A CESA Technology Innovation White Paper

What States Need to Know about Plug-In Solar

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Clean Energy States Alliance

BENTHAM PAULOS | JANUARY 2026

ABOUT THIS REPORT

This paper was produced by the Clean Energy States Alliance (CESA) in response to requests from CESA Member states for information about plug-in solar technology and policy issues, due to increased legislative and stakeholder activities on this topic. The paper seeks to present clear, plain-English information about the topic for state energy agencies, their legislative counterparts, and other stakeholders. Information is presented in the form of questions and answers and is based on information collected in the fall of 2025. The paper will be updated periodically in response to new information and additional questions from states.

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ACKNOWLEDGEMENTS

Review and input for this paper was provided by Tom Stanton, Daniel Gerber of Berkeley Lab, and Kevin Chou of Brightsaver, along with Vero Bourg-Meyer, Hanna Jones, Samantha Donalds, and Warren Leon of CESA.

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Cover image: © iStockphoto/amriphoto.
Report design: David Gerratt/NonprofitDesign.com

Contents

Introduction

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What is plug-in solar?

Plug-in or “balcony” solar refers to small solar systems that are plugged into conventional power outlets to connect to home power circuits. They are plugged in like an appliance, but instead of drawing power from the outlet, they send power into it for use in other parts of the home. They can also plug directly into a battery, which then powers appliances.

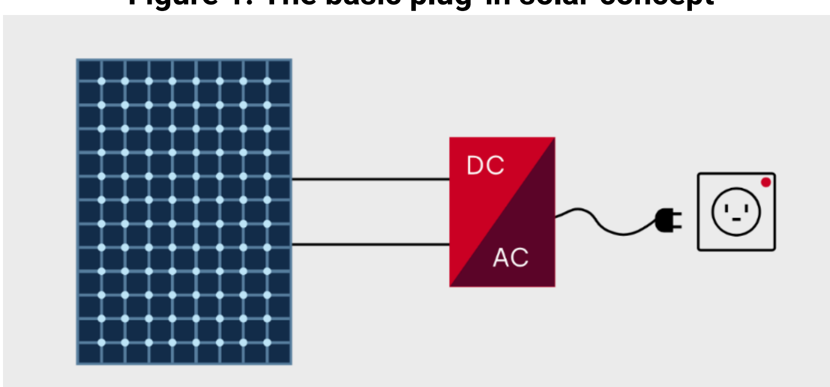
Because these small solar systems do not usually require electrical work and are not typically mounted on roofs, they can be installed by people with little to no technical expertise. This can avoid the need for electricians and permits, and thus reduces installation and other “soft” costs. In Europe, where it is more established, plug-in solar kits can be purchased like an appliance, without hiring a contractor.

A key issue affecting regulations and technology choices is whether power generated by the plug-in solar system is used only within the home or exported to the power grid. This paper discusses various plug-in solar configurations and how they interact with regulatory issues.

What types of plug-in solar exist?

The basic concept of plug-in solar, as shown in Figure 1, is one or more solar panels, an inverter that converts direct current (DC) power to alternating current (AC), and a plug that connects to a building or load.

Figure 1: The basic plug-in solar concept



Source: UL

Plug-in solar systems can vary based on size, location relative to load, interaction with the building or other loads, the use of batteries, and the use of energy controllers.

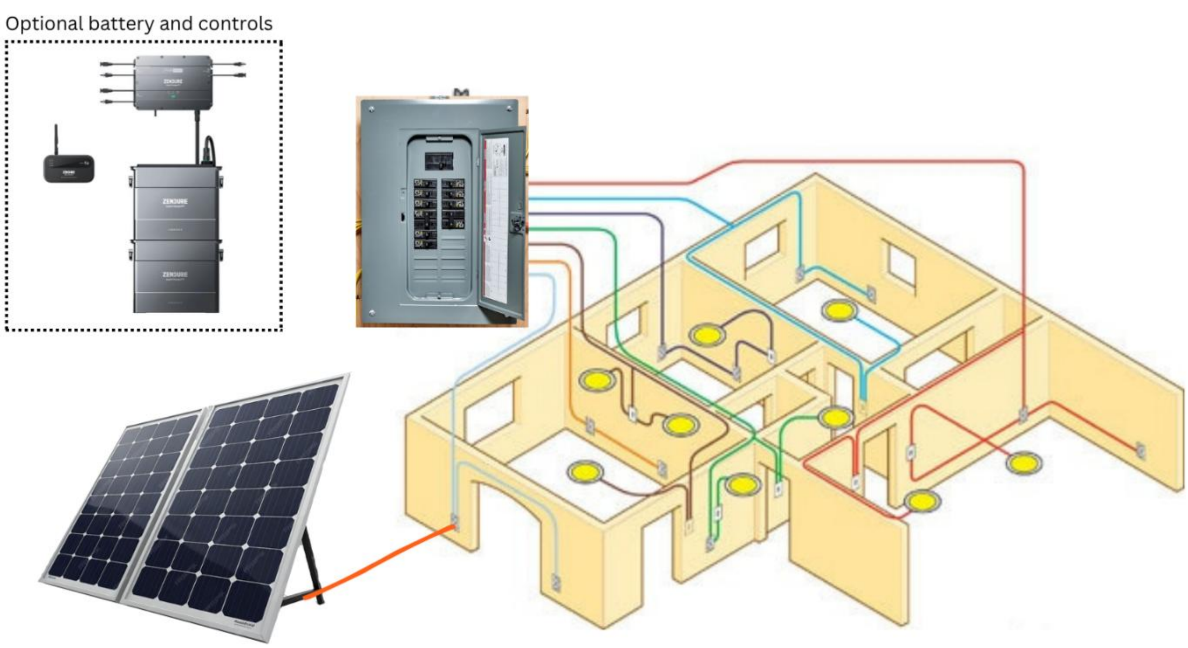
Three common variations are:

1) Plugged into a wall outlet and drawing power directly: The most common form in Europe, where plug-in solar is widespread, is one or more solar panels connected to microinverters, which are plugged directly into an existing circuit in a home. The electricity generated is consumed by load within the building in real time, and the unused power, if any, is sent to the grid.

2) Plugged into a battery and drawing power from the battery: A less common but simple approach is to connect the solar panels to a battery, and plug appliances directly into the battery, creating a mini-microgrid that is not connected to household circuits.

3) Plugged into a wall outlet *and* a battery: Some plug-in solar systems have batteries and smart communications / controls, and they may be on a separate dedicated circuit connected to the main electrical panel. More powerful systems can be connected to a 240-volt (V) circuit. These additional capabilities allow for more energy production and can be configured with smart controls to prevent energy exports to the grid.

Figure 2: A simple plug-in solar system



The building depicted has an electrical system divided with seven circuits. The plug-in solar system is connected through a regular 120 V outlet into one of the circuits. More complex systems may have batteries and smart communications / controls. *Source: CESA*

The system design chosen depends in part on the regulatory treatment of customer-sited, or behind-the-meter (BTM), solar in a given location. BTM solar policies vary by city, state, utility territory, and country on issues such as interconnection (how energy generators connect to the power grid) and accounting (how the import and export of energy is counted and credited). Rules around exporting energy to the grid are especially critical – see further discussion below.

Electricity basics

Amps measure electrical current, the rate at which electrons flow through a conductor. If compared to water flow, it would reflect the size of a hose. A household circuit is typically 15 to 50 amps (A).

Volts measure the "pressure" of the electricity, or how much energy it carries. Standard household electricity in the United States is 120 V, while large appliances like HVAC, ovens, and water heaters may require 240 V. In Europe, 240 V is common for all circuits.

Watts is a unit of measure for *power.* It measures how much electricity an appliance requires to turn on and operate, or how much a solar panel can generate at a given moment. One thousand watts is a kilowatt (kW). Consumption or production of watts (W) over time is measured in kilowatt hours (kWh).

Watts = Amps x Volts

How big is a plug-in solar system?

Although conventional household solar installations in the US have increased in size, with a median size of 11.7 kW in early 2025, plug-in solar systems are much smaller. In Germany, *Balkonkraftwerke* systems are limited to 800 W of AC output; larger systems are regulated as conventional distributed solar systems. Utah legislation, so far the only US policy on the books, limits "portable solar generation devices" to 1200 W.

Solar panel DC generation capacity vs. inverter AC output

Solar panels are rated in direct current (DC) maximum generation capacity, while inverters are rated in alternating current (AC) output. An inverter rated at 800 W of AC output can be fed by more than 800 W of DC solar capacity. Solar panels frequently produce less than maximum DC output, due to time of day, clouds, orientation, shading, and other factors. If they produce more than the capacity of the inverter, the inverter will only put out its AC maximum, effectively throttling the DC generation of the panels.

What are the benefits to consumers?

Like any BTM solar system, plug-in solar can save customers money compared to power purchased from a utility or power marketer. It will have the most favorable economics in locations with high electricity rates and bills, when it is situated for maximum sunlight and energy production, when it offsets the most grid-supplied power, and when it can be purchased and installed at a low cost.

As discussed below, European plug-in solar kits have fallen to as low as €0.55/W. Because of the embryonic market in the US, only a few US marketers currently advertise plug-in systems, with prices near $1.75/W, and high shipping costs. A more mature US market with a wider availability of plug-in solar components would likely approach European prices.

In the US, a well-sited 800 W system might produce 1,000 kWh per year (with a 15% capacity factor), about 10% of an average household's demand. At a cost of $1,400 ($1.75/W) and an electricity price of 20¢/kWh, the simple payback would be about 6.7 years. This assumes all energy generated is consumed by the customer or exported at a full retail rate under a net metering contract. Exports that are compensated at a lower rate (under net billing) or not at all will reduce the value of generation. Utah legislation specifically excludes plug-in solar systems from accessing net metering, meaning exported energy is not compensated.

Table 1 offers sample financial calculations for the payback period of a plug-in solar system in the US. As shown in the table, for an 800 W system, the payback period could range from 4 to 13 years, depending on the cost of equipment, electricity rates, and how much energy is produced.

Table 1: Sample calculation of payback period for a plug-in solar system in the US

	High value	Low value
System size	800 W	800 W
Operational hours per year	8,760 hours	8,760 hours
Capacity factor (the ratio of actual energy output to theoretical maximum output)	15%	10%
Annual energy output (Watts x hours x capacity factor)	1051 kWh	700 kWh
Retail price of electricity	$0.30/kWh	$0.15/kWh
Annual value of generation (annual energy output x retail price)	$315.36	$105.12
Solar equipment and installation cost	$1.75/W	$1.75/W
Total cost	$1,400	$1,400
Payback period	4.4 years	13.3 years

To make your own calculations, an online version of this table is available here.

Brightsaver, a plug-in solar advocacy organization, estimates a payback range of 2 to 7 years in the US, similar to German estimates.

Because plug-in solar avoids the cost and delay associated with sales, permitting, and interconnection, and can be a do-it-yourself (DIY) project, it can have lower installed costs per watt than conventional solar. While solar panel and battery costs have fallen substantially, soft costs (i.e., non-hardware costs) still make up over half the total installed cost of a conventional rooftop system. EnergySage, a solar marketplace, reports the average solar-only residential system costs of $2.48/W in 2025.

Because plug-in solar systems are easily installed and removed, they can be an option for renters. It is called “balcony” solar in Europe because it appeals to renters who live in apartment buildings and is often deployed on their balconies. A system is reasonably portable, so it can be moved when the system owner moves. Smaller systems, with flexible panels and portable batteries, can be used with recreational vehicles and camping.

Systems that come with battery storage can provide backup power during outages, although only for a limited load. A two-panel, 800 W system, for example, may be paired with a 1 or 2 kWh battery, which could power a refrigerator and a CPAP machine for 24 hours.

Plug-in solar may be used as a second system for an existing solar customer, to increase solar output. Or it may be an option in states that have ended or reduced compensation for net metering, as long as the system is configured not to export to the grid. However, avoiding exports to the grid either requires a battery, which adds considerable cost, or a control system that can curtail output, which reduces the value of the system. A third option is to allow export but not compensate the system owner for it, as discussed below.

Comparisons to conventional and community solar

Plug-in solar fills a niche in the solar market, along with conventional BTM rooftop solar and community solar subscriptions. It has pros and cons relative to those options. As shown in Table 2, larger conventional rooftop systems have the highest upfront cost, but also the highest savings. Plug-in and community solar are easier options, but with smaller rewards.

Table 2: Comparison of solar options

	Cost per watt	Total installation cost	Savings	Wealth building	Speed of deployment	Installation
Plug-in solar	Potentially very low	Small	Small	Small	Very fast	DIY, plugs into outlet
Conventional rooftop solar	Higher	Larger	Largest	Larger	Slower	Professional, ties in to main panel
Community solar subscription	None	None	Small	None	Depends on availability	Offsite

Why is it popular in Europe?

Plug-in solar is spreading in Europe, especially in Germany, which has a million systems registered with authorities, and an estimated four million systems altogether. BSW Solar, the German solar trade association, reports that 435,000 plug-in solar installations were registered in Germany in 2024, out of a total one million new solar PV systems.

Germany and other European countries have higher retail electricity prices than the US average, due partly to high utility taxes. European electricity taxes average 22% of bills. The Ukraine war disrupted natural gas supplies, further raising energy prices.

As the market for plug-in solar has expanded in Europe, the price of plug-in solar systems has dropped. In Germany, *Balkonkraftwerke* systems are available for sale through Ikea, with a 1 kW system (two panels and a microinverter) going for about $540 for Ikea members.

Figure 3: IKEA plug-in solar offerings in Germany

Source: Svea Solar

What are the potential impacts for the electricity system?

The cumulative grid impacts of plug-in solar are the same as any other kind of BTM solar. They all result in reduced daytime net demand and can reduce nighttime load when paired with batteries. While individual plug-in systems are small, if deployed in large numbers, they can add up to a substantial effect. The estimated four million German systems would deliver around 3 gigawatts (GW) of daytime generation (compared to about 100 GW of distributed and utility-scale solar in Germany).

Like all BTM resources that reduce power purchases, plug-in solar reduces revenue to utilities. If delivery grid costs are collected through volumetric rates (¢/kWh) then less revenue will be collected to cover grid costs.

Given their small output relative to a house or apartment load, plug-in solar systems are unlikely to have many technical impacts on local distribution grids, which are sized for load and peak demand.

What are the barriers in the United States?

Since policymakers are only beginning to contemplate plug-in solar, many of the policy barriers to it have not been addressed. They are likely to center around financial accounting, interconnection rules, and safety certification.

Accounting policies like net energy metering (NEM) and net billing, as well as interconnection rules are usually applied only when solar systems export power to the grid and go through the interconnection process. If a system is configured to avoid exports, policies for grid-connected systems will presumably not apply. Further, where regulations allow, systems could simply export to the grid without receiving compensation, as in the Utah legislation.

In California, customers who already have NEM agreements because of a rooftop installation can add plug-in solar to expand their existing system by up to 1 kW without utility permission or review. Brightsaver offers 1 kW "net metering expansion" kits to California customers. Because exports are already permitted under the NEM or net billing contract, this simply increases daytime generation.

Safety certification hinges on how system components and the system as a whole are and will be treated by local permitting agencies, UL (formerly Underwriters Labs), and the National Electrical Code (NEC).

A peer-reviewed research article by Daniel Gerber et al. goes in depth on electrical safety and certification issues for plug-in solar. In short, local permitting agencies generally have jurisdiction over electrical issues in buildings, but not over plug-in appliances, which are covered by Nationally Recognized Testing Laboratories (NRTLs) like UL. Permitting agencies and UL both tend to follow the NEC. Because the NEC does not explicitly address plug-in solar (neither the appliance itself nor electrical issues related to plugging it in), the current language is subject to interpretation.

The article concludes:

> *We find plug-in DERs [distributed energy resources] to have several viable market pathways today, including approaches that use zero-export technology to enable installation without an interconnection agreement. However, key technical issues remain that could pose fire and safety risks, highlighting the need for a new UL standard to test plug-in DERs. While UL standards cannot override the NEC, the most problematic NEC provisions appear to stem from interpretation rather than explicit prohibitions, suggesting that a new UL standard is feasible. ... Ultimately, a UL standard tailored to plug-in DERs will be essential to overcoming many of the remaining regulatory hurdles.*

NEC standards are revisited every three years, most recently in 2023. UL is currently researching plug-in solar safety standards. They released a white paper in December 2025 on "plug-in photovoltaics" (PIPV) and are pursuing an Outline of Investigation (UL3700) "to further define requirements for safety and compliance in plug-in PV as technology evolves." The white paper concludes that "allowing PIPV to be plugged in to any existing branch circuit with no mitigation for the above concerns is not supported by UL Solutions. There are potential engineered solutions that can be applied and will be necessary to promote safe use of PIPV products."

A wildcard barrier could be attitudes about plug-in solar from landlords and homeowner associations (HOAs). Since plug-in solar is portable, it may be appealing to tenants, but landlords may not allow tenants to put solar panels on balconies or in other locations. Many US states have adopted "solar access laws" that override HOA restrictions on rooftop solar. Those laws may or may not also apply to plug-in solar. A number of European jurisdictions have addressed this issue, as discussed below.

Is plug-in solar safe?

The analysis by Gerber et al. identified three safety issues around plug-in solar: touch safety, bidirectional Ground Fault Circuit Interrupters (GFCIs), and breaker masking.

Touch safety

Touch safety refers to the risk that a person would unplug an active solar system, accidentally touch the prongs of a plug while it is still electrically connected, and get a shock. American plugs (NEMA 15-50) can be touched while partially pulled out of a socket and still conducting a current. European sockets (Schuko) are recessed into the wall to reduce that hazard. The safety risk is true of any appliance plugged into an outlet, but more so for solar panels when they are generating in sunshine; their microinverter will also cut off power, possibly quicker than a GFCI.

Figure 4: American NEMA 15-50 outlet (left) and European Schuko outlet (right)

Bidirectional Ground Fault Circuit Interrupters

GFCI capability is built into some 120 V outlets to cut off power in event of a ground fault. They are commonly used next to water sources, like bathroom or kitchen sinks, or outdoors. GFCIs on the market today are not rated or tested for their ability to handle electricity flow in both directions, and little research has been done on the issue. If a plug-in solar system is plugged into a GFCI outlet, it may not correctly interrupt ground faults, and in rare cases become damaged, preventing it from interrupting ground faults in the future. Informal testing for the Gerber et al. report found that some GFCI outlets could manage bidirectional flow without problems, and others could not.

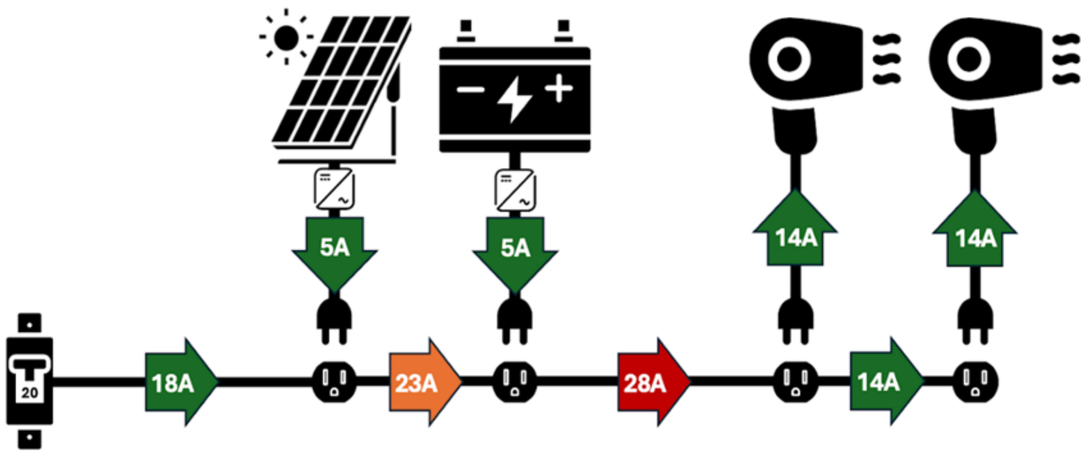
Figure 5: GFCI outlet

Breaker masking

Breaker masking refers to the case when the amount of current on a circuit exceeds the breaker limit, resulting in overloaded wires. Figures 6 and 7 illustrate acceptable and dangerous examples on a circuit with plug-in solar.

In the problematic example (Figure 6), an excessive amount of load is put on a circuit, such as two 14 A hairdryers at the end of a 20 A circuit. This would normally trip the breaker, protecting the line from overheating. But a plug-in solar system upstream from the load reduces the amperage seen by the breaker, preventing it from seeing the overload and cutting off the line.

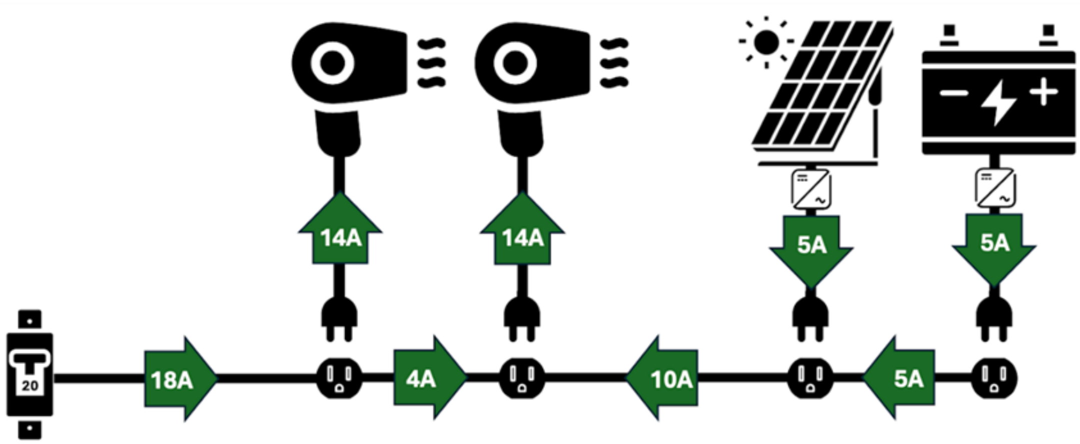
Figure 6: Illustration of the breaker masker problem



In this example, the breaker does not trip despite there being 28 A on a section of a 20 A circuit. *Source: Gerber et al.*, [Barriers to Balcony Solar and Plug-In Distributed Energy Resources in the United States](#).

On the other hand, a solar system put at the end of the same circuit would supply the hair dryers and reduce overloading on the circuit (Figure 7).

Figure 7: Plug-in solar that does not cause a breaker problem



In this case, plug-in solar at the end of the branch would likely not cause a problem, but this placement requires precise knowledge of the circuit. *Source: Gerber et al.*, [Barriers to Balcony Solar and Plug-In Distributed Energy Resources in the United States](#).

Similarly, the most solar a dedicated 20 A circuit at 120 V could handle is 2.4 kW. More solar watts would overload the circuit and trip the breaker. A more powerful 240 V circuit, or a higher amp limit, would allow for more generation.

NEC could address these safety issues with testing and input from UL.

Suggested solutions

A recent white paper from UL explores the three safety risks outlined above and suggests a few solutions:

- Development and certification of bidirectional GFCI receptacles.
- Putting the plug-in solar system on a dedicated circuit, with no other load plugged into that circuit, would reduce the risk of overload and breaker masking. Using a plug and receptacle designed for a plug-in solar system, rather than the standard 3-prong (NEMA 5-15) design, would reduce touch risk, and could incorporate bidirectional GFCI and over-current protection.
- A home could have a dedicated circuit with a specific plug-in solar receptacle to prevent users from plugging in at less safe locations.
- Inverters could have bidirectional GFCI and over-current protection built in.
- Putting a special receptacle at a specific place in a home to prevent users from plugging in at less safe locations.

Note that some of these solutions would result in increased costs due to either special equipment or the requirement to use an electrician, making plug-in solar less appealing.

The UL white paper was written as input to a forthcoming "Outline of Investigation" that could lead to a system-level standard for plug-in solar, likely requiring a unique plug and receptacle, plus bidirectional GFCI and overcurrent protection.

What is the regulatory status in the United States?

So far only one state, Utah, has an explicit policy treating plug-in solar. Additional legislation is under discussion in Vermont and New Hampshire, and in several other states.

There may already be plug-in installations in some states, since no state or jurisdiction explicitly prohibits them. Small solar systems and components have been available for some time, including an active market for RVs and camping.

Utah's HB340 (2025) created a new class of customer generation called a "Portable solar generation device." According to the law, this category:

a) has a maximum power output of not more than 1200 W;
b) is designed to be connected to a building's electrical system through a standard 120 V alternating current outlet;
c) is intended primarily to offset part of the customer's electricity consumption;
d) meets the standards of the most recent version of the National Electrical Code; and
e) is certified by UL or an equivalent nationally recognized testing laboratory.

Further, the law restricts utilities from requiring fees or extra equipment, and it exempts utilities from liability for any damage caused by the systems. It also requires "anti-islanding" capability to cut off generation during grid outages, which is standard in modern micro-inverters.

Plug-in solar system installed on a rooftop in Berkeley, CA. Photo Credit: CESA.

Most notably, Utah's legislation exempts plug-in solar systems from net metering. This means that power can be exported to the grid, but system owners receive no compensation from utilities, such as through a net metering bill credit. Utilities in Utah use modern digital meters that track imports and exports, and any exported power would be essentially gifted to the utility. Installing a battery and a monitoring and control system would retain all the power for self-consumption and eliminate exports.

How does it relate to net metering / net billing?

A key regulatory issue with plug-in solar is whether electricity will be exported to the grid, which would make the system subject to interconnection requirements and accounting protocols (net energy metering or net billing), just like conventional BTM systems.

A customer with plug-in solar will be subject to one of the following regulatory options for exported energy:

- Exports are not allowed
- Exports are valued at retail rates (net metering)
- Exports are valued at a lower wholesale or avoided cost rate (net billing)
- Exports are exempt from regulation, meaning exports are not compensated

If the plug-in solar system is only powering loads within the building at all times, with no exports, there are few if any regulatory issues other than safety and consumer protection. To avoid exporting energy, systems can be sized never to exceed instantaneous demand, which is more likely for homes with large and continuous daytime loads, such as from central air conditioning or a pool pump. Alternatively, solar panels and appliances can be connected to a battery, without contacting the home's wiring, in a kind of mini-microgrid.

Otherwise, plug-in solar systems must communicate with a power meter connected to the building's electrical panel to detect the level of energy demand at all times. This requires additional communication and control hardware, likely installed by a qualified electrician. In such a system, when solar generation exceeds household demand, surplus energy is directed into a battery, or curtailed. This more sophisticated plug-in solar system is closer in cost and functionality to a conventional distributed solar system, though it could be a DIY installation depending on the hardware used.

Largely uncharted territory is the idea of using plug-in solar and battery systems in virtual power plants (VPPs), in which a network of customer-sited energy resources can be dispatched en masse to support grid efficiency and reliability. Increasingly capable inverters may be able to communicate with VPP aggregators and markets, and change operations in response to price signals. Given the small size of plug-in systems, this may not be financially practical.

Terminology: Net metering vs. net billing

There are two approaches to accounting for BTM solar power generation when generation exceeds customer demand and electricity is exported to the grid.

With **net energy metering** (NEM), imports and exports are metered together, resulting in a net total (positive or negative) at the end of a billing period. A value per kWh is applied to the net to determine the amount billed (or credited).

With **net billing**, a modern two-way electricity meter tracks imports and exports separately. Imports are charged at the retail rate, and exports are credited back to the customer at a lower wholesale or “avoided cost” rate. This determines the net dollar amount billed each month.

States and utilities are increasingly moving away from NEM toward net billing and other mechanisms, prompting an increase in solar + battery systems that avoid exports. For the current status of policies, see the North Carolina Clean Energy Technology Center’s DSIRE summary maps for net metering.

How is plug-in solar regulated in Europe?

Although Germany is the most notable home of plug-in solar, and has the most complete set of policies, other European countries are developing policies and seeing market activity.

Solar Power Europe has a roundup of European policies:

Subsidies: Germany, Austria, and Lithuania offer either upfront financial support such as capital subsidies or reductions in the Value Added Tax (VAT), or production incentives in the form of feed-in tariffs (FITs) or net metering.

Rebates in Germany are offered mostly by state and local governments, and many are aimed at low-income households. Bonn for example covers 90% of the cost of a kit for low-income households, compared to 60% for other residents, while Heidelberg covers the full cost as part of a "care-package." Plug-in solar, like all solar systems under 10 kW, can be configured to receive a feed-in tariff of 8.4¢/kWh for energy exported to the grid, well below retail rates.

Bans: Plug-in solar is legal in all EU Member States except in Sweden and Hungary. Sweden requires safety measures including use of an electrician that effectively prohibit plug-in installations, while Hungary simply bans it.

Registration required: While balcony systems have been popular for several years, Germany started a simple online registration form in 2024, which has collected over 1 million registrations so far (out of possibly 4 million total). Utilities were concerned about a lack of visibility into how many homes have plug-in solar and where they are located. Italy, Portugal, Lithuania, Switzerland, and Greece also require notification to utilities.

Government permits: Lithuania exempted plug-in solar from needing a construction permit in 2024 but still requires that neighbors be notified.

Landlord / HOA permission: Germany amended its Rental Contract Law to deem plug-in solar a "privileged measure," guaranteeing tenants the right to obtain approval from their landlords or housing association, unless the landlord can prove the installation would be unsafe. Belgium requires permission from a housing association.

Technical requirements: The AC output of inverters for plug-in systems is limited to 800 W or below in all EU countries. This is due to the broader European regulatory framework for electricity, which applies to generators at or above 800 W. Below that threshold, member states can regulate power generation more freely. Regulations from 2024 state that "Member States may promote the introduction of plug-in mini-solar systems of up to 800 W capacity in and on buildings." Switzerland, which is not part of the European Union, uses a lower maximum of 600 W AC, as does France.

Some countries also limit the DC capacity of the panels. (As noted above, the DC generation capacity of panels can be higher than the AC output of the inverter.)

The German Commission for Electrical, Electronic & Information Technologies (DKE) published in December 2025 the world's first safety standard for plug-in solar "as a complete system." It sets a maximum AC output of 800 W, and a maximum DC input of 960 W, or up to 2,000 W if a special "Wieland" plug is used. DKE is developing a product standard for plug-in batteries.

There are plug-in kits available on the European market today as large as 6 kW total output and up to 25 kWh of battery storage, to maximize self-consumption. They then use an energy management system that caps energy exports at 800 W AC.

In Spain, legislation requires plug-in installations to be permitted, installed by a licensed electrician, and be on a separate circuit. They are exempt from getting a grid connection permit if they have controls that ensure no surplus goes to the grid. Vendors like Robisun, Anker, and Marstek sell "zero-feed-in" hardware to prevent exports.

Likewise in France, energy exports are not allowed from plug-in systems, and the customer must submit a "Convention of self-consumption without injection to the grid" to the utility. Systems that export must be installed by a licensed electrician.

What is the policy agenda needed to make plug-in solar happen in the US?

Plug-in solar advocates, such as Brightsaver, recommend a policy approach like the one embodied in the Utah legislation. Policies supporting plug-in solar might include the following elements:

- Define a new class of small photovoltaic systems no larger than 800 or 1,200 W (or some other appropriate size).
- Exempt these small systems from utility interconnection requirements and from net metering.
- Require product safety certifications.

For safety certification, UL and Gerber et al. recommend promulgation of UL standards that address touch safety, breaker masking, and bidirectional GFCIs.

As a new consumer product, states may want to promulgate consumer protection requirements, such as for claims about savings, regulations, and safety. To encourage safe DIY installations, agencies, utilities, or marketers should develop clear guidelines, plus educational and how-to materials.

Because plug-in solar has lower up-front costs and can be deployed by renters, states may also want to incorporate plug-in solar into existing low-income solar programs. Plug-in solar systems could be subsidized for households with high energy burdens, with bill arrearages, or that participate in energy assistance programs. Programs could provide installation assistance to ensure safety, education about the systand clear guidelines about costs and benefits.

Solar systems with batteries may also be promoted to households that rely on powered medical equipment, or that suffer from frequent power outages.

What questions should state legislators and state energy agencies consider?

- What should the maximum size of plug-in systems be?
- Should energy exports to the grid be allowed? Should there be a size limit for exporting systems?
- How should plug-in systems relate to net metering or net billing? Should energy exports be compensated, and at what level?
- Are current product safety standards sufficient?
- Under what circumstances, if any, should building or electrical permits be required and installations inspected?
- Is it necessary for utilities or local/state officials to register systems?
- How should officials encourage or regulate market development? Should vendors be registered or pre-approved? What scrutiny is required to ensure vendors are selling safe and effective products?
- Are incentives desirable, such as rebates or production payments, perhaps to broaden access to this technology for low-income households?
- How can plug-in solar be incorporated into existing low-income solar programs?
- Should batteries be encouraged or required?
- What should officials do for consumer protection and to encourage safe installations and fair sales practices? What information should manufacturers and distributors be required to provide regarding installation, connection, operation, or utility savings claims?
- In what circumstances should the use of an electrician be required?
- Is it worthwhile to include plug-in solar + battery systems in VPP or demand response programs?

Additional reading

- *Safety Considerations for Plug-In Photovoltaic (PIPV) Systems*, UL Solutions, December 12, 2025.
- *Plug-In Solar Bills Are in the Works in New Hampshire and Vermont*, Sarah Shemkus, Canary Media, September 23, 2025.
- *Why Balcony Solar Panels Haven't Taken Off in the US*, Akielly Hu, Wired, May 3, 2025.
- *Balcony Solar Comes to California*, John Fitzgerald Weaver, PV Magazine, April 25, 2025.
- *Barriers to Balcony Solar and Plug-In Distributed Energy Resources in the United States*, Daniel L. Gerber, Achim Ginsberg-Klemmt, Lyn Stoler, Jordan Shackelford and Alan Meier, *Energies*, April 20, 2025.
- *Utah H.B. 340 Solar Power Amendments*, Utah Legislature, March 25, 2025.
- *Plug-In Solar PV: Solar for All - A Deep-Dive on a Fast-Emerging PV Segment*, Solar Power Europe, March 2025.

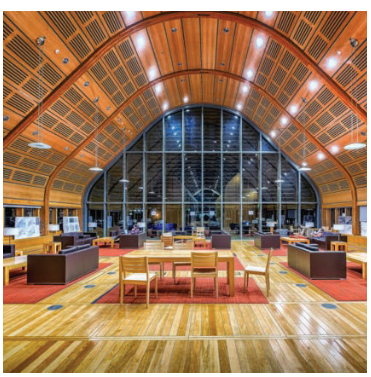












Row 1 (L-R): CESA; Resonant Energy; CESA; Bigstockphoto/DavidM199. Row 2 (L-R): Portland General Electric; CESA; Murray Carpenter/Maine Public.
Row 3 (L-R): Orsted (US Offshore Wind; CESA; Solara/California Energy Commission; iStockphoto/Fotomax. Row 4 (L-R): Tom Piorkowski; CESA; Shutterstock/Soonthorn Wongsaita

ABOUT CESA

The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy. CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country. CESA works with state leaders, federal agencies, and other stakeholders to develop and promote clean energy programs and markets, with an emphasis on renewable energy, energy equity, financing strategies, and economic development. CESA facilitates information-sharing, provides technical assistance, coordinates multi-state collaborative projects, and communicates the views and achievements of its members.

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