



CONTRACTORS STATE LICENSE BOARD

BATTERY ENERGY STORAGE SYSTEMS

Battery Energy Storage Systems

Staff have prepared four options for committee consideration and provided information that supplements CSLB's review of the appropriate classification to install a battery energy storage system and its March 21, 2019 "Energy Storage Systems Report." The options presented are concepts and not intended to be and do not include draft or final regulatory language.

The report, including related letters, is available upon request by calling (800) 321-CSLB (2752) or from the CSLB website:

http://www.cslb.ca.gov/Resources/BoardPackets/ESS_Report_revised.pdf

Background

On April 17, 2018, the board directed staff to hold a public participation hearing on battery energy storage systems (BESS) to gather information for a review of the appropriate license classification(s) to install a BESS in a standalone contract or as part of the installation of a solar photovoltaic system.

CSLB's current administrative interpretation authorizes the following classifications to install a BESS:

- "C-10" (Electrical) – Appropriate to install a standalone battery energy storage system. The classification may also perform solar photovoltaic system installation independently or at the time of BESS installation.
- "C-46" (Solar) – Appropriate to install a BESS at the time of the solar photovoltaic system installation.
- "A" (General Engineering) – Appropriate to install a BESS if the installation requires specialized skill and engineering.
- "B" (General Building) – Appropriate to install a BESS as part of the installation of a solar photovoltaic system if the installation is in connection with a structure.

Note: Labor Code section 108.2 requires electrician certification for all persons who engage in the connection of electrical devices for "C-10" Electrical contractors. Electrician certification is not required for classifications other than C-10 Electrical. If the board determines that only C-10 Electrical contractors can install BESS, certified employees would be required for every installation that involves connection of an electrical device.



Seventy-one people testified at a CSLB-held two-day public hearing (April 25-26, 2018), and CSLB received 269 letters on the appropriate classification to install a BESS. A letter signed by twenty-eight members of the Legislature was received in support of restricting BESS installation to the C-10 Electrical classification. CSLB staff referred to this public testimony and correspondence in the March 2019 BESS report.

March 21, 2019 Board Motion

At the March 21, 2019 board meeting, members reviewed the Energy Storage System Report. The report included a review of California Code of Regulations section 832.46, which defines a C-46 Solar contractor as follows:

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.

After reviewing staff's Energy Storage System Report and its related correspondence, and hearing testimony from 74 members of the public, the board unanimously adopted the following motion:

1. Consider energy storage system size, complexity, voltage, and potential risks.
2. Draft proposed regulatory language to present to the board for consideration that would prohibit or restrict certain contractor classifications from performing the installation of energy storage systems.
3. Assign this to the appropriate board committee or committees and provide updates at each board meeting.

Committee Assignment

In preparation for the May 13, 2019 committee meetings and June 6, 2019 board meeting, Chair Marlo Richardson assigned the BESS classification review to the Legislative Committee. A brief status update was provided at the committee and board meetings.

Additional Staff Research

In furtherance of the board's directive to consider BESS size, complexity, voltage, and potential risk when developing proposed regulatory language, staff contacted government and construction industry stakeholders for their analyses of the issue and

conducted interviews between June and July 2019. They are listed alphabetically as follows:

California Building Industry Association

As stated in my [Robert E. Raymer, PE, Senior Engineer/Technical Director for the California Building Industry Association] May 17, 2018 letter written on behalf of the California Building Industry Association (CBIA), CBIA is concerned if CSLB prohibits C46-Solar Contractors from installing energy storage systems (ESS), new home builders will see a significant reduction in the available workforce that can legally install an ESS system. The reduction in workforce will delay construction and increase the cost of new residential construction. In addition, CBIA is not aware of any building code or safety violations that have occurred during the installation of an ESS on a residential new home and the current industry practice is for the same contractor to install the ESS at the same time as the photovoltaic system.

I would encourage the CSLB to continue to permit a C46 contractor to install and maintain energy storage systems on single family residential structures when the ESS is installed at the same time as the photovoltaic system. If CSLB has safety concerns, requiring the C46 to follow plans drawn by an electrical engineer should ensure proper installation practices.

CBIA anticipates the construction of approximately 120,000 dwelling units in 2020. Approximately 70,000 of the units will be single family homes required to have solar on the roof or tied to community solar. Approximately 15,000 of the single-family homes will have battery energy storage systems. CSLB staff's estimated increase of \$100 per unit to use certified electricians to install the battery energy storage systems is accurate.

California Building Officials

CALBO stands behind my [Katie Almond, Government Affairs Manager] April 25, 2018 letter. Subject letter includes the following statement:

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.



California Department of Finance

Staff contacted the Department of Finance (DOF). The representative declined to have their name mentioned in this report, but advised CSLB staff to review Government Code section 11342.548 – Major Regulations:

Government Code Section 11342.548 defines a “major regulation” as any regulatory change subject to the Office of Administrative Law’s review that will have an economic impact on California business enterprises and individuals in an amount exceeding \$50 million, as estimated by the agency.

DOF adopted regulations for conducting a standardized regulatory impact analysis and those regulations [1 CCR §§ 2000 – 2004] took effect on November 1, 2013. DOF encourages consultation if regulations are likely to have cost or benefit over \$10 million to ensure that you are making your economic impact assessment is in the manner specified by DOF’s regulations.

DOF has economic modeling software, for which it is possible to obtain a license to use. The modeling software, RIMS II Multiplier, would assist in estimating costs and benefits and in determining whether costs or benefits will reach the threshold for a major regulation.

Separate from its conversation with DOF, CSLB staff reviewed a Stanford University study regarding BESS installation labor costs (<https://www.gsb.stanford.edu/faculty-research/working-papers/emergence-cost-effective-battery-storage>) and an analysis of Employment Development Department average wages for electrician and solar panel installers (www.labormarketinfo.edd.ca.gov). From these reports, staff determined that the use of a certified electrician to install a BESS on a new construction single-family residential unit could result in an estimated \$100 increase in cost per instance. Using CBIA’s estimate of 15,000 new construction BESS installations in the next few years, the additional cost to the public would be \$1.5 million annually.

Staff has not performed an analysis regarding any increased cost for certified electricians to perform BESS installations on existing residential units. However, according to the California Solar & Storage Association, there were 11,179 solar photovoltaic paired with battery ESS installations in California between 2016 and the first quarter of 2019. These numbers exclude any installations from the San Diego Gas and Electric territory, a rather large market.

Depending on board direction, DOF will likely require additional financial evaluation. CSLB staff have begun the process of obtaining the DOF software described above.

California Energy Commission

On July 1, 2019, staff participated in a conference call with California Energy Commission (CEC) Senior Advisor Bill Pennington and staff. CEC staff expressed the following concerns:

- California is experiencing a significant shift to electricity generated behind the meter. For this shift to be successful, it is necessary to install batteries that capture energy midday that can be used in the evening.
- New home construction and climate and decarbonization goals require affordability. Larger decarbonization goals may be compromised by the increased cost of mandating only certified electricians install energy storage systems.
- The increased cost of using certified electricians to install ESS may be approximately \$100 per unit. However, general contractors will not use a C-46 Solar contractor to install the photovoltaic (PV) system and a C-10 Electrical contractor to install the ESS; they will use the C-10 contractor for both if the C-46 cannot install the ESS.
- CSLB needs to consider the additional cost of certified electricians installing the ESS and the PV.
- CSLB data does not demonstrate that C-46 contractors receive more complaints than C-10 contractors specific to ESS installation.

Because of the concerns above, CEC staff oppose restricting C-46 contractors from installation of ESS at the time of PV installation.

California Public Utilities Commission

CPUC staff were interviewed, however, requested not to be quoted.



Options and related facts for committee consideration

Below are four options for committee consideration, followed by further discussion of each. Committee members may support one of these options, or none of them, or develop its own option. To assist the committee in reviewing each option, the facts and information that follow include references to the Energy Storage System Report and other staff research. (Referenced page numbers are to the ESS Report.)

- Option 1: Preclude the C-46 Solar classification from installing battery energy storage systems
- Option 2: Permit the C-46 Solar classification to install battery energy storage systems on specified residential units with restrictions
- Option 3: Permit the C-46 Solar classification to install battery energy storage systems on residential units with restrictions
- Option 4: Make no change to the existing C-46 Solar classification

Option 1: Preclude the C-46 Solar classification from installing battery energy storage systems

California Code of Regulations Section (CCR) 832.46 currently defines a solar contractor as follows:

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.

The language in CCR 832.46 does not mention battery energy storage systems. A BESS is not a photovoltaic solar system. Testimony and letters received and reviewed by staff contend that a BESS is not required to install a thermal or photovoltaic solar energy system (p. 4). Rather, they contend that a BESS is a separate system from a solar PV, subject to separate codes, safety risks and installation (p. 23).

At the March 21, 2019 board meeting, members reviewed the Energy Storage System Report, which included the following facts for consideration.

- Testimony and letters received and reviewed by staff contend that to prevent electrical overloading, residential and commercial systems will often require a service upgrade, and that approximately 20 percent of installations require a service upgrade due to the installation of equipment, such as an electric car charger or PV system that exceeds the energy threshold of the service panel. Longstanding CSLB practice has been that a C-10 Electrical classification is required for the service upgrade (p. 23).
- Testimony and letters received and reviewed by staff contend that there are safety concerns with each battery type depending on the “set up and management,” and that poor installation can increase battery safety risks (p. 24).
- Testimony and letters received and reviewed by staff contend that BESS should only be installed by C-10 electrical contractors (throughout, particularly p. 53).
- At an April 2018 public participation hearing, 63 people testified in support of BESS systems being installed by C-10 contractors employing certified electricians regardless of whether as a standalone system or part of a PV system installation. Speakers representing training instructors, electricians, apprentices, fire, inspection, and safety groups spoke in favor of this conclusion (p. 25).
- An April 25, 2018 letter from the California Building Officials (CALBO) states that CALBO “support[s] a C-10 classification as the most appropriate for installing an BESS” and that the C-10 classification “has the proper training and expertise in order to provide the required safety measures and ensure proper code compliance” (p. 35).



- CSLB received 149 letters from the public supporting the C-10 license as the most appropriate classification to install BESS (p. 42). Six of these letters were from local and state government representatives; one was signed by 28 members of the State legislature and 23 local or state officials (p. 66).
- In addition to letters on behalf of the C-10 Electrical contractor industry, CSLB received a press release and petition signed by 2,877 individuals on behalf of the C-10 Electrical contractor industry. The letter urges the board to clarify current regulations to require that only specialty contractors holding a C-10 Electrical contractor license may install battery energy storage systems. The letter notes that a battery is electrical in nature and that C-10 contractors and their employees are trained in electrical systems (pp. 42 and 53-54).
- Letters and testimony received from certified electricians, licensed contractors, electrician trainers, safety specialists, utility representatives, and building and fire department officials stated that BESS installations may pose a health and safety risk. Many of the letters summarized in the report state that BESS systems pose unique and particularly hazardous safety, fire, and electrocution risks, and that improperly installed systems cause hazards and can overheat, explode, create arc flashes and blasts of electricity, or burst into flames (p. 69).
- Testimony and letters received and reviewed by staff contend that battery energy storage systems involve the connection of electrical devices and the employees of C-10s, who are required to be certified electricians, are the appropriate persons to make those connections (p. 71).
- The electrician certification requirement in Labor Code 108.2 does not provide an exception for C-46 solar contractors (p. 71).
- CSLB has consistently required electrician certifications for C-10 contractors employing workers that “engage in the connection of an electrical device,” notwithstanding that the contractor may have an “A” General Engineering or “B” General Building classification, in addition to a C-10 Electrical classification (p. 71).
- According to research performed by staff, California is unique among states in allowing a contractor designated by a specialty “solar” classification to connect an energy storage system device as part of a solar photovoltaic installation, and does not in some way cap that ESS installation by voltage, or require the ESS work to be subcontracted out to, or performed under, an electrician. Of the states that do have a solar license classification (Connecticut, Florida, Hawaii, Idaho, Louisiana, Nevada, and Utah), only Hawaii and Utah mention energy storage. In Utah, a solar contractor may not install energy storage systems as part of a PV installation. In Hawaii, energy storage system work must be subcontracted to an electrical contractor (p. 72).

Option 2: Permit the C-46 Solar classification to install battery energy storage systems on specified residential units with the following restrictions:

- Limit the BESS installation authority to a PV system up to 10 kilowatts on a single-family dwelling or a duplex, and the BESS must not exceed a 5-kW (backup)/20-kWh (energy)¹;
- The BESS is installed at the same time as the solar photovoltaic energy system; and,
- No upgrade or alteration is made to the existing electrical system of the structure.

A. Facts supporting size, complexity and residential limitations

Option 2 would limit the C-46 to the installation of a BESS at a maximum of 5 kw/20 kWh only when installed at the same time as PV system at a maximum of 10 kw rating in single or duplex family dwellings.

- At the January 18, 2019 CSLB-held C-46 industry meeting, solar industry representatives stated that the battery ESS most commonly used in the residential market are “plug and play,” comparable to a simple appliance installation. The “plug and play” systems at the residential level have built-in circuit protections that preclude the arc flash and thermal runaway. While battery cells can deliver high fault currents that can spark from blunt impact, installers do not have access to the terminals, as a safety measure by the manufacturer (p. 24).
- The California Solar Rights Act defines which types of solar energy systems qualify for its legal protections. That Act allows consumers access to sunlight and limits HOAs and local governments from preventing the installation of solar energy systems. The systems qualifying for its protections include small-scale consumer systems designed to meet onsite electric load, which are the systems installed on residential structures.²
- The Solar Rights Act also provides that “small residential rooftop solar energy systems” are those not larger than 10 kilowatts alternating current nameplate rating, that conform to all applicable state fire, structural, electrical, and other building codes, and are installed on a single duplex or family dwelling and do not exceed legal building height for the local jurisdiction (Government Code § 65850.5(j)(3)).
- The U.S. Department of Energy’s National Renewable Energy Laboratory (NREL) determined that a 5kw (backup power)/20 kW hour (energy) lithium-

ion battery would enable a typical customer to optimize self-consumption of PV electricity including peak-demand saving and time-of-use shifting.³

- For context, the Tesla Powerwall, a commonly used residential battery energy storage system paired with PV, is rated at 14 kW hours energy.⁴

B. Facts supporting the authorization of a C-46 installing PV at the same time as BESS

- As described in Option 1, CCR 832.46 does not permit the C-46 classification to contract solely for BESS; however, CSLB has permitted the C-46 to install an energy storage system as part of a solar system pursuant to Business and Professions Code section 7059 - Rules and Regulations Affecting Classification of Contractors, that reads in part:

Nothing contained in this section shall prohibit a specialty contractor from taking and executing a contract involving the use of two or more crafts or trades, if the performance of the work in the crafts or trades, other than in which he or she is licensed, is incidental and supplemental to the performance of the work in the craft for which the specialty contractor is licensed.

- At the January 18, 2019 C-46 industry meeting, solar industry representatives stated that the solar industry has been installing batteries on residential units for many years and most residential batteries are plug and play. Manufacturers are building PV systems to include battery ESS because of increased demand. Only one permit is required to install a solar system when paired with a battery (p. 24).
- CSLB received 121 letters from the public supporting C-46 licensees installing ESS when paired with solar PV (p. 42).
- CSLB has solicited but not received examples of workmanship or serious injury or death resulting from installation of ESS paired with solar photovoltaics. Staff polled CSLB enforcement field offices to determine if any of the 21,301 complaints CSLB opened in the past year involved energy storage systems. The field offices reported zero such complaints (p. 70).
- On May 17, 2018, California Building Industry Association (CBIA) Government Affairs Senior Engineer Robert Raymer, encouraged CSLB to continue to permit a C-46 contractor to install and maintain energy storage systems on single family residential structures when the ESS is installed at the same time as the photovoltaic system, rather than limiting the number of individuals authorized to install the technology. Mr. Raymer expressed concern that a reduction in workforce would delay construction and increase the cost of new residential



construction, particularly given that CBIA is not aware of any building code or safety violations that have occurred during the installation of an ESS on a residential new home.

- California Energy Commission staff, which included CEC Senior Advisor Bill Pennington, oppose restricting C-46 contractors from installation of ESS at the time of PV installation. They fear new home construction and climate and decarbonization goals may be compromised because of increased costs if only C-10 contractors can perform the work.

C. C-46 not authorized to perform upgrade or alteration to existing electrical system

For more than 10 years, the CSLB classification deputy has consistently replied to contractors and building departments inquiring about C-46 contractors performing main electrical service, panel upgrades or replacements as follows:

It is not appropriate for C46-Solar contractors to perform main electrical service panel upgrades or replacements as part of a solar PV installation project. A C46 contractor may only perform electrical work that is required to accommodate the installation of the solar PV system. A C10-Electrical contractor is the appropriate classification for complete electrical service panel upgrades or replacements.

At the May 2, 2018, County Building Officials Annual meeting, attended by more than 30 building officials, CSLB staff were advised that more than 20 percent of ESS installations require an upgrade to the electrical panel and/or existing electrical system. Many building officials stated that they require a C-10 Electrical classification to upgrade the electrical panel/system, which aligns with CSLB's standard practice (pp. 35 and 76).

Option 3: Permit the C-46 Solar classification to install battery energy storage systems on residential units with certain restrictions.

- Limit the BESS installation authority to a PV system on a residential dwelling;
- The BESS is installed at the same time as the solar photovoltaic energy system;
- No upgrade or alteration is made to the existing electrical system of the structure; and,
- With plans drawn or approved by an electrical engineer.

Facts and information supporting option 3:

- Robert E. Raymer, PE, Senior Engineer/Technical Director for the California Building Industry Association, stated in a May 17, 2018 letter written on behalf of the California Building Industry Association (CBIA) that if CSLB has safety concerns, requiring the C-46 to follow plans drawn by an electrical engineer should ensure proper installation practices.
- Paige B. Vaughan, a California Building Official, Design Build Institute of America, stated to CSLB staff that requiring a C-46 to follow plans drawn by an electrical engineer should ensure proper installation practices.
- According to a panel of industry experts representing the C-10 Electrical industry at a January 17, 2019 stakeholder meeting on the topic of energy storage, whether residential or commercial installation is being considered, calculations are required to ensure that the existing electrical system can withstand installing a BESS (p. 23).
- Business and Professions Code section 6702.1 provides that all electrical engineering plans and specifications that are “permitted” or that are to be “released for construction” shall bear the signature and seal or stamp of the electrical engineer and the date of signing and sealing or stamping.
- According to the U.S. Department of Energy, a “qualified professional engineer or firm should always be contracted to oversee any energy storage project.” However, this statement was made in the context of those who are interested in the addition of energy storage to a single or multiple commercial buildings.⁵
- CSLB has not researched if plans drawn by an electrical engineer are currently required for the installation of BESS by any number of local jurisdictions in a residential application or whether and how much this would result in additional cost to the marketplace.

Option 4: Make no change to the existing C-46 classification

- At a September 1981 board meeting, members confirmed that it was the intent of the new C-46 classification to include the electrical components of solar systems (p. 11).
- In stating the rationale and purpose behind developing the stand-alone C-46 license, CSLB's 1981 Statement of Reasons that provided the rationale for adopting the C-46 classification explained that CSLB "has received several letters from industry representatives stating that there are a minority of contractors who specialize in installation of all types of solar systems. Those contractors specializing in multiple or hybrid solar systems must have expertise that differs from the accumulation of the various specialty classifications which include specific solar technology" (pp. 16-17).
- At a January 18, 2019 C-46 industry expert meeting, solar industry representatives stated that C-46 Solar contractors have been installing batteries for the last 40 years, and in many ways lead-acid is more dangerous than new lithium ion enclosures (p. 24).
- CSLB has solicited but not received examples of serious injury or death resulting from improper installation of ESS paired with solar photovoltaics (p. 70).
- CSLB polled its enforcement field offices to determine if any of the 21,301 complaints CSLB opened in the past year involved energy storage systems. The field offices reported zero such complaints (p. 70).
- CSLB received a report from the California Division of Occupational Safety and Health on the injuries reported over the last fiscal year in the Department of Industrial Relations' electrical classification, and none of the reports identified accidents involving the installation of battery energy storage systems (p. 70).
- California Energy Commission staff, which included CEC Senior Advisor Bill Pennington, oppose restricting C-46 contractors from installation of ESS at the time of PV installation. They fear new home construction and climate and decarbonization goals may be compromised because of increased costs if only C-10 contractors can perform the work.

¹ This concept comes from the definition of a small residential rooftop solar energy system contained in the California Solar Rights Act at Government Code section 65850.5(j)(3)(A).

² California's Solar Rights Act, "A Review of the Statutes and Relevant Cases." University of San Diego, Energy Policy Initiatives Center, University of San Diego School of Law. P. 6

³ Id. at P. vii

⁴ https://www.tesla.com/sites/default/files/pdfs/powerwall/Powerwall%20_AC_Datasheet_en_northamerica.pdf

⁵ [On-Site Energy Storage Decision Guide](#). Better Buildings, U.S. Department of Energy. April 2017, pp. 2 and 3.

<https://betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/BB%20Energy%20Storage%20Guide.pdf>