investments and now 75% of all SGIP funds are dedicated to energy storage projects.

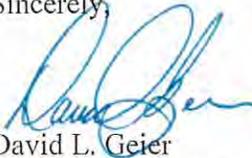
It is clear that storage technology is about to become a transformative aspect of the California electrical infrastructure. Utilizing energy storage systems helps with grid optimization, the integration of distributed generation resources, and the reduction of greenhouse gas emissions.

However, these systems pose unique and particularly hazardous safety, fire and electrocution risks. Improperly installed systems cause hazards and can overheat, explode, arc flashes and blasts of electricity, or burst into flames. Installing large energy storage systems in residential and commercial settings will require special care.

SDG&E has a responsibility to ensure that integrated customer-side energy storage systems do not pose safety risks to customers or our employees, and do not threaten the integrity and performance of the electrical distribution system.

We strongly recommend treating energy storage systems as a separate system that may be connected to a solar PV system, rather than treating it as a mere add-on. Only contractors qualified to install these systems as stand-alone projects should be allowed to install energy storage systems when they are paired with PV systems.

Sincerely,



David L. Geier  
Senior Vice President – Electric Operations

/rn



February 20, 2018

Mr. David Fogt  
Registrar of Contractors  
Department of Consumer Affairs, Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: C-46 Energy Storage Jurisdiction**

Dear Mr. Fogt:

Southern California Edison Company (SCE) provides this letter for the Contractor State Licensing Board's (CSLB's) consideration as the CSLB evaluates issuing a formal determination on whether C-46 contractors should be permitted to install energy storage systems that are paired with solar photovoltaic systems. As described below, SCE believes that only those contractors who are duly-qualified to install stand-alone energy storage systems should be authorized to install such systems paired with solar photovoltaic, in order to ensure their safe and reliable operation and the safety and reliability of the distribution grid.

Energy storage systems are a distinct specialty area. While C-46 contractors are licensed to install, modify, maintain or repair thermal and photovoltaic solar energy systems, this does not directly translate to the expertise needed for energy storage systems. The installation and function of energy storage systems, which are a nascent technology that takes many forms and sizes, require adherence to *specialized* safety standards. This remains true when energy storage systems are paired with solar systems.

The safety of utility employees, customers, contractors, the environment, and the public at large is always SCE's paramount concern. Improperly installed energy storage systems create a serious risk of electrocution and fire. Specialized installers who are expert in the unique safety codes and standards for energy storage systems mitigate that risk.

In addition, SCE expects that the amount of energy storage systems on the electricity grid, and their role in maintaining electric system reliability, will grow rapidly in the coming years. The state's ambitious environmental goals, and customers' clean energy preferences, are driving an increase in energy storage systems (as well as renewable resources) interconnecting to SCE's

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Updated: 3/18/2019

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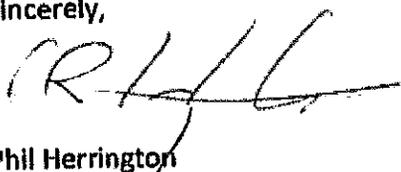
distribution system. SCE strongly supports the state's climate and air quality objectives, a key part of which is our responsibility to ensure the reliable operation of an increasingly cleaner – and more complex – distribution grid. Energy storage systems, properly installed by skilled contractors with the necessary expertise, will play a vital role in maintaining that reliability.

Finally, adopted regulations do not support extending energy storage installation qualifications to C-46 contractors. A C-46 licensed contractor: "installs, modifies, maintains, and repairs thermal and photovoltaic solar energy systems. A licensee classified in this section *shall not undertake or perform building or construction trades, crafts, or skills, except when required to install a thermal or photovoltaic solar energy system.*"<sup>1</sup> An energy storage system is not "required to install" a solar system, but can be connected to a solar system at a customer's election. Contractors with a C-10 or "A" license are properly authorized to install these energy storage systems.

SCE urges the CSLB to make paramount the safety and reliability issues cited above when determining contractor qualifications for combined solar and energy storage system installations.

Thank you for your consideration.

Sincerely,



Phil Herrington  
Senior Vice President, Transmission & Distribution  
Southern California Edison

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<sup>1</sup> 16 CCR § 832.46 (emphasis added).

# SAN JOAQUIN & CALAVERAS COUNTIES ELECTRICAL APPRENTICESHIP & TRAINING PROGRAM

May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

I would like to thank the board for taking the time to read my letter and allowing me the opportunity to voice my concerns on this issue. My name is Garrett Greer, and I am the training director for the San Joaquin & Calaveras Counties Electrical training center, and I would like to address the public, and worker safety concerns related to energy storage systems.

As a California State Certified Electrician, and the administrator of an electrical training program for over 50 apprentices who are studying diligently to earn their California State general electrician certification, it is our duty as an electrical training center to ensure that we provide them with electrical theory and hands on skills to ensure the systems they install will both function as designed and the craftsmanship is of the highest quality. However, our top priority has always been and will continue to be the safety of our trainees, and of the general public. A properly trained, and certified electrician is aware of the hazards inherent in any electrical installation, and has the training to be a "qualified person", as defined by the National Electrical Code, and the California Electrical Code. When we pair the training and experience of a certified electrician with a C-10 contractor, who understands the hazards associated with the installation of electrical systems, a high degree of electrical safety is achieved. They work together so they go home safely to their families, and we protect the public from the dangers of a substandard installation resulting from unqualified persons doing the work of a certified electrician.

In addition to the 8,000 hours of on the job training, that is required to obtain an electrical certification, our electrical trainees will complete 1,020 hours of classroom training which includes subjects such as DC and AC theory, and codes & practices, as pertaining to the NEC, and NFPA 70E. Blueprint reading, motor controls and other theory and skills based subjects are also taught to ensure they understand not only how to install electrical systems, but how they function and make them fully aware of the potential risks, to themselves and the public, and how to alleviate these risks.

We spend five years training our apprentices on the National Electrical Codes (NEC), so they will understand the minimum requirements as set by the code to avoid fire hazards, and shock hazards to themselves and the public. By the time our apprentices have completed their apprenticeship – in addition to all their code study and practice – they will be a qualified person, and be able to pass the exam, and receive a California State General Electricians Certification. They will also have completed NFPA 70E, first aid and CPR and OSHA-10. We teach OSHA

## SAN JOAQUIN & CALAVERAS COUNTIES ELECTRICAL APPRENTICESHIP & TRAINING PROGRAM

because it is a necessary course for understanding the hazards of a jobsite, not for its electrical safety, which is very limited in scope.

We put a lot of emphasis on safety and awareness because our industry requires this for the safety of the worker, first responders, and general public, and energy storage systems are no exception. We recognize that energy storage systems have become an integral component in our industry which is why we as an electrical training facility have invested in additional test equipment, labs, and instructor training, to train our students on how to handle energy storage equipment, and how to protect themselves as well as the public. We make sure they are made aware of, and can protect themselves and other from the potentially fatal hazards through arc flash, electrical shock, chemical spills and explosions, and other fire and life safety risks associated with energy storage systems.

We recognize that this safety training is essential. An untrained, unqualified person – without a state certification -- installing these systems not only puts them at risk, but their co-workers around them and the public these systems will serve.

As an electrical safety professional, I strongly recommend that energy storage systems are installed only by C10 contractors who utilize qualified persons as defined by the NEC. Those qualified persons are electricians who understand and practice not only the proper installation of energy storage system but have received the theory and training to make them as safe as possible.

Sincerely,



Garrett Greer

Training Director, Electrical Instruction  
Certified General Electrician #160624

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

Thank you for taking the time to read this letter, allowing members and participants of the industry your board will affect, to voice their concerns regarding energy storage system installations. My name is James Stark, I am the assistant training director for the San Diego Electrical Training Center. The predominant concern for most of the industry would be life safety and equipment safety during and after an energy storage system is installed. The secondary concern would be a quality, functional, installation. The apprenticeship I graduated from in 2008 and now have the honor to help manage, has over 500 apprentices, aspiring to earn their California State general electrician certification, it is our duty as an electrical apprenticeship to ensure that we provide them with electrical theory and hands on skills to ensure the systems they install, will be installed correctly, safely, and will function as designed. We spend hundreds of hours covering safety and safety procedures during install. Our apprentices will complete 1,020 hours of classroom training which includes subjects such as DC and AC theory, blueprint reading, codes & practices, motor controls, and other theory and skill related classes to ensure they understand not only how to install electrical systems, but how they function. Our curriculum includes classes such as OSHA 10, OSHA 30, NFPA 70E, EM-385, CPR and project supervision which includes arc flash hazard training. Our training is designed to ensure that our students are fully aware of the potential risks and how to minimize the them. We spend five years getting them familiar with the National and California Electrical Codes. It is our responsibility to recognize emerging energy technologies, such as energy storage systems, and prepare our students for the work. We recently added Energy Storage and Micro grid Training and Certification (ESAMTAC) to our curriculum to ensure our students will be prepared. Battery storage and other energy storage systems will always have inherent danger involved with there installation and construction. The primary reason these systems are so dangerous is the fact that at the component level there is no means of disconnect. As the strings are being connected the potential is increasing. The danger is increasing. My point is the system is not going to remain at twelve volts or some other low voltage that seems harmless. The unqualified, untrained individual in the room is the most dangerous. Let me provide an example: I have experienced situations where the least trained individual was working on the some of the most dangerous and delicate terminations in the room. The case involved a manufacturer who sent out there own "technician" to work on and

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terminate a specific piece of equipment in a data center. There were large 48-volt, 2000 Amp battery banks throughout the room. Since the terminations were only 48 volts many of the terminations and the cables were exposed or barely guarded from inadvertent contact. The room and facility and safety protocols in place for how work was to be performed etc... The two "technicians" wore zero personal protective equipment (PPE) and proceeded to leave uninsulated tools scattered about sitting on top of battery banks. The situation was so dangerous that my entire crew refused to work in the same room. When confronted and asked what experience they had with electrical systems, they stated that they were not state certified electricians and had only received training on the system that they were working on. Luckily, no one was injured but one can imagine it is just a matter of time and someone will be seriously injured or dead. We informed the "technicians" of what they were doing wrong and where they could receive more training.

Please consider this; If it is obvious that the C10 contractor can perform the work, safely, with well qualified workers, who are trained in the installation of energy storage systems and other electrical systems. Why then would an entity, municipality or governing board decide to take a chance on allowing a contractor's license that was designed for solar installation, were the contractor may not even employ a certified general electrician. Whatever the reason or rationale, the decision would be an unnecessary risk of peoples lives and the customers property.

Sincerely,

**James Stark**

*Assistant Training Director*



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(858) 569-0624 FAX  
[JStark@sdett.org](mailto:JStark@sdett.org) EMAIL

May 16, 2018

CSLB Board Memebers:

Thank you for giving me the opportunity to comment about who's most qualified to install ESS. My name is Charlie Spencer and I have over forty years' experience in the industry as an electrician, designer, manager and partner in a construction company. I have served on many industry focus groups as well as serving as a Safety Director with a few contractors.

The Codes and Standards regarding ESS are far reaching due to the complexity of the subject. The installer should be familiar with all codes and standards which include National Electrical Codes as well as California and City specific adoptions of those codes as well as the various Nation Fire Protection Association standards on ESS. There are also many other Utility Company Rules regarding the installation, coordination and products that may or may not be permitted.

Having helped write educational curriculum for these installations and having served on focus groups with the mission of creating a safe work environment for both the installer and those who may encounter power being generated, I strongly recommend that only licensed C-10 contractors with California licensed electrical workers be allowed to install ESS.

Thank you again for giving me this opportunity to comment.

Charlie Spencer

Director of Engineering and Productivity

Morrow-Meadows Corporation



## The Alameda County Joint Apprenticeship and Training Committee for the Electrical (Inside Wireman) Trade

14600 Catalina Street ■ San Leandro, CA 94577  
Telephone (510) 351-5282 ■ Fax (510) 351-2949



Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

May 17, 2018

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young and the California State Licensing Board,

My name is Byron Benton and I am the Training Director for the Alameda County Electrical Apprenticeship program. I appreciate this opportunity to communicate with you on the importance of having C-10 Contractors and California State certified general electricians doing the installation and maintenance of energy storage systems that are paired with solar photovoltaic systems.

As an electrical Training Director for the past 15 years, it has been my responsibility to see that all apprentices in our program (established in 1946), as well as California State certified general electricians have the proper training to safely perform work on all electrical systems. In fact, safety training such as OSHA Construction safety training, NFPA 70E, Standard for Electrical Safety in the Workplace, and the applied knowledge of the National Electrical Code (NEC) is not only taught and reinforced during the 5 years of the apprenticeship program, but is constantly reviewed and applied throughout a general electrician's working career.

Regarding the issue of DC versus AC electrical work, DC is the foundation upon which all electrical theory is based. DC theory is akin to learning the letters of the alphabet for an electrician. OHMs law where voltage = current multiplied by resistance is the most basic electrical equation and something that is taught to our 1<sup>st</sup> year apprentices. During the second year of the electrical apprenticeship program, apprentices are exposed to training, both in the classroom and related hands on applications, on solar photovoltaic systems. This training includes the full gamut of solar PV systems to include all related electrical equipment such as solar inverters, where the DC (direct current) that solar panels produce when activated by the sun needs to be converted to AC (alternating current) that is compatible with the utilities electric grid that supplies electrical energy to the building.

In the 3<sup>rd</sup> year of the electrical apprenticeship program, apprentices learn about DC semi-conductors and electronics with multiple power sources. In the 4<sup>th</sup> year, variable frequency drives (VFDs) are part of the classroom and hands on experience. VFDs reduce energy use by converting AC to pulsating DC and then lowering the frequency to achieve significant energy savings, while maintaining the desired motor performance.

Throughout the 5-year electrical apprenticeship, a program that consists of over 1,000 hours of related classroom instruction and a minimum of 8,000 hours of on the job training, the National Electrical Code (NEC) is presented, reviewed, and applied to ensure the proper and safe installation of all electrical systems (DC and AC). Some real world examples of electrical work performed by electrical apprentices and state certified general electricians since inception are DC motors, solar PV systems, battery storage, and UPS or uninterrupted power supply battery back-up systems.

To say that one group is the expert on DC installations and maintenance versus another group being the expert on AC is like saying I am an expert on the letters of the alphabet compared to an English teacher who is an expert on writing essays.

I would like to share an incident that I was personally involved in to highlight the serious safety risk in allowing workers other than state certified general electricians and electrical apprentices, working for C-10 contractors, to install and maintain energy storage systems that are paired with solar PV systems. While working at Chiron (now Novartis) in Emeryville two workers, not electricians, attempted to perform electrical work. A mistake during the work process resulted in an electrical panel blowing up. One of the unqualified workers was immediately rushed to the hospital for electrical burns, while the main research building on the Chiron Emeryville campus was left without power.

The customer immediately reached out to the C-10 contractor that I was employed with for assistance. After a fellow state certified electrician and I worked 24 hours around the clock, power to the building was restored. Upon completion, we were asked to provide Chiron with guidelines to safely perform electrical work as part of their building and maintenance protocols. These adopted procedures were based on the National Electrical Code, OSHA construction safety and the NFPA 70E, Standard for Electrical Safety in the workplace. These industry standards and guidelines are the same resources that our electrical apprentices and state certified electricians are constantly reviewing and applying.

As a California State Certified Electrician and electrical training professional for the past 31 years, I implore you to protect workers, customers, and the general public by requiring that only C-10 contractors and state certified general electricians be allowed to install and maintain all electrical energy storage systems. Anything less will have catastrophic results!

Sincerely,

A handwritten signature in cursive script that reads "Byron L. Benton".

Byron L. Benton  
Training Director



**SAN FRANCISCO JOINT APPRENTICESHIP  
AND TRAINING COMMITTEE**

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**INSIDE WIREMAN**

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May 15, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

I am the training director of the San Francisco Joint Apprenticeship Training Center. I have been in this position for 2 years, and have 22 years of experience as a skilled, trained, and certified electrician. I am writing to express support for limiting Energy Storage System installation to C-10 contractors for reasons of worker and public safety related to the systems' variability in type, size, and power. These comments do not concern C-46 installation of photovoltaic energy resources. Thank you for the opportunity to comment on this matter.

Safety is a fundamental principle in how the JATC educates apprentice electricians. Each of our students obtains 8,000 hours of on-the job training and 1,104 hours of classroom education prior to taking their certification exam. Reliance on a 10 or 30-hour OSHA certification is wholly inadequate to the risks of ESS. Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems. Relying on Cal/OSHA general safety training or an electrical safety guide to install and maintain ESS puts workers and the public at great risk to fire and shock hazards

Arguments by C-46 licensees of their own skills and testing requirements obscure a fundamental fact about the skills of contractors and the training of the workers. **While there may be some contractors who personally perform ESS installation in the course of business, overwhelmingly the work is done by their inadequately trained employees.** What is adequate training, is the 5 years of rigorous training we provide. We train our apprentices to be familiar with the National Electric Code, not just so they can pass an exam, but so they will understand the minimum requirements as set by the code to avoid fire hazards and shock hazards to themselves and the public. By the time they have completed their apprenticeship and prepare to become certified electricians, in addition to all their code study and practice, apprentices will also have completed OSHA-10, OSHA-30, NFPA 70E, and be first aid and CPR certified.

"BRIDGING THE FUTURE THROUGH TRAINING"



This training is vital for working with the next generation of ESS that vary widely in type, size, and power requiring a broader base of electrical and safety knowledge. Some commercial behind-the meter systems are approach 10MW in size and even residential systems are storing ever greater amounts of power. The installation of energy storage systems requires the ability to assess and adapt to the unpredictable field conditions that an installer may encounter in or around a building where the system is located. There may be other unexpected variables and hazards as well.

In conclusion, I strongly urge you to limit all ESS installation to C-10 electrical contractors who are obligated to employ state certified electricians with the requisite skills and training to work in a manner that keeps them safe and allows the operation of these systems without undue hazard to the public and emergency responders.

Sincerely,

Peter Chursin



Training Director SFJATC

**SAN FRANCISCO JOINT APPRENTICESHIP AND TRAINING**  
*"Bridging the Future through Training"*



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EMPIRE ELECTRICAL  
TRAINING TRUST

SERVING MARIN  
SONOMA, MENDOCINO  
HUMBOLDT, DEL NORTE  
AND LAKE COUNTIES



To: CSLB

RE: Written Comments - Classifications Authorized to Install Energy Storage Systems

I would like to thank the CSLB for taking the time to read my letter and allowing for the opportunity to voice my concern. My name is Rob Barsi, and I am the training director for the Redwood Empire Electrical Training Center and I would like to address the public safety concerns related to C-46 contractors installing and maintaining electrical energy storage systems.

I understand that the current policy is to allow C-46 solar PV contractors to install and maintain energy storage systems when paired with solar PV systems. I also understand that this policy is dated and based on older technology. The current systems are far more advanced and allow for much larger storage possibilities. In the past, solar was mainly used on smaller residential properties and the storage requirements were not as large or advanced.

I have personally been involved with the installation of various sized commercial solar projects and it is my belief that only C-10 electrical contractors should be handling the electrical energy storage portions of these systems. The state of California requires that the employees of C-10 contractors who install and/or maintain electrical equipment must be "*State certified General Electricians*". Any C-46 solar contractor can install solar panels with relatively low safety risks that may be covered in CAL/OSHA 10 and CAL/OSHA 30 classes. These classes are general safety classes applicable to all tradespeople including painters, roofers, carpenters, etc. Only C-10 electrical contractors and the California State Certified General Electricians they are required to employ have been specifically trained in electrical safety and installation. Energy storage systems vary widely in type, size, and power requiring a much larger base of electrical and safety knowledge.

Page 1

There are National Electric Code (NEC) requirements that a "Qualified Person" install and maintain Energy Storage Systems (ESS). A State Certified Electrician which a C-10 contractor is required to have working on any electrical system, is a Qualified Person. They have received the minimum essential safety training required including compliance with Federal OSHA 1910 for General Industry, Federal OSHA 1926 for Construction, and NFPA 70E standard for electrical Safety in the Workplace. Those without this training, such as C-46 solar PV contractors, won't be able to recognize the hazards involved as they have not been adequately trained. C-46 contractors have no minimum California state certification requirement for education, training, skills, and experience. That fact alone puts workers and public safety at risk.

Licensed C-10 electrical contractors are qualified to manage construction and installation of energy storage systems, of all scales. They also have the necessary electrical safety training in recognizing and protecting workers from arc-flash, arc-blast, and electrical shock hazards, covered by NFPA 70E

It would be a highly risky and technically improper for the CSLB to treat energy storage systems as a subsystem of a solar photovoltaic (PV) energy system. While these systems can and will be increasingly paired together, they are highly distinctive and separate systems – subject to their own inherent risks, technical specification, codes, installation and fire safety standards. Most energy storage systems are battery-based and pose very different fire and life safety risks such as, fire, arc blast, thermal runaway, explosion and/or exposure to released gases and hazardous chemicals.

C-10 electrical contractors and qualified workers have the knowledge and qualifications to effectively perform all necessary aspects of energy storage system installation that will ensure customers the greatest degree of reliability and safety from such systems. C-10 electrical contractors and electricians are trained in the science of this technology as well as all applicable safety codes and standards that have specific application to these systems.

There is NO minimum California state certification requirement for education, training, skills, and experience of the workers who install PV systems for C-46 contractors. That means that if C-46 contractors are permitted to install energy storage systems, those same workers – with no minimum certification requirements for education, training, skills, and experience - would be installing and maintaining high powered systems, and putting worker and public safety at risk.

Considering the dangers related to energy storage systems, and the high importance of proper and safe installation and maintenance, allowing C-46 contractors and their workers to install energy storage systems is a worker and public safety risk that should not be taken.

As a Training Director my two largest concerns for my apprentices are their safety and their training. Our apprentices work for and are trained by C-10 electrical contractors and many become contractors themselves. I know what it takes to take and pass the state exam to become a "Qualified Person" who can, and does work for these contractors.

As I stated earlier in my letter I strongly believe that only C-10 contractors and State Certified General Electricians are qualified to safely and effectively install and maintain energy storage systems. Their training, certification, experience and knowledge is crucial in their safety and the safety of the public.

In closing, I thank you again for taking the time to read my letter and allowing for me to voice my concern. I urge you to please take the points I have made into consideration in your final judgement.

Sincerely,

Rob Barsi  
Training Director  
Redwood Empire Electrical Training Center

# Request for Qualifications and Proposals for Solar or photovoltaic Systems and Advanced Energy Storage Systems

## Project Details

Project ID	Last Updated	Status	Address
4149456	03/06/2018	Sub-Bidding	1000 W. Foothill Blvd. Glendora, California 91741
Contracting Method	Sector	Estimated Value	Los Angeles County
Bidding as Prime	Public - State/Provincial	\$100,000	Los Angeles-Long Beach- Anaheim, CA Region
Bid Date	Est. Start Date	Solicitation #	United States
Thursday, April 12, 2018	Friday, May 11, 2018	06-1718	
Project Type	Bonds	Building Use	
Renovation	Bid (10%)	Educational - College, University	

## Description

Renovation of an educational facility in Glendora, California. Completed plans call for the renovation of a educational facility. RFP #06-1718, Solar/Photovoltaic & Energy Storage Systems

The District is committed to creating a more vibrant, healthy, prosperous and sustainable community. The District is interested in generating electric power with solar systems on its main campus site, and is looking to identify qualified contractors to design and install solar generation and advanced energy storage systems that provide the greatest benefits to the Owner, and serviced by Southern California Edison.

The District is issuing this Request for Qualifications and Proposals ("RFQ/RFP") to solicit proposals from qualified Solar Contractor(s) ("Contractor") interested in the development of approximately 0.5 megawatts (MW) of solar generation systems coupled with Electric Vehicle (EV) charging stations and advanced energy storage systems (collectively, "Projects").

**Submittal of Bid Proposals.** All Bid Proposals shall be submitted on forms furnished by the District. Bid Proposals must conform with, and be responsive to, the Bid and Contract Documents, copies of which may be obtained from the District as set forth above. Only Bid Proposals submitted to the District prior to the date and time set forth above for the public opening and reading of Bid Proposals shall be considered.

**Prevailing Wage Rates.** Pursuant to California Labor Code 1773, the Director of the Department of Industrial Relation of the State of California has determined the generally prevailing rates of wages in the locality in which the Work is to be performed. Copies of these determinations, entitled A Prevailing wage scale are maintained at the District's Administrative Offices located at 1000 West Foothill Boulevard, Glendora, California 91741, and are available to any interested party upon request. The Contractor awarded the Contract for the Work shall post a copy of all applicable prevailing wage rates for the Work at conspicuous locations at the Site of the Work. The Contractor and all Subcontractors performing any portion of the Work shall pay not less than the applicable prevailing wage rate for the classification of labor provided by their respective workers in prosecution and execution of the Work. Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors of any tier, listed or not, that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. No bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors current registration with the Department of Industrial Relations to perform public work. If awarded a Contract, the Bidder and its subcontractors, of any tier, shall maintain active registration with the Department of Industrial Relations for the duration of the Project.

This Project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. In bidding on this project, it shall be the Bidder's sole responsibility to evaluate and include the cost of complying with all labor compliance requirements under this

contract and applicable law in its bid.

Contractor's License Classification. In accordance with the provisions of California Public Contract Code 3300, the District requires that Bidders possess the following classifications of California Contractors License Board at the time that the Contract for the Work is awarded: B General and C10 Electrical, and C46 Solar.

Any Bidder not so duly and properly licensed shall be subject to all penalties imposed by law. No payment shall be made for work, labor, materials or services provided under the Contract for the Work unless and until the Registrar of Contractors verifies to the District that the Bidder awarded the Contract is properly and duly licensed to perform the Work.

Contract Time. Substantial Completion of the Work shall be 60 days for Phase 1 and 180 days for Phase 2, after issuance of the Notice to Proceed. Failure to achieve Substantial Completion within the Contract Time shall subject the Contractor to assessment of Liquidated Damages for delayed Substantial Completion, as set forth in the Contract Documents.

Bid Security. Each Bid Proposal shall be accompanied by Bid Security in an amount not less than ten (10%) of the maximum amount of the Bid Proposal, inclusive of any additive alternate bid items. Failure of any Bid Proposal to be accompanied by Bid Security in the form and in the amount required shall render such Bid Proposal to be non responsive and rejected by the District.

No Withdrawal of Bid Proposals. Bid Proposals shall not be withdrawn by any Bidder for a period of sixty 60 days after the opening of Bid Proposals. During this time, all Bidders shall guarantee prices quoted in their respective Bid Proposals.

Waiver of Irregularities. The District reserves the right to reject any or all Bid Proposals or to waive any irregularities for informalities in any Bid Proposal or in the bidding.

Award of Contract. The Contract for the Work, if awarded, will be by action of the District's Board of Trustees to the responsible Bidder submitting the lowest responsive Bid Proposal; on the basis of the Base Bid Proposal or on the Base Bid Proposal and any combination of Alternate Bid Items selected in accordance with the applicable provisions of the Instructions for Bidders.

## Structural Details

Educational	Renovation
-------------	------------

## Project Contacts

Name	Company	Role	Phone	Fax	Email
Construction Manager	Citrus Community College District	Owner	(626) 963-0323	(626) 335-8823	

## Project Events

Type	Date & Time	Description
Est.Start Date	05/11/18	-
Bid Date	04/12/18 at 2:00 PM PT	Sealed bids must be submitted to Citrus community college district purchasing office Maintenance, Facilities, Purchasing, Warehouse Complex, 1000 West Foothill Boulevard, Glendora, California 91741-1885
Mandatory Site Walkthrough	03/20/18 at 10:00 AM PT	The mandatory Job-Walk will be conducted at Citrus community college district, purchasing office, 1000 West Foothill Blvd., Glendora, California.

## Document Acquisition

Availability Documents From  
Requesting plans Citrus Community College District  
Acquisition Notes

The Bid and Contract Documents are available for Twenty Dollars (\$20.00) per set after the job walk.

## Construction Requirements

Updated: 3/18/2019

## Trades

26 - Electrical	Low-Voltage Electrical Distribution (262000), Photovoltaic Collectors (263100), Electrical Protection (264000), Lighting (265000),
28 - Electronic Safety and Security	Solar Power Sources for Electronic Safety and Security (280507.19),
48 - Electrical Power Generation	Solar Energy Electrical Power Generation Equipment (481400), Solar Energy Collectors (481413), Electrical Power Generation Battery Charging Equipment (481913),

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## San Diego Electrical Training Trust

4675 Viewridge Avenue  
San Diego, CA 92123-1644  
(858) 569-6633 FAX (858) 569-0624  
Website: [www.positivelyelectric.org](http://www.positivelyelectric.org)

345

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

**Re:** Written Comments - Classifications Authorized to Install Energy Storage Systems

To whom this may concern, my name is Ken Collier. I want to thank the board for this opportunity to comment on issues concerning Energy Storage Systems and to address concerns I have in regards to ESS.

To be clear, my comments will be focused on whether C-46 contractors should install and/or maintain energy storage systems. My comments ARE NOT about whether a C-46 contractor should or shouldn't be installing PV or solar modules. These of course are considered to be two separate systems and each one poses different risks and hazards, require different expertise, and have different permitting and code requirements.

I'm a Certified Electrician in the State of California and I've been in the electrical trade for almost 25 years. I'm currently working as the Lead Instructor at the **San Diego Electrical Training Center** where we have over 500 apprentices enrolled and we teach continuing education classes to over 900 Electricians.

As an instructor, I've taught many different subjects relating to electrical safety including, The National Electrical Code, grounding, electrical theory and NFPA 70E (Arc Flash Hazard Awareness). As a Certified OSHA Outreach Trainer, I've trained over 1000 apprentices and certified electricians in OSHA-10 Hour Construction Safety, OSHA-30 Safety Program Management for Supervisors and EM-385 Army Corp of Engineers Construction Safety.

Since 1983 the San Diego Electrical Training Center is responsible for training some of the best electricians in the word. Our professional trade school is considered to be ranked amongst the top 10 electrical apprenticeships in the country. SDETC apprentices will graduate from our program having studied some of the following topics:

DC Theory, AC Theory, Grounding and Bonding, National Electrical Code, Energy Storage and Microgrid Systems, Power Quality, Photovoltaics Installation, Load Calculations for Electrical Systems and Electrical Test Instruments just to name a few.

In my expert opinion, any worker who would be required to install and/or maintain an ESS containing batteries would have to be nothing less than a QUALIFIED ELECTRICAL WORKER as defined by CalOSHA, Federal OSHA, NFPA 70E and NFPA 70B. The amount of energy stored in a standby battery system that CANNOT be switched off by the way, requires a level of training that is equal to that only of a certified electrician. Tailgate safety meetings and CalOSHA safety training IS NOT enough to prepare a worker to be able to work safely around this potentially lethal system.

Most people are aware that a photovoltaic system is a DC voltage source and a battery storage system also stores a DC voltage that can be charged anywhere from 2 to 48 volts. What most people don't understand is that these are two very different systems that require different types of installation and safety training to be able to work safely with these batteries. Only fully qualified contractors with highly trained state certified general electricians should be installing and maintaining these systems.

When it comes to safety rules, regulations and standards, it has been my experience that most of them are reactive meaning that we only enact new safety rules, regs & standards after enough people have been seriously injured or killed. Here we have the opportunity to be proactive and put into place a set of standards to protect workers from possible electrocution. Thanks again and I hope that the board will make the right decision.

Sincerely,

*Kenneth Collier*  
**Lead Instructor**

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Classifications Authorized to Install Energy Storage Systems

My name is Chris Neuwirth, I am the Training Director for the Fresno, Madera, Tulare and Kings Counties Electrical JATC.

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic (PV) systems. It is the position of the Fresno Electrical JATC that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems.

California's energy future depends on the development and deployment of energy storage systems. Energy storage is a game-changer that will help the state meet its clean energy and climate change goals and make homes, public agencies and businesses more energy independent and efficient. However, improperly installed energy storage systems can pose significant public safety risks if not installed and handled by properly licensed and trained experts.

Ambiguity in state regulations has allowed solar installation (photovoltaic) companies to install energy storage when connected to PV systems. However, storage systems are entirely separate systems that pose very different fire and safety risks and that require much more skilled installations. Simply put, solar contractors are not properly licensed and lack the expertise to safely install these systems.

As California moves toward zero net energy buildings, and new residences are required to have PV solar power, commercial and residential energy storage systems will become more and more common. It is imperative that we ensure that these systems are installed safely and correctly, and we are mindful of the fire and life safety risks of these systems. The addition of an energy storage system to a solar PV system is a significant and substantive addition to the project, not a mere incidental add-on.

The perception of the public regarding the use and deployment of energy storage systems is too important an issue to gamble away on the potential of faultily installed systems that could fail, cause damage, or personal injury. That would be a serious setback to our state's energy and environmental goals. The CSLB must ensure that all

energy storage systems are installed and maintained only by properly licensed contractors who utilize trained and certified workers with in-depth knowledge of electrical theory and all electrical systems.

I urge the CSLB to clarify that only qualified C-10 electrical contractors, utilizing workers who are trained, experienced, and certified, be authorized to install and maintain energy storage systems regardless of whether or not they are paired with a solar PV system.

Thank you, I appreciate the Board's consideration of these comments.

Sincerely,

Chris Neuwirth  
Training Director  
Fresno Area Electrical Training Center



# CENTRAL VALLEY JOINT APPRENTICESHIP AND TRAINING COMMITTEE



May 17, 2018

STANISLAUS, MERCED, MARIPOSA AND TUOLUMNE COUNTIES

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Comments on Classifications Authorized to Install Energy Storage Systems

Dear Ms. Young:

We, the undersigned California state certified general electricians are writing to you about a very important electrical safety issue, and we appreciate the opportunity to make these comments to the California Contractors State Licensing Board (CSLB).

The issue and important safety question facing the CSLB is whether C-46 PV solar contractors should install and maintain electrical energy storage systems (ESS) when paired with PV solar systems (PV).

We want to emphasize that we are not commenting on C-46 contractors installing PV solar, we are only commenting on whether C-46 contractors should be installing ESS.

We believe electrical safety is paramount, so it is very important to address and clear up some possible misunderstandings. At recent CSLB hearings, C-46 contractors and their leaders made a number of misleading statements or inferences that need to be challenged:

1. **C-46 statement or inference:** This is a union or IBEW issue.

**Counter:** In California, there are thousands of C-10 contractors who do not employ any union electricians. Our state has tens of thousands of California state certified general electricians who are not union members. To become a California state certified general electrician you have to pass the test - whether you are union or not.

2. **C-46 statement or inference:** C-46 contractors are capable of doing energy storage work because they pass a test.

**Counter:** Any contractor of significant size must spend their time running their business. Employees do the installations. So it is the qualifications of the employee installers that really matters. The difference in worker qualifications is vast. **There is NO minimum**

1925 Yosemite Blvd.  
Modesto, CA 95354

Phone (209) 579-5417  
Fax (209) 521-0908

Updated: 3/18/2019

**California state certification requirement for electrical education, training, skills, and experience of the workers who install (PV systems) or energy storage systems for C-46 contractors.** In contrast, C-10 contractors are required by law to employ certified electricians who have undergone at least 8,000 hours of electrical training and field experience.

3. **C-46 statement or inference:** Cal/OSHA training is adequate to prepare and protect C-46 installation employees and the public.

**Counter:** Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. Cal/OSHA does publish a *Guide to Electrical Safety* which is not a class and is not the basis for a certification. It is important to note that this guide, while helpful for some basic electrical safety tips, should never be considered adequate for installing or maintaining energy storage systems.

4. **C-46 statement or inference:** There is "no evidence" that there are problems or complaints with C-46 contractors.

**Counter:** According to CSLB data:

- Number of C-10 contractors: 24,391 active; 6,068 inactive  
In 2017, there were 1,372 complaints filed against C-10 contractors, which calculates to 5.6 complaints per every 100 C-10 contractors – a 5.6% complaint rate.
- Number of C-46 contractors: 1,167 active; 174 inactive.  
In 2017, there were 376 complaints filed against C-46 contractors, which calculates to 32.2 complaints per every 100 C-146 contractors – a 32.2% complaint rate.

5. **C-46 statement or inference:** If C-46 contractors are not allowed to install ESS, the market will be disrupted or harmed.

**Counter:** A claim of market disruption, does not make sense because according to a CSLB report, in 2017 there were 24,495 C-10 contractors and 1152 C-46 contractors in California. When the roughly 382 dual license holders are subtracted from the 1152, there are only about 770 C-46 only contractors. How could roughly 770 make any significant impact on a marketplace with more than 24,000 providers of electrical services? It is only 3%!

**Additional counter:** While 367 out of 1152 C-46's have dual licenses (32%), 482 C-46's have no worker's comp and claim no employees. That means that 670 C-46s do have employees. Therefore, the 367 dual license holders (who are in good standing) represent 54% (367/670) of the C-46s who have employees. With more than half of C-46s (who have employees) already seeing the benefits of having a C-10 license and utilizing state certified electricians, the market will not be harmed or disrupted.

6. **C-46 statement or inference:** Residential "plug and play" ESS are safe.

**Counter:** So-called "plug and play" ESS are not as simple, easy, and safe as claimed. A UL listing means that equipment samples have been tested for safety but is no guarantee of safety. Unfortunately, some UL listed devices do catch fire. A circuit breaker reduces fire risk but does not eliminate it. A breaker can be overloaded, or the load may be too far from the breaker, or wire sizes may be wrong, or the breaker may be too old or have been overused. The way to make residential ESS safer is to have qualified, certified personnel install and maintain it.

7. **C-46 statement or inference:** The power, danger, and risk of PV and energy storage work are similar. (If I can work on PV, I can work on energy storage.) A spokesperson from Sunrun commented at the CSLB on April 25<sup>th</sup> and claimed that because C-46 workers install PV they could install energy storage and that the safety issues were similar.

**Counter:** The C-46 representative who indicated this does not understand energy storage, or potential energy. PV produces a stream of electrons that can be likened to a stream of water. In contrast, ESS store a large amount of electricity with great potential like the Hoover Dam. PV will shock you, energy storage can kill you. ESS electrical hazards include arc flash, arc blast, DC electric shock, and thermal runaway. Battery cells can operate at hazardous voltages and deliver severe electrical shock. They must be isolated electrically while any work is being performed on them or other parts of the energy storage system. If an ESS suffers an electrical short circuit or fault, it can cause an arc flash which can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions.

**In summary, C-46 contractors should not be permitted to install energy storage systems. Their workers have no minimum state certification requirements for education, training, skills, and experience. The ESS electrical safety events that can result from uncertified workers with limited or no training and experience can be extremely hazardous to the safety of workers, first responders, and the public.**

**We strongly recommend that the CSLB permit only C-10 contractors to install and maintain energy storage systems - whether they are paired with a PV system or not.**

Thank you for considering our comments.

Sincerely,

Name	Address
<u>Scott A. Taylor</u>	_____
<u>Matthew Weiss</u>	_____
<u>Nick Farrell</u>	_____
<u>PATRICK LOPEZ</u>	_____

Guillermo RIVERA

Jorge Salgado

Michael Rodriguez

Leon Histo

Joey Warshaw

Mark Bowden

DAVID KERN

*Fresno Area Electrical Training Center  
5420 E. Hedges Ave.  
Fresno CA 93727*

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Re: Classifications Authorized to Install Energy Storage Systems

My name is Rory McCarthy

My positions are an Osha Outreach Instructor, JATC Electrical Instructor, and former Navy Electrician with battery charging and maintenance experience.

I am writing to support clarification by the CSLB that C-46 solar contractors should not be authorized to install energy storage systems even when they are connected to solar photovoltaic systems. It is my position that C-46 contractors are not qualified to install energy storage systems when they are paired with solar photovoltaic systems because they and their workers are not qualified to install energy storage systems as standalone systems.

I am/we are particularly concerned that workers who install for C-46 contractors have no state requirements for electrical training and experience. While they may have Cal/OSHA training, that is general safety training and does not address the need for those workers to have the electrical knowledge and experience to safely and effectively install energy storage systems.

While energy storage systems may be paired with solar photovoltaic systems and connected in a variety of configurations, they are separate systems. Energy storage systems have different functions and characteristics than photovoltaic systems and are subject to distinct California Building Standards Code requirements.

In addition to the fact they are separate systems with unique installation requirements, energy storage systems also pose unique and heightened fire and life safety risks to occupants, building officials, and emergency responders. Energy storage systems can overheat, explode, catch fire, and pose significant electrocution risks. The intensity of

these risks is far greater than those posed by PV solar. It is critical that energy storage systems are installed by workers with the proper expertise and training. Accordingly, it would be a serious mistake to treat energy storage systems as mere incidental components of PV systems.

For example, the California Fire Code sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirement for battery systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems. The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems. Adding to the complexity of energy storage systems is the requirement of California Fire Code section 608.13 that permit applications for certain systems must include a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis.

Battery storage system permits must also provide specific storage room design information and details on hourly fire-rated assemblies, fire suppression, smoke detection and ventilation systems. None of which is required for PV systems. Energy storage and PV systems are very different, and they have much different electrical safety and fire requirements, risks, and hazards.

It is my concern to ensure safe building construction, and a safe built environment for the public. As California moves toward zero net energy buildings, and new residence are required to have PV solar power, commercial and residential energy storage systems will become more and more common. It is imperative that we ensure that these systems are installed safely and correctly, and we are mindful of the fire and life safety risks of these systems. I treat the addition of energy storage system to a solar PV system as a significant and substantive addition to the project, not a mere incidental add-on.

I urge the CSLB to clarify that only qualified C-10 electrical contractors, utilizing workers who are trained, experienced, and certified, be authorized to install and maintain energy storage systems regardless of whether or not they are paired with a solar PV system.

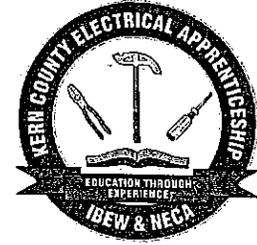
Thank you / I/we appreciate the Board's consideration of these comments.

Sincerely / Regards,  
Rory McCarthy  
Fresno Electrical Training Center

# Kern County Electrical JATC

---

3805 N. Sillect Ave. Bakersfield, CA 93308  
Office 661-324-0105 Fax 661-324-4121 office@428jatc.org



May 15, 2018

Ms. Heather Young

CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Email: Heather.Young@cslb.ca.gov

Re: Written Comments - Classifications Authorized to Install Energy Storage Systems

I would like to thank the board for the opportunity to address them concerning C-46 contractors installing and maintaining energy storage systems. My name is Greg Rogers and I'm the Training Director for the Kern County Electrical Apprenticeship School. I have grave concerns about untrained and unqualified workers installing and maintaining energy storage systems and feel only a C-10 contractors trained electricians can safely perform this type of work.

In our electrical apprenticeship program, we train our apprentices over a five-year period. Our program is comprised of 8,000 hours of on the job training and 960 hours of classroom instruction. All our apprentices must pass the California General Electrician Certification exam to graduate and be classified as a state certified electrician. During the apprentices training we spend considerable time learning electrical theory and safety with extensive study of the National Electric Code, OSHA and electrical safety NFPA 70E. These topics are very complex and require a working knowledge of electrical theory to fully understand and mitigate the electrical hazards associated with energy storage systems.

Energy storage systems operate with direct current and not the more common alternating current. An understanding of electrical theory and safety codes is needed to safely install and maintain these systems. Arc flashes with direct current systems are much larger than alternating current arc flashes because of the way the electric current flows. Direct current arc flashes don't self-extinguish, like alternating current arc flashes do, and this characteristic causes considerably more damage to the equipment and front-line worker. In our training program we spend considerable time the first two years studying and comprehending electrical theory. We demand our apprentices and electricians thoroughly understand the difference between the two types of current, so they can safely perform

work on them. Not thoroughly understanding electrical dangers and how to mitigate them could result in catastrophic consequences to electrical equipment and life.

Thank you for taking my opposition into consideration and urge you to consider the extensive knowledge required in electrical theory and electrical safety needed to safely install and maintain energy storage systems.

Sincerely  
Greg Rogers  
Training Director  
Kern County Electrical JATC



May 18, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

RE: C-46 Installation of Energy Storage Systems.

Email: [Heather.Young@cslb.ca.gov](mailto:Heather.Young@cslb.ca.gov)

Dear Ms. Young.

Thank you for the opportunity to offer these comments. These are a version of my spoken comments at the April 25<sup>th</sup> public hearing in Sacramento. These comments are specifically related to whether C-46 licensees are should be allowed to install energy storage systems; their installation of photovoltaic energy resources is not in dispute.

The mission of the San Francisco Electric Construction Industry (SFECI) is to promote and advance the interests of electrical workers, the contractors that employ them, and the communities in which they live work and play. Our contractors and electricians meet the electrical needs of our clients and community by providing the professional expertise customers expect and deserve.

I am an urban planner with certification by the American Institute of City Planning and a background in construction industry labor markets, workforce development, and infrastructure. With that in mind I'd like step back from questions about specific battery types or code requirements and focus your attention on questions of workforce development and training, wage theft and job quality, public safety, and the type of construction industry that your decision will incentivize

Since the Great Recession the construction industry has struggled to return to its past levels of employment. According to the Employment Development Department construction occupation employment in May 2016 was less than three fourths of the levels of 2006, at the peak of the industry's pre-recession employment. The declines are generally spread throughout the industry with one notable exception among the top ten major occupations that comprise more than three-quarters of all construction workers: Electricians.

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After dropping to less than 42,000 in the depths of the recession, the Electrician occupation exceeded its 2006 level of 60,000 in 2016 and saw real wage growth of nearly 9%, compared to the industry's 5%. The market's demand for skilled and certified electricians is growing faster than the state's most common construction occupations. Solar has grown from 1,700 workers in the 2012 survey, the first year it appeared in California's reports, to nearly 3,900 in 2016. Despite such rapid growth, real wages declined by nearly 3% according to EDD.

This is consistent with UC Berkeley research on job quality in the solar industry that showed not only lower pay but less training and fewer advancement opportunities. It is therefore no surprise that there is no statewide network of registered apprenticeship programs for solar installers according to the Division of Apprenticeship Standards. It is also undoubtedly one reason for the six-fold disparity in the complaint ratio between C-46 and C-10 licensees. CSLB data shows that the complaint ratio for C-46 installers for 2017 was more than 32%, compared to 5.6% for C-10 contractors.

The lack of training and a sustainable career progression has consequences. As the Labor Center has shown, compensation levels are associated with training, training is directly related to personal safety, and this technology's safety issues extend beyond just personal protection but of the entire built environment where its installed.

The CSLB's regulatory decision will help determine whether the nascent battery storage industry, which is projected to handle thousands of megawatts and command billions of dollars within a matter of years. And as the technology matures & proliferates, particularly within the dense urban environments of our load centers, the license board will play a central role in determining whether the industry installing it will be structured around extensive safety, training, and skills or a bare bones regulatory framework that, at the end of the day, sets the competitive dynamic around the lowest price.

The high failure rate of the Certified Electrician exam is a testament to the difference between the low-skill, low-wage approach of the C-46 sector and the C-10 sector's commitment to training, safety, and job quality. Allowing C-46 contractors to deploy their undertrained, underskilled, and underpaid workforce with dangerous technology they don't understand will not only pose a danger to workers but the project owners and the entire built environment, and it will stifle the market's demand for skilled and certified electricians.

Thank you for consideration of this vital matter.

Sincerely,



Alex Lantsberg  
Director, Research & Advocacy



January 31, 2019

Mr. David Fogt  
Registrar of Contractors  
Contractors State Licensing Board  
9821 Business Park Drive  
Sacramento, California 95827

**RE: Sierra Club Comments on Licensing for Battery Storage Installations**

Dear Mr. Fogt:

The Sierra Club strongly supported Senate Bill 100, which will move California toward a clean energy economy by 2045, and battery storage systems will be critical elements, along with solar and other clean energy resources, of making this legislation a reality. To succeed, we must have qualified people install and maintain battery storage systems in the safest and most effective manner whether they are stand alone or are paired with solar. For us, that means all battery storage systems – from residential to utility scale – should be installed only by licensed C-10 contractors with state certified electricians.

The transition to 100% clean energy economy is an opportunity to build a stronger and more equitable California by bringing clean air to communities burdened by harmful pollution, and providing healthy, quality jobs and careers for residents and families.

We appreciate the opportunity to comment on this matter.

Sincerely,

Luis Amezcua  
Senior Campaign Representative



April 25, 2018

Mr. Steven Sands, Registrar  
California Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**President**

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Deputy Building Official  
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City of Solvang

Andrew Stuffer, C.B.O.  
Chief Building Official  
City of Santa Barbara

Brad Wungluck, C.B.O.  
Chief Building Official  
City of Manteca

Dear Mr. Sands:

It has come to our attention that the Contractors State License Board is holding a public participation hearing regarding Energy Storage Systems (ESS) in order to review the appropriate classification(s) to install and ESS in a standalone contract or when included in the installation of a photovoltaic system.

As background, CALBO represents local city and county governments throughout the entire state of California. CALBO members are primarily responsible for enforcing building code requirements in an estimated 95% of the buildings constructed in the state. We ensure that proper public health and structural safety requirements, codes and standards are adhered to within the built environment. We protect the citizens we serve and the overall safety of the public.

Currently licensed electricians, or a C-10 classification, are qualified to install and maintain an ESS. This classification has the proper training and expertise in order to provide the required safety measures and ensure proper code compliance. Alternatively, considering the allowance of a C-46 licensee to perform this job function could jeopardize the integrity and safety of the ESS unit and jeopardize the safety of those within the dwelling. This classification of license does not have the proper training or experience to comply with current installation requirements. Therefore, we support a C-10 classification as the most appropriate for installing an ESS.

Feel free to reach out to CALBO directly with any questions or clarification in our position.

Sincerely,

Katie Almand  
Government Affairs Manager

# **POLITICO GROUP**

May 18, 2018

Heather Young & Board Members  
Contractors State License Board  
P.O. Box 26000  
Sacramento, CA 95826  
Heather.young@cslb.ca.gov

## **RE: NECA COMMENTS FOR CSLB ENERGY STORAGE SYSTEMS PUBLIC PARTICIPATION WORKSHOP**

Dear Ms. Young and Board Members:

I am writing on behalf of the California Chapters of the National Electrical Contractors Association (NECA) in response to the Contractor State License Board's (CSLB) request for public comments on the public safety concerns associated with energy storage systems and related topics. NECA represents over 1200 electrical contractors throughout the State of California who perform a wide variety of electrical work from residential and commercial to small and large-scale energy generation, distribution and storage projects. NECA members include both C-10 and C-46 contractors. While C-46 contractors are clearly qualified and authorized to install solar PV systems, only C-10 contractors have the comprehensive electrical theory background and the certified electrician workforce necessary to safely install modern energy storage systems.

As the demand for energy storage systems continues to grow and the size of energy storage systems grows increasingly larger, the public safety concerns associated with the installation of energy storage systems are of paramount concern. Battery storage systems are no longer low-voltage lead-acid car battery systems. Energy storage systems today are often utility-sized lithium battery arrays with megawatts of storage capacity. This dramatic increase in scale has exacerbated the unique hazards and safety risks posed by energy storage systems. An energy storage system that is improperly installed has the potential to create serious safety hazards for both workers and the public, including electrocution, fires, and explosions.

Appropriately trained and licensed contractors and workers are necessary to ensure these systems are installed and operate properly and safely. The California legislature has directed that complex electrical work performed by specialty contractors in California must be performed by

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1127 11<sup>th</sup> Street Suite 747 – Sacramento, CA 95814 – (916) 444-3770 – Fax (916) 442-6437

Updated: 3/18/2019

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properly trained and certified electricians. The opinion of some CSLB staff that C-46 contractors should be allowed to install energy storage systems that are connected to a photovoltaic (PV) system is not only inconsistent with that goal, it also increases the likelihood of poor quality installations, thereby endangering workers and the public. Moreover, this opinion conflicts with the plain language of the CSLB regulation limiting the scope of C-46 contractor work. The CSLB should disavow this staff opinion and affirm the only specialty contractors authorized to install energy storage systems are C-10 contractors, even where that system is connected to a solar energy system.

### **Public Safety Concerns of Energy Storage Systems**

Treating energy storage systems as a part of the solar installation process ignores the fact that energy storage systems are independent electrical systems that present unique risks and hazards compared to solar energy systems. Public safety risks associated with energy storage systems are far more serious and include electrocution, arc flashes, arc blast, and fire caused by shorting or a thermal runaway of a battery storage system, among others. There are also unique risks posed by the handling of hazardous materials incorporated in energy storage systems, such as the highly-flammable electrolyte within lithium ion batteries. In short, there is no comparison in scope and breadth between the hazard risks of PV systems and the risk of combustion, explosion, or hazardous materials leaks posed by energy storage systems.

Because they are separate systems with unique functions and risks, energy storage systems are also subject to separate code, safety, and installation standards.<sup>1</sup> Energy storage systems are subject to specific requirements under the California Fire Code, as the type of batteries and the associated materials, arrangement of the facility, and size of the system can all pose fire fighting challenges.<sup>2</sup> Energy storage systems are also treated separately from PV solar energy systems under the National Electrical Code.<sup>3</sup>

These differences in public safety risks and standards show that not only are energy storage systems and solar PV systems entirely independent systems, but that the installation of energy storage systems demands a greater degree of competency and familiarity with electrical

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<sup>1</sup> See NEIS, American National Standard, NECA 416-2016, Recommended Practice for Installing Energy Storage Systems (ESS).

<sup>2</sup> See Cal. Fire Code § 608.

<sup>3</sup> See National Electrical Code (2017), Articles 690 & 706.

systems than is necessary for the installation of solar PV systems alone. The knowledge necessary to install a solar PV system does not equate to the knowledge and experience needed to properly and safely install energy storage systems.

### **The Legislature Created A Certified Electrician Program for Complex Electrical Work**

In Chapter 4.5 of the Labor Code, the California legislature established a system of training and certification for electricians to be implemented by the Division of Labor Standards Enforcement. Labor Code Section 108, subsection (c) defines an “electrician” as a person who engages in the connection of electrical devices for licensed electrical contractors. Section 108.2(b)(1) specifies that California electrician training and certification is required for an employee to perform electrical work for C-10 electrical contractors.

The purpose of Labor Code Chapter 4.5 is to establish a system of minimum competency, training, and accountability for those engaged in high risk electrical work.<sup>4</sup> While C-46 classifications are not addressed under this section, the scope of electrical work allowed under C-46 classification is expressly limited on its face to solar PV installation. The legislature did not contemplate that staff would propose to expand this scope to the sort of complex electrical work involved with the modern energy storage systems covered under the 2017 National Electrical Code Article 690. Allowing C-46 contractors to install complex and high-risk energy storage systems thus undermines the intent of the Legislature that individuals performing electrical work of this kind demonstrate sufficient competency before engaging in such work.

### **The Scope of the C-46 Classification Cannot be Expanded by Exam Questions**

As a final point, it has been suggested in recent years that the inclusion of questions on energy storage systems on the C-46 contractor licensing exam ensures C-46 licensees are qualified to install energy storage systems when the system will be paired with a solar energy system. This argument incorrectly assumes that basic familiarity with energy storage systems equates to the knowledge needed to perform quality installations. It makes complete sense that energy storage systems are covered on the C-46 contractor test given that solar and energy

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<sup>4</sup> Cal. Code of Regs., Title 8, § 290. Labor Code Section 108.2, for example, specifies that certification is not required for persons performing work for contractors licensed as class C-7 (low voltage systems) or class C-45 (signs), both lower-hazard electrical work occupations.

storage systems are often connected. However, this is no different than C-46 contractors needing to be familiar with general building or roofing concepts to ensure that a roof-mounted system does not damage the structural integrity of a roof or cause leaks. Basic familiarity with roofing concepts does not mean that the C-46 contractor can install the roof. For the same reason, familiarity with concepts needed to *connect* a PV system to an energy storage system does not mean C-46 contractors are qualified to properly *install* an energy storage system.

More fundamentally, the scope of work authorized under a C-46 license cannot be expanded by exam questions. The scope of the C-46 contractor classification is set by CSLB regulations adopted by the Board. Permitting the authorized scope of work to expand on the basis of exam topics would result in an unlawful underground regulation.

Thank you for the opportunity to comment on these issues.

Sincerely,



Eddie Bernacchi  
Legislative and Regulatory Advocate

# Ogletree Deakins

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May 17, 2018

Ms. Heather Young  
CSLB Executive Office  
9821 Business Park Drive  
Sacramento, CA 95827

Re: Energy Storage Systems

Dear Ms. Young,

I represent the Los Angeles County National Electrical Contractors Association (NECA) and am writing this comment letter on its behalf related to the CSLB classification expansion of C-46 contractors concerning work on energy storage systems.

First, I wish to provide you with a bit of my background and experience. My entire practice is focused on workplace safety. Prior to becoming an attorney, I worked in construction for many years. I served California throughout the 90's, managing Cal-OSHA accredited crane safety inspection company. Since becoming an attorney, I have been a member of over a dozen Cal-OSHA advisory committees established by the Cal-OSHA Standards Board and often testify before the legislature on proposed bills related to health and safety in California. I recognize that the health and safety of the California worker is of the utmost importance. Therefore, as in any rulemaking activity, the issue of safety must be kept in the forefront of any change.

One of the cornerstones to health and safety of any worker is their training, experience and qualifications. This is especially paramount for the work that may be performed on energy stored systems. As we know, this work has become more complex as these systems have evolved in the industry. In many cases, these stored systems are more complex and present many hazards, including exposure to serious and fatal injuries. Therefore, it is imperative that the contractor that performs work on these systems have experienced and qualified electrical workers do such work.

It has been said by some that they are "OSHA Certified" in that the employees have been through the OSHA 10. This by no means whatsoever is an acceptable qualification to be qualified to perform work on stored electrical systems. The OSHA 10 course covers the following topics:

- Orientation
- Module 1: Introduction to OSHA and the OSH Act
- Module 2: General safety and Health Provisions
- Module 3A: Health Hazards: Hazard Communication
- Module 3B: Health Hazards: Hazardous Materials
- Module 4: Cranes and Rigging
- Module 5: Focus Four: Electrical Safety
- Module 6: Struck-By and Caught in Between
- Module 7: Fall Protection
- Module 8: Personal Protective Equipment
- Module 9: Hand and Power Tools
- Module 10: Scaffolds
- Module 11: Stairways and Ladders

This is a basic “general safety” orientation. This course cannot nearly prepare an employee to be a qualified electrical worker who can safely work on stored energy system.

In contrast, a qualified electrical worker that would perform C10 work must meet the requirements of Cal-OSHA, Title 8, Section 2700, “Qualified Electrical Worker. A qualified person who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved.” Clearly, this criteria is well beyond that of an OSHA 10 or even an OSHA 30 course. In fact, the idea that there is a simple OSHA certification course for stored energy as some would try to have this Board believe is nonsensical.

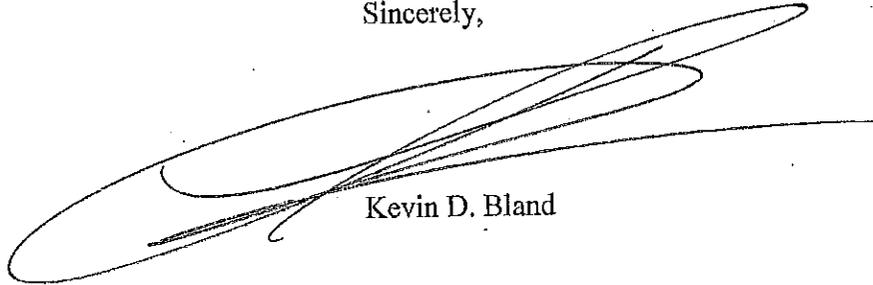
These stored energy systems have the potential to severely injure or kill. Having been part of many Cal-OSHA hearings, I can tell you that trying to argue that an individual had taken OSHA-10 or OSHA-30 would be a feeble defense given the complexity and knowledge required to properly install these systems.

Therefore, it is NECA’s position that work performed on energy storage systems must be limited to those qualified who hold the C-10 license. We urge this board to adopt a policy that work performed on these systems are squarely within the scope of the C-10 contractor.

May 17, 2018  
Page 3

Thank you for the opportunity to provide you with our comment and your consideration of the same.

Sincerely,

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

Kevin D. Bland

KDB:hsg

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LINDA T. SOBCHYNSKI

May 18, 2018

*VIA EMAIL AND OVERNIGHT MAIL*

Heather Young  
and Board Members  
Contractors State License Board  
P.O. Box 26000  
Sacramento, CA 95826  
heather.young@cslb.ca.gov

Re: **Comments on Public Participation Hearing on Energy Storage Systems**

Dear Ms. Young and Board Members:

I am writing on behalf of the Coalition of California Utility Employees ("CUE") to provide written comments in response to the April 25 & 26, 2018 Public Participation Hearing on Energy Storage Systems that was noticed by the Contractors State License Board ("CSLB"). The stated purpose of this hearing is to provide the public the opportunity to provide their perspective and input on "the appropriate classification(s) to contract and install Energy Storage Systems (ESS)." The hearing notice also asked for information on: (1) the types of battery ESS being installed and if they are new and/or evolving technology; (2) the National Electrical Code requirements specific to ESS; (3) public safety concerns related to ESS; and (4) the range of volts an ESS can store, and the differences between residential and commercial systems. At the hearing the CSLB announced it would take written comment on these matters up until May 18, 2018.

The member unions of CUE represent employees of most the electric utilities in California, both public and private. CUE has long been active in the legislative efforts to increase the Renewable Portfolio Standards including both solar and energy storage capabilities in California in order to address climate change. As a

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May 18, 2018

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result of these legislative efforts, the amount of solar PV systems and energy storage systems connected to utility distribution systems is increasing at a dizzying pace. The race to install these systems, however, should not be at the expense of public or employee safety.

## **I. CUE SUPPORTS THE PRIOR COMMENTS OF THE CALIFORNIA INVESTOR-OWNED ELECTRICAL UTILITIES**

CUE joins with the prior comments of the California investor-owned electrical utilities (“IOUs”) in strongly encouraging the CSLB to follow its current regulatory classification provisions and confirm that C-10 contractors are the only specialty contractors that are licensed to install energy storage systems. C-10 contractors are required to use certified electricians and thus provide a level of expertise and safety that is necessary to ensure the safety of these systems.

Attached as Exhibits A, B & C to this comment are letters from Southern California Edison (“SCE”), Pacific Gas & Electric (“PG&E”), and San Diego Gas & Electric (“SDG&E”). Each of these IOUs warn about the unique hazards posed by energy storage systems and argue that only contractors qualified to install energy storage systems as stand-alone systems should be allowed to install those same systems when paired with PV projects. These letters raise concerns regarding the safety of their customers and their employees, and the reliability of their electrical systems when interconnected with these devices.

PG&E’s letter states that energy storage systems are relatively new technology that is still coming into full maturity. Because these systems pose unique and hazardous safety risks if not properly installed or operated, PG&E asks the CSLB to adopt contractor eligibility requirements that put safety first.

SCE’s letter states that “Energy storage systems are a distinct specialty area.” “The installation and function of energy storage systems, which are a nascent technology that takes many forms and sizes, require adherence to specialized safety standards.”

SDG&E’s letter notes that energy storage systems “vary widely in type, size and technology” and that “some large commercial systems are now hitting the 10 to 20 MW level.” SDG&E further states that the “safety and performance of energy storage systems is a particular concern to California Utilities because these systems

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are increasingly interconnected with utilities' own distribution systems. SDG&E state that these systems pose unique and particularly hazardous safety, fire and electrocution risks that can pose a danger to its customers and employees and threaten the integrity and performance of the electrical distribution system.

Several C-46 contractors have suggested that the utilities oppose the installation of energy storage systems and solar power systems. This claim is ludicrous. The vast majority of solar and energy storage system capacity has been and will continue to be procured by the IOUs. Both state law and CPUC directives set ambitious goals for the procurement of solar and energy storage capacity by the utilities, and the utilities have continually exceeded these obligations. For example, AB 2514 requires the IOUs to install 1,325 MW of energy storage by 2024 and AB 2868 added an additional 500 MW to these obligations. These obligations require procurement of energy storage at the transmission level, the distribution level, and behind the meter.

In addition, the California Self-Generation Incentive Program ("SGIP") has recently been revised to require 75% of the funds to go to behind-the-meter energy storage projects, with 90% of the incentives going to projects larger than 10 kW.<sup>1</sup> By the end of 2016, the SGIP had already provided incentives to 716 advanced energy storage projects representing almost 49 MW of rebated capacity.<sup>2</sup> Per the terms of the SGIP program at the time, none of those projects were installed under C-46 contractor licenses.<sup>3</sup>

Not only do the utilities support energy storage installation, they and the employees represented by CUE's member unions have the biggest stake in their success and safety.

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<sup>1</sup> Id.

<sup>2</sup> Exhibit E, ITRON, 2016 SGIP Advanced Energy Storage Impact Evaluation - report to Southern California Gas Company (August 31, 2017) at p. 2-2.

<sup>3</sup> See Exhibit F, 2016 SGIP Handbook at p. 23 (requiring A, B or C-10 contractor license for program eligibility).

## II. CUE'S RESPONSE TO WORKSHOP QUESTIONS

### A. The Types of Battery ESS being Installed and if they are New and/or Evolving Technology

There is no question that battery ESS is an evolving technology. Battery Energy Storage systems have evolved a long way from the lead acid car batteries that used to be connected to solar PV systems. Those battery systems were *de minimis* in size and risk. Lead acid car batteries do not pose the risk of thermal runaway that new lithium batteries pose and are only 12 to 14 volts in size. The old car batteries systems have such low voltage capacity that they are not even covered by the energy storage system provision contained in the National Electric Code. Article 706 of the 2017 National Electrical Code differentiates between modern energy storage systems and the old 12 volt car battery storage systems by limiting its application to energy storage systems operating at over 50 volts ac or 60 volts dc.<sup>4</sup>

Modern energy storage technology is not yet mature, and is thus rapidly changing. Moreover, it varies widely in type and size. A 2014 report on various CPUC-incentivized energy storage system demonstration projects shows the large variety of systems that are being developed. These systems included zinc-based flow energy storage systems, sodium sulfur energy storage systems, lithium-iron phosphate energy storage systems, vanadium redox energy storage systems, iron chromium redox flow energy storage systems, lithium ion energy storage systems, and zinc-bromide based energy storage systems.<sup>5</sup>

Each type of system can carry distinct risks. Because of this, the California Fire Code requires the installation of systems of a certain size to include a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis.<sup>6</sup> In addition, safety cap, thermal runaway management, spill control, neutralization, ventilation, seismic protection, fire suppression and smoke detection requirements will vary based on energy storage technology and configuration.<sup>7</sup>

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<sup>4</sup> Exhibit G, 2017 National Electrical Code, § 706.1.

<sup>5</sup> Exhibit I, CPUC, Relevant CPUC, Energy Commission, and ISO Proceedings & Initiatives, California Energy Storage Roadmap Companion Document (December 2014).

<sup>6</sup> Exhibit H, California Fire Code § 608.13.

<sup>7</sup> See Exhibit H, California Fire Code, Table 608.1.

## **B. The National Electrical Code Requirements Specific to ESS**

Attached as Exhibit G are the relevant sections of the 2017 National Electrical Code. Article 690 addresses solar PV systems, while Article 706 addresses energy storage installation requirements.

Section 690.4 of the 2017 National Electrical Code lists the equipment that may be included in a PV system as the following: (1) Inverters; (2) motor generators; (3) PV Modules; (4) PV panels; (5) ac modules; (6) dc combiners, (7) dc to dc converters; and (8) charge controllers. Figure 690.1(b) shows the five most common configurations of PV systems and states that the PV system disconnect in each of these diagrams separates the PV system from all other systems. In each of these diagrams that show a PV system connected to an energy storage system, the PV system is separated from the energy storage system by both a "PV system disconnect" and an "Energy Storage System disconnect."

Energy storage installation requirements are then set forth in Article 706. Article 706 sets forth unique charge controller, corrosion prevention, location, interconnection, flow controls and ventilation requirements.

The National Electrical Code, however, is not the only code that needs to be looked at in evaluating the difference between these systems. The California Fire Code also imposes specific, unique requirements on the installation of an ESS that a contractor must carefully follow. These requirements vary based on the type and size of systems and require substantial judgment in application.

The California Fire Code also sets forth separate installation and safety requirements for solar PV systems and battery storage systems. The relevant sections of that code are attached as Exhibit H. California Fire Code section 608 sets forth installation and safety requirements for stationary storage battery systems, while California Fire Code section 605.11 sets forth installation and safety requirements for solar photovoltaic power systems. The Fire Code requirements for energy storage systems include specific hazard assessment, fire safety, ventilation, spill control, thermal runaway management and other safety requirements that are not required for solar PV systems. Because they are separate systems with distinct safety requirements, the California Fire Code also sets forth separate permitting requirements for solar PV systems and battery storage systems. California Fire Code sections 105.7.2 and 608.1.1 set forth permit requirements for battery

systems, while California Fire Code section 105.7.15 sets forth permit requirements for solar photovoltaic power systems. The information required to be submitted for each of those permits is substantially different.

### **C. Public and Employee Safety Concerns Related to ESS**

These systems are treated different in the codes because energy storage systems have unique functions and attributes that are vastly different from solar PV systems. A solar PV system generates and exports energy – but does not store energy. An energy storage system does not generate energy, but rather stores and discharges energy.

It is this storage of energy that makes these systems so much more dangerous than a PV system. There is no comparison between the hazard risks of PV systems and the risks of combustion, explosion and hazardous material or gas leaks posed by energy storage systems.

Improperly installed energy storage systems can result in electric arc flashes, fire, explosion, electric shock, hazardous gases or leaks of hazardous chemicals. The type of risk and the necessary protective measures vary based on the size, type and location of the system. Because there is no one size fits all installation standard, contractors must have sufficient training in electrical theory and electrical risk assessment methodologies to understand and safely install the varying technologies and configurations found in field conditions.

CPUC staff has warned about the “novel safety issues” raised as storage technology becomes a transformative aspect of the California electrical infrastructure.<sup>8</sup> Due to these concerns, staff cautioned that to “ensure that we are ready from a safety perspective, a pinch of prevention is more valuable than a pound of cure.”<sup>9</sup>

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<sup>8</sup> Exhibit J, CPUC, Issues, Priorities and Recommendations for Energy Storage Interconnection Staff Proposal (July 18, 2014) at p. 5.

<sup>9</sup> Id.

**D. The Range of Volts an ESS can Store, and the Differences between Residential and Commercial Systems**

Energy Storage Systems can range from a 12 volt lead acid battery to systems over 100 MW in size. Attached as Exhibit K is a list of private Energy Storage projects that have contracted with PG&E in 2016 alone.<sup>10</sup> These projects include both transmission side and customer side installations ranging from 10 MW in size to 50 MW in size.

Residential energy storage projects are relatively small compared to non-residential energy storage projects.<sup>11</sup> While the number of projects installed across the sectors is almost equal, most of the SGIP storage rebated capacity (96%) is installed at non-residential customer sites. 86% of residential projects are smaller than 5 kW systems.<sup>12</sup> Commercial projects tend to be much larger, averaging approximately 140 kW, with some projects exceeding 10 MW.<sup>13</sup>

**E. The Appropriate Classification(s) to Contract and Install Energy Storage Systems**

CSLB contractor classifications do not provide any distinction between contractor work that is performed on the customer or transmission side, nor does it limit contractor qualifications based on the size of the project. Accordingly, in determining the appropriate contractor classification for energy storage systems, the CSLB must consider the types and scope of work this would include and must consider the fact that C-10 contractors are the only specialty contractors required to use trained and licensed electricians. When it comes to complicated and unusually dangerous electrical work, C-10 contractors are the only appropriate specialty contractor classification.

---

<sup>10</sup> Exhibit K, PG&E, Application of PG&E for Approval of Agreements Resulting from Its 2016-2017 Energy Storage Solicitation and Cost Recovery (Dec. 1, 2017) at p. 3.

<sup>11</sup> Exhibit E, ITRON, 2016 SGIP Advanced Energy Storage Impact Evaluation - report to Southern California Gas Company (August 31, 2017) at p. 2-7.

<sup>12</sup> Exhibit E, ITRON, 2016 SGIP Advanced Energy Storage Impact Evaluation - report to Southern California Gas Company (August 31, 2017) at p. 3-6.

<sup>13</sup> Exhibit E, ITRON, 2016 SGIP Advanced Energy Storage Impact Evaluation - report to Southern California Gas Company (August 31, 2017) at p. 2-7, 3-6; PG&E, Application of PG&E for Approval of Agreements Resulting from Its 2016-2017 Energy Storage Solicitation and Cost Recovery (Dec. 1, 2017) at p. 3.

Moreover, on its face, C-46 contractors are barred from installing energy storage systems that are subject to National Electrical Code energy storage system standards. The C-46 license expressly restricts the scope of work to work that is "required to install a thermal or photovoltaic solar energy system." While energy storage systems may be paired with PV systems, they are different beasts. They perform different functions and are subject to different installation, permitting and code standards. These systems also present different fire and life safety risks and are generally located on entirely different areas of a building or property.

At the April 25, 2018 hearing on this matter, several C-46 contractors claimed that installing an ESS takes the same skills and knowledge as installing a solar PV system and claimed that the energy storage systems do not pose any greater health and safety risks than PV systems. As demonstrated from the discussion above, these claims are incorrect. Members of the unions in CUE who routinely work on electrical equipment from 110 volts to 500 kV are keenly aware of the difference between solar PV systems and energy storage systems. Any contractor that would claim these systems do not pose any different health and safety risks and do not require any different skills or knowledge than the installation of PV systems clearly lacks sufficient understanding of these systems to ensure safe installation. Because of the specialized skill and knowledge needed to install energy storage systems safely, and because of the wide variety of these systems and the rapid technological shifts, only workers that are trained electricians should install these systems.

### III. CONCLUSION

Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. Where connected to the grid, these systems can also pose risks to utility infrastructure and utility workers. These dangers do not diminish when energy storage systems are paired with solar PV systems. Only fully qualified contractors should be installing these systems.

Sincerely,



Thomas A. Enslow

May 18, 2018  
Page 9

TAE:ljl

cc: David R. Fogt, CSLB Registrar, [david.fogt@cslb.ca.gov](mailto:david.fogt@cslb.ca.gov)

4103-004j

# **EXHIBIT A**



*Pacific Gas and  
Electric Company*

Mark Krausse  
Director  
State Agency Relations

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February 20, 2018

Mr. David Fogt  
Registrar of Contractors  
Department of Consumer Affairs, Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

RE: C-46 Energy Storage Jurisdiction

Dear Mr. Fogt:

Pacific Gas and Electric Company (PG&E) understands that the Contractors State License Board is considering the issuance of a formal determination to clarify whether C-46 solar contractors will be permitted to install energy storage systems that are paired with solar PV systems. We understand C-46 solar contractors are not allowed to install stand-alone energy storage systems. PG&E would like to express our support for the proposal that would require only contractors qualified to install energy storage systems as stand-alone projects to install those same units paired with PV systems.

Energy storage systems can pose unique and potentially hazardous safety risks if not properly installed or operated. PG&E believes that as this relatively new technology comes into full maturity, installations of energy storage systems in residential and commercial settings should require a skilled, highly-trained workforce to ensure the long-term safety of customers, workers and the public.

PG&E's top priority is always the safety and reliability of the services we provide to our customers. It is with this in mind that we ask the board to adopt eligibility clarifications for contractors that will put safety first.

Respectfully,

Mark Krausse

# **EXHIBIT B**



An EDISON INTERNATIONAL<sup>®</sup> Company

February 20, 2018

Mr. David Fogt  
Registrar of Contractors  
Department of Consumer Affairs, Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

**RE: C-46 Energy Storage Jurisdiction**

Dear Mr. Fogt:

Southern California Edison Company (SCE) provides this letter for the Contractor State Licensing Board's (CSLB's) consideration as the CSLB evaluates issuing a formal determination on whether C-46 contractors should be permitted to install energy storage systems that are paired with solar photovoltaic systems. As described below, SCE believes that only those contractors who are duly-qualified to install stand-alone energy storage systems should be authorized to install such systems paired with solar photovoltaic, in order to ensure their safe and reliable operation and the safety and reliability of the distribution grid.

Energy storage systems are a distinct specialty area. While C-46 contractors are licensed to install, modify, maintain or repair thermal and photovoltaic solar energy systems, this does not directly translate to the expertise needed for energy storage systems. The installation and function of energy storage systems, which are a nascent technology that takes many forms and sizes, require adherence to *specialized* safety standards. This remains true when energy storage systems are paired with solar systems.

The safety of utility employees, customers, contractors, the environment, and the public at large is always SCE's paramount concern. Improperly installed energy storage systems create a serious risk of electrocution and fire. Specialized installers who are expert in the unique safety codes and standards for energy storage systems mitigate that risk.

In addition, SCE expects that the amount of energy storage systems on the electricity grid, and their role in maintaining electric system reliability, will grow rapidly in the coming years. The state's ambitious environmental goals, and customers' clean energy preferences, are driving an increase in energy storage systems (as well as renewable resources) interconnecting to SCE's

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Rosemead, CA 91770

distribution system. SCE strongly supports the state's climate and air quality objectives, a key part of which is our responsibility to ensure the reliable operation of an increasingly cleaner – and more complex – distribution grid. Energy storage systems, properly installed by skilled contractors with the necessary expertise, will play a vital role in maintaining that reliability.

Finally, adopted regulations do not support extending energy storage installation qualifications to C-46 contractors. A C-46 licensed contractor: "installs, modifies, maintains, and repairs thermal and photovoltaic solar energy systems. A licensee classified in this section *shall not undertake or perform building or construction trades, crafts, or skills, except when required to install a thermal or photovoltaic solar energy system.*"<sup>1</sup> An energy storage system is not "required to install" a solar system, but can be connected to a solar system at a customer's election. Contractors with a C-10 or "A" license are properly authorized to install these energy storage systems.

SCE urges the CSLB to make paramount the safety and reliability issues cited above when determining contractor qualifications for combined solar and energy storage system installations.

Thank you for your consideration.

Sincerely,



Phil Herrington  
Senior Vice President, Transmission & Distribution  
Southern California Edison

---

<sup>1</sup> 16 CCR § 832.46 (emphasis added).

# EXHIBIT C



David L. Geier  
Senior Vice President  
Electric Operations

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February 20, 2018

Dean R. Grafilo, Director  
Contractors State License Board  
**Department of Consumer Affairs**  
**Consumer Information Division**  
1625 North Market Blvd., Suite N 112  
Sacramento, CA 95834

**RE: Utility C-46 Energy Storage Jurisdiction Letter**

It has come to our attention that the CSLB has been asked to issue a formal determination clarifying whether C-46 solar contractors will be allowed to install energy storage systems that are paired with solar PV systems. It is our understanding that C-46 contractors are not currently allowed to install energy storage systems as stand-alone projects due to the fact energy storage systems have unique attributes that are vastly different from solar PV systems. A solar PV system generates and exports energy, while an energy storage system has two functionalities: the charge and discharge mode. Energy storage systems also vary widely in type, size and technology. Energy storage encompasses a diverse range of categories, including mechanical, thermal and chemical storage. Energy storage systems can also include the use of flywheels, ultracapacitors, superconducting magnetic energy storage, molten salt, synthetic oil or compressed air and varies wildly in size, with some large commercial systems now hitting the 10 to 20 MW level.

Because of these factors it is our opinion that energy storage systems have their own separate installation and safety standards and codes requirements that must be followed. Requiring appropriately trained and licensed contractors for electrical energy storage installation is necessary to ensure that these systems are installed properly and safely.

The safety and performance of energy storage systems is a particular concern to California utilities because these systems are increasingly interconnected with utilities' own distribution systems. Over the past few years, numerous legislative and regulatory requirements have been adopted that direct California's investor-owned utilities to procure significant energy storage capacity, including distributed, customer-side, behind-the-meter storage. California's Self-Generation Incentive Program (SGIP) was reauthorized with increased funding and an emphasis on distributed energy storage investments and now 75% of all SGIP funds are dedicated to energy storage projects.

It is clear that storage technology is about to become a transformative aspect of the California electrical infrastructure. Utilizing energy storage systems helps with grid optimization, the integration of distributed generation resources, and the reduction of greenhouse gas emissions.

However, these systems pose unique and particularly hazardous safety, fire and electrocution risks. Improperly installed systems cause hazards and can overheat, explode, arc flashes and blasts of electricity, or burst into flames. Installing large energy storage systems in residential and commercial settings will require special care.

SDG&E has a responsibility to ensure that integrated customer-side energy storage systems do not pose safety risks to customers or our employees, and do not threaten the integrity and performance of the electrical distribution system.

We strongly recommend treating energy storage systems as a separate system that may be connected to a solar PV system, rather than treating it as a mere add-on. Only contractors qualified to install these systems as stand-alone projects should be allowed to install energy storage systems when they are paired with PV systems.

Sincerely,



David L. Geier

Senior Vice President – Electric Operations

/rn

# **EXHIBIT D**

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# CPUC REQUIRES ADDITIONAL 500 MW OF ENERGY STORAGE FROM CALIFORNIA IOUS

May 02 2017

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By [Buck Endemann](#), [William Holmes](#), [Andrea Lucan](#)

Under AB 2514, California’s landmark energy storage law passed in 2013, California’s three Investor-Owned Utilities (“IOUs”) (Southern California Edison (“SCE”), Pacific Gas & Electric (“PG&E”), and San Diego Gas & Electric (“SDG&E”)) are required to install 1,325 MW of energy storage by 2024.<sup>[1]</sup> Recent California Public Utilities Commission (“CPUC”) decisionmaking under a later-passed energy storage law, however, has added an additional 500 MW to the IOUs’ procurement obligations.

In 2013, the CPUC broke down AB 2514’s 1,325 MW storage target into three sub-targets, where each IOU must procure a specific amount of transmission-connected, distribution-connected, and

behind-the-meter storage resources in a series of biennial procurement cycles through 2020.[2] The California IOUs have collectively made considerable progress toward these respective energy storage sub-targets, and have even begun procuring energy storage projects outside of the AB 2514 procurement cycles (such as in connection with fulfilling local capacity requirements and (for SCE) in response to the Aliso Canyon gas shortage).[3]

AB 2868, signed by California Governor Jerry Brown in 2016, requires PG&E, SCE, and SDG&E to propose programs and investments for up to 500 MW of distributed energy storage systems (defined as distribution-connected or behind-the-meter energy storage resources with a useful life of at least 10 years).[4] While there is considerable overlap with the types of resources covered by AB 2514, AB 2868's 500 MW proposal excludes transmission-connected resources is not subject to the 2020 procurement or 2024 installation requirements and various other requirements of the AB 2514 program.

Emboldened by the success of AB 2514, on April 27, 2017, the **CPUC ordered** the IOUs to incorporate proposals for programs and investments for the full 500 MW of distributed energy storage systems (166.66 MW for each of PG&E, SCE, and SDG&E).[5] While the CPUC emphasized that the additional 500 MW does not raise AB 2514's original procurement targets, Commissioner Peterman's decision directed each IOU to incorporate the applications for AB 2868's distributed energy storage systems into AB 2514's existing process for approving the biennial utility procurement plans.[6] For practical purposes, the CPUC decision will facilitate the interconnection of an additional 500 MW of energy storage to the California grid, along the same general processes of AB 2514, although the existing limitations on large pumped-hydro, electric-vehicle charging, and gas-to-power storage resources remain in place.[7]

Consistent with other California energy storage initiatives, this CPUC decision continues California's focus on the customer and distribution-connected opportunities for energy storage. Additionally, after a one-year hiatus, California's Self-Generation Incentive Program ("SGIP") was reauthorized recently with increased funding and an increased emphasis on distributed energy storage investments. SGIP provides funding and subsidies for a variety of behind-the-meter energy projects, mostly on commercial and industrial properties, and in the past had been dominated by fuel cell technologies. The revised SGIP program has a much bigger focus on energy storage, however, with eligible storage projects receiving 85% of the additional SGIP funds, with 90% going to (non-residential) projects larger than 10 kW (overall, 75% of all SGIP funds are dedicated to energy storage projects).[8]

With the interest generated by AB 2514's procurement targets, the new 500 MW of storage required by AB 2868, and the reauthorized SGIP program, California will likely continue to lead the nation in procured and installed energy storage capacity. The CPUC has stated that its policy goal for storage is "market transformation," which has to date favored initiatives focused on distribution-connected and behind-the-meter energy resources.[9]

PG&E, SCE, and SDG&E are required to host at least two workshops by the end of 2017 to develop consistent definitions of terms, proposals for how to evaluate projects, and their plans for incorporating the 500 MW of distributed energy storage systems into their 2018 energy storage

procurement and investment plans.<sup>[10]</sup> K&L Gates' energy storage lawyers will continue to monitor these ongoing developments.

[1] See Cal. Pub. Utilities Code §§ 2835 *et seq.*; Cal. Public Utilities Commission, D.13-10-040.

[2] Cal. Pub. Utilities Commission, D.13-10-040 at 11-14.

[3] Cal. Pub. Utilities Commission, D.17-04-039 at 15.

[4] Cal. Pub. Utilities Code §§ 2838.2 – 2838.3.

[5] Cal. Pub. Utilities Commission, D.17-04-039 at 20.

[6] Cal. Pub. Utilities Commission, D.17-04-039 at 15-22.

[7] Cal. Pub. Utilities Commission, D.17-04-039 at 7-13.

[8] Microgrid Knowledge, *California Doubles SGIP Benefits, Gives Big Boost to Energy Storage Funding*, available at <https://microgridknowledge.com/energy-storage-funding-sgip/>

[9] Cal. Pub. Utilities Commission, R.10-12-007, Assigned Commissioner's Ruling Proposing Storage Procurement Targets and Mechanisms and Noticing All-Party Meeting at 3, 20 (June 10, 2013).

[10] Cal. Pub. Utilities Commission, D.17-04-039 at 20-21.

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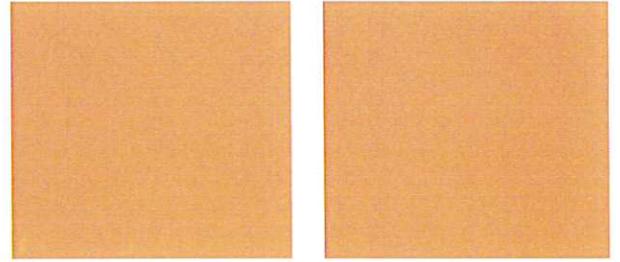
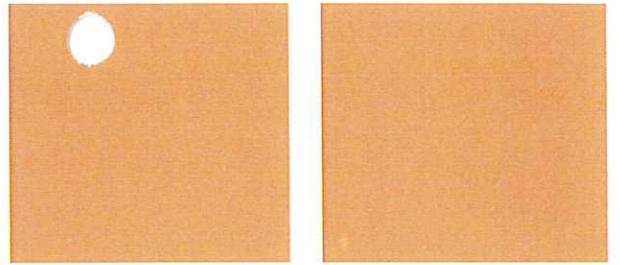
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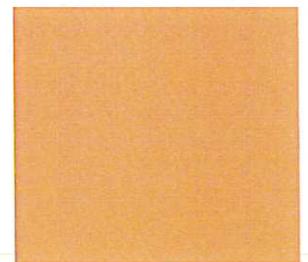
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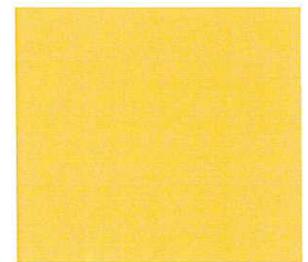
# **EXHIBIT E**



# 2016 SGIP ADVANCED ENERGY STORAGE IMPACT EVALUATION



Submitted to:  
Southern California Gas Company  
SGIP Working Group



Prepared by:

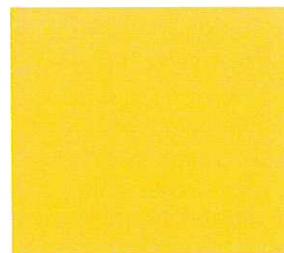


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August 31, 2017

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## **2016 SGIP Energy Storage Evaluation Report Foreword**

This evaluation of the impact of Self-Generation Incentive Program (SGIP) energy storage systems in 2016 contains several notable findings. On average, SGIP systems are helping to reduce load during system peak hours, and reduce customer demand overall. Customer bills are likely lowered by the performance of SGIP systems. Overall, SGIP systems are estimated to have provided benefits to Pacific Gas and Electric (PG&E) and Southern California Edison (SCE), and their ratepayers, in the form of avoided costs in 2016.

While the evaluation's findings indicate that SGIP is generally helping to reduce system peak demand, customer peak demand and customer bills, a key goal of the SGIP program is to reduce greenhouse gas (GHG) emissions, which is not currently being met. The evaluators believe that this is principally due to rate designs that are misaligned with peak marginal GHG hours, which prevent customers from receiving signals that would lead to GHG reductions. The evaluation also reveals other system performance issues that require attention. These include data availability for residential and certain small non-residential systems, low efficiency and increased system peak demand arising from smaller systems, and renewable integration for all systems.

To meet these goals improvements should be considered to ensure that SGIP systems reduce GHG emissions, effectively integrate intermittent renewable resources, provide reliable data, and meet minimum efficiency requirements.

Steps are now underway to address the GHG emissions issues including a focus on rate design, but these will take time to be fully implemented for all utilities. For example, Commission Decision (D.) 17-08-030<sup>1</sup> made substantial changes to San Diego Gas & Electric's rate design by moving to a 4-9PM peak period and adopting a new super off-peak period during springtime months to encourage load consumption at times when renewable oversupply conditions occur on the grid. This should encourage energy storage charging and discharging patterns that better align with GHG reductions and renewable integration objectives. PG&E and SCE have pending rate cases before the Commission where similar proposals are under consideration. While rate design updates address some issues identified in the 2016 evaluation, Staff believes there are additional opportunities to better align system performance with SGIP goals.

Energy Division proposes to address the results of the 2016 Evaluation Report at a public workshop on November 17<sup>th</sup>, 2017 at the CPUC's headquarters in San Francisco. All interested parties are welcome to attend and discuss solutions to the problems identified by the evaluation. After the workshop, Energy Division expects to draft a Staff Proposal that contains recommended changes to SGIP for the CPUC's consideration.

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<sup>1</sup> Available at: <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M194/K599/194599448.PDF>

Energy Division preliminarily proposes the following possible solutions for consideration by parties ahead of the November 17<sup>th</sup> workshop. Parties are welcome to use these ideas as a starting point for their own proposals, or prepare other proposals for discussion at the workshop. Energy Division's preliminary proposals are to:

- Extend SGIP's Performance Based Incentive requirements to all energy storage systems over 10kW in size to ensure that performance data is provided for these systems
- Ensure that all SGIP projects going forward meet efficiency requirements by either
  - establishing a penalty process, or
  - withholding a portion of the incentive payments, for those developers that fail to meet efficiency requirements
- Require complete and accurate data from residential and small non-residential projects, subject to penalties for those developers that fail to provide sufficiently reliable data
- To the extent updated rate designs do not address the problem, modify the operating requirements of SGIP systems such that a certain number of cycles are required to charge during periods of low marginal GHG emissions and discharge during periods of high marginal GHG emissions

Please contact Energy Division's SGIP analyst – Patrick Doherty – if you wish to participate in the workshop. He can be reached at [PD1@cpuc.ca.gov](mailto:PD1@cpuc.ca.gov) or (415) 703-5032.



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May 18, 2018

**Via Email & Overnight Mail**

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Contractors State License Board  
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**Re: IBEW Comments on Energy Storage Systems for CSLB Public Participation Hearing**

Dear Ms. Young and Board Members:

On behalf of the California International Brotherhood of Electrical Workers locals ("IBEW"), I am writing to provide comments in response to the Contractors State License Board ("CSLB") public participation hearing on energy storage systems. IBEW's California locals represent over 30,000 California electricians. IBEW's members have installed most of the major solar and energy storage projects in the State – including the Imperial Irrigation District Battery Energy Storage Project's 30-megawatt, 20 megawatt-hour lithium-ion battery energy storage system, which was considered at the time of its construction to be among the largest of its kind in the western United States.

IBEW disagrees with the interpretation issued by one member of the CSLB staff that C-46 solar contractors should be permitted to install energy storage systems when such systems are installed with solar photovoltaic ("PV") systems.<sup>1</sup> This staff interpretation is in direct conflict with the Board's own classification regulations, which strictly limit the scope of work authorized under a C-46 contractor license to work that is required for the installation of the PV system alone. To the extent that staff is attempting to treat energy storage systems as part

<sup>1</sup> See Contractors State License Board, Enforcement and Licensing Committee Meeting Packet, p. 93

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of the PV system, staff is ignoring that these are separate systems with separate code and safety requirements. Moreover, the unique and significant risks associated with energy storage systems strongly support a policy of treating these systems as separate systems that require the specialized electrical knowledge and the certified electrician workforce provided by C-10 contractors. Proper installation of energy storage systems, whether connected to a solar energy system or otherwise, requires the use of trained and skilled electrical workers. Because C-46 contractors are limited in the electrical work that they may perform, almost a third of C-46 contractors also carry a C-10 contractors license. Like other non-PV electrical work, the installation of energy storage systems is beyond the scope of the C-46 license.

#### **I. THE C-46 SOLAR CONTRACTOR LICENSE CLASSIFICATION DOES NOT INCLUDE INSTALLATIONS OF ENERGY STORAGE SYSTEMS**

Under State law, specialty contractors that are licensed in one class are prohibited from performing work in the field of another class unless they are also licensed in that class or the work is “incidental and supplemental” to the work in the craft for which the contractor is licensed.<sup>2</sup> The scope of work a licensed specialty contractor may legally perform is set by the classification regulations adopted by the CSLB.<sup>3</sup> For solar contractors, section 832.46 of the CSLB regulations authorizes licensees to perform the following work:

A solar contractor installs, modifies, maintains, and repairs thermal and photovoltaic solar energy systems.

A licensee classified in this section shall not undertake or perform building or construction trades, crafts, or skills, except when required to install a thermal or photovoltaic solar energy system.

Thus, under the CSLB’s regulations, whether or not C-46 contractors are authorized to install battery energy storage systems turns on whether battery energy storage systems are a part of PV solar energy systems, or, instead, are separate systems that may be paired with and used in conjunction with each other.

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<sup>2</sup> Bus. & Prof. Code § 7059; 16 C.C.R. § 830(b).

<sup>3</sup> See 16 C.C.R. § 832.

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CSLB regulations do not define “photovoltaic solar energy system.” However, a prior CSLB Licensing and Enforcement Committee document did provide the following definition of Electrical Energy Storage systems:

Electrical Energy Storage (EES) systems store electricity obtained when power is not being used, which usually occurs during off-peak times. The stored electricity is used to maintain a constant voltage, and also can be utilized during a power outage.

These stations consist of foundations and transformers set on concrete pads, and battery containers set on helical piers (usually galvanized steel piers driven into the ground to a predetermined depth with a piece of machinery). The systems typically include 40 MWh or 80 MWh of battery energy storage, which captures clipped photovoltaic solar generation during off-peak times. The capacity or size of such systems can range from a small 5KW residential system to a 80(+) MW commercial, industrial, or utility installation.<sup>4</sup>

As this explanation shows, the basic purpose of an energy storage system is to store or capture the electricity generated by an electrical generating system so that it may be distributed as needed. Solar energy systems, on the other hand, generate or produce electricity.<sup>5</sup> While these two types of systems may be paired, electrical energy storage systems are functionally independent from the solar systems to which they are connected.

This interpretation is consistent with the CPUC’s decision in Rulemaking12-11-005, which described energy storage systems as separate devices that may be “paired” with other power sources, including solar PV systems.<sup>6</sup> The California Fire

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<sup>4</sup> Contractors State License Board, Enforcement and Licensing Committee Meeting Packet, pp. 59-60 (Oct. 28, 2016) available at [http://www.cslb.ca.gov/Media\\_Room/Board\\_And\\_Committee\\_Meetings/2016/](http://www.cslb.ca.gov/Media_Room/Board_And_Committee_Meetings/2016/).

<sup>5</sup> In recognition of this distinction, the October 2018 CSLB Licensing and Enforcement Committee document explained, “A C-46 Solar contractor may only perform electrical work that will *energize* the solar system being installed. Microgrids and EES systems are not intended to energize a solar energy system; they are designed specifically to capture the electricity generated by the solar energy system.” *Id.*

<sup>6</sup> The Second Amended Ruling and Scoping Memo states that storage devices are an “addition or enhancement” to a NEM-eligible generation facility. R.12-11-005, Second Amended Ruling and Scoping Memo (June 29, 2017) at p. 3. In its “Decision Adopting Net Energy Metering Bill Credit Estimation Methodology for Generating Facilities Paired with Small Storage Devices,” the

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Code and the National Electrical Code also both treat solar energy systems and energy storage systems as separate devices.

Section 832.46 of the CSLB regulations expressly states that a C-46 contractor “shall not undertake or perform building or construction trades, crafts or skills, except when required to install a thermal or photovoltaic solar energy system.”<sup>7</sup> This express restriction on the scope of C-46 contractor work is even more limited than the general restriction on the scope of specialty contractor work set forth in Business and Professions Code section 7059. Section 7059 states that a specialty contractor may only perform work that falls under the scope of other contractor classifications if that work is “incidental and supplemental” to the performance of the work in the craft for which the specialty contractor is licensed.

While energy storage systems can be connected to solar energy systems, they are neither “required” to install PV systems nor are they “incidental” to the installation of PV energy systems. As explained above, the energy storage system and the PV system are each separate systems that can work together or separately. These systems may be connected so that each system may utilize the energy generated by the other, or they may be powered independently by any other source of energy, including the utility power grid. When used together, a solar PV system and an energy storage system may be connected in a wide variety of configurations.<sup>8</sup> They can be connected to the same inverter or separate inverters. They can be grid connected and can be designed to disconnect from the grid during power outages and then automatically reconnect to the grid once power from the grid is restored. They can also be configured to operate independently of the grid in what are known as microgrid systems.

The mere fact that a solar PV system is connected to an energy storage system does not make an energy storage system *required to install* or incidental to the installation of a solar energy system. Such a broad interpretation would make any system or device connected to, or powered by, a solar PV system required work.<sup>9</sup>

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Commission describes energy storage devices as “paired” with solar PV devices or other non-solar energy producing systems. R.12-11-005, Decision Adopting Net Energy Metering Bill Credit Estimation Methodology for Generating Facilities Paired with Small Storage Devices (March 4, 2016) at p. 2.

<sup>7</sup> 16 C.C.R. § 832.46 (emphasis added).

<sup>8</sup> [Exhibit 1] Declaration of Dan Henrich.

<sup>9</sup> [Exhibit 1] Declaration of Dan Henrich.

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For example, the connection between installation of a solar energy system and installation of a paired energy system is not unlike the connection between the construction of the frame of a house and the roof. No one would contend that the roofer can frame the house because it is required for the installation of the roof. For the same reason, just because the power generated by a solar PV panel is conveyed to an energy storage system does not mean the energy storage system is required for the installation of the PV panel.

Because energy storage systems are independent electrical systems. They are not required for, or incidental to, the installation of a solar PV system. Accordingly, the installation of energy storage systems does not fall within the scope of the C-46 contractor license under the CSLB's regulations.

## **II. ENERGY STORAGE SYSTEMS ARE SUBJECT TO SEPARATE STANDARDS AND PRESENT UNIQUE SAFETY RISKS WHICH REQUIRE THE USE OF PROPERLY TRAINED CONTRACTORS**

The primary reason for restricting the classification of specialty contractors that may work on energy storage systems is to ensure that adequately trained and skilled contractors and workers are properly and safely installing these systems.<sup>10</sup> Because of the unique risks and hazards associated with energy storage systems, their installation requires different skills and knowledge than what is needed for solar installations. This is demonstrated by the separate code, installation, and fire and life safety standards for solar PV systems and energy storage systems.<sup>11</sup>

For example, California Fire Code requirements that apply to energy storage systems but not PV solar systems include:

- Safety cap, thermal runaway management, spill control, neutralization, ventilation, seismic protection and smoke detection requirements that can vary based on energy storage technology and configuration.<sup>12</sup>

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<sup>10</sup> [Exhibit 2] NEIS, American National Standard, NECA 416-2016, Recommended Practice for Installing Energy Storage Systems (ESS) at p. 23. See also [Exhibit 3] ESAMTAC, Energy Storage and Microgrid Training and Certification (August 2016).

<sup>11</sup> See [Exhibit 2] NEIS, American National Standard, NECA 416-2016, Recommended Practice for Installing Energy Storage Systems (ESS). See also [Exhibit 3] ESAMTAC, Energy Storage and Microgrid Training and Certification (August 2016).

<sup>12</sup> See CFC, Table 608.1

- A failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis when certain technologies or configurations are used.<sup>13</sup>
- Specific location and room design requirements that vary depending on technology, size and configuration.<sup>14</sup>
- Specific permit application requirements, including providing the following information:
  - Location and layout design of the storage room.
  - Details on hourly fire-resistant-rated assemblies.
  - Quantities and types of storage batteries and systems.
  - Details on fire suppression, smoke detection and ventilation systems.
  - Rack storage arrangement, including seismic support criteria.

Large energy storage systems may also need engineered fire suppression systems depending on the technology and configuration used.

The 2017 National Electrical Code also covers solar PV systems and energy storage systems as two separate systems. Article 690, on PV solar energy systems, explains that the PV system ends at the PV system disconnect.<sup>15</sup> Energy storage systems installation requirements are covered in an entirely different section of the code, in Article 706.

These systems have different code requirements because energy storage systems pose different types and scales of risk compared to PV systems. A system that is improperly installed could cause serious public safety hazards, including electrocution, arc flashes, arc blasts, and fires caused by shorting or a thermal runaway of a battery storage system.<sup>16</sup>

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<sup>13</sup> CFC § 608.13

<sup>14</sup> Cal. Fire Code § 608.2

<sup>15</sup> National Electrical Code (2017) at Figure 690.1(b) n. 2 (“The PV system disconnect in these diagrams separates the PV system from all other systems.”).

<sup>16</sup> [Exhibit 1] Declaration of Dan Henrich.

There is a broad body of literature addressing the safety risks and concerns of ESS. We have attached the following studies and reports for the CSLB's review:

- *Battery Energy Storage Systems: A Guide for Electrical Contractors*, Department of Commerce, Government of Western Australia (March 2017).<sup>17</sup>
- S. Vorrath, *Household Battery Storage Is a Game Changer – But Is It Safe?*, One Step Off The Grid (Nov. 25, 2015).<sup>18</sup>
- *Energy Storage System Safety: Comparing Vanadium Redox Flow and Lithium-Ion Based Systems*, Energy Response Solutions, Inc. (Aug. 2017).<sup>19</sup>
- *Fire Codes for Energy Storage Systems*, Klausbruckner.com (Jan. 2017).<sup>20</sup>
- *How Safe Are Utility-Scale Energy Storage Systems?*, Energyskeptic.com (June 2015).<sup>21</sup>
- P. Rogers, *Response to Energy Storage Systems*, Fireengineering.com (June 2015).<sup>22</sup>
- U. Irfan, *Battery Fires Reveal Risks of Storing Large Amounts of Energy*, Scientific American (Nov. 2011).<sup>23</sup>
- *Lithium-ion Battery Energy Storage Systems: The Risks and How to Manage Them*, AIG Energy Industry Group.<sup>24</sup>
- A. Blum & R. Thomas Long Jr., *Hazard Assessment of Lithium Ion Battery Energy Storage Systems*, Fire Protection Research Foundation (Feb. 2016).<sup>25</sup>

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<sup>17</sup> Attached as Exhibit 4.

<sup>18</sup> Attached as Exhibit 5.

<sup>19</sup> Attached as Exhibit 6.

<sup>20</sup> Attached as Exhibit 7.

<sup>21</sup> Attached as Exhibit 8.

<sup>22</sup> Attached as Exhibit 9.

<sup>23</sup> Attached as Exhibit 10.

<sup>24</sup> Attached as Exhibit 11.

<sup>25</sup> Attached as Exhibit 12.

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As California makes a push for greater use of energy storage systems, the last thing the State needs is for these systems to be catching fire due to installation by unqualified contractors. Battery fires and explosions are becoming more and more common as the energy storage industry expands.<sup>26</sup> It is critical that energy storage systems are installed by competent contractors and electricians that are informed of the risks involved. As the C-46 license alone does not ensure trained and skilled workers will perform the installation, C-46 specialty contractors should not be permitted to install energy storage systems simply because they are installing a related solar energy system.

### **III. THE HIGH RATE OF COMPLAINTS AGAINST C-46 CONTRACTORS SHOULD BE TAKEN INTO ACCOUNT WHEN CONSIDERING WHETHER THE SCOPE OF THE LICENSE CLASSIFICATION SHOULD BE EXPANDED**

Further evidence weighing against expanding the scope of the C-46 classification to allow licensees to install energy storage systems is the comparatively high rate of complaints against C-46 contractors. According to CSLB there are 1,167 active and 174 inactive C-46 contractors. In 2017, there were 376 complaints filed against C-46 contractors, or 32.2 complaints per every 100 C-46 contractors – a 32.2% complaint rate. This is compared to 24,391 active and 6,068 inactive C-10 contractors, for which there was just 1,372 complaints filed in 2017 – a rate of 5.6%.

The comparatively high number of complaints against C-46 contractors is not surprising given the low wages and lack of training requirements for C-46 employees. The California Occupational Guides indicate that wages for solar installers range from \$11.50 to \$21.00 per hour.<sup>27</sup> A review of job postings by U.C. Berkeley found job listings for solar installers offering wages as low as \$10/hour.

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<sup>26</sup> See [Exhibit 3] ESAMTAC, Energy Storage and Microgrid Training and Certification (Aug. 2016) at pp. 2-3.

<sup>27</sup> B. Jones & Carol Zabin, Are Solar Energy Jobs Good Jobs? U.C. Berkeley Labor Center (July 2, 2015) available at <http://laborcenter.berkeley.edu/are-solar-energy-jobs-good-jobs/>.

#### **IV. GOVERNMENTAL IMMUNITY DOES NOT APPLY IN LAW SUITS FOR THE FAILURE TO ENFORCE MANDATORY LICENSING REQUIREMENTS**

Allowing C-46 contractors to install energy storage systems also creates safety and reliability concerns. Liability not only would fall on the contractor but could also fall on the local building department or the CSLB itself.

The CSLB and local building departments have a mandatory duty to enforce the Contractor classification requirements consistent with regulatory requirements. If CSLB or a local building official allows a C-46 contractor to do work outside the scope of the C-46 license, the CSLB or local building official could be found liable if this work caused death, injury or property damage. Building officials must ensure that a contractor's license covers the type of work for which a permit is sought. In the event a contractor causes death, injury, or property damage while engaged in unlicensed activity, the building department or CSLB may face legal action for the failure to enforce contractor licensing requirements or prevent unauthorized activities.

The governmental immunities typically afforded to state agencies are inapplicable in suits for failure to discharge a mandatory duty.<sup>28</sup> While the CSLB has the authority to adopt regulations that set the scope of a specialty contractor license, it has a mandatory duty to follow that regulation once it is adopted. Expanding the scope of a specialty contractor license through staff fiat or through the addition of questions to the contractor license test, rather than by amendment of the regulation, would constitute an unlawful underground regulation. If energy efficiency systems are installed by C-46 contractors as a result of the CSLB's unlawful modification of adopted regulations and those systems fail and cause death, injury or damage, the CSLB could face liability for that harm.<sup>29</sup>

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<sup>28</sup> *Elson v. Public Utilities Commission* (1975) 51 Cal. App. 3d 577.

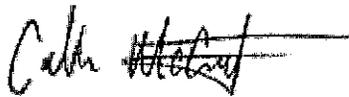
<sup>29</sup> Govt. Code § 815.6.

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**V. CONCLUSION**

IBEW appreciates the opportunity to provide comments on these issues.

Sincerely,

A handwritten signature in black ink, appearing to read "Collin S. McCarthy", with a horizontal line extending to the right from the end of the signature.

Collin S. McCarthy

CSM:lj1

# **EXHIBIT 1**

## Declaration of Dan Henrich

1. I am President of PDE Total Energy Solutions (PDE). PDE has been designing and installing Battery Energy Storage Systems (BESS) and Microgrids for over 25 years. We have installed systems for the US Military, , Universities, Utilities, commercial buildings, and remote islands, such as our microgrid on the Island of Anguilla in the Caribbean that provides 100% renewable power for a desalination plant.
2. BESS are fundamentally different systems from Solar PV Systems (SPVS). A BESS can connect to SPVS, but a BESS is neither “required” to install solar PV systems, nor is it “incidental” to the installation of solar PV systems. A SPVS can produce energy for use by a connected BESS, but it is not, itself, an energy storage system. A BESS both stores and provides energy, but requires connection to an energy source in order to be charged. These systems may be connected in order that each system may utilize the energy generated by the other, or they may be powered by any other source of energy, including the utility power grid.
3. SPVC and BESS may be connected in a wide variety of configurations. SPVS and BESS can be connected independently of each other and they can also be connected to the same inverter. The systems can be grid connected, and can also be designed to disconnect or “island” from the grid, in the case of a loss of power from the grid. BESS systems can be designed to automatically reconnect to the grid once power from the grid is restored. There are also off grid systems that operate independently of the grid. These systems are called microgrid systems.
4. Just because a SPVC may be connected to a BESS does not make installation of the BESS incidental to the installation of the SPVC. Such a definition would make anything connected to, or powered by, a SPVC “incidental” work. The power generated from a SPVC may be conveyed through a building’s wiring and outlet system, but that does not mean that the building’s wiring and outlet system is incidental work.
5. Because they are separate systems, the National Electrical Contractors (NECA) 416-2016 Installation Guide for energy storage systems refers to the “point of connection” between an energy storage system and an electric power production source. This point of connection must comply with the requirements of California Energy Code Article 705. Article 705 covers installation of “one *or more*” electrical power production sources operating in parallel with a primary source. The SPVC and the BESS are each electrical power production sources that can work together or separately.
6. Safety is a huge concern with BESS, both for installers and occupants. Installation of a BESS requires different skills and poses unique risks and hazards from installation of a SPVS. A system that is improperly installed could cause serious public safety hazards, including electrocution, arc flashes, arc blasts, fires caused by shorting or a thermal runaway of a battery storage system. As prescribed in National Fire Protection Association, NFPA 70E, an arc flash hazard calculation needs to be performed to

determine the proper Personal Protective Equipment (PPE) to be worn when working on these systems. The NEIS “Recommended Standards for Installing Energy Storage Systems” 416-2016 states that “A battery is an independent source of stored energy. Voltage is always present in each battery string. Opening the battery disconnecting means does not de-energize the voltage within the battery string itself. The potential for electrocution is greatest at the battery terminals.”

7. Requiring appropriately trained electricians and licensed contractors for electrical energy storage installation is necessary to ensure that these systems are installed properly and safely. Because they are distinct systems, energy storage systems have their own distinct national installation and safety standards, such as set forth in the National Electrical Code (NEC), National Fire Protection Association (NFPA 70E), and the National Electrical Installation Standards (NEIS).

I declare to the best of my knowledge that the foregoing is true and correct.

Date: October 9, 2017

//s//

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Dan Henrich  
President  
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# **EXHIBIT 2**



**NECA 416-2016**  
Recommended Practice for Installing  
**Energy Storage Systems (ESS)**

AN AMERICAN NATIONAL STANDARD



Published by  
National Electrical Contractors Association

Additionally, Superconducting Magnetic Energy Storage (SMES) is not covered by this Recommended Practice due to the extremely short discharge time and limited energy capacity that restricts its application to power quality applications only, and not to longer-duration energy storage applications.

### 1.3 Regulatory and Other Requirements

All information in this publication is intended to conform to the NEC (ANSI/NFPA 70). Installers shall follow the NEC, applicable state and local codes, manufacturer's instructions, and contract documents when installing Energy Storage Systems (ESS).

Only qualified persons as defined in the NEC familiar with the construction and installation of Energy Storage Systems (ESS) and ESS devices and system components shall perform the technical work described in this publication. Administrative functions such as receiving, handling and storing, and other tasks may be performed under the supervision of a qualified person. All work shall be performed in accordance with NFPA 70E, *Standard for Electrical Safety in the Workplace*.

General requirements for installing electrical products and systems are described in NECA 1, *Standard for Good Workmanship in Electrical Construction* (ANSI). Other NEIS provide additional guidance for installing particular types of electrical products and systems. A complete list of NEIS is

must not be connected to three-phase electric power production systems unless the interconnected system is designed to prevent significant unbalanced voltages. Three-phase inverters and AC modules for ESS must have all phases automatically de-energize upon loss of or imbalance in voltage in one or more phases of the electric power production system unless the interconnected system is designed to prevent significant unbalanced voltages.

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### **7.3 Point of Common Coupling**

The point of connection between an ESS and electric power production sources must comply with the requirements of NEC Article 705, and the following:

- An ESS is permitted to be connected to the supply side of the service disconnecting means

Practice for Installing Energy Storage Systems (ESS) NECA 416

- e
- in accordance with NEC Article 230, provided that the sum of the ratings of all overcurrent devices connected to power production sources does not exceed the rating of the service.
  - The outputs of ESS are permitted to be interconnected at a point or points elsewhere on the premises where the system qualifies as an integrated electrical system and incorporates protective equipment in accordance with all applicable sections of NEC Article 685.
  - The outputs of ESS are permitted to be interconnected at a point or points elsewhere on the premises when the aggregate of non-utility sources of electricity has a capacity in excess of 100 kW or the service is above 1000 volts, when the conditions of maintenance and supervision ensure that qualified personnel service and operate the system, and when safeguards, documented procedures, and protective equipment are established and maintained.

ior not less than 90% of their length. For battery racks, provide a minimum clearance of 25 mm (1 in.) between a cell container and any wall or structure on the side not requiring access for maintenance.

## 8.2 Battery System Safety

*NOTE: A battery is an independent source of stored energy. Voltage is always present in each battery string. Opening the battery disconnecting means does not de-energize the voltage within the battery string itself. The potential for electrocution is greatest at the battery terminals.*

# **EXHIBIT 3**

## **Energy Storage and Microgrid Training and Certification**

A collaborative of energy storage and microgrid industry organizations has come together to create Energy Storage and Microgrid Training and Certification, or ESAMTAC. Led by Penn State University, this group includes the National Fire Protection Association (NFPA) which produces the National Electrical Code, the Electric Power Research Institute (EPRI), the National Electrical Industry Standards (NEIS) project which utilizes the American National Standards Institute (ANSI) approval process, the National Electrical Contractors Association, NAATBatt International, the IBEW, the GridSTAR Resource Center at the Philadelphia Navy Yard, The California Clean Energy Fund (CalCEF), and CalCharge.

### **The Market:**

- The energy storage and microgrid (ESM) industry is taking off and revenue is projected to grow at a considerable pace. According to a conservative forecast by Statistics MRC, the Global Advanced Energy Storage Systems market accounted for \$13.64 billion in 2015 and is expected to reach \$19.59 billion by 2022, growing at a CAGR of 5.3%.
- ESM revenue forecasts are supported by a number of likely growth factors including a rapid decline in the cost of battery cells that are used in mobile and stationary applications. ES prices are dropping on a trajectory similar to PV solar. Since GM purchased the batteries for the first 2011 Chevy Volts, their costs have dropped more than 70%. The Tesla “gigafactory” in Nevada will be one of many additional contributors to the economies of scale that are forecasted to pull prices down even more. A number of experts have projected that within a few years the cost of Li-Ion cells will drop to a range of \$125 - \$150 per kWh.
- ESM industry growth will produce substantial business opportunities including a broad array of applications:
  - Backing up and leveling generation produced by rapidly growing PV and wind sources
  - Shoring up the reliability of an aging power grid
  - Managing grid stress to avoid brownouts and blackouts with ES capacity
  - Enhancing grid security (to better withstand physical and/or cyber-attack) by creating smaller, more resilient micro-grids in buildings, public and private campuses, neighborhoods, cities, and regions
  - Energy arbitrage to buy at low cost night rates, store, and use during the day
  - Peak shaving to avoid high utility demand rate charges
- ESM projects range from residential and small commercial applications to large commercial, industrial, defense, and utility-scale projects.

- The ESM opportunity also has a broad geographic footprint. According to the U.S. DoE Energy Storage Exchange, ESM projects and initiatives are active in every region of the United States.

**The Challenge:** While the exciting and rapidly growing ESM industry is developing, and billions of dollars are being invested, industry stakeholders are concerned about the industry's ability to overcome a number of challenges. Among those are deployment, performance, safety and image. The recent history of the energy storage industry is unfortunately rife with poor execution, bad publicity, or both:

- **Sony Battery Plant Fire**  
On Nov. 4, 1995, in Koriyama, Japan, a fire erupted at a Sony Corp. plant which produced lithium ion batteries. The 200,000 square foot factory was heavily damaged as the fire raged for seven hours. More at <http://www.science-bbs.com/50-chem-electrochem-battery/2d847ee2d95eb1be.htm>
- **Panasonic (Matsushita) and LG Chem Plant Fires**  
In October 2007, Matsushita Battery Industrial Co. halted production of lithium-ion battery cells at their Osaka, Japan production facilities due to a fire which destroyed a significant part of Matsushita's Moriguchi City plant.  
  
In a similar situation, LG Chem experienced a devastating fire early March, 2008. The fire damaged one of the company's rechargeable battery plants south of Seoul, South Korea. Damages were about \$85 million in loss of sales, with production capacity halted for more than two months. More at <https://www.frost.com/sublib/display-market-insight.do?id=123729013>
- **Laptop Battery Recalls**  
In 2006, the massive global recall of lithium-ion laptop batteries made by Sony Corp. grew to a total of more than 7 million units, according to the U.S. Consumer Product Safety Commission.  
  
The recall affected brands including Sony, Fujitsu, Dell, Apple, HP, Lenovo and Toshiba. More at [http://www.nbcnews.com/id/15254251/ns/technology\\_and\\_science-security/t/sony-laptop-battery-recall-widens/#.U4ZtEixOWUk](http://www.nbcnews.com/id/15254251/ns/technology_and_science-security/t/sony-laptop-battery-recall-widens/#.U4ZtEixOWUk)
- **Fires Blamed on the Chevy Volt**  
Numerous news stories, with headlines like CHEVY VOLT INVOLVED IN GARAGE FIRE were aired or published in 2011 and 2012. Reports included a Chevrolet Volt investigated for a fire that destroyed a garage in rural Connecticut, and another in North Carolina. More at <http://www.leftlanenews.com/chevy-volt-suspected-in-garage-fire.html#ixzz333W6CCGk>

While those initial stories made headlines, Fire Marshall's reports - which cleared the Volts - did not make the front page. More at <http://www.autoguide.com/auto-news/2011/11/chevy-volt-not-the-cause-of-garage-fire-says-fire-marshall.html>

- **Boeing Dream Liner Becomes "Nightmare Liner"**  
Boeing's global fleet of 787 Dreamliners was grounded in 2013, with airlines suspending service on the most advanced civil airliner, to comply with an order from regulators following an emergency landing by one of the planes. The Federal Aviation Administration instructed airlines to prove that lithium-ion batteries in the model, which went into service in late 2011, "are safe and in compliance," prompting regulators in Europe and Japan to follow suit and putting all 50 Dreamliners operated by eight airlines worldwide out of duty. More at: <http://www.bloomberg.com/news/2013-01-16/boeing-787-dreamliner-fleet-grounded-by-u-s-after-emergency.html>
- **Tesla Vehicle Fire Concerns**  
During six weeks of 2014, three fires were reported in the Tesla Model S. More at <http://www.usatoday.com/story/money/cars/2013/11/07/third-fire-in-tesla-model-s-reported/3465717/>
- **Lithium-ion Batteries Banned as Cargo on Passenger Planes**  
April, 2016: According to a new ban enacted by the U.N.'s International Civil Aviation Organization, lithium-ion batteries cannot be shipped as cargo on passenger planes. More at <http://money.cnn.com/2016/02/23/news/companies/lithium-ion-battery-ban-airplanes/index.html>
- **Half Million 'Hoverboards' Recalled Over Battery Fires and Explosions**  
July 6, 2016: U.S. regulators announced recalls of more than 500,000 "hoverboards". The motorized, self-balancing scooters contain lithium ion batteries that can overheat and catch fire or explode, the Consumer Product Safety Commission said. More at <https://www.washingtonpost.com/news/the-switch/wp/2016/07/06/half-a-million-hoverboards-recalled-over-battery-fires-and-explosions/>

Considering the public relations challenge, it is not surprising that many energy storage companies and industry organizations are very concerned about safety and what can be done to improve their performance and their image. The U.S. Dept. of Energy (DoE), the National Alliance for Advanced Technology Batteries / NAATBatt (<http://naatbatt.org/>), and CalCharge (<http://www.calcharge.org/>) have all stated that energy storage standards, training and certification are a high priority

## Energy Storage and Microgrid Training and Certification (ESAMTAC)

**Purpose:** To create an education and training program, and credential, that will prepare electrical workers for the safe and effective assembly, testing, commissioning, maintenance, repair, and retrofitting of energy storage and microgrid systems. This will be pursued in a way that leverages expertise in the manufacturing, construction, and energy sectors which are participating in the design and construction of residential, commercial, and utility scale energy storage and microgrid systems. In doing so, ESAMTAC will help advance the growing potential of energy storage systems and microgrids by contributing to the growth of the high quality workforce needed to build and maintain an efficient and resilient electric grid and, at the same time, support the deep penetration of renewable energy in the marketplace.

**Development:** The Penn State led ESAMTAC team has convened subject matter experts including experienced designers and builders of next generation ESM systems to define the knowledge, skills, and key competencies required to assemble, commission, maintain and retrofit grid interactive ESM systems. Tasks for the credential are now being defined by experts in the ESM industry, and verified through the observation of actual ESM construction on select case study projects. The knowledge, skills, and competencies for each task are being defined with corresponding testing and skills demonstration requirements for each. Curriculum and online learning modules are being designed, including simulation tools and active learning exercises that address the gaps in existing education and training programs. These tools will be evaluated this fall (2016) for their effectiveness in classroom and online learning settings including an instructor training workshop in which participants are provided opportunities to experiment and provide feedback.

**Training Sites:** ESAMTAC will be taught at industry training centers, community colleges, and utility training facilities by ESAMTAC instructors beginning in early 2017.

**Schematic Program Concept:** ESAMTAC consists of two courses and related credentials. The Primary Course (or Part A) builds knowledge and skills to construct and test microgrid systems and components with an emphasis on energy storage systems. The Primary Course focuses on a *component-level* understanding of microgrid systems.

The Advanced Course (or Part B) builds upon Part A with an emphasis on the processes and tasks to support the more advanced commissioning, operation, maintenance, repair and retrofitting (C-O&M) of ESM systems and the electrical skills and safety competencies needed to supervise the safe execution of C-O&M activities by crews which may include some non-credentialed individuals. The Advanced Course focuses on a *systems-level* understanding of microgrid systems.



### Energy Storage and Microgrid Installation Certification Program Design

#### Primary Course: Energy Storage and Microgrid Systems Construction Certification (32 hours)

**Description:** This credential is designed to recognize knowledge and skills required for the safe and productive assembly of micro grid systems with an emphasis on the construction of large stationary battery systems. The training and certification process is designed to build upon a robust background in electrical construction including knowledge of safety codes and standards. A significant emphasis is placed on the knowledge of micro grid system components and attributes related to safe assembly and handling, and the interconnection of micro grid system components. The laboratory portion of this certification focuses on the handling and assembly of battery cells, assembly of strings in open and cabinet conditions, and the steps required to energy and de-energize strings of cells in support of safe assembly and cell removal/replacement.

#### ESAMTAC Primary Course, Major Tasks and Subtasks Included

##### EPRI Approved Certification: *Assembly of ESM Systems*

1. Plan EMS Construction
  - a. Plan review
  - b. Identify safety hazards
  - c. Re-examine conditions in the event of a change
2. Identify Interconnection Requirements
  - a. Verify utility approval
  - b. Interconnection permitting
3. Assess Site Conditions
  - a. Verify design drawings for existing/proposed conditions
  - b. Assess existing site characteristics (Subsurface conditions, Power quality, load profile, utility capacity)
  - c. Assess conditions of existing equipment and maintenance records of existing equipment
  - d. Arc flash risk assessment / incident energy analysis
  - e. Verify existing equipment locations / conduit / space conditions / size, working space, access / labeling
  - f. Verify access to and condition of communication systems
  - g. Identify points of coordination with communication, emergency systems
  - h. Verify high hazard area / egress (NFPA 101)
  - i. Overcurrent protection coordination study

# **ESAMTAC** Energy Storage and Microgrid Training and Certification

4. Manage ESM Materials / Equipment
  - a. Verify equipment / materials / Storage requirements
  - b. Acceptance testing
  - c. Verify equipment functions
  - d. Vendor supplied / owner supplied / contractor provided equipment /supplies
  - e. Existing lighting, outlets & power
5. Prepare Tools and equipment – Training Where Required
  - a. Specialty tools
  - b. Fall protection
  - c. Rescue equipment
  - d. Materials handling / lift
  - e. Unique PPE
  - f. Test instruments w/ ratings
6. Perform Layout / Location of Equipment
  - a. Equipment
  - b. Distribution Hangers
  - c. Clearances
  - d. Penetration / sealing
7. Set ESM Equipment
8. Install Cabling
  - a. Verify size/type of conductors based on field conditions / layouts
  - b. Verify types size of tools
  - c. AC conductor installation
  - d. DC conductors installation
  - e. Battery connections / terminations – accumulation of hazards as strings are assembled – procedural and order is key
  - f. Battery monitoring
  - g. Terminations / crimping
  - h. Torqueing
  - i. Document termination / torque level
  - j. Grounding and bonding
9. Energizing, De-energize, Isolate Equipment
10. Turnover Training to Operator / Owner / Manager
11. Complete Labeling / Documentation

## **ESAMTAC Skills Testing**

A hands-on skills test will be included in the Primary Certification. Laboratory design:

- 1) The focus of the lab will be on energy storage systems and potentially battery management systems and controllers that are immediately connected to and required for the operation of strings of battery cells. *Task list:*

- a) Demonstrate knowledge and use of protective equipment, clothing, and tools
  - b) Demonstrate safe handling methods of battery cells
  - c) Demonstrate knowledge of assembly and working in enclosures including containers and battery racking systems
  - d) Assemble string of cells with either or both bus bars and cables and record measured voltages from individual and strings of cells
  - e) Demonstrate understanding of string isolation systems
  - f) Demonstrate ability to make connections between battery array and battery management systems including DC conductors and monitoring/instrumentation systems.
  - g) Demonstrate ability to complete appropriate documentation of ESM work as required for warranty assurances, permitting, inspection, and commissioning activities
- 2) A set of standards for the lab apparatus defined to enable training and certification bodies to conduct the examination on equipment that is available based on their unique site and conditions.
  - 3) The design of a standard "kit" for the laboratory will also be pursued from at least one industry partner who could make the system available for purchase.

**Primary Course Curriculum Topics:**

- I. Introduction
  - a. Advantages and benefits
  - b. Markets and Applications
  - c. Development process
  - d. Preview & Role of credential
  - e. Terminology
- II. Science and Technology, Economics of most common systems & life cycle
- III. Safety, Codes, and Regulations
  - a. Battery technologies and chemistries
  - b. Rigging and material handling
  - c. Processes and applications
  - d. Inside-out, O&M (NFPA 70E integration)
  - e. Outside-In (first responder support)
- IV. Systems and topologies
  - a. Components
  - b. Systems & Topologies / Inverter types / Monitor & Control strategies
  - c. Generation technologies: CHP, solar, wind
  - d. Storage technologies
    - i. Methods
    - ii. Battery chemistries
- V. O&M, replacement, decommissioning
- VI. Mechanical and structural considerations
- VII. Lab Component: Emphasis on tools and PPE related to assemble of stationary BESS systems

**ESAMTAC Advanced Course: Energy Storage and Microgrid Commissioning, Operations, and Maintenance (32 hours) - EPRI Approved Certification**

**Description:** This advanced credential will build upon the Primary course/credential and will focus on the development of systems-based competencies of energy storage, photovoltaic, and microgrid systems and the knowledge and skills that will enable the recipient to support and or supervise the commissioning, operation, maintenance, troubleshooting, upgrading, and replacement of microgrid components and systems. This credential prepares the recipient for roles including: (1) supporting functions required to interface and coordinate with component systems and respective manufacturing and application engineering professionals; (2) performing tasks associated with regular testing, maintenance of energy storage and PV systems; (3) maintaining documentation and communications related to operations and servicing of microgrid systems, and (4) supervising any or all of the functions above. Prerequisites for the Advanced Course will include the Primary Course and Credential as well as experience working with customer relations and servicing of occupied and/or operational facilities.

**Topics:**

- I. Smart Building Systems
- II. Power systems communication infrastructure
- III. Component parts & protocols of ESM systems
- IV. SCADA / interface systems
- V. Operations and reset procedures
- VI. Cyber security networking / Network segmentation
- VII. Design & code compliance / certification
- VIII. Site controller interface and programming
- IX. Evaluation of monitoring data
- X. Sensors and monitoring systems
- XI. Commissioning and testing standards
- XII. Advanced troubleshooting methods for BESS systems
- XIII. O&M processes & Retrofit procedures

August, 2016

**ESAMTAC** Energy Storage and Microgrid Training and Certification



CalCharge



# **EXHIBIT 4**



# Battery Energy Storage Systems

## A guide for Electrical Contractors

*Battery Energy Storage Systems (BESS) are being installed in increasing numbers in electricity distribution networks, homes, remote area power supplies and commercial/industrial installations. Electrical contractors may be asked to recommend and quote for a BESS or install, commission and test a system designed or selected by others. The BESS may or may not form part of a solar PV installation. It is important they familiarise themselves with the systems and relevant safety requirements prior to doing work on BESS.*

Over the last few years battery technology has undergone rapid change, with a range of new chemistries being developed. Current Australian Standards do not cover many critical aspects, creating potential safety hazards for installers, owners/operators and the general public.

Standards Australia is developing a new standard (AS/NZS 5139) for battery installations but its release date is not yet clear.

For this reason, EnergySafety has prepared the following guidance to alert electrical contractors and electricians to the safety issues associated with BESS. The guiding principle is one of careful design and specification of equipment for each specific installation to achieve the highest practicable standard of "safety in design". This is the responsibility of all parties providing the equipment to the customer.

The Clean Energy Council's publication *Grid-Connected Energy Systems with Battery Storage* provides comprehensive requirements for its accredited installers (<http://www.solaraccreditation.com.au/installers/compliance-and-standards/accreditation-guidelines.html>). The Australian Energy Storage Council (ESC) also has produced a *Guide for Energy Storage Systems* ([www.energystorage.org.au](http://www.energystorage.org.au)).

### Network operator requirements

Network operators may have requirements affecting selection and installation if the BESS is to be grid-connected. Electrical contractors need to check with the relevant network operator to ascertain all compliance requirements.

Electrical contractors may have to submit a Preliminary Notice to the relevant network operator as a means of ensuring its requirements are known and understood. The network operator may require full technical details of the proposed BESS. Approval from the network operator is required before it will agree to connect. Battery storage may mask a customer's true demand which can be suddenly imposed on the network if the BESS ceases to operate.

### BESS Risks

Batteries can be a serious safety risk for occupants and installers if incorrectly installed and operated, potentially leading to electric shock, fire, flash burns, explosion or exposure to hazardous chemicals and released gases.

Various battery types will have different probability of failure and varying consequences of that failure (ie a different risk profile). Those responsible for the specification and/or supply of the BESS must ensure that an appropriate risk assessment is undertaken for the specific customer circumstances, location, the equipment proposed and its installation.

Any business installing a BESS must ensure the safety of workers and customers. The BESS must be installed, commissioned and maintained correctly to ensure this. Electrical contractors may need to train customers so they can operate and shut down their BESS safely. Some customers may have technically competent staff on site but most will not.

## Battery types

Many different battery technologies are available for use as a BESS. Some of these have been in use for many years while others have only recently been developed. Some of the common battery technologies on the market are:

- lead-acid;
- nickel cadmium;
- lithium ion;
- nickel metal hydride;
- sodium ion;
- sodium sulphur; and
- vanadium Redox Flow.

Each of these has different performance characteristics which must be considered when selecting a BESS to suit a customer's needs.

Manufacturers also offer a few options for BESS, including:

- a pre-packaged battery module (enclosed factory-connected batteries);
- a pre-packaged system (enclosed factory connected batteries with other components

such as a charger control or inverter); or

- a custom-made battery bank (individual batteries installed with other components and interconnected).

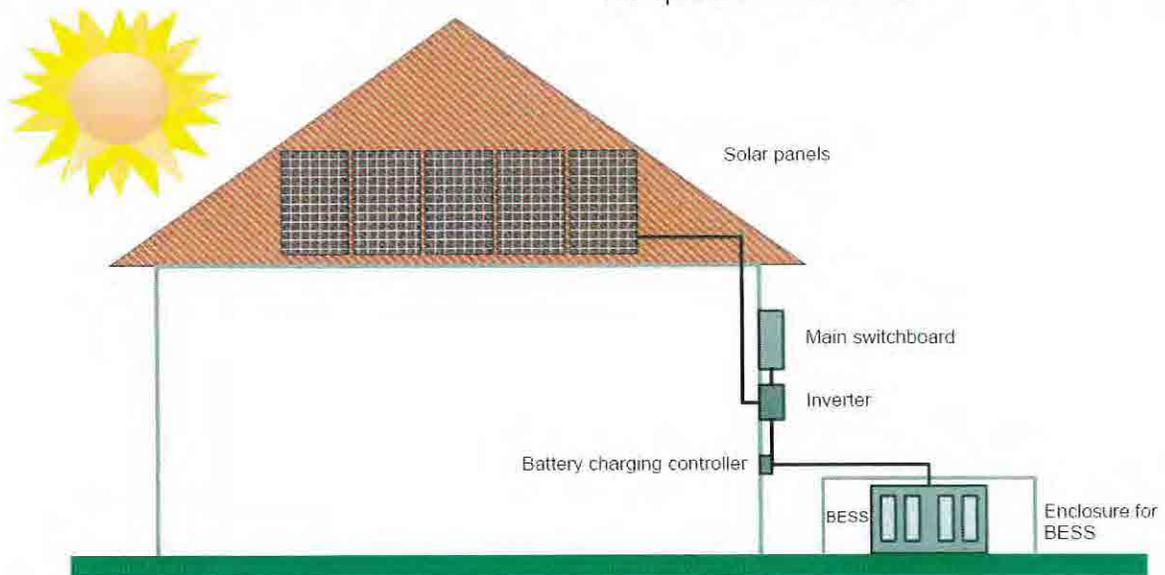
## BESS selection

A BESS needs to suit a customer's electricity demand profile. Customer installations connected to network operator distribution systems are designed to export power into the grid, while remote area supplies are not. BESS in remote installations may have to be integrated with wind and/or diesel generators as well as solar PV panels.

## Competency requirements

Electrical contractors must ensure their employed electricians have been trained and are familiar with the particular BESS they are asked to install or maintain. BESS designers must be competent in electro-technology and be familiar with such systems, including risk assessment methodologies.

The following sketch depicts one typical example of a solar photo-voltaic installation with battery storage for a domestic dwelling. Many other designs and installations are possible to reflect site-specific circumstances.



Domestic installation with solar panels and battery storage

## Hazards associated with BESS

Installers and owners must be aware of hazards associated with the chosen technology and know how to handle, install and operate the system safely.

### Electric shock

Banks of battery cells can deliver a severe electrical shock. There are likely to be 230 volt-rated parts or other system components operating at hazardous voltages.

The battery bank must be electrically isolated while any work is being performed on it or upstream or downstream parts of the system. Battery terminals must be isolated with secure insulating barriers.

Before proceeding, a risk assessment is to be carried out, a Safe Work Management Procedure is to be prepared and suitable protective equipment and insulation barriers must be used.

A drawing showing any remote battery bank locations must appear on the main switchboard. Minimum labelling for grid-connected inverter systems are set out in AS 4777.1:2016, which includes requirements for battery storage.

### Arc flash

A battery has sufficient energy to cause an arc flash if it suffers a short circuit or fault. An arc flash can have temperatures above 12,000°C, capable of melting metal or causing fires and explosions. Generally higher battery energy storage capacities have a higher risk of arc flash. Arcing faults may cause catastrophic failure of battery cell enclosures unless the fault currents are removed quickly by correctly rated electrical protective devices.

### Fire and explosion

Most lead-acid batteries generate hydrogen and oxygen when charging. Other battery types also emit flammable gases and need adequate ventilation to avoid an explosion, fire or risk to occupants.

Lithium-ion batteries do not produce any exhaust gases during normal operation, but they can produce flammable and toxic gases if there is a fault.

Fire and explosions can result from component failure, a short circuit or loose connections. The chemistry of lithium-ion batteries makes them prone to 'thermal runaway' if they are damaged or overheated by overcharging. Elevated ambient temperatures should be considered by the installer when locating a BESS on a customer premise. Some brands of lithium-ion batteries have superior features intended to prevent the uncontrolled rupture of cells under runaway conditions making them inherently safer.

### Hazardous chemicals

Battery casings can degrade or be damaged by impacts. They can also rupture as a result of excessive temperatures and excessive pressure generated from a change in chemical reaction from over-charging or following a short circuit. Electrolyte (fluid or gel) can leak from a ruptured casing, resulting in toxic fumes, burns, corrosion or explosion.

Some compounds produced during the failure of a cell can be extremely toxic. The clean-up, decontamination and disposal of damaged equipment may require specialised equipment and skills. Disposal of contaminated items or batteries at the end of their service life usually will require treatment as a hazardous waste.

## Electrical safety requirements in Western Australia

BESS installations in WA must comply with applicable regulatory requirements, including:

- *Electricity Act 1945*;
- AS/NZS 3000:2007;
- The Australian Building Code;
- WA Electrical Requirements (WAER);
- The network operator's technical rules;
- The network operator's consumer connection agreement; and
- AS 4777 - Grid connection of energy systems via inverters - Installation requirements and, where applicable, AS 5033 – Installation and safety requirements for photovoltaic (PV) arrays.

Depending on the battery technology used, the following Australian Standards may be applicable:

- AS 3011-1992, Electrical installations — secondary batteries installed in buildings;
- AS 2676.1-1992: Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings - Vented cells;
- AS/NZS 4509.1:2009;
- AS/NZS 4509.2:2010: Stand-alone power systems – System Design; and
- AS 4086.2—1997: Secondary batteries for use with stand-alone power systems – Installation and Maintenance.

### Minimum Installation Requirements

As a reminder, the following key requirements from the Wiring Rules apply:

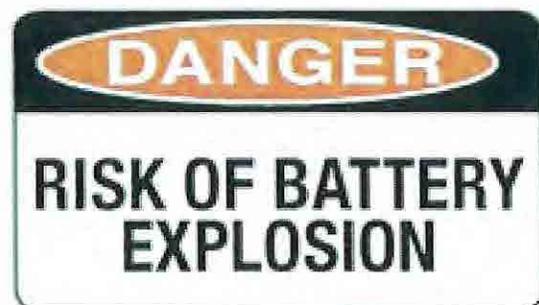
- All components of the electrical installation must be properly selected and installed for the application (Clause 1.7 of AS/NZS 3000:2007).
- All components of the electrical installation must be installed in accordance with the BESS's manufacturer's instructions.
- Installation work practices must be in accordance with the Wiring Rules.
- Wiring systems and cables must be selected and installed in accordance with the Wiring Rules and be adequately protected against external influences i.e. mechanical impact, UV and environmental damage.
- The short circuit circuit/fault current ratings of BESS are specified by the manufacturer. It is imperative that the overcurrent protection device (fuse/circuit breaker) is adequately sized to cope with such currents.
- Battery Isolation - Correctly-sized DC switch/isolators must be installed to completely isolate a battery from all circuits connected to it during maintenance.
- AC and DC circuits must be properly segregated from each other with the DC

circuit labelled.

- All switches must be clearly labelled.
  - Adequate signage should be provided with the BESS, including:
    - Signage for Grid-connected BESS shall be provided according to AS/NZS 4777.1:2016.
    - Signs for stand-alone power systems incorporating BESS shall be according to AS/NZS 4509.
- For all other systems as a minimum the following sign must be provided
- A sign must be provided indicating that the switchboard has alternative energy sources and showing the BESS location on the premise.



- A sign indicating “Danger of battery explosion from open flames, sparks and smoking”.



- A sign explaining the shutdown procedures for the BESS.
- Main Battery Fuses – A battery's fault current is limited only by its internal resistance. If short-circuited, a battery can deliver an extremely high current in a short space of time, in the order of 100 to 1,000 times the typical discharge current normally used. This will cause explosive failure of the battery unless circuit protection operates very quickly.

A protection device should be located as close as practicable to the main output terminals of the battery. Any cabling to the location of protective fuses or circuit breakers should be double insulated.

### Location

Given their particular risks, some BESS batteries are not suitable for installation in habitable parts of homes or an attached building, while others may be specifically designed for indoor locations such as laundries or garages.

Prior to the selection of the installation location, a risk assessment should be conducted by a competent person familiar with the chosen technology, with due consideration for the consequences of a contingency event. Where batteries are sensitive to operating temperature, particular consideration should be given to this matter in the risk assessment. A copy of this risk assessment should be provided to the customer as part of the equipment documentation.

Manufacturer's guidelines should be strictly followed.

A BESS may be mounted on a suitable outside wall (with an appropriate IP rating) or installed in a fire and weatherproof enclosure. The fire rating of an enclosure is particularly important if the BESS is to be indoors. Installers must pay due regard to the manufacturer's recommendations about operating temperature limits, exposure to direct sunlight and avoidance of impact risks. Pre-packaged BESS may include weatherproof enclosures for outdoor mounting and may not need any additional protection.

Enclosures should prevent access by untrained people, children, pets or vermin.

The following should be considered when selecting a suitable location:

- Building codes applicable to batteries (national and local) and changes to floor loadings. The National Construction Code (NCC) also has specific requirements for battery installations. Please refer to the NCC for more details;
- if located in an electrical switch room, the room complies with Wiring Rules requirements;
- the location complies with the manufacturer's recommendations to protect the system from weather and extreme heat, light and temperature, which may reduce performance, the life span of the system or trigger one of the hazards mentioned above. Most batteries have an optimal operating temperature range to achieve their design life and maintain safety. In Western Australia, locations exposed to north and west-facing aspects are undesirable for BESS installations for reasons of high solar radiation;
- the room or enclosure must be suitably ventilated for the location and the type of BESS;
- the enclosure must be capable of containing any electrolyte spills (if applicable);
- adequately fire-rated walls are used to avoid or delay the spread of fire, should it occur, giving fire authorities time to attend the scene;
- suitable means of access/egress to the area is provided during installation and for maintenance work; and
- the enclosure provides adequate mechanical protection to the BESS.

### Testing, verification and commissioning

The BESS must be tested and commissioned in accordance with the network operator's requirements, manufacturer's instructions and relevant standards, including the Wiring Rules.

When the BESS installation is complete, the electrical contractor must submit a Notice of Completion to the relevant network operator or to Energy Safety for non-grid connected or remote installations. In either case, the installation may be subject to a safety inspection by an Inspector (Electricity), who may require access to the BESS owner's documentation package, including the risk assessment. In addition, the electrical contractor is also required to provide an Electrical Safety Certificate to the customer/owner of the electrical

installation in accordance with the Electricity (Licensing) Regulations 1991.

Hand-over must include owner and user training on:

- how to operate the BESS safely and shut it down in an emergency;
- the purpose of various safety warnings and lights; and
- safety data sheets.

### **Maintenance**

The BESS owner's documents must include the maintenance requirements specified by the manufacturer, which should be followed. They must be performed by a licensed electrical contractor unless operating at ELV.

# **EXHIBIT 5**



(<https://onestepoffthegrid.com.au>)

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for **36** months  
\$ 3,599 Due at lease signing. No security deposit required †

## Household battery storage is a game changer – but is it safe?

By **Sophie Vorrath** (<https://onestepoffthegrid.com.au/author/sophie-vorrath/>) on November 25, 2015

Amid all the hype about the booming residential battery storage market, remarkably little has been said about the safety of putting what amounts to a mini-power plant in your home.

As ZEN Energy founder and boss Richard Turner told One Step last month (<http://onestepoffthegrid.com.au/how-garnaut-co-plan-to-help-communities-take-the-power-back-from-the-grid/>), installing a residential battery storage system is no small thing – indeed, we have heard it described, on numerous occasions by various energy industry insiders, as the most dangerous item you will ever put in your house.



(<http://onestepoffthegrid.com.au/wp-content/uploads/2015/11/170-44Yewdall-n.jpg>)

Updated: 3/18/2019

<https://onestepoffthegrid.com.au/household-battery-storage-is-a-game-changer-but-is-it-safe/>

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“We’ve got a bit of a challenge in educating people about energy storage,” Turner said, referring not only to the way batteries work as part of a residential energy system, but also to “all these people bobbing up saying they’re energy storage experts.”

“It takes years to understand lithium-ion batteries. It’s a very very slow process. ... People need to be mindful that, with solar and storage, you’re putting a full power plant in your home.”

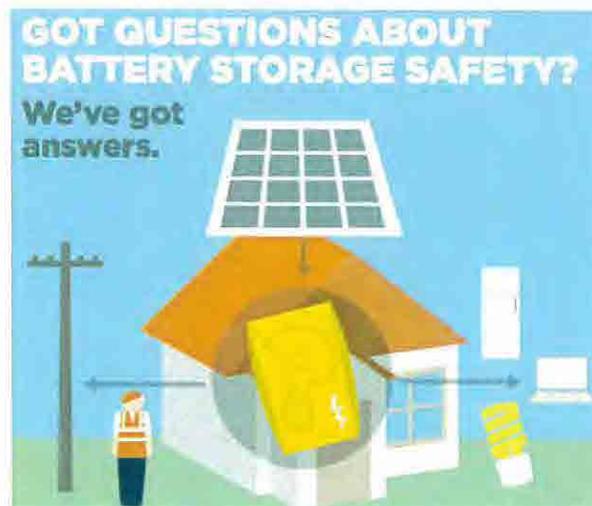
Turns out, the Clean Energy Council has also noticed this knowledge gap and, with the launch this week of Australia’s first home energy storage safety guide in collaboration with CSIRO, is doing something about it.

Backed by ARENA, the consumer safety guide and the energy storage safety report were completed by CSIRO as part of the Clean Energy Council’s Future-Proofing in Australia’s Electricity Distribution Industry (FPDI) project.

CSIRO Energy Group Leader Dr Sam Behrens said it identifies a number of safety challenges and knowledge gaps to overcome in the next few years, as energy storage technologies are rolled out across Australian domestic and small commercial markets.

“We’re seeing a lot of momentum with domestic energy storage system safety among government, industry and research bodies, so this is a timely point to release our findings,” he said.

CEC chief, Kane Thornton, said the lead-out time provided the industry with a rare opportunity to work on standards and regulations to ensure the integrity of energy storage technology before it had been widely adopted.



(<http://onestepoffthegrid.com.au/wp-content/uploads/2015/11/Screen-Shot-2015-11-25-at-11.47.58-am.png>)

“The CSIRO Energy Storage Safety report takes an in-depth look at the different kinds of batteries, best practice safety and installation requirements, safe operation, disposal and recycling of energy storage products and systems,” he said.

“(It) identified a lack of information on battery systems in general, as well as a need for standards to be updated for these new technologies, Australian battery disposal and recycling initiatives, and better education for emergency services.

For ZEN Energy’s Turner, this general lack of understanding of how batteries work, and how their power output and storage capacity is rated, is another key knowledge gap to address.

“You need to be pricing energy storage systems not only by the kWh, but also by its capabilities,” Turner told One Step.

“It’s very important to understand the amount of power that a battery can put out. What we’re finding is majority of imported systems can only put out 2kW of power, and that only just covers the air-con.

“People need to be very very aware, not only how many kWh their storage system is, but how much power the battery system can put out.”

But the good news, says Thornton, is that the CEC has already started work on addressing many of the recommendations in the CSIRO report through its Australian Energy Storage Roadmap, we released at the beginning of the year.

Here are the CSIRO’s top recommendations:

- Improve awareness of and access to information on the variety of battery energy storage technologies and their appropriate operation and care among consumers (general public), designers (engineers and electrical tradespeople) and installers (electrical tradespeople).
- Research and identify the best methods for lithium-ion battery storage system recycling, and establish a lithium-ion battery recycling initiative.
- Research and identify the best methods to safely (passively) extinguish domestic and small commercial-scale lithium-ion battery storage fires.
- Align Australian and international standards, and improve local regulatory and building codes relevant to energy storage systems.
- Establish a set of best practices specific to the battery storage industry, including development and upkeep of an installation, maintenance and incident reporting database for energy storage systems in Australia.
- Develop training and nationally recognised accreditation pathways for designers and installers specific to energy storage in domestic and small commercial scales.

*Energy Storage Safety: Common consumer questions and the report Energy Storage Safety: Responsible installation, use and disposal of domestic and small commercial systems are available on the FPDl website (<http://fpdi.cleanenergycouncil.org.au/>).*

*The Clean Energy Council released the Australian Energy Storage Roadmap (<http://www.cleanenergycouncil.org.au/policy-advocacy/storage-roadmap.html>) at the beginning of 2015, to provide a framework for the development of the emerging sector.*

Updated: 3/18/2019

843

## Young, Heather@CSLB

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**From:** Tara Kelly <tara.kelly@sullivansolarpower.com>  
**Sent:** Friday, May 18, 2018 11:17 AM  
**To:** Young, Heather@CSLB  
**Subject:** Written Comments: Classifications Authorized to Install Energy Storage Systems

Good morning Ms. Heather Young,

Below is a letter to you on behalf of Daniel Sullivan, founder and president of Sullivan Solar Power Inc. of California.

Dear Ms. Young,

My name is Daniel Sullivan, founder and president of Sullivan Solar Power. I am writing on behalf of Sullivan Solar Power and thank you for the opportunity to voice our concern on this important issue. Our company has been licensed as an operational C-10 solar installer for 14 years, and has been actively leading the practice of ethical and to-code solar photovoltaic (PV) and energy storage installation. We have over 7,000 clients and are currently the top developer across both SDG&E and Edison utilities for developing residential energy storage, securing more than 1.7 million dollars from the Self-Generation Incentive Program with over 550 contracted energy storage projects. We also have installed over 70 million watts of PV solar, including projects for the U.S. Navy, SDG&E, UC San Diego and the San Diego Padres.

My comments are focused on whether C-46 contractors should install and maintain energy storage. Solar PV with energy storage on a home is a mini power plant and should be treated as such, being installed by electricians. These are separate systems that pose different risks, require different expertise and have different permitting and code requirements. Cal/OSHA training is completely inadequate to prepare and protect C-46 installation employees and the public from installing energy storage systems. Cal/OSHA 10 and Cal/OSHA 30 are training classes that include a certification if passed. However, they are general safety classes for tradespeople including painters, roofers, carpenters, etc. While these classes include some references to electrical safety, they are not electrical safety classes. This poses a safety concerns.

Energy storage systems (ESS) - including residential systems - are rapidly increasing in quantity. Some behind-the-meter commercial systems exceed 10 megawatts. Improperly installed energy storage systems pose risks to workers, emergency responders and the general public. When connected to the grid, these systems can also pose risks to utility infrastructure and utility workers. Only fully qualified contractors with highly trained state certified general electricians should be installing these systems.

A key distinction between C-46 contractors and C-10 contractors is that C-46 contractors can, and do, hire workers with no formal training. According to data collected by UC Berkeley, these same untrained workers are paid as little as \$10 to \$11 per hour. Putting these low wage, uncertified workers to work on energy storage systems - which if installed improperly are extremely dangerous - puts workers and end consumers at risk. In contrast, C-10 contractors are required to employ state certified electricians who have secured at least 8,000 hours of formal electrical training or on the job experience before they are allowed to make unsupervised electrical connections.

As a turnkey solar installation company, I am and my company is very familiar with what it takes to do solar PV work, and I also know what knowledge, skills and abilities (KSAs) are required to do energy storage system (ESS) projects. These are completely different types of systems with different code requirements, risks, and dangers. I can state clearly that the KSAs of a C-46 contractor and especially C-46 employees are not adequate to safely install ESS systems.

While we are excited about California leading the charge in energy storage and finding advanced ways to create a more sustainable and manageable grid, we are cautious that inexperience in this space will pose a threat to public safety and the negatively affect standards in implementation needed to move us forward. In our experience as a C-10 contractor with electricians with over 8,000 hours of training, even we are constantly bumping into hurdles in installation and code as we deal with this new technology. However, our certified electricians are able to use their training to navigate the correct and safe implementation of energy storage paired with PV storage, in ways a C-46 would not. I thank you for your time, and sincerely ask that you consider restricting energy storage development to those who are state certified to install in a safe and proper way.

Sincerely,  
Daniel Sullivan  
Founder and President

# **LETTERS RECEIVED FROM ELECTED OFFICIALS**

# State and Local Elected Officials Urge Contractors State License Board to Ensure Only Qualified, Licensed Electrical Contractors Install Battery Energy Storage Systems

March 7, 2019  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

## RE: Clarification of Regulations for Battery Energy Storage System Installation

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery **transforms** electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *“install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose.”*

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system.** CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

The Honorable Melissa Hurtado  
**Senator, Fourteenth District**

The Honorable Jim Beall  
**Senator, Fifteenth District**

The Honorable Robert Hertzberg  
**Senator, Eighteenth District**

The Honorable Connie M. Leyva  
**Senator, Twentieth District**

The Honorable Maria Elena Durazo  
**Senator, Twenty-Fourth District**

The Honorable Miguel Santiago  
**Assemblymember, Fifty-Third District**

The Honorable Cecilia Aguiar-Curry  
**Assemblymember, Fourth District**

The Honorable Reginald Byron Jones-Sawyer, Sr.  
**Assemblymember, Fifty-Ninth District**

The Honorable Cathleen Galgiani  
**Assemblymember, Fifth District**

The Honorable Sabrina Cervantes  
**Assemblymember, Sixtieth District**

The Honorable Lorena Gonzalez  
**Assemblymember, Eightieth District**

The Honorable Jose Medina  
**Assemblymember, Sixty-First District**

The Honorable Marc Levine  
**Assemblymember, Tenth District**

The Honorable Autumn Burke  
**Assemblymember, Sixty-Second District**

The Honorable Bill Quirk  
**Assemblymember, Twentieth District**

The Honorable Mike A. Gipson  
**Assemblymember, Sixty-Fourth District**

The Honorable Kansen Chu  
**Assemblymember, Twenty-Fifth District**

The Honorable Sharon Quirk-Silva  
**Assemblymember, Sixty-Fifth District**

The Honorable Ash Kalra  
**Assemblymember, Twenty-Seventh District**

The Honorable Al Muratsuchi  
**Assemblymember, Sixty-Sixth District**

The Honorable Robert Rivas  
**Assemblymember, Thirtieth District**

The Honorable Tom Daly  
**Assemblymember, Sixty-Ninth District**

The Honorable James Ramos  
**Assemblymember, Fortieth District**

The Honorable Tasha Boerner Horvath  
**Assemblymember, Seventy-Sixth District**

The Honorable Eloise Gomez Reyes  
**Assemblymember, Forty-Seventh District**

The Honorable Todd Gloria  
**Assemblymember, Seventy-Eighth District**

The Honorable Blanca E. Rubio  
**Assemblymember, Forty-Eighth District**

The Honorable Shirley N. Weber  
**Assemblymember, Seventy-Ninth District**

The Honorable Malia Cohen, Chair  
**Board of Equalization**

The Honorable Joan Hartmann  
**Third District Supervisor, Santa Barbara County**

The Honorable Leticia Perez  
**Fifth District Supervisor, Kern County**

The Honorable Andre Quintero, Mayor  
**City of El Monte**

The Honorable Jerry Velasco, Mayor Pro Tem  
**City of El Monte**

The Honorable Dee Andrews, Vice Mayor  
**City of Long Beach**

The Honorable Al Austin II, Councilmember  
**City of Long Beach**

The Honorable Jeannine Pearce, Councilmember  
**City of Long Beach**

The Honorable Lena Gonzalez, Councilmember  
**City of Long Beach**

The Honorable Roberto Uranga, Councilmember  
**City of Long Beach**

The Honorable Willie Rivera, Councilmember  
**City of Bakersfield**

The Honorable Angie M. Jimenez, Councilmember  
**City of Montebello**

The Honorable Adele Andrade-Stadler, Mayor  
**City of Alhambra**

The Honorable Hans Liang, Mayor Pro Tem  
**City of Monterey Park**

The Honorable Graciela Ortiz, Councilmember  
**City of Huntington Park**

The Honorable Maria Morales, Councilmember  
**City of El Monte**

Yolanda Rodriguez-Pena, Vice President, Board of Education  
**Azusa Unified School District**

Natalie M. Ybarra, Vice President, Board of Education  
**Bassett Unified School District**

Jesse Urquidi, Board Member  
**Norwalk La Mirada Unified School District**

Deborah Bautista Zavala, Board Member  
**Woodland Joint Unified School District**

Laura Santos, Trustee  
**Mt. San Antonio College**

Christopher Apodaca, Trustee  
**ABC Unified School District**

Frank Tarantino, Trustee  
**Sweetwater Union High School District**



STATE CAPITOL  
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SACRAMENTO, CA 94249-0010  
(916) 319-2010  
FAX (916) 319-2110

E-MAIL  
Assemblymember.Levine@assembly.ca.gov  
WEBSITE  
www.assembly.ca.gov/Levine

# Assembly California Legislature

**MARC LEVINE**  
ASSEMBLYMEMBER, TENTH DISTRICT

COMMITTEES  
AGRICULTURE  
HIGHER EDUCATION  
WATER, PARKS AND WILDLIFE

SELECT COMMITTEES  
CHAIR: CRAFT BREWING AND DISTILLING  
CO-CHAIR: NATURAL DISASTER RESPONSE,  
RECOVERY, AND REBUILDING  
BIOTECHNOLOGY  
CAMPUS CLIMATE  
END OF LIFE HEALTH CARE  
HATE CRIMES  
IMPROVING BAY AREA TRANSPORTATION  
SYSTEMS  
CHAIR: CALIFORNIA LEGISLATIVE JEWISH  
CAUCUS

March 6, 2019

Ms. Marlo Richardson  
Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

Dear Chairwoman Richardson:

I am writing to urge the Contractors State License Board (CSLB) to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery transforms electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to "install, erect or connect any electrical wires, fixtures, appliances, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."

C-10 licensed electrical contractors have an extensive background in electrical theory and, by law, are required to install battery energy storage systems with highly trained electricians who have been certified by the state. In contrast, C-46 licensed solar contractors are not specifically qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

DISTRICT OFFICES: 3501 CIVIC CENTER DRIVE, SUITE 412 • SAN RAFAEL, CA 94903 • (415) 479-4920 • FAX (415) 479-2123  
11 ENGLISH STREET • PETALUMA, CA 94952 • (707) 576-2631  
50 D STREET, SUITE 301 • SANTA ROSA, CA 95404 • (707) 576-2631

Letter to Contractors State License Board

I urge the CSLB to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system. CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only specialty contractors who hold a valid C-10 electrical contractors license.

Thank you for your attention to this matter.

Sincerely,



MARC LEVINE

Assemblymember, 10<sup>th</sup> District

cc: Members, Contractors State License Board



## VICE MAYOR DEE ANDREWS

March 5, 2019

CITY OF LONG BEACH

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

### **RE: Clarification of Regulations for Battery Energy Storage System Installation**

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

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**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system.** CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

A handwritten signature in black ink, appearing to read "Dee Andrews".

Vice Mayor Dee Andrews  
Sixth District, City of Long Beach

March 4, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

To Whom It May Concern,

As a Long Beach Councilmember, I want to thank you for your continued efforts to protect California residents by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of construction industry workers and the public. I am writing to request that the Board continue this work by clarifying current regulations to require that only specialty contractors holding a C-10 electrical contractors license install battery energy storage systems.

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is critical in helping California meet its clean energy and emissions reduction goals and expanding the adoption of solar, wind and other clean energy sources in pursuit of sustainability. It is important that these systems be installed and maintained correctly by highly qualified and licensed C-10 electrical contractors to minimize health and safety risks associated with this work.

I urge the Board to not compromise safety standards by continuing to allow non-C-10 certified solar contractors to install battery energy storage systems. Please adhere to the Board's mission to protect construction workers and uphold public safety. If you have any questions about my support, please do not hesitate to contact my office.

Sincerely,

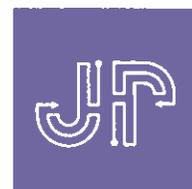
A handwritten signature in blue ink, appearing to read 'Lena Gonzalez', written in a cursive style.

**LENA GONZALEZ**  
*First District Councilwoman*  
*City of Long Beach*

## JEANNINE PEARCE

Long Beach City Councilwoman: District 2  
333 W Ocean Blvd Fl. 14 Long Beach CA 90802  
City Hall: 562.570.2222

[jeanninepearce.com](http://jeanninepearce.com)



COUNCILWOMAN  
JEANNINE PEARCE

March 5, 2019

Contractors State License Board  
9821 Business Park Drive  
Sacramento, CA 95827

### **RE: Clarification of Regulations for Battery Energy Storage System Installation**

Thank you for your continued efforts to protect California consumers by ensuring the construction industry adheres to policies that promote the health, safety and general welfare of the public. We are appreciative of the thorough review the Board has taken in recent months and are writing to **urge the Board to clarify current regulations to require that only specialty contractors holding a C-10 electrical contractors license may install battery energy storage systems.**

The use of battery energy storage systems is rapidly expanding in hospitals, schools, businesses and homes throughout the state. This technology is key in helping California meet its clean energy and emissions reduction goals and to expand the adoption of solar, wind and other clean energy sources. However, if not installed and maintained correctly by highly-qualified and licensed C-10 electrical contractors, battery energy storage systems pose unique fire, electrical and public safety risks to installers, consumers, utility workers and emergency personnel.

Ambiguity in the regulations has allowed C-46 solar contractor licensees to install battery energy storage systems when paired with a solar photovoltaic (PV) system, even though these battery energy storage systems are separate electrical systems and the C-46 solar contractors do not have the electrical training or expertise required.

A PV energy system is very different technology than a battery energy storage system. A battery **transforms** electrical energy to chemical energy and back into electricity. For that reason, CSLB regulations specifically require a C-10 license to *"install, erect or connect any electrical wires,*

qualified to safely install this complex technology and their installing employees have no training nor certification requirements.

**We are urging the Board to not compromise safety standards by continuing to allow a C-46 solar contractor to install a battery energy storage system.** CSLB regulations specifically prohibit C-46 solar contractors from installing standalone battery energy storage systems.

Please adhere to the mission of the CSLB and protect public safety and consumers by ensuring battery energy storage systems are installed by only contractors who hold a valid C-10 electrical contractors license.

Sincerely,

A handwritten signature in black ink that reads "Jeannine Pearce". The signature is written in a cursive, flowing style.

Councilwoman Jeannine Pearce

City of Long Beach, Council District 2

City Hall: (562) 570-2222

333 W Ocean Blvd |14th Floor

Long Beach, CA 90802

**ELECTRICAL INDUSTRY FACT SHEET,  
PETITION**

# PROTECT PUBLIC SAFETY: REQUIRE QUALIFIED INSTALLATION OF BATTERY ENERGY STORAGE SYSTEMS

Urge the Contractors State License Board to Protect Public Safety and Require Only Licensed C-10 Electrical Contractors to Install Battery Energy Storage Systems

## SAFE INSTALLATION OF BATTERY ENERGY STORAGE SYSTEMS BY QUALIFIED ELECTRICAL CONTRACTORS AND ELECTRICIANS IS KEY TO PROTECTING PUBLIC SAFETY

■ Battery energy storage systems are rapidly expanding and being installed in schools, hospitals, businesses and homes throughout the state. Battery storage is a key technology to help California meet our clean energy and emissions reduction goals and expand the adoption of solar, wind, and other clean energy sources.

■ The Contractors State License Board's (CSLB) primary mission is to protect consumers and the public. If not installed correctly by highly-qualified and licensed electrical contractors, battery energy storage systems pose unique fire, electrical, and public safety risks to installers, consumers, utility workers, and emergency personnel.

- ▶ A system that is improperly installed or maintained could cause serious public safety hazards including electrocution, arc flashes, arc blasts, fires, and explosions or thermal runaway.
- ▶ In some cases, arc flashes (which can reach temperatures hotter than the surface of the sun), arc blasts, and thermal runaway can be so serious that they affect the entire electrical system to which an energy storage system is connected—a building, a school, a home, even the electric grid itself.
- ▶ The threat to worker, first responder, and overall public safety is very serious. Explosions and intense heat produced by an arc blast or thermal runaway include the release of toxic gases, high speed projectiles, and extremely destructive fires.
- ▶ Due to the potential hazards, battery energy storage systems have their own separate installation standards, safety requirements, and national electric and fire codes.

Updated: 3/18/2019



...it would be a mistake for the Contractors State License Board to allow specialty solar contractors that are not authorized to install stand-alone energy storage systems to install these systems... Only contractors who have been trained in electrical risk assessment and electrical theory should work on these potentially dangerous systems."

**ELECTRICAL SAFETY FOUNDATION  
INTERNATIONAL**

## THE CSLB SHOULD CLARIFY REGULATIONS AND REQUIRE THE EXPERTISE OF A C-10 ELECTRICAL CONTRACTORS' LICENSEE TO SAFELY INSTALL AND MAINTAIN BATTERY ENERGY STORAGE SYSTEMS

■ Current regulations require a C-10 electrical contractor's license to install battery energy storage systems as a stand-alone system.

- ▶ State certified electricians have 8,000 hours of hands-on experience and have passed a rigorous state exam.
- ▶ C-10 licensed contractors and their certified electrician employees have expertise in all types of electrical work, including connecting electrical equipment to the grid, and upgrading existing electrical systems for additional load and service. They also hold a thorough understanding of the National Electrical Code (NEC), which is critical to preventing injury, destruction and death.

■ California regulation **specifically prohibits** C-46 licensed contractors (solar photovoltaic companies) and their employees from installing battery energy storage systems as a stand-alone project. However, ambiguity in the regulations has allowed C-46 solar contractors to install battery energy storage systems when paired with a solar photovoltaic system.

- ▶ C-46 licensed contractors aren't required to have a background in electrical theory and safety. Nor are they tested on the NEC in total.
- ▶ The employees of C-46 licensed contractors, who perform installations of battery energy storage systems, have no state requirements for training and certification. As such, they do not receive the extensive and specialized training needed to safely install and maintain battery energy storage systems.

■ Clarification in the regulation will not slow efforts to achieve our clean energy goals. There are more than 78,000 C-10 contractors ready and able to implement battery storage energy systems vs. the approximately 1,500 C-46 contractors who do not also carry a C-10 license.

■ A solar (photovoltaic) energy system is completely different than a battery energy storage system. Both systems operate independently from one another. Further, a battery transforms electrical energy into chemical energy and then back into electricity.

For that reason, CSLB regulations explicitly require a C-10 license to "install, erect or connect any electrical wires, fixtures, appliances, apparatus, raceways, conduits, solar photovoltaic cells or any part thereof, which generate, transmit, transform or utilize electrical energy in any form or for any purpose."

Updated: 3/18/2019

Training, Skills and Experience	C-10 and Licensed Electricians	C-46 and Employee Installers
8,000 Hours of Electrical Experience	<input checked="" type="checkbox"/>	<input type="checkbox"/>
State Certification Exam	<input checked="" type="checkbox"/>	<input type="checkbox"/>
AC & DC Training and Experience	<input checked="" type="checkbox"/>	<input type="checkbox"/>
National Electrical Code	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Continuing Education State Requirement	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# ACT NOW!

URGE THE BOARD:  
PROTECT PUBLIC SAFETY:  
REQUIRE QUALIFIED, SAFE  
INSTALLATION OF  
BATTERY ENERGY STORAGE  
SYSTEMS

[SafeEnergyStorage.com](http://SafeEnergyStorage.com)

857

**We, the 2,877 undersigned, strongly urge the Contractors State License Board to uphold its commitment to protect consumers and the public by allowing only qualified C-10 Electrical Contractors to install and maintain battery energy storage systems.**

Nick Warner Electrician IBEW Local 302	Cathleen Vick CEO Morrow-Meadows Corporation	Gaylord "Rusty" Roten President IBEW Local 11
Joe Fitzgerald Asst. Business Manager IBEW Local 617	Jeff Davis VP Construction CSI Electrical Contractors, Inc.	Paul Zarich Electrical Inspector San Francisco Department of Building Inspection
Jon Badsky Journeyman Electrician IBEW Local 302	David Ostrander Construction and Maintenance Supervisor City of Los Angeles General Services Department	Alexander Rollinson Union Electrician IBEW Local 617
DJ Siegman Electrician/Instructor IBEW Local 617	Neal Lauzon President IBEW Local 441	Carol Kim Director of Community Engagement San Diego County Building Trades Council Family Housing Corp
Richard Eisenbeis Retired Inside Wireman IBEW Local 302	Denise Petersen Marketing Director Morrow-Meadows Corporation	Erik Ward Electrician Cupertino Electric, Inc.
Philip Barthman Building Inspector Alameda County	Paul Rodgers Electrician Golden Gate Bridge	Vianey Alvarez Office Manager Hayward Unified School District
David McClure Foreman IBEW Local 617	Eduardo Vega Electrician IBEW	Jesus Gutierrez JW Electrician IBEW Local 100
Vince Ferrante Foreman/Electrician Contra Costa Electric, Inc.	Randy Williamson Journeyman Electrician IBEW	
Erik Webb Apprentice IBEW Local 428		

Joshua DeSoto  
Director of Education  
NECA - San Diego Chapter

Samantha Hartwell  
Apprentice  
IBEW

C Yee  
Electrician  
IBEW Local 302

Krista Brooks  
Journeyman Electrician  
IBEW Local 617

Matthew Coppa  
Journeyman Electrician  
IBEW

Alex Caraballo  
Journeyman Electrician  
Elcor Electric

Josue Munoz  
Journeyman  
IBEW Local 302

Charles Mortenson  
Apprentice  
IBEW

Erinn Swett  
Purchasing Manager  
Devidson Communities

Brad Becker  
General Foreman  
Prime Electric

David Thomas  
State Licensed Electrician  
IBEW

Daniel Schmaderer  
Fire Life and Safety  
BEC

Daniel Diaz  
Electrician  
Fidato Technology

Jay Wilson  
Journeyman Electrician  
IBEW Local 617

Rick Jarvis  
Vice President  
Morrow-Meadows Corporation

Randy Olmos  
VP Construction  
Morrow-Meadows Corporation

Bob Babloyan  
VP Operations Executive  
Morrow-Meadows Corporation

Jerrod Finder  
5th Yr. Apprentice  
IBEW Local 100

Carrie Taylor  
Electrician  
IBEW

Shawn Pylant  
Journeyman Electrician  
IBEW Local 100

Ryan Lamb  
Union Journeyman Inside  
Wireman  
IBEW Local 100

Victor Vera  
Foreman  
Morrow-Meadows Corporation

Jason Stewart  
Sr. Project Manager  
Morrow-Meadows Corporation

Frank Schwamborn  
Foreman/ Electrician  
Morrow-Meadows Corporation

Jerry Garcia  
Journeyman Electrician  
Morrow-Meadows Corporation

Scott Kingsmill  
President  
Gilbert & Stearns, Inc.

Jerardo Garcia  
Journeyman Electrician  
Morrow-Meadows Corporation

Mario Montufar  
Inside Wireman  
IBEW

Michael Vredevelt  
Field Foreman  
Morrow-Meadows Corporation

Fitzgerald Member IBEW Local 617	Joseph Estrada Asst. Business Manager IBEW Local 100	Tim Harven Inside Wireman IBEW Local 100
Gregg Montarano Electrician Golden Gate Bridge	Teala Reynolds Construction Wireman IBEW Local 100	Jeffrey Garzotto General Foreman Collins Electric Company, Inc.
Morgan Disney Journeyman inside wireman IBEW	Robert G. McDonald Inside Wireman IBEW Local 100	Luis Loya Electrician Los Angeles Unified School District
Osbaldo Navarrete Inside Wireman IBEW	Ruben Estrada Journeyman Electrician Collins Electric Company, Inc.	Samuel Perez Electrician IBEW Local 100
Reynaldo Lara Journeyman Wireman IBEW Local 332	Jose Mendoza Journeyman Electrician IBEW	Chris Calhoun PE A-C Electric Company
David Mauro Electrician IBEW	Rene Garcia Inside Wireman IBEW Local 100	Steve Marlow Systems Integrator Morrow-Meadows Corporation
Moses Brown IV Union Electrician IBEW Local 332	Ryan Biondich 3rd Yr. Apprentice Electrician IBEW Local 100	Paul Marti Apprentice IBEW Local 100
Robert Chon Apprentice Coordinator Santa Clara County EJATC	Jason Sharp Inside Wireman IBEW Local 100	Jeremiah Hendricks Crew Foreman Morrow-Meadows Corporation
Robert Seaberg Journeyman Electrician IBEW	John Stevens Journeyman Inside Wireman IBEW Local 100	Billy Wilson Electrician IBEW
Francis Whiston Inside Wireman Redwood Electric Group	Michael Wei Engineering Manager Morrow-Meadows Corporation	

Whitney Tuimavave Electrician IBEW Local 617	Kevin McSherry Project Manager Morrow-Meadows Corporation	John Sivula Foreman Morrow-Meadows Corporation
Peter Ryan ICC Electrical Inspector and Building Inspector University of Santa Barbara	Darren McClure Project Executive Morrow-Meadows Corporation	John Anagnostou Foreman Morrow-Meadows Corporation
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Leon Marshall Journeyman inside wireman IBEW Local 617	Jason McCord General Foreman Morrow-Meadows Corporation	Casey Phipps Project Superintendent Morrow-Meadows Corporation
Christy Miller Electrician IBEW Local 617	Kyle Sturman Senior Project Manager Morrow-Meadows Corporation	Richard Rose VDC/BIM Engineer Morrow-Meadows Corporation
Christopher Paup Commercial Electrician Cupertino Electric, Inc.	Nohel Mejia Account Receivable Morrow-Meadows Corporation	Chris Cates General Foreman Morrow-Meadows Corporation
Miguel Favela Electrician IBEW	Margaret Lammey Human Resources Representative Morrow-Meadows Corporation	Mikes Rollesfson Project Manager Morrow-Meadows Corporation
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Craig Gini Vice President Collins Electric Company, Inc.	Robert Atkinson Project Manager Morrow-Meadows Corporation	Chris Mueller General Field Superintendent Morrow-Meadows Corporation
		Carlos Guerra Electrician Morrow-Meadows Corporation

<p>Michelena Goddard Administrative Assistant IBEW Local 617</p>	<p>Krystal Northover Account Receivable/ Contracts Administrator Morrow-Meadows Corporation</p>	<p>Brian Jurado Project Manager Morrow-Meadows Corporation</p>
<p>Scott Allen Electrician IBEW Local 617</p>	<p>Amy Knight Accounts Receivable Manager Morrow-Meadows Corporation</p>	<p>Michelle Frausto Medical Coder Pacific Grove Hospital</p>
<p>John Queiser Retired IBEW</p>	<p>Nicole Hutchins Senior Account Analyst Morrow-Meadows Corporation</p>	<p>Brendan Dessa Project Manager Morrow-Meadows Corporation</p>
<p>Sean Burke Executive Board IBEW Local 617</p>	<p>Leo Black Project Superintendent Morrow-Meadows Corporation</p>	<p>Jeremy Dixon Director of Integrated Data Systems Morrow-Meadows Corporation</p>
<p>Carlos Baez Electrician Prime</p>	<p>Patrick McCrary Senior Estimator Morrow-Meadows Corporation</p>	<p>Troy Berens Project Engineer Morrow-Meadows Corporation</p>
<p>Pierce Soracco Journeyman Electrician IBEW Local 617</p>	<p>Candice Hobdy Traffic Officer City of Los Angeles</p>	<p>Ramon Hizon VDC/BIM Engineer Morrow-Meadows Corporation</p>
<p>Emil Heizmann General Foreman Morrow-Meadows Corporation</p>	<p>Devin Rose Estimator Morrow-Meadows Corporation</p>	<p>John Rice General Foreman Morrow-Meadows Corporation</p>
<p>Time Gretter Union Electrical Apprentice IBEW Local 617</p>	<p>Jeremiah Smith Purchasing Manager Nor-Cal Morrow-Meadows Corporation</p>	<p>Kevin Coke Journeyman Electrician Morrow-Meadows Corporation</p>
<p>Ciaran Maguire Journeyman Wireman Decker Electric Company Inc.</p>	<p>Paul Sweeney Electrician IBEW</p>	<p>Timothy Vu Lighting Control Engineer Morrow-Meadows Corporation</p>
<p>Steven Kennedy Journeyman Wireman IBEW Local 617</p>		

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David Umbertus Inside Journeyman Wireman Morrow-Meadows Corporation	James Oliva Project Engineer Morrow-Meadows Corporation	Chris Jones Electrical Foreman Morrow-Meadows Corporation
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David Wilson General Foreman Tri-Bay Electric	Sonny Dietrich General Foreman Morrow-Meadows Corporation	Michelle Mitchell Project Manager Morrow-Meadows Corporation
Justin Clark Electrician Bass Electric	Jason Menes Superintendent Morrow-Meadows Corporation	Christy Fisher Safety Manager Morrow-Meadows Corporation
Chris Bufka Journeyman Electrician IBEW	Matthew Ackerman Journeyman Wireman Morrow-Meadows Corporation	David Hill VP Procurement Morrow-Meadows Corporation
Aaron Yee Electrician IBEW Local 617	Charles Jacobi Pre-Construction Design Manage Morrow-Meadows Corporation	Craig Kronick General Foreman Morrow-Meadows Corporation
Ray Birdsong Electrician Apprentice Redwood Electric Group	Jorge Murrieta State Licensed Electrician IBEW Local 569	Delbert Richardson General Foreman Morrow-Meadows Corporation
Richard Webster Electrician IBEW		Joshua Conant General Foreman Morrow-Meadows Corporation

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Phong Vo Electrician IBEW Local 617	Gina Bushman Journeyman Electrician IBEW Local 100	Dave Lakin Asset Manager Morrow-Meadows Corporation
Jason Santana Electrician IBEW Local 617	Andy Dominguez Electrician IBEW	Edward Acosta Pre-Construction Low Voltage Manager Morrow-Meadows Corporation
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Santiago Rodriguez  
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Sprig

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IBEW

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Dong Le  
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Estimator  
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Morrow-Meadows Corporation

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Eduardo Herrera Apprentice IBEW	Miguel Mandujano Foreman Morrow-Meadows Corporation	Leticia Catillon Contracts Administrator Morrow-Meadows Corporation
Tyler Brewton Apprentice IBEW Local 428	Robert Lopez Foreman Electrician Morrow-Meadows Corporation	Henry Himmel Inside Wireman Morrow-Meadows Corporation
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Robert Sotelo General Foreman Morrow-Meadows Corporation	Heather Lotti Estimator Morrow-Meadows Corporation	Jim Bagnall Sr. Project Manager Morrow-Meadows Corporation
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Cesar Lozano Electrician Rod Fuller Electric Corporation	Cale Pewthers General Foreman Morrow-Meadows Corporation	Victor Cipparrone General Foreman Morrow-Meadows Corporation
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Sergio Lopez  
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Matt Kruidhof Electrician SASCO	Laura Gray Assistant Project Manager Taft Electric Company	Luis Alvarez Inside Wireman Electrician IBEW Local 441
Kevin Phan Electrician IBEW	Leonard Nicodemo Division Manager Taft Electric Company	Gog Sebastian Electrician Pro Tek Electric
Evan Da Silva Electrician Stout & Burg Electrical Construction Contractors	Jason Sztapka Sr. Project Manager Taft Electric Company	Matthew Snelson Electrician Apprentice Morrow-Meadows Corporation
James Campbell Electrician Apprentice Dynalectric	Colton Gallion Journeyman Electrician Century Electric	Kevin Caldwell Electrician Rosendin Electric
Jeremiah Bright Electrician Briggs	Bailey Jamison Retired Residential Electrician Century Electric	Daniel Sampson Electrician IBEW
Jaclyn Mele Electrician Morrow-Meadows Corporation	Eric Williams Foreman Morrow-Meadows Corporation	Tyler Perry Apprentice Daniels Electric
Alec Webb Electrician Kiewit Power Corporation	Peter Seaberg Electrician IBEW Local 332	Adrian Agramon Electrician Morrow-Meadows Corporation
	Bradford Davison Inside Wireman IBEW	Tyler Kluender Journeyman Wireman Morrow-Meadows Corporation

Robert Madrigal Electrician Rosendin Electric	Abel Flores General Field Superintendent Morrow-Meadows Corporation	Nicolas Mosqueda General Foreman Morrow-Meadows Corporation
Pavel Geftar Electrician SASCO	Humberto Chavarria Foreman Morrow-Meadows Corporation	Eric Jara General Foreman Morrow-Meadows Corporation
Jarvis Garcia Electrician IBEW	Suzanne Jones Service Dispatcher Morrow-Meadows Corporation	Gillbert Herrera Electrician Elcor
Israel Magana Electrician SASCO	Timothy Riley Electrician IBEW Local 302	Victor Chao Retired Inside Wireman Journeyman IBEW
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Matt Hirsh Foreman Electrician Century Electric	Todd Johnson Apprentice Inside Wireman Rosendin Electric	Jon Woodworth Senior Vice President Rosendin Electric, Inc.
Jeff Cooksey Journeyman Electrician Century Electric	Armanso Ceja Inside Wireman Apprentice Anderson and Howard	Duncan Frederick Director of Marketing Rosendin Electric, Inc.
Kevin Sullivan Residential Electrician Century Electric	Mitchell Rocha Apprentice IBEW	Chris Selover Electrician Saint Francis Electric
Steve Miller Retired Foreman Electrician Century Electric	Dustin Johnson Apprentice Contra Costa Electric	

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Anthony Indendi  
Journeyman Electrician  
IBEW

Scott Roberts  
Site Superintendent  
Rosendin Electric, Inc.

LeBron Brown  
Electrician  
IBEW 617

Steve Sturtridge  
Data Comm  
Morrow-Meadows Corporation

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Electrician/Instrument Tech  
Chevron, Richmond Refinery

Nolan McCarthy  
Apprentice  
Sprig Electric

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Taft Electric Company

Grant Asmann  
General Foreman  
Rosendin Electric, Inc.

Dennis Kay  
Electrician  
MDE Electric

Anh Nguyen  
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Senior Vice President  
Rosendin Electric, Inc.

Lyle Wilson  
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Sprig Electric

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Josh Anspach  
Project Manager  
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Matthew Sweeney  
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P.E.  
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Karim Khalil  
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Adolfo Alfaro  
Electrician Apprentice  
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William Richardson  
Electrician  
IBEW Local 743

Diana Ayers  
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IBEW Local 332

Andrew Sherwin  
Inside Wireman  
Rosendin Electric, Inc.

Joseph Fletscher  
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Elcor Electric, Inc.

Derrick Porteous  
Electrician  
IBEW

Long Vu  
Electrician  
IBEW

Enrique Flores  
Inside Wireman  
IBEW Local 332

Andre Perez  
Union Electrical Apprentice  
IBEW Local 332

Corey Davidson  
Forman/Journeyman Wireman  
IBEW 11

Anthony Torres  
Apprentice  
MDE Electric

Timothy Gutierrez  
Inside Wireman Apprentice  
Sprig Electric

Hector Morales  
Electrician Apprentice  
Select Electric

Efrain Rojas  
Electrician  
Sprig Electric

Christian Martinez  
Apprentice Electrician  
Sprig Electric

Christine LaSalle  
Solar Customer  
Polaris

Nathan Detry  
Electrician  
MDE Electric

Nicholas Nguyen  
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MDE Electric

Jesus Soto  
Inside Wire Apprentice  
Herzog Electric/IBEW Local 11

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Electrician  
Redwood Electric

Adam Cole  
Electrician  
IBEW Local 332

Royal Ward  
Electrician  
Rosin

Seth Landig  
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Cupertino Electric

Trehern Mason  
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Cupertino Electric

Michael Boyd  
Interior Technician  
Kinkisharyo

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Rocco Caringello  
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TDN

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Palmer Electric, Inc.

Jonathan Rodriguez  
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Bear Electric

Adan Avila  
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Rosendin Electric, Inc.

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John Sawtelle  
Electrician/Apprentice  
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Jon Pizano  
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Sprig Electric

Christopher Contreras  
Inside Wireman  
Redwood Electric

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General Foreman  
Baker Electric

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The Companion Group

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Baker Electric

Kevin Alvin  
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IBEW Local 569

Cory Pippen  
Foreman  
Chula Vista Electric

Trevor Cunningham  
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Baker Electric  
Richard Del Priore  
N/A  
IBEW

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Journeyman Wireman  
IBEW Local 569

Kurt Torrez  
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IBEW

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Renee Yanez  
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IBEW

Dean Haefs  
General Foreman  
IBEW Local 11

Joaquin Gutierrez  
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IBEW Local 11

Ricky Killey  
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Taft Electric Company

Ascencion Solis  
Construction Wireman  
SBE

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Electrician  
Select Electric

Chris Shuman  
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Rafael Gomezbernier  
Journeyman Electrician  
Mass Electric Construction  
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Oscar Torres Apprentice Electrician GEC2	Miguel Sanchez Electrician CSI Electrical Contractors, Inc.	Roy Helsebus Retired IBEW
Ruben Garcia Electrician CSI Electrical Contractors, Inc.	Luis Corral Inside Wireman IBEW Local 11	Anthony Glenn Instructor ETI
Mike Matoui Electrician IBEW Local 11	Keith Fairchild Electrical Foreman A&R Electric	Matthew Couch Journeyman Wireman Cupertino Electric/IBEW11
Mark Meyer Journeyman Wireman IBEW	Michael Costigan Electrician IBEW	Finus Harris Electrician HMT/IBEW Local 11
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Jorge Burgos Superintendent IBEW/Mass Electric	Joel Sanchez Electrician IBEW Local 11	Joel Greenfield Wireman Apprentice IBEW 11
Mario Valdez Electrician Apprentice Cupertino Electric	Jerry Sikorski Foreman GES	Douglas Hall Electrician IBEW 11
Matthew Small Wireman IBEW Local 11	Fleeta Clutchette Apprentice Inside Wireman IBEW Local 11/DSE Electric	Toby C Moore Retired Electrician Dynalectric
Juan Lopez Wireman IBEW Local 11	Jordan Castillo Electrician Clark Electric, Inc	James Henderson Educator LAUSD
Truliana Price Electrician IBEW 11/Rosendin	Felix Ricarte Electrician IBEW Local 11	Jasmine Ivy Apprentice IBEW Local 11
Arturo Hernandez Citizen Spectra	Hector Campos Electrical Foreman Fisk Electric	Rick Angle Foreman H&S Electric
Brian Becker Electrician Dynalectric	Edwin Orantes Foreman Mass Electric	Jeff Madaus Foreman Rosendin Electric, Inc.
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Juan Hernandez Inside Wireman AC Electric	Anthony Zarate Electrician Rosendin	Stanley Call Apprentice Inside Wireman IBEW

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Citizen  
Harris L Woods Electric

Steven Meili  
Electrician  
Morrow-Meadows Corporation

Jose Martinez  
Electrician  
LA DWP

Ricky Leon  
Journeyman Wireman  
IBEW Local 11

Christopher Lewis  
Apprentice Electrician  
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Crystal Herrera  
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Gustavo Torres  
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Juan Lopez  
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Mortenson Construction

Juan Segovia  
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IBEW Local 11

Mark Herwig  
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Walton Electric

Jason Swan  
Journeyman  
ESSCO

Jesus Ruiz  
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John Healy  
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Aaron Fabun  
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Tom Pena  
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Comet Electric

Erica Norton  
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Edmonds

Roman Dunenez  
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Pedro Guerrero  
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Fielding Electric

Jesse Ramos  
Electrician  
Rosendin Electric

Brian Alberts  
Electrician  
Hertzog

Ray Quintana  
Electrician  
Gregg Electric

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James E Knaus Journeyman/Electrician IBEW Local 11	Kevin Berberyman Journeyman Electrician HMT Electric	Mario Huerta Inside Wireman IBEW Local 11
Dan Ferialdi General Foreman IBEW Local 11	Fernando Lopez Electrician Cal Spectra Instrumentation	Janaka Van Dyke Journeyman Electrician Morrow-Meadows Corporation
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Franklin Love Inside Wireman Kiewit Infrastructure West	Matthew Cotter Electrical Inspector City of Los Angeles	Luis Pelayo Superintendent DSE Electric Inc
Ian Gibson Journeyman Wireman IBEW Local 11	Sean Hensin Inside Wireman IBEW Local 100	Aaron Broderick Electrical Production Engineer CSI Electrical Contractors, Inc.
Benjamin Jung Electrician IBEW Local 11/Baker Electric	Thomas Smearman Electrician Jacobs	Samuel Sutherland Inside Wireman IBEW Local 11/Spectra
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Kyle Quibelan  
Inside Wireman  
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Electrician  
IBEW

Todd Hawkins  
Inside Wireman  
Taft Electric Co.

Tony Perea  
Inside Wireman  
IBEW

Tracy Brown  
Foreman  
O'Bryan Electric

Doug Jenkins  
Foreman  
IBEW

Cody Castro  
Electrician  
IBEW Local 332

Anthony Stallworth  
Electrician  
IBEW 11

Dallas Walter  
Apprentice  
IBEW

Miguel Lopez  
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IBEW Local 332

Mathew Cose  
Electrician  
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Gene Rabina  
Electrician  
Los Angeles Electric Co

Heather Mundy  
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IBEW Local 332

Rene A Barranza  
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Mario Banuelos  
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Canaan Simpson  
Inside Wireman  
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Ray Barron  
Electrician  
Dynalectric

Issac Castro  
Inside Wireman  
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John Baclay  
Electrician  
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Byron Morales  
Electrical Foreman  
Walton Electric

Toney Lange  
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Inside Wireman Apprentice  
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Kaitlin Haugland  
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Comet Electric

Jose Ramirez  
Wireman  
IBEW Local 11/MMC

Jonathan Cosentino  
Inside Wireman Apprentice  
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Bradley Tyler  
Signal Maintainer  
Mass Electric

Joseph Espinoza  
Foreman  
IBEW

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Air System Inc.

James Contreras  
General Foreman  
Morrow-Meadows Corporation

Genaro Nunez  
Electrician  
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Santiago Rodriguez Electrician Sprig Electric	Michael Gerez Superintendent Rosendin	Raul Ochoa Avila Journeyman Wireman IBEW Local 11
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Parker Haerr Apprentice Electrician IBEW Local 332 Lachlan Mason Inside Apprentice Elcor	Miguel A Garcia General Foreman IBEW Local 11	Juan Gonzales Electrician IBEW 11
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Samson Gonzalez Electrician Redwood Electric Group	Hoang Pham Foreman Walton Electric	James Morris Electrician Helix
Christopher Hewitt Inside Wireman Apprentice Redwood Electric Group	Jesus Villarreal Inside Wireman Industrial High Voltage	Lance Sage Electrician IBEW
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	Robert Tinoco Foreman Unison Electric	Jayson Lee Electrical Mechanic City of Los Angeles

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Neal Mauseth Inside Apprentice Rosendin Electric	Sheryl Vlot Attorney Williams & Vlot Ariel Cruz Journeyman Inside Wireman Walton Electric	Nathan Morton Residential Apprentice MDE Electric
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Aaron Gamboa Inside Wireman Apprentice Elcor Electric	Eduardo Rosas Journeyman Wireman IBEW Local 11	Timothy Boyd Apprentice Inside Wireman Redwood Electric Group
Christina Segura Electrician Decker Electric	Sergio Hernandez Electrician IBEW Local 11	Edward Torres Journeyman Wireman IBEW Local 11
Dima Gorodetsky Electrical Apprentice Redwood Electric Group	Ramon Juarez Electrician IBEW Local 11	Rafael Vasquez Foreman Polaris Electric
Marvin Sumner Electrician IBEW Local 617	Gerardo Zarate Electrician Rosendin	Bruce Caudle Electrical Foreman Taft Electric Company
Jorge Manrique Inside Wireman SASCO Electric	Kevin Thuresson Apprentice IBEW	Michael Ross Electrician Apprentice Dynalectric
Alexander Vieira Inside Wireman Apprentice IBEW Local 332	Jeffrey Lockett Apprentice Inside Wireman IBEW Local 11	David Torres Inside Wireman IBEW
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Safeguard Business Systems  
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Earl Wallace  
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Teodoro Urias  
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O.E.G Electric

Chris Scott  
Journeyman Wireman  
Imperial Electric

Jordon Dain  
Union Electrician  
Best Electric Co

Daniel Murguia  
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Benjamin Delamore  
Inside Wireman/ Apprentice  
Elcor Electric

Jose Salcido  
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Joshua Valdovinos  
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Taft Electric Company

Jonathan Castro  
Apprentice Electrician  
IBEW

Omar Morales  
Electrician Foreman  
Dutchman Electric

Erik Van Dyke  
Electrician/ Inside Wireman  
IBEW Local 11

Ian Ellinton  
Journeyman Electrician  
IBEW Local 11

Roosevelt Townsend  
Insidewireman Apprentice  
DCD Electric

Davion Darden  
General Foreman/ Certified  
Electrician  
Aldridge Electric

James Unfried  
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ACCS

Marshon Blackwell  
Apprentice Electrician  
Spectra Instrumentation

Justin Naillieux  
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Joselito Batres  
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Max Moss-Lyeb Electrician IBEW	Ezequiel Jaime Journeyman IBEW	Jose Martinez Electrician IBEW
Rolando Ordinario Journeyman IBEW Local 11	Andres Cruz Journeywireman IBEW Local 11	John Brown Electrician IBEW Local 11
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David Magana Electrician Dyna Electric	Robert Pierce Voter LADWP	Rashad Robles Electrician LASD/Civil Service
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Sal Hernandez  
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IBEW Local 11

Robert Rodriguez  
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IBEW

William Garcia  
General Foreman  
Johnson Peltier

Marshall Parker  
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GEC 2.0

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Eric Claveria  
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A&R Electric

Brent Kilmurray  
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A-1 Electric Service Co, Inc.

Eric VanPelt  
California Resident  
GEC 2.0

Cesar Chavez  
Jacobs

Chris Walker  
General Foreman  
Cupertino Electric

Kevin Doshna  
Inside Wireman  
Rosendin Electric

Ricardo Velasquez  
Electrician  
IBEW Local 11

Vicent Padilla  
Voter  
Retired

Nelson Mohr  
Sound Journeyman  
IBEW Local 11

Ray Mendoza  
Journeyman  
A&R Electric

Luis Marquez  
Apprentice Wireman  
IBEW Local 11

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David Stone Electrical  
Contractors

James Dunn  
Inside Wireman  
O' Bryant Electric, Inc.

Corrine Irwin  
SLP  
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Louis Aguirre  
Journey Wireman  
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Electrician  
Leed Electric

Carlos Aranibar  
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Faith Electric

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Gary Van Eede Electrician IBEW Local 11	Samuel Villa Jr. Apprentice Belco Electric	Brian Woodward Electrician IBEW
Wayland Leong ECH LAWA	Mark Romeo Genera Foreman Morrow-Meadows Corporation	Fred Luli Electrician IBEW
Ruben Linares Installer Anderson and Howard	Jeremy Dixon Jr. Citizen Morrow-Meadows Corporation	Josias Nunez Apprentice Electrician Fielding Electric Co
Raymond Rodell Apprentice Sunbelt Electric	Chris Streip Journeyman Wireman Retired	Quincey Morton Electrician IBEW
Eric Knox Electrician IBEW	Roberto Duran Electrician IBEW Local 11	Ezequiel Ortiz Electrician PDE Electric
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Electrical Training Institute

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James Larson  
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IBEW

Roger Davis  
Journeyman Wireman  
Cupertino Electric

Raul Medina  
Electrician  
BEW Local 11

Douglas Rhodes  
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IBEW Local 11

Jose Lopez  
Electrician  
CSI Electrical Contractors, Inc.

Steve Sanchez  
Foreman Inside Wireman  
CSI Electrical Contractors, Inc.

Ahmad Jamahl Anderson  
Apprentice  
Walton Electric

Timothy Bowens  
Inside Wireman  
ETI

Marcelo Bowsa  
Electrician  
Pacific Industrial Electric

Vincent Ramirez  
Foreman  
Neubauer Electric

Joshua Whisler  
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IBEW

Christopher Berry  
General Foreman  
CSI Electrical Contractors, Inc.

Glenn Young  
Journeyman Electrician  
IBEW Local 11

Jeffery Welsh  
Foreman  
HMT Electric

Robert Boardman  
Journeyman Wireman  
IBEW Local 11

Hector Meneses  
Journeyman Wireman  
Touchstone Engineering

Victor Villa  
Apprentice  
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Union Electrician  
IBEW Local 11

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Morrow-Meadows Corporation

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Supervisor  
Port of Los Angeles

Rudy Cazares  
Electrician  
IBEW Local 11

Jonathan Lopez  
Journeyman Wireman  
IBEW Local 11

Julian Delgado  
Inside Wireman  
Conti Corporation

David Sinaki  
Concerned Citizen  
Carol Electric

Chris Castellanos  
Inside Wireman  
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Gabriel Garcia  
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Accurate Energy Services

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Jennie Garcia Electrician IBEW	Jesus Gomez Apprentice Electrician IBEW Local 11	Derek McDermid Electrician Apollo
Ariel Melena Wireman Contra Costa Electric	Byron Rodriguez Electrical Apprentice A-1 Electric Service Co, Inc	Jason Jacobo Apprentice Rosendin
Alex Chahinian Superintendent Morrow-Meadows Corporation Russell Richardson Journeyman Wireman IBEW	Hugo Lopez Electrician Conti Corporation	Carly Sivula Electrician IBEW
Pedro Gonzalez Wireman IBEW Local 11	Richard Castle Jw Inside Wireman IBEW Local 11	Guillermo Fuentes Electrician IBEW Local 11
Daniel Finnerty Electrician IBEW	Daryl Mitchell Journeyman Sound Installer L-Tech	Daniel Richman Pres. Witeman Double D. Construction
Stephen Slepoy Journeyman Electrician IBEW	John Austin Electrician H&S	David Campos Journeyman IBEW Local 11
Tom Wainscott Journeyman Wireman IBEW Local 11	Kristofer Youngstrom Journeyman IBEW Local 11	Alfonso Perez Civil Service Los Angeles County Sheriff Department
	Steven Sanchez Apprentice DSE Electric	

Drake Dietrich Union Electrician IBEW	Roland Villafuerte Electrical Apprentice Building & Computer Electric, Inc.	Gino Costello Electrician IBEW Local 11
Lisa Barber Journeyman Electrician IBEW	Trevor Holt Electrician's Apprentice Pacific Industrial Electric	Miguel Morales Apprentice Apollo Electric
Ronald Thompson Electrician IBEW Local 11	Raymond Aguilar Jr. Journeyman Electrician IBEW Local 11	Abdul Wajid Electrician LADWP
George Lopez Electrician IBEW	Tiffani Shaik Community Member International Code Council	Saul Guerra Inside Wireman IBEW Local 11
Robert Hoffman Electrical Inspector LAUSD	Alexander Orozco Inside wireman Apprentice Cal Spetra	Thomas Greenwood Inside Wireman Apprentice IBEW Local 11
Edmundo Chacon Electrician SASCO Electric	Ronald Hoch Electrician IBEW	Steve Hathaway Concerned Citizen Morrow-Meadows Corporation
Thomas Naccarato Journeyman Electrician IBEW Local 11	Anthony Sanchez Electrician IBEW	Jonathan Morales Electrician IBEW
Miguel Sotelo General Electrician IBEW Local 11	Daryl Blaire Inside Wireman Apprentice IBEW Local 11	Pablo Marquez California Resident IBEW Local 11
Steven Linker General Foreman Cupertino Electric	Pedro Ramirez Inside Wireman IBEW Local 11	Luis Sosa Union Electrician IBEW Local 11
Andrew Martino Journeyman Electrician IBEW Local 11		Raul Pelayo Foreman Advanced Cable Systems

Alejandro Murillo Inside Wireman IBEW Local 11	Ali Sadeghi Electrician IBEW	Richard Gray Electrician Leed Electric
Lutha Bennett Installer IBEW	Steve Fernandez Foreman Morrow-Meadows Corporation	Ron Burrows Journeyman Rosendin
Kevin Cline Inside Wireman Apprentice NEAL Electric	Dynnell Pugh Electrician IBEW Local 11	Harley Lavitt Electrician Apprentice Taft Electric Company
Kenneth Favrow Electrician IBEW Local 11	Mark Chikuma Journeyman Wireman Morrow-Meadows Corporation	Juan Dena Journeyman DCD Electric
Fabian Guadlianone Electrician LAUSD	Sal Lagunas Electrician Sunbelt Electric	Joe Simmons Inside Wireman Neubauer Electric
Christian Miller Inside Wireman Conti Corporation	Gilberto Vargas Journeyman Wireman IBEW Local 11	Charles Theroux Journeyman IBEW Local 11
Justin Belts Electrician HMT Electric	Richard Banuelos N/A CSI Electrical Contractors, Inc.	Michael Mortl Project Manager CSI Electrical Contractors, Inc.
Eric Butler II Electrician IBEW	Josh Mandeville Electrician Unison Electric	Steve Warner CA State Certified General Electrician IBEW Local 11
Emmanuel Blanco General Foreman Rosendin	Matthew Apker General Foreman Rosendin Electric	Miguel Mejia Journeyman BEC
Eric Melgar Electrician IBEW Local 11	Jeff Weaver Electrician IBEW Local 11	

Frank Canales Retired Electrician IBEW	Jeffrey Lorenzen Journeyman Wireman Taft Electric Company	Christian Alfredo Estrada Journeyman Barnett Electric
Malcolm Lewis Electrician IBEW	Anthony Vatala Journeyman Electrician H&S Electric Inc.	Udbaldo Mazariegos Journeyman Inside Wireman IBEW Local 11
Curtis Dean Journeyman Electrician IBEW	Ricardo Camorlinga Journeyman Wireman IBEW	Daniel Mendez Voter Cerritos College
Rafael Gomezbernier Journeyman's Electrician Mass Electric	Danae Pouliot Transportation Wireman IBEW	Kevin Johnson Retired Electrician IBEW Local 11
Rafael Garcia Electrician IBEW Local 11	Victor Conde Union Electrician IBEW	Rick Vargas Apprentice Sunbelt Electric
Dustin Lopez Electrician LAUSD	Steven Ernst Electrician Mass Electric Company	Giovanni Diocampo Electrician Polaris Electric
Martin Kennedy Inside Wireman IBEW	Howard Harris Sales Hanks Electrical Supplies	Martin Carlin Electrician Rosendin Electric
Anthony Maldonado Electrician IBEW	Evan Tanaka Inside Wireman Cupertino Electric	Brian Hoole Electrician Plant Electric
Victor Lambaren Foreman Rosendin	Reyes Hockman Wireman IBEW	Jorge Lobato Electrician Dyna Electric
Samuel Hernandez Cruz Journeyman Electrician IBEW Local 11	Isaiah Ortiz Electrician Apprentice Dynalectric	Joey Valtierra Service Tech BEC

Steven Miranda Union Electrician IBEW	Mike Kufchak Director of Veteran Affairs IBEW Local 11	Weixun Qiu Electrician KDC Inc.
Leando Matudan Instructor IBEW Local 11	Kenneth Franjola Journeyman Electrician IBEW Local 11	Brian Thomas Journeyman Electrician IBEW Local 11
David Ruiz Inside Wireman IBEW Local 11	Ryne Spaulding Apprentice Electrician Morrow-Meadows Corporation	Peter Van Foreman Morrow-Meadows Corporation
Tim Cossar CW ESSCO	Rick Wilkinson Foreman Southern CA SASCO	Raul Ceja Electrical Foreman Leed Electric
Jerry Komulaine Journeyman Wireman B&C Electric	Ecarum Sumpter Electrician IBEW Local 11	Gregg Snow Foreman Jacobs
Aron Valades Soriano Journeyman Wireman Dynalectric	Sergio Perez Apprentice IBEW	Adam Perez Electrician IBEW
Abner Carpio Nunez Inside Wireman Morrow-Meadows Corporation	Carl Winterbauer Retired Tri-Technic Inc.	Briana Lablanc Inside Wireman IBEW Local 11
Albert Garcia Electrician IBEW Local 11	Oscar Rivas Electrician Taft Electric Company	Luis Martinez Electrician IBEW
Victor Macias Inside Wireman IBEW	Paul Alvis Journeyman Wireman IBEW Local 11	Henry Hernandez Inside Wireman Electrician IBEW Local 11
	Lupe Mora Customer Services GED	

Sean Prysock Joureyman Wireman DWP	Sergio Pena Foreman Belco Electric	Francisco Lopez Master Electrician IBEW
Leonardo Medina Journeyman Inside Wireman IBEW Local 11	Samuel Madrid Electrician Rosendin Electric	David Lowen Electrician IBEW
Dillon Carroll Electrical Apprentice IBEW	Richard Case Retired Electrician Kirkwood Dynalectric	Dilon Cortez Electrician Morrow-Meadows Corporation
Omar Banelos Concerned Citizen Electro	Zach Brooks Inside Wireman Herzog Electric	Kyle Atherton Electrician IBEW
Robert Houston Pacage Handler UPS	Narcis Flutur Concerned Citizen MD Herzog	Juan Espinoza Inside Wireman IBEW Local 11
David Casillas Foreman Obryant Electric	Derrick Stephens Journeyman Electrician Dynalectric inc.	Marlo Fria Sierra Journeyman Wireman KDC DBA Dynalectric
Bryan Fromdahl Journeyman Inside Wireman Johnson-Peltier	Erik Arreola Inside Wireman Apprentice IBEW Local 11	Brian Basler Journeyman Electrician SCC
Deandre Saunders Barber Black Hollywood BCI	Adam Gonzalez Citizen SASCO Electric	Joseph Leonard Resident IBEW Marlon Gallegos Electrician IBEW
Warren Vasquez Journeyman Inside Wireman IBEW Local 11	Michael Pletka Journeyman IBEW Local 11	Jose Esparza Electrician Los Angeles County
Mario Hernandez Foreman Electrician AC Electric	Ruben Ortega Jw Inside Wireman Unison Electric	

Nathan Sanchez Foreman AC Electric	Gavin Espinosa Journeyman Electrician IBEW Local 11	Emilio Lopez Journeyman Wireman IBEW Local 11
Anthony Soto Electrical Apprentice Rosendin	Avak Bagiryants Electrician JW IBEW Local 11	Lazaro Diaz Sounds Installer Crosstown Electric
Shawn McDonald Concerned Citizen Cupertino Electric Inc.	Bruno Araiza General Foreman Cupertino Electric	Rebecca Davidson Crane Operator Covanta Energy
John McEntagart Business Manager IBEW Local 551	Thinh Nguyen Jw Inside Wireman Comet Electric	Joseph Romanosky Voter Washington Animal Hospital
Don Heinrich Electrical Director Shimmick/ARCOM	Louie Ochoa Journeyman Wireman IBEW Local 11	Derrick Roddy General Foreman IBEW Local 11
Juan Perez Apprentice Electrician IBEW Local 11	Marco Arroyo Signal Systems Electrician City of Los Angeles	Fernando Morales Electrician City of Los Angeles
Ricardo Canales Journeyman Wireman Electrician IBEW Local 11	Joseph La Marche Certified Electrician IBEW	Inyoung Kim Management Citrus Health Partners
Jeffrey Markarian Electrician IBEW	Tim Donnelly Electrician Morrow-Meadows Corporation	John Harms Journeyman Wireman Cupertino Electric
Venessa Ingalls-Llamado Journeyman Wireman IBEW	Anthony Bravo Retired Marin Bravo Electric Inc.	Marcia Romanosky Citizen Retired
	Bryan Gonzalez California Resident Comet Electric	David Shauger Machinist Shape Corp.

Ricardo Navarro Electrician LA County	Andrew Andrade Electrician IBEW	Edgar Vargas Electrician IBEW
Eric Worrell Apprentice Electrician IBEW	Armando Lucero Foreman Carol Electric	Kevin Pham Electrician Fisk Electric
Rodney Vargad JW Electrician Dynalectric	Jose Alvarado Inside Wireman Johnson Peltier	Russell Walters Waiter Sharky's Cove
Marcus Dehart Inside Wireman IBEW Local 551	Cesar Morales Foreman Mass Electric	Daniel Parenteau Inside Wireman LAUSD
Charles Cole Electrician IBEW Local 551	Reyes Franco Journeyman Electrician Rosendin Electric	Curtis Tong Electrician Guillen Electric
Jason Kelly Electrician HVAC Controls Corp.	Thomas Brawley Journeyman IBEW Local 11	Tyler Stellplue Electrician B&C Electric
Timothy Wong Project Manager St. Francis Electric	Donovan McDonald Electrician JP Inc.	Edgar Gonzalez Citizen IBEW
Ryan Keane Electrician IBEW Local 551	Russ DeYoung PM OBE	Hugo Garcia Electrician CSI Electrical Contractors, Inc.
Aquila Sousa Do Reis General Electrician Cupertino Electric Inc.	Luis Julian Electrician IBEW	Ignacio Abarca Journeyman Electrician Pie
Michael Proctor Electrician EJ Weber Electric	Remy Nevarez Inside Wireman TEK Electric	Michael Colvin California Resident IBEW Local 11

Spencer Perry Inside Wireman Mike Brown Electric	Carlos Walker Electrical Worker IBEW	Miguel Angulo Inside Wireman IBEW Local 11
Dustin Kiefer Journeyman Electrician IBEW Local 551	Pete Smith General Foreman Baker Electric	David S Journeyman Wireman Cupertino
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Alec Cabral O&M Administrator CSI Electrical Contractors, Inc.	Francisco Arago Union Electrician IBEW Local 11	James Yount Citizen City of Los Angeles
Admin Alcazar General Foreman Electrician J&A Electric Inc.	Francisco Deleon JW Electrician IBEW Local 11	Cecibell Gonzalez LVN East Los Angeles Doctors Hospital
Adam Morrow Journeyman Inside Wireman E.J. Weber	Mario Uribe Inside Wireman Rosendin Electric	Mohamad Yamak Electrician Rosendin
John Laumann Electrician Redtop Electric	Adam Meave General Foreman IBEW Local 11	Jesse Marquez CW-3 CSI Electrical Contractors, Inc.
Parker Satterlee Apprentice Electrician On Target Electric	Anthony Simpson Electrical Inspector Metro/LADBS	Gerardo Hernandez-Ubario California Resident Morrow-Meadows Corporation
Jonathan Holzboog Apprentice IBEW	Anthony Anguiano Journeyman Inside Wireman IBEW Local 11	

Virginia Reyes Citizen Costco	Anthony Santos Voter Cal-Spectra	Robert Bigoss Electrician Project Manager Halcyon Electric, Inc.
Justin Reyes Citizen Dynalectric	Rennie Blye Concerned Citizen International	Diego Gomez Citizen Spectra
Ricardo Valles Inside Wireman IBEW	Ernie Garcia General Foreman Comet Electric	Norman Chau Journeyman Wireman Rosendin Electric
Sergio Lopez Field Electrician Southland HVAC and Construction	Matthew Dirling Electrician IBEW	Samuel Esworthy Union Member IBEW Local 11
Jairo Vazquez Electrician IBEW Local 11	Danielle Boyer Electrician HMT Electric	Oscar Bravo Electrician IBEW
Israel Sanchez Apprentice IBEW	Ricardo Villasenor Inside Wireman Union Elec. HMT	Erik Villatoro Electrician B&C Electric
Nenna Price Electrician IBEW Local 332	Kenneth Williams Electrician IBEW	Robert Diaz Journeyman Inside Wireman HMT Electric
Ronald Dreiling Journeyman Electrician CSI Electrical Contractors, Inc.	Scott Benefield General Foreman CSI Electrical Contractors, Inc.	Homer Hernandez Transportation Electrician IBEW Local 11
George Carillo Electrician IBEW Local 11	Curt Johnson Concerned Citizen Carol Electric Co.	Wayne Ash Wireman IBEW Local 11
	Bret Cartier Electrician Cartier Electric	Jaime Morales Journeyman Wireman IBEW Local 11

Dean Gamble  
Quality Electrical Inspector  
MEC

Raymond Buhlmann  
Journeyman Wireman  
IBEW Local 11

Luis Garcia  
California Resident  
Baker

Zachary Ayala  
Journeyman Electrician  
IBEW Local 11

Marvin Rivera  
Inside Wireman  
IBEW Local 11

Ruben Mendoza  
Inside Wireman  
IBEW Local 11

Andrew Barron  
Electrician  
CSI Electrical Contractors, Inc.

Steven Gallegos  
Electrician  
DSE Electric

Brian Lewis  
Foreman  
Dynalectric

Dominic Guerrero  
Journeyman Wireman  
IBEW

Matt Thomas  
General Foreman  
HMT Electric

Agustin Garcia  
Foreman  
DSE Electric

Erin Siebuhr  
Manager  
HS

Kris Bakhos  
General Foreman  
HMT Electric

Byron Bailey  
Electrician  
HMT Electric

Alexander Toney  
Barber  
Black Hollywood BCI

Christopher Livingston  
Vice President  
Big Sky Electric Inc.

Scott Easley  
Foreman  
Collins Electric Company, Inc.

Sean Dangleis  
Union Electrician  
Daniels Electric

Marcus Mangum  
Electrician  
Pro-Cal Electric

Travis Crawley  
Resident  
IBEW

Michael Unfried  
Retired  
IBEW

Felipe Loera  
General Foreman  
Conti Corporation

Zachary Solomon  
Electrician  
Morrow-Meadows Corporation

Eric Daniels  
Electrician  
Polaris Electric

Ellis Bailey  
General Foreman  
SASCO Electric

Carlos Ballejo  
Electrician  
IBEW Local 332

Eugene Ascherman  
Journeyman Wireman  
IBEW Local 11

Oliver Lopez  
Inside Wireman  
IBEW Local 11

Henry Ramirez  
Journey Level Wireman  
IBEW Local 11

Steve Babos Journeyman Wireman IBEW Local 11	Ben Cather Foreman Baker Electric	Marco Alas Electrician SASCO Electric
Leonard Copp Journeyman Wireman IBEW Local 11	John Bankhead Customer Success Manager Edlio	Moses Hernandez Citizen Neal Electric
Victor Blas Inside Wireman IBEW	Jorge Nunez Electrician REI	Brett Harper Apprentice Wireman Leed Electric
Barry Bryan C-10 Contractor Bear Electric	Jose Marroquin Inside Wireman SASCO Electric	Jorge Chavez Concerned Citizen DWP
Joseph Valdes Apprentice Walton Electric	Mike Brady Electrician/Journeyman IBEW Local 11	Edwin Cushing Construction Foreman NVEC
Adulfo Serrano Journeyman Wireman Morrow-Meadows Corporation	Salvador Sepulveda Journeyman IBEW Local 11	Jorge Lopez General Foreman Chula Vista Electric
Loren Hess Project Manager Baker Electric	Taylor Meave Student College	Jesse Herrera Inside Wireman DSE
Scott Jessip Foreman Apollo Electric	Francisco Muneton Electrician IBEW	Travis Lee California Resident Lowe's
Aurelio Galindo Concerned Citizen Rosendin Electric	Andrew Lopez Inside Wireman IBEW Local 11	Kimberly Lee Concerned Citizen Ventura Unified School District
Raymond Cruz Electrician Rosendin Electric	Anthony Vergara Electrician IBEW Local 11	Roger Lee California Resident Oilfield Electric

Rick Redman Electrician IBEW Local 11	Victor Carmona Inside Wireman MB Herzog Electric	Greg Soderman Journeyman Wireman IBEW Local 441
Ionel Stinean Electrician Unison Electric	David Mendoza Electrician IBEW Local 440	Eric Ventura Inside Wireman IBEW Local 595
Amber Carter Apprentice Electrician Neubauer Electric	Jesse Elizalde Substation Tech Anaheim Utilities	Manuel Robles Journeyman IBEW Local 441
Rene McGaugh Electrician Bear Electric	Hugo Soriano Apprentice Electrician IBEW Local 440	Chris Kirby Foreman Electrician Colevan Electric
Robert Tovar Electrician IBEW Jose Lopez Citizen IBEW Local 11	Jesse Isaacson Electrical Work Planner PG&E  Lance Cheever Journeyman Wireman IBEW	Kai Peko Apprentice Morrow-Meadows Corporation  Eric Takahashi Inside Wireman IBEW Local 595
Alberto Mancia Apprentice Dynalectric	Eduardo Aguilar Electrician IBEW Local 595	Silverio Ramirez Journeyman Electrician IBEW Local 569/Chula Vista Electric
Reynaldo Lacap Inside Wireman LADWP/IBEW Local 11	William Higgins Foreman IBEW Local 3	Jay Stevens Service Technician Morrow-Meadows Corporation
Leticia Najera Electrician IBEW Local 11	John Leyvas Journeyman Wireman Morrow-Meadows Corporation	Bart Comstock Electrician LK Comstock
Diana Owens Project Coordinator Select Electric	Joseph Newby Journeyman Wireman GES	

Dion Mau Foreman Select Electric	Gary Lama Superintendent CSI Electrical Contractors, Inc.	Cesar Guzman Electrician Neal Electric
Jorge Ayala Journeyman Wireman Working Civil Service	Jason Chabot Journeyman Wireman IBEW Local 1253	Tibor Pasti Electrician Thoma Electric, Inc.
Ron Harkness Foreman Apollo Electric	Ruben Gonzalez Electrical Mechanic LA DWP	Aron Ramos Journeyman Herzog Electric/IBEW Local 11
Gerald Guerrero Foreman Sturgeon	Manuel Ormonde Apprentice Inside Wireman IBEW Local 440	Ramon Gonzalez Journeyman Wireman IBEW
James Limas Electrician IBEW Bill Barlogio Electrician Thoma Electric Inc.	Joshua Buckner Inside Wireman Wiggins Electric	Faith Storey Sound Apprentice Teraband
Nickolas Hernandez Apprentice IBEW	Ronald Bayless Journeyman Wireman IBEW Local 440	Ricardo Martinez Journeyman Wireman IBEW Local 441
Florencio Castro Apprentice Electrician IBEW Local 11/Dynalectric	Abel Guadarrama Journeyman Electrician Morrow-Meadows Corporation	Terrance Logue Foreman Electrician Artistic Lighting & Electric
Daniel Severin General Foreman IBEW	Christopher Ramirez Apprentice Giannelli Electric	Joseph Ortega Journeyman Wireman IBEW Local 441
Brian Corre Apprentice Electrician Sasco	Eric Amaro Electrician Crimson Midstream	Luis Soriano Journeyman Lineman AEP Texas
	Dylan Lecair CEO Lecair Electric, Inc.	Cesar Rosales Electrician IBEW

Kyle Story Electrician IBEW	Rose Marie Dahl-Fuchs Secretary/Treasurer Lecair Electric, Inc.	Andrew Muro Driver Uber
Eshirika Brice Apprentice Inside Wireman IBEW Local 11	Israel Magana Electrician SASCO	Steve Sherman Electrician IBEW
Juan Perez Business Development Rep IBEW	Justin Etchells Inside Wireman Emcor Electric	Sean Higgins Apprentice Wiggins Electric
Christopher Salorio Project Superintendent SASCO Electric	Joaquin Hernandez Journeyman Wireman Anderson Howard	Richard Marquez Electrician IBEW Local 11
Jeremiah Jones Journeyman Electrician IBEW	Garrett Wilson Inside Wireman Gregg Electric	Gary Wing Electrician Contra Costa Electric
Frederick Waters Journeyman Electrician IBEW Local 551	Mark Poduska Apprentice Electrician O'Bryant Electric	Dan Smith Concerned Citizen Taft Electric Company
Dale Paris Inside Wireman IBEW Local 302	Joshua Gonzales Journeyman Morrow-Meadows Corporation	Stan Szeto Apprentice Electrician Contra Costa Electric
Favian Ramirez California Resident IBEW	Dakota Garner Apprentice Inside Wireman Gilbert and Stearns	Jose Villaba Superintendent Cherne Construction Company
Steve Walthall General Electrician IBEW Local 440	Rogelio Valencia Journeyman Wireman Gilbert and Stearns	Graham Trimper Foreman Electrician Gilbert and Stearns Electric
David Proctor Electrician IBEW	David Cendejas Journeyman Wireman Gilbert and Stearns	

Joseph Williams  
Estimator  
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Jaime Sanchez  
Inside Wireman  
IBEW

Sam Snyder  
Director of Warehouse  
Operations  
CSI Electrical Contractors, Inc.

Steve Obrien  
JW  
IBEW Local 551

Ross Commins  
Electrician  
Electrix

Roger Roper  
Certified Journeyman Electrician  
IBEW Local 440

Javier Dawson  
Electrician  
Newtron

Austin Crivelli  
Jw Inside Wireman  
IME

James Carvelho  
Union Journeyman Electrician  
IBEW Local 551

Amber Cox  
Controller  
The Mike Cox Electric, Inc.

Rashid Aman  
Foreman  
Gilbert and Stearns

Patrick Brown  
Retired  
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Jose Espinoza  
Journeyman Wireman  
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Labor Compliance Officer  
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Alicia Aceves  
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Dan Prada  
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Juan Guzman  
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Taylor Hood  
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Carl Heller  
Retired Electrician  
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Jennifer Corbin  
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Emily Blake  
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Taylor Bihn Electrician Apprentice IBEW	Salvador Flores General Electrician/Foreman IBEW	Daniel Blake Journeyman Inside Wireman IBEW Local 440
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Jesus Moreno Apprentice Sunbelt Electric	Steve Finnegan Foreman Chula Vista Electric	Prem Sandhu Journeyman Wireman IBEW Local 595
Robert Christiansen Wireman HVAC Controls Corp.	Barbara Dees Electrician IBEW Local 595	Walter Glib Journeyman Wireman Sasco Electric
Donovan Helminiak Foreman Cupertino Elect	Andrew Rios Journeyman Wireman IBEW Local 11	Lester D Laterza Concerned Citizen Schiltz & Laterza, CPA's
Tammy Christiansen Health Tech West Sonoma County Unified High School District	Rand Zeller Retired IBEW	Jason Miller California Resident SASCO Electric
Thomas Ritch Electrician/Instructor REJATC	Oliver Farias Foreman Connor Com	Tony Cortez Electrical Foreman Del Monte Electric
	Scott Chilson Inside Wireman IBEW Local 440	Andrew Castillo Inside Wireman IBEW Local 11

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Jaime Suarez California Resident CSI Electrical Contractors, Inc.	Merle Porter Superintendent/Field Supervisor Rosendin	Joseph Taylor Electrician IBEW Local 595
Michael Berkowitz Foreman Electrician Redtop Electric	Abram Krawcheck Electrician Collins Electric Company, Inc.	Jerry Martin Business Owner Martin, Ketterling & Associates
Nicholas Opdyke Electrician Morrow-Meadows Corporation	Randy Underwood Estimation Manager Mike Cox Electric	Moses Flores Foreman Rosendin
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Edward Krouse Journeyman Electrician IBEW	Guadalupe Machuca Journeyman Wireman Morrow-Meadows Corporation	Jorge Rodriguez Citizen Del Monte Electric
Bradley Ingram Journeyman Wireman IBEW	Shawn Hudson Project Engineer Chula Vista Electric	Ryan Kyle Electrician Collins Electric/IBEW
David Nelson Electrician IBEW		Jose Casas Membership Development IBEW Local 551

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Inside Journeyman Wireman  
IBEW Local 551

Mike Gless  
General Foreman  
IBEW Local 551

William Leeming  
Electrician  
Silman Industries

Paulo Barros  
Journeyman/Inside Wireman  
IBEW Local 551  
Christopher Elam  
Electrician  
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Ismael Rubio  
Transportation Apprentice  
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Daniel Luther  
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Brian Singler  
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Hjalmar Hake  
Technician  
WBE

Market Newton  
Electrician  
McMillan Electric

Matt Fleming  
Foreman  
Chula Vista Electric

David Gutierrez  
General Foreman  
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Raymond Thomason  
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Gaspar Gharapetian  
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Albert Mar  
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Albert Campos  
Worker  
LA

Robert Morris  
Retired Electrician  
IBEW Local 595

William Carver  
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Kristi Ehrhardt  
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James Guerin  
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IBEW Local 440

Don Lee  
California Resident  
Redwood Electric Group

Ben Hawkins  
Journeyman Wireman  
IBEW Local 551

Mindy Conant  
Apprentice  
E Electric

William Killacke  
Foreman  
A-1 Electric, Inc.

Bryan Tamayo  
Journeyman  
IBEW Local 440

Pat Saggs  
Foreman Electrician  
IBEW Local 952

Sam Ducato  
General Foreman  
St. Francis Electric

Robert Perez  
JW  
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Dan Miller  
Training Director  
SLO JATC

Javier Nichols  
Inside Wireman  
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Robert Smith  
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Mark Simonin  
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Dan Corr  
General Foreman  
Sierra Electric

Steve Soria  
Journeyman  
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Damian Root  
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Nicholas Dillon  
Journeyman Inside Wireman  
IBEW

Paul Garczynski  
Insidewireman  
IBEW Local 440

Edward Henrichson  
Lead Electrician  
GE

Nolan Chedister  
Journeyman Inside Wireman  
Morrow-Meadows Corporation

Justin Solomon  
Journeyman Inside Wireman  
IBEW

Nick Tost  
Journeyman Electrician  
Presidio Systems

Joseph Coleman  
Journeyman  
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Tim Umekubo  
California Resident  
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Ignacio Flores  
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Gabriel Smith Journeyman Electrician IBEW James Daniels Journeyman Electrician IBEW Local 551	Justin Chisholm Concerned Citizen Braver Electric	Francisco Carrillo Journeyman IBEW Local 440
Trevor Kraft Electrician Thoma Electric	Elizabeth Figueroa Apprentice Electrician IBEW Local 595	Cody Cass Wireman IBEW Local 440
Aaron Verduzco Electrician Thoma Electric	Jorge Alvarado Electrician Neal Electrical Co.	Carlos Botello Inside Wireman IBEW local 440
Jeff Weber Journeyman Wireman Rossi & Carr Electrical Inc.	Paul Lord Retired IBEW Local 639	Donald Williams Retired Insire Wireman IBEW Local 440
James Peirce Journeyman Wireman Lee Wilson Electric	Johnny Wyatt Electrical Foreman IBEW Local 639	Robert Granados Inside Wireman IBEW Local 440
Robert Gilliland Electrician Rossi & Carr Electrical Inc.	Juan Torres Inside Wireman IBEW Local 11	Dante Coz Electrician IBEW Local 440
	Eduardo Perla Foreman HMT Electric	Joseph Serticchio Retired Electrician IBEW

Joseph Fitzer Electrician Thoma Electric	Rosendo Ramirez Journeyman Electrician Bowen Electric	Robert Segura Journeyman Inside Wireman IBEW Local 440
Marco Minera Electrician IBEW	Glen McClester Electrician IBEW Local 952	David Valdivia General Foreman Morrow-Meadows Corporation
Joshua Conant General Foreman MM	Albert Mayfield Chief Estimator Kaiser Permanente	Daniel Martinez Journeyman Wireman IBEW Local 440
Travis Schrag Electrician Thoma Electric	Nicholas Dennis Apprentice Electrician Lunardi Electric, Inc.	Noah Newman Journeyman Wireman IBEW
Richard Dragan Apprentice Electrician Herzog Electric	William Laster Inside Wireman IBEW Local 595	Ariel Batres Journeyman Wireman IBEW Local 440
Rick Tweedy Electrician Thoma Electric	Marcos Tapia Inside Wireman IBEW	Jenaro Valencia Electrician Foreman Shimmick Const.
Christopher Parr Construction Wireman IBEW Local 11	Jaron Lake Sales SB Marketing	Banjamin Hogue Journeyman Wireman IBEW Local 440
Christian Saenz Electrician Thoma Electric	Michael Johnson Inside Wireman IBEW Local 595	Devin McFadden Electrician IBEW Local 551
Blain Miller Apprentice IBEW Local 952	John Ponzetti Electrician IBEW Local 639	Gregory Guido Journeyman Gregg Elec
Ernesto Cortez Electrician Davis Electric	Bernie Balland Electrician IBEW Local 440	Manuel Desquitado Inside Wireman Journeyman IBEW

Raul Zamora Foreman IBEW	Anthony N Williams Electrician IBEW	Forest Heil Electrician Aptim
Jeffrey Trick Inside Wireman IBEW Local 551	William Tarpley Journeyman Wireman IBEW Josh Hirshfield Electrician IBEW Local 551	Nicholas Negrete Apprentice/Electrician Morrow-Meadows Corporation
Michael Martin Service Electrician Thoma Electric	Edson Morgan Construction ETI	Francisco Ruiz Journeyman Electrician IBEW Local 440
Loren Martin Electrician IBEW Local 639 Belinda Kesisoglu RN PIH	James Tintsman Master Electrician IBEW Local 551	Rafael Martinez CW IBEW Local 440
Bill Murphy Inside Wireman IBEW Local 440	Shawn Magill Journeyman Electrician CPFC/ Kaiser Permanente	Ryan Butler Electrician IBEW
Robert Campos Concerned Citizen R&R Electric	Dan McCaffery Construction General Foreman Kaiser Permanente	Jack Schmermund Journeyman IBEW Local 551
James Buxton General Foreman Taft Electric Company	Andrew Alaniz Apprentice IBEW Local 11	Jason McCarty Journeyman Wireman IBEW
Ilene Campos Voter Bakery	Charles Alejo Insidewireman IBEW Local 595	Ricardo Torres Electrician Gregg Electric
Nathan Groth JW McMillan Electric	Brian Hacker Electrician IBEW	Joe Mendoza Retired IBEW Local 440
		Mark Hinton Apprentice Electrician Baker Electric

Jose Lopez Apprentice Electrician Gregg Electric	David Ochoa Citizen PME	Norwood Hurst Apprentice Electrician O'Bryant Electric
Ryan Blackmon Electrician IBEW	Scott Courier Retired IBEW Local 551	Steve Earhart Director Ventura County Electrical
Patrick Harder Retiree IBEW	Chad Eaton Journeyman Wireman IBEW Local 440	John Stencler Electrician IBEW Local 952
David Martinez Journeyman Electrician CSI Electrical Contractors, Inc.	Brian Kennedy Electrician IBEW Local 595	Alvaro Cruz Inside Wireman/Apprentice IBEW
Cody Blackmon Contact Inside Wireman IBEW Local 440	Bryan Hocking Journeyman Inside Wireman IBEW Local 952	Jason Allen Citizen Taft Electric Company
Daniel May Voter Taft Electric Company	Rachel Hoobing California Resident Del Monte Electric	Andres Mendez Apprentice IBEW
Raymond Tienda Journeyman Wireman IBEW 440	David Robinson Electrician Thoma Electric	David Labadie Jr. Journeyman Wireman IBEW Carlos Guzman Citizen Zeller Electric
Daniel Pruett Voter Sulpher Crest Electric	Kyle Dales Journeyman Inside Wireman Morrow-Meadows Corporation	Kenneth Maxam Wireman IBEW Local 440
Jeremy Howard Citizen California	Jose Flores Electrician IBEW Local 595	Steven Krevenas Citizen Taft Electric Company
Daniel Coxon Electrician Wihhins	Alberto Miramontes Inside Journeyman Wireman Morrow-Meadows Corporation	

Alfredo Flores  
Electrician  
Artistic Lighting & Electric

Terry Adair  
Electrician  
IBEW

Michael Kroll  
Inside Wireman  
Electricraft

Chris Cabot  
Electrician  
IBEW Local 551

John Gaona  
Electrician  
IBEW Local 440

Nate Perry  
Electrical/Solar Troubleman  
Electricraft

Jason Gumataotao  
Journeyman Inside Wireman  
IBEW Local 595

Auliya Giddings  
Electrician  
IBEW Local 595

Roy Johnson  
Inside Wireman Apprentice  
Collins Electric Company, Inc.

Nick Clark  
Apprentice  
IBEW Local 595

Ricardo Ruacho  
Elect Apprentice  
IBEW

Chris Ramos  
California Resident  
IBEW Local 595

Kebrah Stewart  
Concerned Citizen  
Taft Electric Company

Manuel Gonzalez  
Journeyman Electrician  
Baker Electric

Teresa Donahue  
Inside Wireman  
Retired

Alexander Comendant  
California Resident  
Bockman & Woody Electric

Robert Perez  
Resident  
Design Electric

Gin Lam  
Inside Wireman  
Crockett Electric Co.

Juan Eliab  
Journeyman Inside Wireman  
IBEW Local 595

Galina Perez  
Resident  
Narvar

Eustacio Aranda  
Electrical Mechanic  
Los Angeles Department of  
Water and Power

Andrew Garcia  
Citizen  
Zeller Electric

Bruce Fincher  
California Resident  
Retired

John Riley  
Produce Manager  
Stater Brothers Markets

Rosalio Parra  
Union Electrician  
Redwood Electric Group

Andrew Martin  
Resident  
Resident

Alejandro Marquez  
Electrician  
IBEW

Joe Ramirez  
Journeyman Wireman  
IBEW Local 440

Javier Diaz  
Electrician  
Becker Electric

Kelvin Garcia Inside Wireman IBEW Local 595	Juan Guzman-Garcia Electrician Apprentice Thoma Electric	Joseph Ransome Electrician CDM Smith
Daniel Dahl Inside Wireman SD Electric Inc.	Michael Anklam Foreman Electrician Redtop Electric	Michael Flores Warehouse Thro
Kyle Jensen Apprentice IBEW Local 551	Daniel Borja Electrician IBEW	Joe Casadidio Foreman Electrician WBE
Erik Trettevik Electrician Cupertino Electric Inc.	Kahlil Kam Electrician IBEW Local 595	Felipe Ortega III Composite Technician II Space-X
Nicholas Chaffeur Electrician Morrow-Meadows Corporation	Robert Green Electrician IBEW Local 595	Zachary Miller Union Apprentice R McClure Electric
Brad Roller Electrician CBF	Charles Hamilton First Responder/Electrical Safety Trainer NECA/IBEW/LMCC	Richard Luna California Resident LADWP
James Peterson Electrician Eagle Electric	Derek Chase Distribution Manager SCGN	Brian Malloy Journeyman Wireman Rosendin Electric
Martin Alvarez California Resident Prime Electric	James Ledbetter Construction Wireman IBEW Local 595	Antonio Castaneda California Resident Scott and Sons Electric
John Palacios Electrical Superintendent Conti Corporation	Stephen Medeiros Journeyman Inside Wireman Retired	Daniel Adams California Resident Taft Electric Company
Walter Kita Inside Wireman IBEW Local 595		Adriana Rosales Executive Administrator Los Angeles LGBT Center

Deane Meakin Electrician IBEW Local 595	Leonard Ancona Electrician IBEW Local 595	Andrew Lee Journeyman Wireman IBEW 952
Jorge Cortes Technician Comtel	Ryan Sprague Electrician City of Oceanside	Josh Stitzer Journeyman Electrician IBEW
Samuel Valencia Journeyman Electrician IBEW Local 595	William Stapelberg Journeyman Electrician IBEW	Eduardo Medina Electrician HMT Electric, Inc.
Forest Hayes Superintendent Abbet Electric	Derek Jenkins Apprentice Electrician IBEW	Eddie Dunn Senior Tech WBE
Francisco Rosa Electrician IBEW	Christine Sigel Journeyman Electrician Bowen Electric	Michael Flores Maintance Post Office
Sean Kyle General Foreman Collins Electric Company, Inc.	Casey Christopher Electrician Cupertino Electric	Chad Hinkle Journeyman Wireman Thoma Electric
Ever Esparza Project Manager CSI Electrical Contractors, Inc.	Alan Self California Resident Rosendin	Mark Bellinger Electrician IBEW Local 952
Michael Knight Contractor/Electrician Self Employed	Jesse Machuca Foreman Rosendin	Tony Silvestri Resident Private Citizen
Kristine Gray Inside Wireman Akima Construction Service	Allan Lagman Journeyman Inside Wireman Del Monte Electric	Michael Donlon California Resident California State University of Channel Islands
Travis Wolf Journeyman Wireman IBEW Local 595	Peter Grgurevic Electrician St. Francis Electric	

Anna Wolf California Resident IBEW Local 595	Jerry Oshea Foreman/Electrician Metro Electric	William Gerber Electrician IBEW
Danny Mora Voter Cupertino Electric	Jaime Quintana Journey Wireman IBEW Kevin Kremer Electrician IBEW Local 595	James Bridgmon Electrician Thoma Electric
Daniel Garcia Inside Wireman Cupertino Electric Inc.	Jack Waller Electrician Cupertino Electric	Richard Kanatzar Concerned Citizen Taft Electric Company
Erick Rodas Foreman IBEW Local 11	Carlos Gomez General Foreman Morrow-Meadows Corporation	Alejandro Alvarado Journeyman Electrician IBEW
Alex Mansfield Inside Wireman IBEW Local 6	Fernando Avelar Electrician IBEW	Casey Markovich Journeyman Electrician Contra Costa Electric
Brian Gaines Concerned Citizen Brain Gaines Systems and Design	Trevor Clarey Inside Wireman IBEW Local 551	Jacob Kahalelio Electrician IBEW Local 551
Daniel Brown Inside Wireman IBEW	Steven Bless Inside Wireman Apprentice IBEW Local 440	Adam Terry Electrician IBEW Local 595
James Blair State Certified Inside Wireman IBEW Local 6	Robby Cordobes CSFA Southern Director	Roberto Valle Inside Wireman IBEW
Donald Baxter Retired Electrician IBEW Local 595	Kimberly Hudson California Resident Rosendin Electric	Aaron Hoffman Citizen CBF Electric, Inc.
		Connor McDonald Electrician IBEW

Noreen Buckley Apprentice IBEW Local 6	German Munguia Electrician IBEW	Ruben Leon Journeyman Inside Wireman IBEW Local 440
Dave Nicholson Journeyman McMillan Electric	Natalie Miramontes Journeyman IBEW Local 440 William Acosta Wireman Apprentice IBEW	Lawrence Dubrul Retired IBEW Local 639
Walter Ceballos Electrician Bass Electric	Martin Schweickert Electrician IBEW Local 595	Aaron Ullyott Electrician IBEW
Eddie Schmid Inside Journeyman Wireman IBEW Local 477	Robert Rodriguez Electrician Apprentice E.S.S.C.O	Oscar Marquez Concerned Citizen Bockman & Woody Electric
Justin Connolly Journeyman Electrician Rosendin Electric, Inc.	David Gilliland Journeyman Electrician IBEW Local 639	Kanaka Keka Electrician IBEW Local 551
Richard Bamberger Electrician Inspector City and County of San Francisco	Calvin Jackson Concerned Citizen DME	Alfredo Gallardo Electrician IBEW
Robert E. Martinez Retired Electrician IBEW Local 6	Sergio Arteaga Apprentice Cal Spectra Instrumentation	Allen Solomon Class A. Driver Weber Logistucs
Deborah Bond Electrician IBEW Local 6	Clarence Johnson Retired IBEW Local 551	Rosendo Marquez Inside Wireman Apprentice IBEW 595
Gabriel Flores Citizen IBEW	Chris Walsh Inside Wireman IBEW	Andrew Martinez Apprentice IBEW Local 595
		Chezare Zanini Electrician Sprig Electric

Bryan Grajeda Citizen Johnson Peltier	Aaron Rothermund Inside Wireman Taft Electric Company	Tito Gonzalez Sound and Communication Installer IBEW Local 551
Matthew Goodnol Electrician IBEW Local 6	William Valencia General Foreman Maximum Electric	Jonathan Conant Jr. Journeyman Wireman IBEW
Kevin Shannon Retired IBEW Local 6	Jonah Gabriel Electrician Kaiser Permanente	Henry Lewis Retired IBEW
Kevin Shannon Voter Oilfield Electric	Marwan Rageh S&C Apprentice IBEW Local 595	Ian McLaren Electrician IBEW
Teresita Araujo Journeyman Electrician IBEW Local 477	Garrett Golobay Foreman Unison Electric	Jason Leyden Journeyman Inside Wireman Thoma Electric
Phillip Heffernan Journeyman Wireman IBEW Local 441	Jordan Winkley Inside Wireman R. McClure Electric Inc.	Jessica Leyden Customer Service MBO
David Helsel Branch Manager Collins Electric Company, Inc.	Matthew Sherman Electrician IBEW Local 595	Alejandro Mora Electricians Apprentice Crockett Electric Co.
Christopher McGovern Apprentice IBEW Local 6	Victoria Garcia Associate Marketing Manager Gap Inc.	Adrian Hardesty General Electrician Wiggins Electric
Matthew Choate Inside Wireman IBEW Local 6	Ron Cattani Journeyman Wireman IBEW Local 11	Mark Zorick Electrician DWP
	Juan Barreras Electrician IBEW Local 440	

Cameron Riach  
Journeyman Inside Wireman  
IBEW Local 6

Christie Peters  
Inside Wireman/Apprentice  
Instructor  
IBEW Local 6

Peter Chursin  
Training Director  
SF Joint Apprenticeship and  
Training Committee

William Godwin  
Inside Wireman  
IBEW

Alex Steingrimsson  
Inside Wireman  
IBEW Local 6

James Currie  
State Certified Electrician  
IBEW Local 6

Forrest Jang  
Retired Electrician  
San Francisco International  
Airport

Robert Tempest  
Inside Wireman  
Bass Electric

Jeffrey Ranta  
Electrician  
City and County of San  
Francisco

Joseph Attinello  
Concerned Citizen  
Retired

Anthony Lescure  
Apprentice Electrician  
Lunardi Electric

Fred Jimenez  
Foreman Electrician  
Rosendin Electric

Carter Kimble  
Apprentice Electrician  
Mike Brown Electric

Dominic Marquez  
Assistant Training Director  
IBEW Local 6

Jim Wheeler  
Retired Electrician  
IBEW Local 6

Jason Pirone  
Electrician  
IBEW

Jeff Brugaletta  
Electrician  
CBF Electric, Inc.

David Howard  
Journeyman Wireman  
IBEW Local 477

Zach Moore  
California Resident  
Elcor

Jeffery Spence  
CW Step  
IBEW Local 595

Thomas Wallis  
Electrician  
Retired

Fredrick Armas  
Electrician  
IBEW Local 639

Richard Wright  
Electrician  
SD Electric Inc.

Cole Hadick  
Nuclear Operator  
PG&E

Trevor Hancock  
Inside Wireman  
IBEW Local 440

Aaron Lucas  
Facilities  
Tesla  
John McPierce  
Electrician  
IBEW Local 551

Luke Rumble  
Inside Wireman  
Controlled Energy

Gregory Chaniot  
Inside Wireman  
SMI Inc.

Frank Sinohui Jr.  
Inside Journeyman Wireman  
IBEW Local 477

Steve Cloherty  
Instructor  
SF Joint Apprenticeship and  
Training Committee

Guillermo Claveran  
Journeyman Wireman  
IBEW

Thomas Richards  
Electrician  
IBEW Local 639

Sean L. Swoboda  
Electrician  
Mass Electric

Wilfred Carino  
Retired Inside Wireman  
IBEW Local 6

Diana Dooley  
Electrician  
CBF Electric, Inc.

Erik Byberg  
Foreman  
Sierra Electric

Zach Portillo  
Inside Wireman Apprentice  
Morrow-Meadows Corporation

Michael Beardsley  
California Resident  
Crockett Electric Co.

Cassandra Laterza  
Social Worker  
County  
Colin Davidson  
Electrician  
Victory Electric

Craig Sharp  
Electrical Foreman  
A&R Electric

Jaime Viramontes  
Apprentice  
IBEW Local 441

Timothy De Moor  
Journeyman Inside Wireman  
IBEW Local 11

Charles Greenlee  
Apprentice  
Decker Electric

Andre LeSassier  
Electrician  
HMT Electric, Inc.

Xavier Burris  
Journeyman Wireman  
IBEW Local 477

Dennis Cantu  
Estimating  
Chula Vista Electric

Morgan Cushing  
California Resident  
BEI Inc.

Korah Rubio  
HR Manager  
On Target Electric

Lorena Raucho  
Housewife  
Retired

Albert Jeronimo  
California Resident  
Marriott

Francisco Lemus  
Electrician  
IBEW Local 440

Benjamin Wing  
Electrician  
Oilfield

William Kenney  
PV Instructor  
DOE

Marcus Lloyd  
Electrician  
IBEW Local 11

Gustavo Rangel  
Apprentice  
Tecnion

David Thoni  
Voter  
Retired

Deanne Hartnett  
Foreman Electrician  
Rosendin Electric Co.

Eduardo Medina  
Estimating  
Chula Vista Electric

Adam Alvarado  
Journeyman Electrician  
Daniels Electric

Nick Vafiadis  
Inside Wireman  
Cupertino Electric

Robert Diehl  
General Superintendent  
Cupertino Electric

Jorge Hernandez  
JW Electrician  
IBEW Local 11

Alan Foster  
Electrical  
Contra Costa Electric

Christopher Contreras  
Construction Wireman  
IBEW Local 234

Kurt McClave  
Journeyman Electrician  
IBEW Local 639

Ryan Stolpp  
Citizen  
C.S.I Electric

Steve Valenta  
Electrician  
IBEW

Robert Meszaros  
JW  
IBEW Local 639

Caleb Heikkila  
Inside Wireman  
IBEW Local 6

Beverly Lyons  
Apprentice Electrician  
E.J. Weber Co Inc.

Francisco Alvarado  
Union Electrician  
IBEW Local 11

Matthew Quinlan  
Inside Wireman  
Prime Electric, Inc.

Dan Tellez  
Journeyman  
IBEW

Ernst Deuter  
Electrician  
IBEW

Shannon Russell  
Retired Journeyman Wireman  
IBEW Local 11

Zachary Parker  
Apprentice Electrician  
IBEW Local 6

Mikeal Stevens  
Inside Journeyman Wireman  
IBEW Local 440

Erin Toth  
Electrician  
IBEW Local 6

Joel Koppel  
SF Planning Commissioner  
IBEW Local 6

James Western  
Foreman  
Becker Electric Inc

Ernerst Barraza  
Electrician  
Morrow-Meadows Corporation

Chuck Pehkonen  
Electrician  
IBEW

David Roth  
Foreman  
Taft Electric Company

Rodolpho Jimenez  
Electrician  
CSI Electrical Contractors, Inc.

Christopher Crowley  
Apprentice  
Cupertino Electric

Carlos Echeverria  
Apprentice Electrician  
IBEW

Niles Follin  
State Certified Electrician  
IBEW Local 6

Brian Adams  
Inside Wireman  
IBEW

Crystal Garcia  
Warehouse  
Amazon

Paul Comer  
Certified Electrician  
IBEW Local 952

Troy Nelson  
Electrical Foreman  
Contra Costa Electric, Inc.

Andria Shafer  
Project Assistant Team Manager  
Contra Costra Electric

Luciano Cervantes  
General Foreman  
SASCO Electric

Fenton Torrez  
CW  
D&R

Chris Corey  
JW  
Conti Corporation

Paul White  
Vice President  
Contra Costa Electric, Inc.

Francisco Manjarrez  
JW Electrician  
Woods Electric

Ivan Rodriguez  
Resident  
Cal Spectra Instrumentation

Charlie Hadsell  
Vice President  
Contra Costa Electric, Inc.

Steve De La Pena  
Journeyman Wireman  
IBEW

Robert Hager  
General Foreman  
HMT

Kathy Mayo  
Office Manager  
Contra Costa Electric, Inc.

Vishnu Gulati  
Inside Wireman  
IBEW Local 6

Chuch Smith  
Retired Electrician  
Dynalectric Co.

Mark Sheeley  
Vice President, Purchasing  
Contra Costa Electric, Inc.

David Holmes  
JW Electrician  
IBEW Local 100

Vince Correa  
Electrician  
HMT Electric, Inc.

Adrian Padilla  
Journeyman Electrician  
Blue Light Electric

Erik Ward  
Foreman  
Cupertino Electric

Alejandro Garcia  
Electrician  
HMT Electric, Inc.

David Thacker  
Foreman  
Polaris Electric

Ron Staub  
Retired Journeyman Electrician  
A-C Electric Co.

Brian Hilburn  
Journeyman Electrician  
HMT Electric, Inc.

Samuel Bonilla Electrician IBEW	Derek Chapman Inside Wireman Bockman & Woody Electric Inc.	Marcos Hernandez Apprentice Dawson Electric
David Medeiros Electrical Superintendent Contra Costa Electric, Inc.	Andrew Pottorff Apprentice Inside Wireman CSI Electrical Contractors, Inc.	Teofilio Mendoza Citizen California
Erin Engleheart Administrative Assistant Contra Costa Electric, Inc.	Anthony Anguiano Journeyman Inside Wireman IBEW Local 11	Rick Foster Retired IBEW Local 440
Roy Bryant Project Manager Contra Costa Electric, Inc.	Rich Truelove Journeyman Wireman Electrician SBE Electrical Contractors	William Wilson Electrician IBEW
Lisa Looney Senior Accounting Clerk Contra Costa Electric, Inc.	Kathy Mac Laren Business Development IBEW/NECA	Harold Sloat Electrician Supervisor LAX
Richard Basta Foreman, Journeyman Wireman Contra Costa Electric, Inc.	Robert Battaglia General Foreman Inside Wireman IBEW Local 6	James Olson California Citizen United Airlines
Pam Combar Retired Electrician IBEW Local 11	David Gomez Business Development IBEW/NECA	Sean Burke Executive Board Becker Electric
Ronald Beserra Electrician IBEW	William Hammond Electrician IBEW	Greg Russie Journeyman Wireman IBEW Local 6
Brendan Greene Foreman CBF Electric, Inc.	Mario Lopez Journeyman Electrician Taft Electric Company	Daniel Whooley Retired Director of Education SF Joint Apprenticeship and Training Committee
Sergio Herrera Journeyman Electrician IBEW Local 11		

Raymond Green  
Employee Relations & Training  
Contra Costa Electric

Judy Canelo  
Journeyman  
IBEW Local

Otter Maximovich  
Image Analyst  
Apex

Kevin Cunningham  
Inside Wireman  
IBEW Local 551

Brian Jones  
Telcom Tech  
Digitech Communications

Luke Fernandez  
Electrician Apprentice  
M.B. Herzog

Christine McKenna  
Journeyman  
Rosendin Electric, Inc.

Jose Avina  
Journeyman Electrician  
IBEW Local 11

Tim Obole  
Wireman  
IBEW Local 11

Frank Perez  
CW  
IBEW Local 100

Scott Carrillo  
Electrician  
Smith and Sons Electric

Melvin Godinez  
Server  
Famous Dave's

Mauricio Morales  
Electrician  
Sprig Electric

CJ Sparks  
Apprentice  
IBEW

Alfonso Palacios  
Apprentice  
IBEW Local 11

Aaron Lane  
Project Manager  
Fisk Electric

Paul White  
Journeyman Inside Wireman  
Electric Motor Shop

Conrad Apocada  
Electrician  
Electricraft

Jesse Mitchell  
Electrician  
IBEW Local 100

Vu Juynh  
Foreman  
Gilbert & Steams, Inc.

Logan Soli  
Electrician  
Weber Electric

Robert Wertz  
Safety Manager  
Woodpoint Enterprises

James Jewett  
Electrician  
IBEW

Ian Longenbaugh  
General Foreman  
Rosendin Electric, Inc.

Douglas Woody  
Journeyman Wireman  
CSI Electrical Contractors, Inc.

Jeff King  
Administrator  
IBEW Local 18

Stephen Powers  
Apprentice Training Director  
IBEW Local 6

Jeremiah West  
Inside Wireman  
IBEW Local 100

Nasario Espinoza  
Electrician  
Gould Electric

Jennie Garcia  
Electrician  
IBEW

Christopher Sunderland Journeyman/Electrician IBEW Local 100	Chase Cobern Electrical Foreman Serviteck Solutions Inc.	Carlos Salazar Union Electrician IBEW Local 6
Pablo Juarez Electrician Shults	Veronica Martinez Assistant BM IBEW Local 11	Terry Hudspeth Journey Wireman IBEW Local 441
Keith Shrainer Inside Wireman IBEW	Sirkristopher Arrington California Resident CSI Electrical Contractors, Inc.	Jonathan Barbosa General Electrician Rosendin Electric Co.
Jesse Lopez Journeyman Electrician IBEW	Chris Cossey Journeyman Electrician Contra Costa Electric	Juan Reyes Journeyman/Electrician IBEW Local 441
Richard Walker Journeyman Wireman IBEW Local 640	Gabriel Rodriguez Journeyman Wireman IBEW Local 441	Eduardo Garcia Electrician IBEW
Justin Kimes Express Technician Mercedes Benz	Phil Bovard Electrician IBEW	Mark Paul Journeyman Wireman IBEW Local 441
Jonathon Schlaman Inside Wireman IBEW	Travis Clay Electrician Contra Costa Electric	Dennis Hanley General Foreman McMillan Electric
Barry McDevitt Inside Wireman IBEW Local 6/Braver Electric	Kevin Gonzalez Journeyman Inside Wireman IBEW Local 100	Jeff Langendorf Installer Net com
Jacob Goguen Apprentice Grand Electric	Jason Branch Inside Wireman Contra Costa Electric	Joseph Salazar Concerned Citizen Redwood Electric Group
Matt Evans Inside Wireman IBEW	Michael Klein Electrician Paganini Electric	John Patrick Journeyman Wireman IBEW Local 100

Tito Morales Journeyman Wireman IBEW Local 11	Nick Andelin Journeyman Inside Wireman Contra Costa Electric	Celso Gutierrez Inside Journeyman Wireman IBEW Local 569
Kolby McMurray Inside Wireman IBEW Local 40	Darin Lannaghan Foreman IBEW Local 6	Stephen Battaglia Inside Wireman Decker Electric
Johnny Barnett Electrician IBEW Local 948	Tyler Cornell Electrical Apprentice IBEW Local 11	Feliciano Avila Electrical IBEW Local 11
Kenneth Collier Instructor/Electrician Electrical Training Institute San Diego	Ruben Izaguirre Journeyman Electrician IBEW Local 477	David Morales Electrician IBEW Local 6
Patrick Quinn Foreman IBEW Local 595	Jonathan Lampe Apprentice Inside Wireman IBEW Local 6	Alejandro Diaz Journeyman Wireman Select Electric
Bryan Reynoso Sound Installer HMT	Patrick Duarte Electrician JDL	Hector Almeida Electrician IBEW
Jim Hughes Journeyman Electrician/Inside Wireman IBEW Local 639	Benjamin Soria Electrician IBEW Local 11	Juaton Boutte Journeyman Electrician IBEW Local 6
David Davalos Inside Wireman IBEW 100	Patrick Grantz Charter Mechanic IBEW Local 3	Juan Ruiz General Foreman Gregg Electric
Sergio Martinez Inside Wireman IBL	Jermaine Lee Electrician Rosendin	Kristen Martin Electrician IBEW Local 6
	Ryan Moynihan Electrician Contra Costa Electric	Warren Adsit Journeyman Wireman IBEW Local 340

Jason Byrd Concerned Citizen Mountain Cascade	Bryon Salinas Electrical Apprentice IBEW	Kaylie Commins Host Golden Bear
Gorgina Halaufia Concerned Citizen Collins Electric Company, Inc.	Gabe Von Wellsheim General Foreman Sullivan Solar Power	Eric Commins Electrician Rosedin
Derek Somerville Installer Building Electronic Control	Michael Amaral Inside Wireman Sprig Electric	Aaron Wallis Electrician How Electric
Rogelio Perez Construction Wireman CSI Electrical Contractors, Inc.	Fernando Martinez Journey Wireman Electrician Foreman Chula Vista Electric	Mark Burgum Electrician Davis Electric
Jose Almanza Electrician IBEW	Nick Giacalone Vice President Best Electrical	Roger Weiss Union Electrician IBEW
John Campbell Sound Technician Apprenticeship Training Coordinator San Diego Electrical Training Trust	Steve Abeyta Construction Standards Administrator San Diego Gas & Electric	Joseph Hagen Inside Wireman Apprentice Metropolitan Electrical Construction
Loye Cherry Retired Inside Wireman IBEW Local 595	Steven Kurtz Vice President CDM Smith/ CDM Constructors Inc.	Guadalupe Machuca Union Electrician IBEW Local 11
Larry Wesch Electrician Thoma Electric	Miguel Estrada Inside Wireman IBEW Local 6	David Ramirez Inside Wireman Walton Electric
Paul Oppus California Resident Cupertino Electric	Brannan Whited Foreman Inside Wireman McMillan Electric	Alanna Heaney Electrician Apprentice IBEW Local 6

Tony Ternes  
Field Supervisor  
Contra Costa Electric

Adam DeVore  
Journey Inside Wireman  
IBEW

Joseph Cary  
Journeyman Wireman  
IBEW Local 477

Steve Pederson  
Electrical Supervisor  
IBEW Local 595

Antonia Ziska  
Wife of Union Electrician  
IBEW Local 440

Carlos Perez  
Electrician  
Miller Electric

Kham Lo  
Journeyman Electrician  
IBEW Local 100

Kolby L. McMurray  
Inside Wireman  
IBEW Local 40

Brooke Garrett  
Electrician  
IBEW

William Moreno  
Electrician  
St. Francis Electric

Daniel Palmquist  
Inside Journeyman Wireman  
IBEW

Curtis Crittendon  
Electrician  
Decker Electric

Jared Cohea  
Journeyman Wireman  
IBEW Local 100

Kevin Lynskey  
Journeyman Electrician  
IBEW Local 11

Ben Santana  
Electrician  
Cupertino Electric

Dave Monnens  
Project Manager  
Contra Costa Electric

Sean Sullivan  
Electrician  
CCCSD

Brian Garrett  
Electrician  
G.E.S

Chris Thompson  
Service Department Manager  
H&S Electric/IBEW Local 11

Dianne Simpson  
Administrative Assistant  
Contra Costa Electric

Rueben Patino  
Journeyman Electrician  
IBEW Local 595

Mario Mendoza  
Journeyman Wireman  
IBEW

Tom Forbes  
General Foreman  
CSI Electrical Contractors, Inc.

Beau Erwin  
Electrician  
Lawrence Berkeley Laboratory

Tracy Adams  
Electrician  
IBEW Local 11

Paul Lauesen  
Secretary, Treasurer  
Pajaro Valley Electric, Inc.

Mayumi Taylor  
Electrician Apprentice  
IBEW Local 595

Austin Aranda  
Journeyman Electrician  
Contra Costa Electric

Jeffrey Asturias  
General Foreman  
Cupertino Electric

Sean Lastoskie  
Journeyman Wireman  
IBEW Local 440

Leonardo Sanchez Apprentice IBEW Local 11	Bridget Baker Construction Wireman Collins Electric Company, Inc.	Ethan Hopkins Electrician Design
Neil Valsecchi Journeyman Electrician IBEW Local 716	Kevin Affleck Electrician IBEW Local 595	Nadine Elseudy Construction Wireman Beci Electric
Cristian Mijangos Electrician IBEW Local 11	Francisco Rosa Electrician IBEW Kan Brou Journeyman Electrician IBEW Local 595	Dan Alter Inside Wireman McClure Electric
Francis Collins Foreman Inside Wireman IBEW Local 6 Craig Schott Electrical Foreman Conti Corporation	Carlos Galvan Apprentice Inside Wireman IBEW Local 595	David Foster Retired Bullhead
Sabrina Hernandez Business Representative/Compliance Officer IBEW Local 6	Steven Rhone Network Operations AT&T	Shannon B Warehouse Manager Belfor
Mark Johnson Project Manager Contra Costa Electric	James O'Brien California Resident AECO	Robin Tracy Installer WBE
Ernie Rosas Sound Installer Anderson and Howard	Brian Mojzes Inside Wireman Brayer Electric	Fred Khudanyan Foreman/ Low Voltage Electrical Morrow-Meadows Corporation
Brian Haskell Project Manager Chula Vista Electric	Louis Yang Electrician McMillan Electric	Hoa Phan California Resident CEI
	Stuart Hatten Retired IBEW Local 595	Allan Guhl Jen. Electrician IBEW Local 180
		Steve Sturtridge Foreman Morrow-Meadows Corporation

Rafael Adame Inside Wireman IBEW	Timothy Smiley Inside Journeyman Wireman IBEW Local 595	Paul Alexanderian Journeyman Electrician IBEW
Kevin Chin Electrician EMCOR	Jacob Kreitzer Electrician IBEW Local 595	Shaun Mason Electrical Contractor Independent Electrical Construction
Keith Jennings Foreman Strategic Mechanical	John Mallon Electrician CBF Electric Todd Wylie Certified Wireman IBEW Local 595	Victor Nerida Inside Wireman MDE Electrical
Paul Hammond Journeyman Wireman IBEW Local 100	Joan Weber Retired Electrician IBEW Local 595	Stephan Podplesky Inside Electrical Journeyman Guarantee Electrical
Ian Kennedy Boss TAOS	Dennis Miller Retired Electrician IBEW	Russel Taylor Journeyman Inside Wireman GECO
Brian Horan Project Manager H&S Electric	Chuck Rayburn Retired Journeyman Electrician IBEW	Michael Louderman Journeyman Wireman IBEW
Timothy McBride CEO Southern Contracting Company	Noah Satizabal Electrician SASCO	Shaun Meadows Electrician IBEW Local 180
Terry Norton General Electrician Carol Electric	Craig Walton Retired IBEW Local 595	Joe Queen Organizer IBEW
Dirk Obenshain Supervisor Contra Costa Electric	Julius Quilalang JW Rosendin	Eric Trout Inside Wireman Long Electric
James R Rowe Retired Journeyman Wireman IBEW Local 100		

Kevin Dalton Project Manager Contra Costa Electric	Kalani Ventimiglio Journeyman Inside Wireman IBEW Local 595	Lee Parker Electrician IBEW Local 595
Teala Reynolds Construction Wireman IBEW Local 100	Jayson Ward Electrician Cupertino Electric	Joe Barty Foreman Long Electric
Johnny Lopez Instructor Electrical Training Institute	Thomas Raymond Union Electrician IBEW Local 11	Stanley Corodova Retired Journeyman IBEW Local 595
David Medlock Journeyman Wireman IBEW Carey Hummel Field Foreman Contra Costa Electric	Dan Broadwater Business Manager IBEW Local 180	Tyler Magnotte Inside Wireman Apprentice Morrow-Meadows Corporation
Ryan Magee Apprentice McGrath Electric	Joe Cimino General Foreman Sprig Electric	Timothy Rackley Inside Wireman Guarantee Electrical
Brad Contreras High Voltage Electrician Hampton Tredder	Patrick Gabrione Electrician IBEW Local 180	Danny Frandsen Electrician IBEW Local 180
Curt Svenpladsen Project Manager Contra Costa Electric	Jeff Simpson Electrical Foreman Kaiser Permanente	Isaias Campos California Resident Redwood
Aaron Velasquez Journeyman Inside Wireman IBEW Local 477	Regis Lehrman Inside Wireman IBEW Local 180	Kevin Clark Electrician Design Electric
Mike Olmos Electrician Mikes Electric	Max Ripley Electrician Schetter	Bree Salmassy Apprentice Emcor
	Nathaniel Mayfield Citizen Cupertino Electric	David Robinson Retired Electrician IBEW Local 180

Michael Rose Safety Coordinator Contra Costa Electric	Jeff Spilman Electrician/Estimator IBEW Local 595	Scott Ohlhausen General Foreman Rosendin Electric
Michael Samansky Electrical Specialist Valero Energy	Brandon Evans Electrician Gills Electric	Jay Seager Apprentice Napa Electric
Milton James California Resident McMillan Electric	Raymond Martinez Journeyman Morrow-Meadows Corporation	Brian Stewart Electrician Retired
Troy Green Inside Wireman IBEW Local 551	Nicholas Gigliotti Retired Electrician IBEW Local 595	Ricardo Perez Apprentice Napa Electric
Mike Thrush Electrician Mike Brow Electric	Richard Rounseville Inside Wireman IBEW Local 595	Glen Flores Electrician IBEW Local 180
Gary Hesterberg Journeyman Wireman Electrician Smith and Sons Electric, Inc.	Jacqueline Zalstein Apprentice Del Monte Electric	Rafael Loayza Electrician IBEW
Jimmie Stearns Retired Electrician IBEW Local 595	Hector Bueno California Resident Del Monte Electric	Justin Haley Foreman IBEW
Martin Alonso Journeyman Electrician IBEW Local 551	Daniel Delgadillo Electrician Rosendin Electric	Steve Nordahl Superintendent Mike Brow Electric
Alejandro Lopez Electrician UC Berkeley	Ghalee Grimes Electrician IBEW Local 180	John Draper Journeyman Napa Electric
	Justin Serpa Electrician Redtop Electric	Mike Campbell Project Manager IBEW

Miguel Aguilera Journeyman Electrician IBEW Local 440	John Ohan Electrician West Coast Electric	Gilmer Asuncion 2nd Year Apprentice Rosendin Electric
Jason Krochak Foreman IBEW Local 595	Tracy Serpa Electrician Redtop Electric	Bret Parrick Electrical Foreman St. Francis Electric
Eddie Moitoso Journeyman Wireman IBEW Local 595	Richard Buol California Resident Kaiser Permanente	John Corr Electrician Sierra
Douglas Hafich State Certified Electrician IBEW Local 180	Barbara Buol Teacher MDUSD	Rick Harris Electrician IBEW Local 180
Kellen Ricker Electrician Morrow-Meadows Corporation	Brandon Popejoy Apprentice Contra Costa Electric	David Sundrud Apprentice Electrician IBEW Local 180
James Smith Electrician H.A. Bowen Electric Inc.	Austin Stafford Electrician Contra Costa Electric	Tony Miller Electrical Foreman Gills Electric
James Rush Electrician IBEW Local 440	Bryan Bins Foreman Columbia Electric	Erik Line Apprentice Contra Costa Electric
Jorge Ruiz Electrician Mass Electric	Vincent Nichols Inside Journeyman Wireman IBEW Local 236	Tom White Journeyman Electrician IBEW Local 180
Michael Olson Retired IBEW Local 6	Daniel McCoy Electrical IBEW Local 180	Gary Faylor Inside Wireman BEW Local 595
Michael Sardo Electrician Rosendin Electric Inc	Brian Scanlon Electrician Colevan Electric	Carla Faylor Instructural Assistant SJCOE

Robert Ramer High Voltage Electrician Berkeley Lab	Jeremy Peconom Journeyman Guaranteed Electric	James Ure Licensed Electrician IBEW Local 180
Shannon Nalley Journeyman Inside Wireman Guarantee Electrical	Eric Ventura Inside Wireman IBEW Local 595	Joshua Alvarado Journeyman Inside Wireman Klecka Electric
John Moylan Electrician IBEW Local 6	Kevin Garcia Electrician Cupertino Electric	Hugh Clumpner Job Foreman/Retired IBEW Local 180
Adam Faylor Director of IT Advent Communications	Albert Martinez Foreman Bockmon and Woody Electrical Co Inc	Jason Bailey Electrician Rosendin
Larry Garcia Inside Wireman IBEW Local 440	Ryan Fennie Electrician IBEW Local 180	James Rowland Jr Journeyman Inside Wireman Best Electrical Company Inc.
Adam Webster GF IBEW	Larry Robinson Instrumentation Lead Del Monte Foods	Randy Pittman Journeyman Wireman Cupertino Electric
Rene Avila Inside Wireman IBEW Local 11	Pail Tjernagel Inside Wireman IBEW Local 595	Sean Campbell Apprentice Electrician Bockmon and Woody Electrical Co, Inc.
Steve Valenta Electrician IBEW Local 441	Susan Bowron Detailer/Electrician Redwood Electric Group	Jeff Casperson Electrician IBEW Local 595
Jeff O'Brien Journeyman Electrician McMillan Electric	Robert Ford Former Apprenticeship Instructor IBEW	Doug Rose II Electrician IBEW Local 595
Peter Arbios Inside Journeyman Wireman IBEW Local 595		

Leonard Ancona Electrician IBEW Local 595	William Hawkesworth Inside Wireman IBEW	Michael Johnson Inside Wireman IBEW Local 595
Samuel Eisenberg Inside Wireman Apprentice IBEW Local 617	Eduardo Hiero Lead Instructor Net Zero Energy Center	Adam Willis Electrician IBEW Local 180
Carl Mascarenas Electrical Mass Electric	William Hurlbut Electrician Schetter Electric	Alan Fleckenstein Instructor San Diego Electrical Training Center
Jeffrey Angat Union Electrician IBEW Local 952	David Bettencourt Inside Wireman ACS	Ryan Sprague Electrician City of Oceanside
Jaylord Suba Technician McMillan Electric	Michael Dejesus Retired IBEW Local 595	Stuart Gobble Foreman Electrician Banister
Mary Cordes-Hutchings Electrician IBEW	Tamika Hayes-Wong Electrician Banister Electric	David Douma Electrical Foreman Capital Projects Facilities Construction
Tito Herrera Journeyman IBEW	Kris Helzer Electrician IBEW Local 180	Geoff Randall Concerned Citizen Sprig Electric
William Johnson California Resident Retired IBEW Electrician	Dean Studer Journeyman Wireman IBEW Local 180	Robert Jones Apprentice Electrician Long Electric
Leo Gutierrez Journeyman Electrician International Line Builders	Frankie Lopez Journeyman Electrician IBEW Local 595	Herb Watts Certified Electrician Kaiser CPFC
Phil Holst Journeyman Electrician IBEW Local 440		

Ken Altomare Retired Marken Mechanical	Georgia Onyemem Electrician IBEW Local 595	Meril Asuncion Electrician IBEW
James Boothe Inside Wireman IBEW Local 180	Gerald Zuniga Electrician CSI Electrical Contractors, Inc.	John Marengo Inside Wireman IBEW
Dean Phillips S&C Technician IBEW Local 595	Ernst Deuter Electrician Bowen Electric	Bradley Hosking Concerned Citizen IBEW
Paul Schmid Journeyman Wireman IBEW Local 6	Jasmin Leichering Union Electrician IBEW	Jeffrey Sousa Journeyman Inside Wireman Banister Electric
Seth Shepard Electrician Rosendin Electric Inc.	Timothy Gillit General Foreman OEG Inc.	Sean Whall Apprentice Napa Electric
Eric Stobel Electrical Apprentice IBEW	Chris Ward Foreman Pacific Metro Electric, Inc.	Justin Whitten Apprentice Electrician IBEW Local 180
Balkiz Sam Electrician IBEW	Nicolas Preciado Electrician IBEW Local 11	Jeronimo Alema Electrician Morrow-Meadows Corporation
Danny Thomas Journeyman Wireman IBEW	Waylong Leak Journeyman Wireman Carter Electric	Paul Leffel Electrician Unemployed
Morris Hayes Inside Wireman IBEW	Dennis Stefani Voter Retired	Matthew Fox Apprentice IBEW Local 440
Byron Benton Training Director Alameda County Electrical JATC	Carlos Bates Inside Wireman IBEW Local 180	David Martinez Journeyman Wireman Southland Electric Inc.

Joshua Watts Apprentice Electrician IBEW Local 180	Alfred Pisciotta Electrician Rosendin Electric	Terry Baldwin Electrician IBEW Local 302
Craig Cathcart Journeyman Electrician Rosendin Electric	Steve Reese Retired IBEW Local 180	Francisco E. Montes de Oca Electrician JW IBEW Local 569
Susan Gagetta Inside Wireman Elcor Electric	Scott Vines Electrician IBEW Local 180	Randy Starling Electrician IBEW Local 569
Gregory Gagetta Pipefitter Harder Mechanical	David Edwards Inside Wireman IBEW Local 100	Jesse Rojas APIW 107 Neal Electric
Blair Benson Inside Wireman IBEW Local 6	Nicholas Prelgovisk Inside Wireman IBEW Local 234	Thomas Bryant Apprentice Electrician Chula Vista Electric
Gavin Mimnaugh Journeyman Inside Wireman IBEW Local 595	Robert Bybee Electrician Design Electric Inc.	Mary Stedham Family member IBEW Local 569
Bryan Easterwood Electrician IBEW Local 440	John Pehrson Electrician Retired	Daniel Martin Journeyman Wireman Chula Vista Electric
Daniel Torres Sprinkler Fitter UA Local 483	Luke Davis Apprentice Wireman IBEW Local 595	Paul David Service Foreman Dynalectric
Jason Brown Server Applebees	Michael Grafton Co-Owner Grafton Electric, Inc.	David Martinez HIM IM Electrician Chevron
Mike Moniz Electrician BEI Construction	Robin Lucier Electrician IBEW Local 180	Julio Cuevas Inside Wireman IBEW Local 595

Randy Shahan Journeyman Inside Wireman IBEW Local 180	Matthew Miller Inside Wireman Guarantee Electrical	Susan Orlofsky UPTE - CWA 9119
Tony Bertolucci Concerned Citizen Home Owner	Eddie Torres Electrician IBEW Local 11	Ryan Mims Organizer AFGE
Daniel Douma General Foreman Redwood Electric Group	Luis Arostigue Foreman Beard Electric	Janine Lowe Secretary IBEW Local 569
Elsworth Stephen Sound Journeyman Building Electronic Controls Inc.	Sean Dudey Apprentice IBEW	Theodor Ambaw Low Voltage Tech Chula Vista Electric
Peter El-Qare Journeyman Wireman Fisk	Ted Obole Journeyman Electrician Retired	Michael Downey Electrician NAVFAC
J.D. Chilton General Foreman Redwood Electric Group	Hector Alvarado JW/Inside Wireman Contra Costa Electric	Nephi Hancock N/A IBEW Victor Chavez Electrician IBEW Local 569
Jose Gonzalez Electrician IBEW	Todd Tohm Journeyman IBEW	Bruce Burton Director, Pension and Reciprocity Department IBEW
Michael Price Concerned Citizen CBF Inc.	Brian Wood Journeyman Electrician Zeco Electric	Jason Jensen Foreman Henkels & McCoy
Bridget Hall High Voltage Electrician UC Berkeley, IBEW Local 595	Greg Westerhouse Foreman Zeller Electric	Jake Piland Assistant Business Manager IBEW Local 100
Cody Trusdall Journeyman Electrician/Cable Splicer	Robert Hansen Foreman REG	

IBEW Local 441	Glenn Arvin Field Superintendent Atlas-Pellizaaari Electric, Inc.	Corey Fox-Mudge Journeyman Electrician IBEW
Brian Stuhmer Concerned Citizen Conco West Inc.	Jose Villalba Superintendent Cheme Construction Co.	Jeffrey Bender Citizen Safty
Roy Pool Concerned Citizen SASCO	Melissa Vaughn N/A N/A	Chris Lutz Electrical Project Manager Kaiser Permanente
Samuel Orozco Inside Wireman Rosendin Electric Inc.	Barbara Schubert N/A N/A	Christopher Hernandez Apprentice Electrician Global Electric
Michael Moody Certified General Electrician IBEW Local 18	James Foley N/A N/A	Terence Smith Electrician IBEW Local 569
Gretchen Newsom Organizer IBEW Local 569	Steve Windmiller N/A N/A	Paul Gigliotti California Resident Cupertino Electric
John Shaver Journeyman Inside Wireman Unemployed	Jonathan Barretta N/A N/A	Taylor Patrick Journeyman Electrician Baker Electric
Jason Bates Electrician Foreman Smith and Sons Electric	Nancy Thompson N/A N/A	David Holm Foreman HMT Electric
Clayton Dehart Electrician North Bay Electric	John Brooks N/A N/A	Charlton Shabazz Journeyman Wireman IBEW Local 569
Dustin Amelotte Electrician Precision Electric	Jeff Miller N/A N/A	

Tony Lundquist  
Journeyman Wireman  
IBEW

Dwayne Loader  
Journeyman Electrician  
Baker Electric

Fabian Valenzuela  
Apprentice Wireman  
Five Star Electric

Omar Vasquez  
N/A  
IBEW Local 100  
Trevor Chapman  
N/A  
N/A

Miguel Quezada  
N/A  
IBEW Local 617

Brian Adams  
N/A  
IBEW Local 100

Mark Robinson  
N/A  
IBEW

Dale Densmore  
N/A  
JW Local 100

Saki San  
N/A  
IBEW Local 428

Anthony McNally  
N/A  
N/A

Bruce Armstrong  
N/A  
N/A

Meg Vasey  
N/A  
N/A

Judy Bernacchi  
N/A  
N/A

Marina Fitzgerald  
N/A  
N/A

Sean Kyle  
N/A  
IBEW Local 595

Cindy Reimer  
N/A  
IBEW Local 332

Frank Celico  
N/A  
N/A

Nick Andelin  
N/A  
Contra Costa Electric, Inc.

Mark Winkleman  
N/A  
N/A

Cheakae Vorise  
Apprenticeship  
IBEW

Anthony De Mars  
Journeyman Wireman  
IBEW Local 569

Henry Aspeytia  
Journeyman Wireman  
IBEW Local 569

Dereck Summers  
Electrician  
Morrow-Meadows Corporation

Jaime Leon  
Wireman  
Dynalectric

Chris Kovar  
JW  
IBEW Local 569

Reyes Hermosillo  
Electrician Apprentice  
IBEW Local 569

William Balsells  
Electrician  
Pacific Industrial Electric

Gustavo Aceves  
Electrician  
Pacific Industrial Electric

Abraham Aguilar  
Electrician  
Pacific Industrial Electric

Gerin Brison N/A IBEW Local 428	Liliana Martinez N/A IBEW Local 332 Joseph Maalona N/A N/A	Dale Aleshire Electrician Pacific Industrial Electric
Kelly Lawson N/A N/A	Bob Lilley N/A Contra Costa Electric, Inc.	Fernando Avelar Electrician Pacific Industrial Electric
Norma Davis N/A IBEW Local 100	Perry Trapani N/A IBEW Local 617	Marcelo Bowsa Electrician Pacific Industrial Electric
Mario Spina N/A Morrow-Meadows Corporation	Brandon Lyons N/A IBEW Local 617	Ryan Butler Electrician Pacific Industrial Electric
David Mendrin N/A IBEW Local 100	Larry Lopez N/A IBEW	John Contreraz Electrician Pacific Industrial Electric
Avery Morris N/A Morrow-Meadows Corporation	Jonathan Borsodi N/A N/A	Michael Cure Electrician Pacific Industrial Electric
Almir Keserovic N/A IBEW Local 617	Robyn Scherr N/A N/A	Michael Ebrecht Electrician Pacific Industrial Electric
Martin Frischknecht N/A Morrow-Meadows Corporation	Thomas Lopez N/A IBEW	Gilbert Encina Electrician Pacific Industrial Electric
Mike Clifton N/A N/A	Jared Cohea N/A IBEW Local 100	Chase Fetters Electrician Pacific Industrial Electric
Kevin Keizer N/A N/A		Randall Furukawa Electrician Pacific Industrial Electric

Justin Goodearl N/A Morrow-Meadows Corporation	William Dearsan N/A IBEW Local 100	Jefferson Han Electrician Pacific Industrial Electric
Ronald Robinson Jr. N/A Sprig Electric	Tait Imperial N/A IBEW Local 100	Norman Hubbard Electrician Pacific Industrial Electric
Enrique Reynoso Jr. N/A IBEW Local 11	Nathan Dickie N/A ESSCO	Trevor Holt Electrician Pacific Industrial Electric
Ronald Nunez N/A IBEW Local 11	Andrew Klein N/A IBEW Local 11/CSI Electric	Danny Kuk Electrician Pacific Industrial Electric
Sean Autry N/A Dynalectric	Ramon Dawson N/A CSI Electrical Contractors, Inc.	Brandon Lawton Electrician Pacific Industrial Electric
Fabio Campos N/A N/A	Merrill Barton N/A IBEW Local 11/Neal Electric	Brian Lopez Electrician Pacific Industrial Electric
Peyton Coker N/A N/A	Mike Zamrock N/A Rosendin	Cesar Magdeleno Electrician Pacific Industrial Electric
Taylor McKern N/A MB Herzog Electrical	Justin Pasco N/A Rosendin Electric	Chris Matheny Electrician Pacific Industrial Electric
Jason Meeks N/A IBEW Local 11	Jose Alcaraz N/A Dynalectric	Jeremy McCague Electrician Pacific Industrial Electric
Joseph Giannone N/A Pro-Cal Electric	Lawrence Garcia N/A Morrow-Meadows Corporation	Randall McMurray Electrician Pacific Industrial Electric

Edgar Leon N/A IBEW Local 11	Patrick Swain N/A O'Bryan Electric	Chris Michalski Electrician Pacific Industrial Electric
Travis Dowdell N/A N/A	Juan Reyes N/A Dynalectric	Jacob Michalski Electrician Pacific Industrial Electric
Guillermo Ochoa N/A N/A	Benjamin Hess N/A Electrical Training Institute	Roger Myles Electrician Pacific Industrial Electric
Henry Fabian N/A IBEW Local 11	Ronald Martellino N/A IBEW/NECA	Dimitri Petrescu Electrician Pacific Industrial Electric
Joseph Leon N/A Rosendin	Jaime Ortiz N/A Shultz	Richard Rodriguez Electrician Pacific Industrial Electric
Ana Durazo N/A N/A	Gary Stiller N/A Morrow-Meadows Corporation	Todd Saunders Electrician Pacific Industrial Electric
Steve Mango N/A WTC Electrical	Daniel Vasquez N/A Morrow-Meadows Corporation	Derek Scherer Electrician Pacific Industrial Electric
Eric Moreno N/A N/A	James Ladd N/A Rosendin Electric	Casey Schoonhoven Electrician Pacific Industrial Electric
Sarah Gonzalez N/A N/A	Brian Villarreal N/A Livermore Dental Care	Brandon Smith Electrician Pacific Industrial Electric
Jeremiah Ramirez IBEW Local 11	Maggie Moore N/A	Daniel Soltis Electrician Pacific Industrial Electric

Morris Barahona N/A Cupertino	Solomon Chi N/A Rosendin	David Torres Electrician Pacific Industrial Electric
Kevin Canel N/A Taft Electric Company	Detwan Green N/A Telenet	Juvy Velarde Electrician Pacific Industrial Electric
Dines Yolanda N/A N/A	Michael Lyon N/A CSI Electrical Contractors, Inc.	Raul Viramontes Electrician Pacific Industrial Electric
Mark Markovic N/A N/A	Armando Guerra N/A Walton Electric	Loren Wagner Electrician Pacific Industrial Electric
Kheiri Gandi N/A N/A	Erik Brower N/A IBEW Local 595	Garry White President Pacific Industrial Electric
Juan Lozano N/A IBEW Local 11	Michael Kostka N/A IBEW Local 551	Onurkan Kurabulut Electrician N/A
Eduardo Davila N/A Morrow-Meadows Corporation	Wayne Gerner N/A IBEW Local 551	Russ McNally Electrician N/A
Abraham Raygoa N/A Johnson Peltier Electric	Scott Golf N/A N/A	Brian Parker CA State Certified General Electrician N/A
Juan Gonzalez N/A IBEW Local 134	Dennis White N/A IBEW	Joseph Saldana Electrician N/A
Luis Alvarez Sinewave Electric	Brian Mora IBEW Local 952	

Rene Palma N/A IBEW Local 11	Wardl Ramey N/A IBEW Local 551	Renee Amable Olague Certified Inside Wireman N/A
John Mellor N/A Obryant Electric	Arther Casillas N/A IBEW Local 440	Jesse Mitchell Journeyman Wireman N/A
Joel Paredes N/A IBEW Local 11	Don Letney N/A Redwood Electric Group	Enrique Guzman Electrical Contractor N/A
Dustin Baker N/A Bockmon and Woody	Melissa Bless N/A N/A	Angel Dominguez Relay Technician N/A
Darrel Weston N/A IBEW	David Wilson N/A N/A	Jeff McRae Senior Project Manager N/A
Randy Gifford N/A IBEW Local 639	Bob Lilley N/A Contra Costa Electric, Inc.	Ricky Morton General Foreman N/A
Shane Frangione N/A IBEW Local 639	Omar Vasquez N/A IBEW Local 100	Mike Mootry Electrical Apprentice N/A
Wade Wieding N/A IBEW Local 441	Derek Green N/A IBEW	Greg Donadio VDC/BIM Engineer N/A
John Jennings N/A N/A	Brooklyn Blackstone N/A IBEW Local 477	Lisa Kane Sr. Safety Manager N/A
Roger Bratset N/A IBEW Local 595	Steven McDonagh N/A Building Safety Alliance	Casey Morales Electrician N/A

Jamie Maddox N/A Electro Construction	Ceryl Baxter N/A N/A	Tom Nguyen Project Manager N/A
Travis McMillan N/A LA DWP	Alicia Baker N/A N/A	Paul Schroeder Foreman N/A
Robert Nielsen N/A N/A	Shannon Rose N/A IBEW Local 595	Ronald Gibson Concerned Citizen N/A
Brian Deering N/A IBEW Local 595	Dale Densmore N/A IBEW Local 100	Martin Decker Citizen N/A
Shane Rail N/A Amgen	Austin Glascock N/A N/A	Cornelius Matei Electrician/Journeyman Wireman N/A
Eric Setterland N/A City of Los Angeles	Ian Rodriguez N/A IBEW Local 6	Jesus Renteria Concerned Citizen N/A
Henry Tirre Retired Electrician N/A	Heather Haggart Concerned Citizen N/A	Jeff Beard California Resident N/A
Joseph Hannifin Electrician N/A	Alberto Perez Journeyman Wireman N/A	John West Retired N/A
Christopher Antonelli Self Employed N/A	Phillip Grana Concerned Citizen N/A	Gerardo Eceberre Citizen N/A
Juan Hernandez Citizen N/A	Katherine Glascock Pre-Apprentice N/A	

Adrian Diaz  
Concerned Citizen  
N/A

BJ Bramlett  
Retired  
N/A

Juan Hernandez  
Citizen  
N/A

Manuel Solis  
Instructor  
N/A

David Olson  
Retired  
N/A

Jesus Valdez  
Citizen  
N/A

Gerald Olms  
Inside Wireman  
N/A

Juan Aceves  
General Electrician  
N/A

Roger Theroux  
Electrician  
N/A

Jennifer Murphy  
Electrician  
N/A

Al Lucero  
Citizen  
N/A

Kelly Hummel Colla  
Concerned California Resident  
N/A

Raymond Hapeman  
California Resident  
N/A

Myron Gardner  
Journeyman Inside Wireman  
N/A

Nancy Sherman  
Project Manager  
N/A

Ryan Acuna  
California Resident  
N/A

Paul Fanning  
California Resident  
N/A

Stephen Emmerling  
Inside Wireman  
N/A

Brandon Johnson  
Citizen  
N/A

Daniel Phillips  
Retired  
N/A

Jason Hasson  
Inside Wireman  
N/A

Rick Swinford  
Project Manager  
N/A

Shannon Talbot  
Electrical Wireman  
N/A

Illona Aguayo  
CA Resident  
N/A

Phillip Fonteno  
Journeyman Wireman  
N/A

Daniel Pimentel  
Electrician  
N/A

Patrick Dunn  
Retired Electrician  
N/A

Nicholas Nazaroff  
Concerned Citizen  
N/A

Drew Winn  
California Resident  
N/A

Louie Aguayo  
CA Resident  
N/A

Lucky Chaney Concerned Citizen N/A	Ariel Otero Journeyman Inside Wireman N/A	Patrick Gotto Jr Retired N/A
Rosemary Mullarkey Retired N/A	Jess Reynolds California Resident N/A	Richard Rivera Regional Superintendent N/A
Robert Soule III Retired N/A	Rosalba Primentel Concerned Citizen N/A	Dan Murphy Retired N/A
Deanna Smith Retired N/A	Sheldon Hall Educator, Electronics N/A	Tom Curran Retired N/A
Nicole Marti Administrative Assistant N/A	Betsy Torres Concerned Citizen N/A	Stephen Marcelino Concerned Citizen N/A
John Phillips Retired N/A	Rachel Gunther Resident N/A	John Keen Retired N/A
Andrea Mullarkey Homeowner N/A	William Santos Inside Wireman N/A	John Golding California Resident N/A
Steve Stavropoulos Concerned Citizen N/A	Julio Carrillo California Resident N/A	Jared Mumm Journeyman Electrician N/A
Kelly Perfetto Concerned Citizen N/A	Miguel Ramos Inside Wireman Electrician N/A	Marc Greenfield Electrician N/A
Douglas Rogers Retired N/A	Phillip Hernandez Retired	Marcus Blackwell Electrician N/A

Greg Bonato Concerned Citizen N/A	Mark Oler California Resident N/A	Craig Derosa Electrician N/A
Earl Hampton Concerned Citizen N/A	Rebecca Kinchen Citizen N/A	Jacob Anderson Journeyman Electrician N/A
Matthew Maloon Retired N/A	Billy Powell Electrician N/A	Robert Jewell Retired Electrician N/A
Frederick Mittman Citizen N/A	Emanuel Costa Electrician N/A	Roy Madrid Retired Journeyman Electrician N/A
Allen Shur Retired N/A	Steve Benjamin Electrician N/A	Danielle Ormonde California Resident N/A
Kenneth Klinger Retired N/A	Jason Skyllingstad Concerned Citizen N/A	Jesus Ramirez California Resident N/A
Dale Peterson Retired N/A	Zenaida Sloat Voter N/A	Josh Hall California Resident N/A
Julio Rivas Senior Communications Technician N/A	Craig Fatkin Retired N/A	Joseph Marcelino Retired Electrician N/A
Daniel Fross Retired Electrician N/A	Melinda Mullin Citizen N/A	John Gray Retired N/A
Bradley Starbird SoCal Resident N/A	William Evans Electrician N/A	David Dollison Jr. Journeyman Electrician N/A

Edward Hanson  
Concerned Citizen  
N/A

Fred Geiger  
Retired Electrician  
N/A

Richard Kerby  
Inside Wireman  
N/A

Hector Medina  
Foreman  
N/A

Robert Brown  
Concerned Citizen  
N/A

Jerald Carlblom  
California Resident  
N/A

Andrew Sloat  
Service Tech  
N/A

Laci Muirhead  
Sales  
N/A

Marvin Silver  
Retired  
N/A

Edward Dijeau  
Retired  
N/A

James Broadbent  
Concerned Citizen  
N/A

Stephen McIntire  
Retired  
N/A

Christopher Pallares  
Electrical Inspector  
N/A

John Disken  
Retired Licensed Electrician  
N/A

Garrett Greer  
Concerned Citizen  
N/A

Richard Elkins  
Concerned Citizen  
N/A

Thomas Wynne  
Retired  
N/A

Jesus Parra Alvarez  
Electrician  
N/A

Esteban Haro  
Concerned Citizen  
N/A

Patrick Gallagher  
Concerned Citizen  
N/A

Hiroko Gallagher  
California Resident  
N/A

John Armstrong  
Resident  
N/A

Valerie Foster  
House Wife  
N/A

# **SOCIAL MEDIA REPORT**

# Export of Records

Captured by ArchiveSocial

## Safe Energy Petition

Generated by Natalie Watmore at 19:32:54 on 3/12/2019 UTC

### Included in this export:

**Account(s):** All

**Content Type(s):** All

**Term(s):** matching *#SafeEnergyStorage*

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190201NECA-San-DiegoMentions43483\_1091400480436019200**NECA San Diego @SanDiegoNECA**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:18:46 on 2/01/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190201Chuck-HuddlestonMentions43483\_1091402864029659136**Chuck Huddleston @bruinjive**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:28:14 on 2/01/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190201David-McClureMentions43483\_1091435832639012864**David McClure @DaveBMcClure**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:39:15 on 2/01/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190201jim-hillMentions43483\_1091466018243801088**jim hill @jimihil**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 22:39:11 on 2/01/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190202Nicholas-J-Segura-JrMentions43483\_1091491004065112064**Nicholas J Segura Jr @nsegura569**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 0:18:28 on 2/02/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190202Joe-FitzgeraldMentions43483\_1091492812980285445

Updated: 3/18/2019

959



**Joe Fitzgerald @JBandit77**

@[CSLB](#) Please clarify regulations to ensure battery storage systems are safely installed by ONLY C-10 electrical contractors. [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 0:25:40 on 2/02/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190205Jerri-ChamplinMentions43483\_1092875234921725952



**Jerri Champlin @jlchamplin22**

.@[CSLB](#) on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 19:58:55 on 2/05/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190205William-DearsanMentions43483\_1092910815642935296



**William Dearsan @WDearsan**

.@[CSLB](#) on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 22:20:18 on 2/05/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190205Jeff-LanpherMentions43483\_1092933885212614656



**Jeff Lanpher @jlanp001**

.@[CSLB](#) on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 23:51:58 on 2/05/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190205Kevin-McSherryMentions43483\_1092934439330631680



**Kevin McSherry @McStreets**

@[CSLB](#) on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 23:54:10 on 2/05/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190206Ross-TinerMentions43483\_1092936520942534656



**Ross Tiner @runninonempty22**

.@[CSLB](#) on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

Updated on 2/10/2019

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206jason-menesMentions43483\_1092939563079626752



**Jason Menes** @jcmenes

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 0:14:32 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Sonny-DietrichMentions43483\_1092941676975288320



**Sonny Dietrich** @DietrichSonny

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#) [#electrician](#) [#local11](#)

at 0:22:56 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Michael-VredeveltMentions43483\_1093004685865144321



**Michael Vredevelt** @solarmikev

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 4:33:18 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Brian-Barb-JuradoMentions43483\_1093143525028319237



**Brian & Barb Jurado** @BarbJurado

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 13:45:00 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Kevin-CokeMentions43483\_1093148847818268673



**Kevin Coke** @OhThatCoke

@cslb on 03/13 Please clarify regulations ensuring battery energy storage systems are safely installed only by C-10 Electrical Contractors and State Certified Electricians [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 14:06:09 on 2/06/2019 UTC

3 **Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Enrique-GuzmanMentions43483\_1093155168663695360



**Enrique Guzman** @nrike54

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 14:31:16 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206JCrispMentions43483\_1093162303422267392



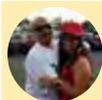
**JCrisp** @LaKeRs1fan

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 14:59:37 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Gladys-BarajasMentions43483\_1093166549253439488



**Gladys Barajas** @gbarajas82

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 15:16:30 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Adam-JohnsonMentions43483\_1093172404103217152



**Adam Johnson** @enozraw

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 15:39:45 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206RobertMentions43483\_1093185032615653377



**Robert** @RBennett122

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 16:29:56 on 2/06/2019 UTC

**Account:** @CSLB **Content type:** Twitter - Mentions

**Record ID:** 20190206Erica-EscalanteMentions43483\_1093222229750370304

Updated: 3/18/2019  
Erica Escalante @eesa2006

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.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 18:57:45 on 2/06/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190206Shelley-KeltnerMentions43483\_1093235109136748544



**Shelley Keltner** @KeltnerShelley

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 19:48:56 on 2/06/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190207Eddie-BernacchiMentions43483\_1093363236856946688



**Eddie Bernacchi** @ebernacchi

.@CSLB Please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 4:18:04 on 2/07/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190207ErikMentions43483\_1093538616024850432



**Erik** @Erik1Webb

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 15:54:57 on 2/07/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190208Rich-DuboisMentions43483\_1093938284554678272



**Rich Dubois** @Megatrawnrikz311

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 18:23:06 on 2/08/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190208Heis4allMentions43483\_1093938971971772416



**Heis4all** @heis4all

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 18:25:45 on 2/08/2019 UTC

Updated: 3/18/2019

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Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190208Cathleen-VickMentions43483\_1093941124673134592



**Cathleen Vick** @CatFrances

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:34:23 on 2/08/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190208Breck-VelascoMentions43483\_1093941304281559041



**Breck Velasco** @breckvelasco

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:35:06 on 2/08/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190211David-LawhornMentions43483\_1095039242902765570



**David Lawhorn** @ocdavel

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 19:17:55 on 2/11/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190211Gretchen-NewsomMentions43483\_1095088130493898753



**Gretchen Newsom** @GretchenNewsom

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 22:32:10 on 2/11/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190211IBEW569Mentions43483\_1095088390444244992



**IBEW569** @IBEW569

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 22:33:12 on 2/11/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190212HectorMentions43483\_1095355827374850048

Updated: 3/18/2019



**Hector @angelshec**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 16:15:54 on 2/12/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190212IBEW-Local-6Mentions43483\_1095457268055719937



**IBEW Local 6 @IBEW\_Local\_6**

EnergyStorage is DangerStorage if you don't have a skilled and trained workforce. @CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 22:58:59 on 2/12/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190213IBEW-234Mentions43483\_1095783641840463873



**IBEW 234 @ibew234**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 20:35:53 on 2/13/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190214Jere-BrightMentions43483\_1095837353514397696



**Jere Bright @qwippster**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 0:09:19 on 2/14/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190214Yuriy-FoxMentions43483\_1095911312427704321



**Yuriy Fox @Absolut\_Elect**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 5:03:12 on 2/14/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190215Timothy-J-RileyMentions43483\_1096200834205986816



**Timothy J. Riley @triley2112**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) 965

Updated: 3/18/2019

[SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 0:13:39 on 2/15/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190216RosendinMentions43483\_1096562937576091649



**Rosendin @Rosendin**

@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](https://SafeEnergyStorage.com) Help us by signing the petition! [SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 0:12:32 on 2/16/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190216RosendinMentions43483\_1096563055108882432



**Rosendin @Rosendin**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](https://SafeEnergyStorage.com) Help by signing the petition! [SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 0:13:00 on 2/16/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190221Bill-RichardsonMentions43483\_1098730204388745217



**Bill Richardson @IBEW743Tramp**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](https://SafeEnergyStorage.com) [SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 23:44:28 on 2/21/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190222Christopher-ContrerasMentions43483\_1098744989566156800



**Christopher Contreras @Mr\_Dr\_Dynamite**

.@CSLB on 3/13 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](https://SafeEnergyStorage.com) [SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 0:43:13 on 2/22/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190222jorge-manriqueMentions43483\_1098789595561451521



**jorge manrique @jmanrique1203**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](https://SafeEnergyStorage.com) [SafeEnergyStorage.com](https://SafeEnergyStorage.com)

at 3:40:28 on 2/22/2019 UTC



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**Steven Linker** @linker\_steven

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 2:24:13 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Eric-ButlerMentions43483\_1099134618513465344



**Eric Butler** @619ebthagreat

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 2:31:28 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Giuseppe-DAngeloMentions43483\_1099156858353283072



**Giuseppe D'Angelo** @Giusepp95489312

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 3:59:51 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Yolita-DinesMentions43483\_1099160972994871296



**Yolita Dines** @yolitamd

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 4:16:12 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Sheryl-Viot-Esq-Mentions43483\_1099324290552524801



**Sheryl Viot Esq.** @Talk2Sheryl

#SaturdayMorning Advocacy for C-10 electrical contractors like my brother...#SafetyFirst ✨

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 15:05:09 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Robert-RomoMentions43483\_1099356882110578689

**Robert Romo** @RealRobertRomo  
Updated: 3/18/2019

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.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 17:14:40 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223AM9095-Mentions43483\_1099363351669268481



**AM90/95** @SelfMadeChase

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#) support the union people. Make sure your installers are qualified and certified.

at 17:40:22 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223TrulainaMentions43483\_1099406066482212864



**Trulaina** @TruFlower

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 20:30:06 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190223Raymond-ServinMentions43483\_1099438321053233152



**Raymond Servin** @RaymondServin2

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 22:38:16 on 2/23/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190224Rafael-GomezbernierMentions43483\_1099494224519520256



**Rafael Gomezbernier** @gomezbernier

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 2:20:25 on 2/24/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190224A-J-SolisMentions43483\_1099504788138450945



**A.J. Solis** @LA\_muzik

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)

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[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 3:02:23 on 2/24/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190224bhHHHMentions43483\_1099555083010727936



**bhhhH @Sorenbro**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 6:22:15 on 2/24/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190225Agustin-GarciaMentions43483\_1100047342038700032



**Agustin Garcia @AgarciAcosta**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 14:58:18 on 2/25/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190225Animatronic-Climbing-EquipmentMentions43483\_1100059079018393600



**Animatronic Climbing Equipment @birotebailey**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 15:44:57 on 2/25/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190225Lonnie-GarzaMentions43483\_1100148313892913153



**Lonnie Garza @IBEWLocal440Riv**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 21:39:32 on 2/25/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190225Marstha1-Mentions43483\_1100178252432322560



**Marstha1. @Marstha1X**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](https://www.SafeEnergyStorage.com)

at 23:38:30 on 2/25/2019 UTC

3 Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226Brian-MalloyMentions43483\_1100185803903434752



**Brian Malloy** @bri\_malloy

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 0:08:30 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226richard-KanatzarMentions43483\_1100201755332104194



**richard Kanatzar** @richardkanatzar

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 1:11:53 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226osenkloMentions43483\_1100217872725377025



**osenklo** @OSENKLO

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 2:15:56 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226forest-hayesMentions43483\_1100218031437864962



**forest hayes** @fhayes3299

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 2:16:34 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226Andrew-AlanizMentions43483\_1100222841281105920



**Andrew Alaniz** @AndrewAlaniz15

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 2:35:41 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226General1776Mentions43483\_1100222852005949440

Updated: 3/18/2019

**General1776** @general1776

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.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 2:35:43 on 2/26/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190226YoungMalcolmRLMentions43483\_1100230106146992128



**YoungMalcolmRL** @FatherOf5RL

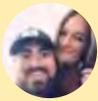
.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 3:04:33 on 2/26/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190226Jordan-WinklerMentions43483\_1100245544180412416



**Jordan Winkler** @RawdogWinkler58

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 4:05:53 on 2/26/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190226Sarn-SaeteurnMentions43483\_1100375469277335553



**Sarn Saeteurn** @sarn\_saeteurn

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 12:42:10 on 2/26/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190226Barbara-DeesMentions43483\_1100437237097914368



**Barbara Dees** @barbdees

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 16:47:37 on 2/26/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190226IBEW-234Mentions43483\_1100456491713085440



**IBEW 234** @ibew234

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

Updated: 3/18/2019

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j

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226KSMentions43483\_1100492724610904064



**K&S @VtaTeCHS**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:28:06 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190226Sean-tisdaleMentions43483\_1100494181175304192



**Sean tisdale @Seantisdale6**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:33:53 on 2/26/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190227Lucky-ChaneyMentions43483\_1100613125869465601



**Lucky Chaney @LuckyChaney**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 4:26:32 on 2/27/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190227John-J-DohertyMentions43483\_1100793763075547137



**John J. Doherty @Doherty4Local6**

Take a few seconds to tell the @CSLB that you believe [#safeenergystorage](#) requires a C-10 contractor with a skilled and trained workforce. Energy Storage is Danger Storage if not installed by qualified electricians. [twitter.com/IBEW\\_Local\\_6/s...](#)

**IBEW Local 6 @IBEW\_Local\_6**

Dear Members and Supporters of IBEW Local 6: We need your help! Please sign this petition requiring state certified general electricians to install all battery energy storage. MORE INFORMATION & SIGN THE PETITION AT THE WEBSITE BELOW:

[SafeEnergyStorage.com](#)

at 16:09:27 on 2/27/2019 UTC

at 16:24:19 on 2/27/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190227grey\_grussieMentions43483\_1100797909107273728

Updated: 3/18/2019

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**grey\_grussie @SF\_RUINS\_HC**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 16:40:48 on 2/27/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190227Baja-WyattMentions43483\_1100825404548407297



**Baja Wyatt @GiantPowerComm**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:30:03 on 2/27/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190227Patrick-McMillanMentions43483\_1100868465710096384



**Patrick McMillan @666GTO**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 21:21:10 on 2/27/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190228Fonz-P-Mentions43483\_1100956243236020224



**Fonz P. @fonzthebandit**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 3:09:57 on 2/28/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190228Carlos-SalazarMentions43483\_1100960968677314560



**Carlos Salazar @SparkCarlos**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 3:28:44 on 2/28/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190301JOHN-CAMPBELLMentions43483\_1101285023070736384



**JOHN CAMPBELL @AudioAssistant**

Updated: 3/18/2019

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j

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 0:56:25 on 3/01/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190301Jose-AlmanzaMentions43483\_1101289978070413312



**Jose Almanza** @Jose415sf

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 1:16:06 on 3/01/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190301PATRICK-QUINNMENTS43483\_1101315798340005888



**PATRICK QUINN** @pdquinn17

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 2:58:42 on 3/01/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190301JeffMentions43483\_1101562100499963907



**Jeff** @Bode952

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 19:17:25 on 3/01/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190301Todd-WylieMentions43483\_1101577444903927808



**Todd Wylie** @toddwcoyote

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:18:23 on 3/01/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190302Larry-RobinsonMentions43483\_1101696506237640704



**Larry Robinson** @LarryRo42956319

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

Updated: 3/18/2019

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190302Mammasparks2019Mentions43483\_1101715885532766209**Mammasparks2019** @mammasparks2019

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 5:28:30 on 3/02/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190302Robin-LucierMentions43483\_1101879333264678912**Robin Lucier** @LucierRobin

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 16:17:59 on 3/02/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190303SirOcelotMentions43483\_1102027613185470469**SirOcelot** (சீர்தல) @SirOcelot

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 2:07:12 on 3/03/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190303DylanMentions43483\_1102268953433300992**Dylan** @Dylan68132103

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:06:12 on 3/03/2019 UTC

**Account:** @CSLB**Content type:** Twitter - Mentions**Record ID:** 20190304Gretchen-NewsomMentions43483\_1102607425759268864**Gretchen Newsom** @GretchenNewsom

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 16:31:10 on 3/04/2019 UTC

3 Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190304Dale-PetersonMentions43483\_1102630721691119616



**Dale Peterson @IBEWCalifornia**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 18:03:44 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190304ichpickMentions43483\_1102649290717945857



**ichpick @ichpick**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 19:17:31 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190304-Earthy-Sara-Mentions43483\_1102651100878954496



**Earthy Sara @earthysara**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 19:24:43 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190304Travis-KohmescherMentions43483\_1102662545653944320



**Travis Kohmescher @tdk1269**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:10:12 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190304John-ElliottMentions43483\_1102663364629667847



**John Elliott @Velcroski**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:13:27 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions  
Record ID: 20190304Wendy-WheatcroftMentions43483\_1102664590301704192



Wendy Wheatcroft @Wendy4SD

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 20:18:19 on 3/04/2019 UTC

Account: @CSLB Content type: Twitter - Mentions  
Record ID: 20190305IBEW569Mentions43483\_1103026257057349632



IBEW569 @IBEW569

Thank you @ToddGloria for joining IBEW to protect #PublicSafety and ensure battery energy storage systems are safely installed by only C-10 electrical contractors and a trained workforce! 🙏📱💡 #SafeEnergyStorage @CSLB [pic.twitter.com/7kTIJsxT2O](https://pic.twitter.com/7kTIJsxT2O)



at 20:15:27 on 3/05/2019 UTC

Account: @CSLB Content type: Twitter - Mentions  
Record ID: 20190305IBEW569Mentions43483\_1103069025737695232



IBEW569 @IBEW569

Thank you #Labor Champion @LorenaSGonzalez for joining IBEW to protect #PublicSafety and ensure battery energy storage systems are safely installed by only C-10 electrical contractors and a trained workforce! 🙏📱💡 #SafeEnergyStorage @CSLB [pic.twitter.com/JCq4cV60nA](https://pic.twitter.com/JCq4cV60nA)



at 23:05:24 on 3/05/2019 UTC

Account: @CSLB Content type: Twitter - Mentions  
Record ID: 20190305IBEW569Mentions43483\_1103072185004904449



IBEW569 @IBEW569

Updated: 3/18/2019

Thank you @tashaboerner for joining IBEW to protect #PublicSafety and ensure battery energy storage systems are safely installed by only C-10 electrical contractors and a trained workforce! 🙌📱💡 #SafeEnergyStorage @CSLB pic.twitter.com/E9hQhz17IE



at 23:17:57 on 3/05/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190306Max-DAgostinoMentions43483\_1103093043467415552



Max D'Agostino @mdelectric619

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage SafeEnergyStorage.com

at 0:40:50 on 3/06/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190306IBEW569Mentions43483\_1103342606778425344



IBEW569 @IBEW569

Thank you @AsmShirleyWeber/ @DrShirleyWeber for joining IBEW to protect #PublicSafety and ensure battery energy storage systems are safely installed by only C-10 electrical contractors and a trained workforce! 🙌📱💡 #SafeEnergyStorage @CSLB pic.twitter.com/UilSloqMIW



at 17:12:31 on 3/06/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190306ColinWardMentions43483\_1103386230622904321



ColinWard @ColinWard17

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors #SafeEnergyStorage SafeEnergyStorage.com

at 20:05:51 on 3/06/2019 UTC

Account: @CSLB Content type: Twitter - Mentions

Record ID: 20190306Rafael-GomezbernierMentions43483\_1103429102818586624



**Rafael Gomezbernier @gomezbernier**

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 22:56:13 on 3/06/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190307RosMentions43483\_1103760136558919680



**Rosè @LuxCue**

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 20:51:38 on 3/07/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190307Bruce-CaudleMentions43483\_1103768335521443840



**Bruce Caudle @DeathCums4U**

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 21:24:12 on 3/07/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190308EdgarMentions43483\_1103870974494072832



**Edgar @not\_edgar**

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 4:12:03 on 3/08/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190308LAEstimatorMentions43483\_1104102019403460608



**LAEstimator @LAEstimator**

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)  
[SafeEnergyStorage.com](#)

at 19:30:09 on 3/08/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190308James-WaltonMentions43483\_1104154246495199233

**James Walton @JamesWaltonUO**

Updated: 3/18/2019



.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 22:57:41 on 3/08/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190309fabiocampos028gmail-comMentions43483\_1104178262257819648



**fabiocampos028@gmail.com** @fabiocampos028

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 0:33:07 on 3/09/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190309EMentions43483\_1104260284183588864



**E @\_air\_wrecka**

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 5:59:02 on 3/09/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190309JesseemirawkMentions43483\_1104487680639791105



**Jesseemirawk** @valdez\_jessee

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 21:02:38 on 3/09/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190310pablo-jimenezMentions43483\_1104584781067481088



**pablo jimenez** @pabloji67272265

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#) [SafeEnergyStorage.com](#)

at 3:28:28 on 3/10/2019 UTC

Account: @CSLB

Content type: Twitter - Mentions

Record ID: 20190310Robert-RomoMentions43483\_1104874336479920128



**Robert Romo** @RealRobertRomo

.@CSLB on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)

Updated: 3/18/2019

[SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 22:39:04 on 3/10/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190310Randi-DelabarcenaMentions43483\_1104874883966595073



**Randi Delabarcena** @sugarhooker27

.@[CSLB](#) on 3/21 please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors [#SafeEnergyStorage](#)

[SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 22:41:14 on 3/10/2019 UTC

**Account:** @CSLB

**Content type:** Twitter - Mentions

**Record ID:** 20190312John-J-DohertyMentions43483\_1105318949367963649



**John J. Doherty** @Doherty4Local6

Sign the petition with me and tell the @[CSLB](#) to please clarify regulations to ensure battery energy storage systems are safely installed by only C-10 electrical contractors

[#SafeEnergyStorage](#) [SafeEnergyStorage.com](http://SafeEnergyStorage.com)

at 4:05:48 on 3/12/2019 UTC