

**ENERGY STORAGE**

ISSUE BRIEF



# Program Design for Battery-Based Virtual Power Plants

**CleanEnergy**StatesAlliance

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February 2026



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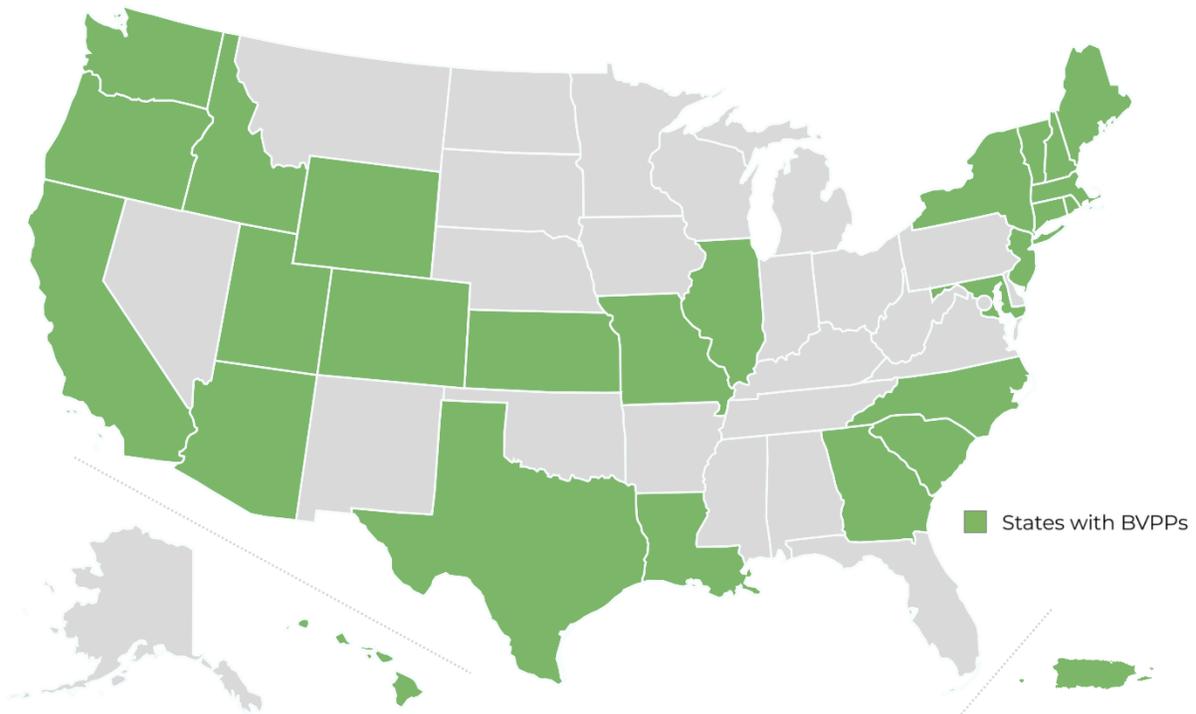
## Introduction

The first commercial battery-based virtual power plant (BVPP) was launched in 2014 as a collaboration between Stem and Southern California Edison. In the decade since, BVPPs have proliferated, with at least 26 states plus Puerto Rico now offering BVPP programs in at least some of their utility territories (see Figure 1). More such programs are currently being developed in numerous state energy agencies and utility regulatory dockets.

This issue brief surveys and summarizes the characteristics of existing BVPPs, discusses design elements such as battery ownership and compensation mechanisms, and provides a high-level overview of the current state of BVPPs in the United States.

For a comprehensive list of BVPP programs across the US, see CESA's Virtual Power Plant Programs Summary Table, available at [www.cesa.org/projects/energy-storage-policy-for-states/virtual-power-plant-programs-summary-table](http://www.cesa.org/projects/energy-storage-policy-for-states/virtual-power-plant-programs-summary-table). This table includes program details and links to program websites.

**Figure 1**  
***Map of Battery-Based Virtual Power Plant Programs in the United States***



*There are active battery-based virtual power plant programs in at least 26 states plus Puerto Rico.*



## What is a Battery-Based Virtual Power Plant?

A BVPP is an aggregated system of distributed energy resources that includes battery storage. Enrolled customers are called upon to provide grid services, for which they are compensated.

Under this definition, a BVPP:

- Provides an aggregated grid service (such as peak demand reduction), for which participating customers are compensated in some way. Distributed battery incentives/procurement alone do not comprise a BVPP.
  - Customer compensation can take many forms, including rebates, performance payments, bill credits, free or discounted equipment, and resilience.
- May include other resources, such as distributed generation and controllable loads.
  - The combination of batteries with solar PV, EVs, managed EV chargers, smart thermostats and water heaters, traditional efficiency measures and electrification can create powerful and cost-effective BVPPs.
- May include batteries owned by customers, utilities, or third parties.
- May be administered by utilities, state agencies, third-party developers/aggregators, or combinations of these.

## Characteristics of BVPPs

Existing BVPP programs necessarily vary from utility to utility and state to state. For example, BVPP battery ownership in states with deregulated energy markets, where utilities may not be able to own energy storage assets, may look different from ownership in traditionally regulated states, where electric utilities are vertically integrated. In addition to the question of who owns the batteries, there are other variables including which entity administers the program; which technologies are eligible to participate; what types of incentives are offered to participants; what rates are offered for cash or bill credit incentives; whether affordability provisions are offered to help lower-income customers participate; what types of customers are eligible to participate; duration of enrollment contracts; what types of grid services are provided; and whether and how third-party developers and aggregators may participate. The answers to these questions are essential to defining the operating structure of the BVPP.

Despite these variables, there are many commonalities between BVPPs, such that a set of common practices is emerging. These common practices include:

- Most BVPPs are administered by utilities, often in partnership with aggregators.
- Most enroll residential customers; some are also open to commercial customers.
- Most enrolled batteries are owned or leased by customers; a few programs feature utility ownership.



- Most programs employ a contract between the customer and the utility or third-party aggregator, with durations ranging from 1-10 years.
- Only a few include affordability provisions (carve-outs, incentive adders, low-cost financing), but this is becoming more common.
- Grid services vary, with peak demand reduction being the most common service provided by BVPPs; however, a few BVPPs provide other grid services. These include:
  - Air emissions reduction
  - Frequency regulation
  - Resource adequacy
  - Distribution system investment deferral
  - Increased deployment of distributed generation
- Customer compensation mechanisms also vary, and may include:
  - Annual or monthly flat rate compensation/bill credit
  - Performance payments based on kWh of load reduction/power export
  - Up-front rebate/enrollment incentive
  - Free or discounted equipment
  - Host facility resilience
- Most BVPPs were launched in 2019 or later (a few pilots were developed earlier). Currently, program creation is occurring at various levels:
  - Regional utilities like Eversource, National Grid, Duke, Evergy, and PG&E have established BVPP programs across multi-state service territories.
  - Third-party developers/aggregators like Tesla and Sunrun have launched programs in various areas where they can partner with utilities.
  - Grid operators, such as ERCOT in Texas, and state energy agencies, such as the California Energy Commission, have created BVPPs that allow participation by utilities and third parties.
- Programs often begin as pilots, with some programs beginning as smart thermostat or water heater programs and later adding batteries.
- Most BVPPs incorporate distributed energy resource management systems (DERMS) and smart meters.
- Typically, the utility and/or aggregator remotely dispatches BVPP resources, with customers having an “opt-out” option.
- Most programs only discharge batteries to a set minimum capacity, leaving enough power to cover unexpected outages and preserve battery life.
- Batteries are usually not dispatched when a grid outage seems possible, for example when a storm is approaching.



- Many programs provide a list of eligible batteries and/or inverters; customers must choose from this pre-approved equipment list in order to participate in the BVPP.

## Examples of BVPPs

Some example programs are briefly summarized below. For a comprehensive list of BVPP programs, see CESA's Virtual Power Plant Programs Summary Table, available at [www.cesa.org/projects/energy-storage-policy-for-states/virtual-power-plant-programs-summary-table](http://www.cesa.org/projects/energy-storage-policy-for-states/virtual-power-plant-programs-summary-table). This table includes program details and links to program websites.

### **ARIZONA: APS Storage Rewards Pilot Program**

In 2025, Arizona Public Service Company (APS) approved a 5-year BVPP bring-your-own-device (BYOD) pilot that will enroll up to 5,000 residential customers. Participants will receive an annual performance incentive payment of \$110/kW exported to the electric grid during called events, based on a seasonal average. The BVPP is intended to provide peak demand reduction services. Participating customers agree to participate in up to 60 events per year, with each event expected to last one to four hours; events will occur between 4:00 P.M. and 10:00 P.M. from May 1 through October 31.

### **CALIFORNIA: Self Generation Incentive Program (SGIP)**

SGIP launched in 2001 as a peak load reduction program supporting customer-sited solar PV. In 2011 it was refocused on greenhouse gas (GHG) emissions reduction, with energy storage as an eligible technology, and in 2016 75% of the SGIP incentive budget was dedicated to supporting distributed energy storage. Between 2019-2020, the original 100% rebate incentive was changed to a 50% rebate, 50% performance incentive structure, with performance payments linked to dispatch on CAISO GHG emissions signals. The program was also recapitalized with \$1.2 billion, approximately half of which was dedicated to an "equity resilience" rebate (\$1,000/kWh) that covers close to 100% of the cost of an average energy storage system for qualifying customers (directed mainly toward low-income customers in wildfire outage areas).

According to the most recent SGIP program evaluation report,<sup>1</sup> between the program's inception in 2001 and the end of 2023, it incentivized 46,222 installations representing roughly 1,727 MWh of energy storage capacity and 312 MW of generation capacity. More than 97% of the storage installations are residential, but due to capacity differences between typical residential and commercial projects, overall program capacity is roughly equal between the residential and non-residential sectors. Program evaluation has shown that once incentives were aligned with dispatch according to GHG emissions signals, the program was successful in reducing GHG emissions.

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<sup>1</sup> *Self-Generation Incentive Program: 2023 SGIP Impact Evaluation*, Verdant Associates, March 2025, [www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/self-generation-incentive-program/2023\\_sgip\\_impact\\_evaluation.pdf](http://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/self-generation-incentive-program/2023_sgip_impact_evaluation.pdf).



### **CONNECTICUT: Energy Storage Solutions Program**

ConnectedSolutions launched in Connecticut in 2021. It was originally developed as a thermostat program, with batteries added as a pilot in Massachusetts in 2016. Batteries were permanently added to the Massachusetts program in 2019, and this was subsequently duplicated in other states by the utilities that administered it (in this case, Eversource, which serves Massachusetts, Connecticut and New Hampshire). By design, ConnectedSolutions is part of the Advanced Demand Management portion of the statewide energy efficiency program. Customers who own or lease batteries enroll them with their electric utility under a 5-year contract; the utility dispatches the batteries for peak demand management, and customers receive performance payments based on actual kWh delivered.

In 2022, ConnectedSolutions in Connecticut was replaced by Energy Storage Solutions. The new program is no longer part of the state's energy efficiency program but is co-administered by the utilities and the Connecticut Green Bank. Residential and commercial customers receive an up-front rebate from the Green Bank, and performance payment from the utility. The residential up-front incentive ranges from \$162.50/kWh to \$600/kWh, and the commercial up-front incentive ranges from \$73/kWh to \$182/kWh, depending on customer type and incentive step. There are also up-front adders for "priority customers," including critical facilities, grid edge customers, and customers replacing fossil fuel generators. Customers from low-income and underserved communities receive 2x rebate adder, including multifamily affordable housing facilities which are considered residential for the purposes of the program and thus qualify for the rebate adder. Performance payments start at \$200/kW summer and \$25/kW winter, and decline to \$115 and \$15, respectively, after the first five years of program operation.

The Connecticut program was quickly fully subscribed on the commercial side, but enrollments lagged on the residential side, leading program administrators to increase the residential incentives.

### **MAINE: Energy Storage System Program**

The Maine Energy Storage System Program is unique in two ways: first, it is restricted to commercial customers (there is a separate BVPP program in Maine for residential customers) and second, it does not provide a dispatch signal for participants.

The program launched in 2023 as a competitive procurement operated by Efficiency Maine Trust, the state's efficiency program. Commercial customers with behind-the-meter (BTM) energy storage systems greater than 20 kW are eligible to participate. Performance payment rates are \$200/kW of validated reduction in grid-supplied energy. Participating systems must be deployed at least 15 times per summer season. Each dispatch must be at least three hours in duration, and the ISO-New England load must be within 15% of the peak summer load for the discharge event to qualify. There is no dispatch signal; instead, determination of peak demand hours is the sole responsibility of the energy storage system owner.



### **NORTH CAROLINA: Duke Energy Power Pair**

Launched in 2024, the Power Pair program, administered by Duke Energy, offers an up-front rebate plus monthly performance payments to residential solar+storage customers enrolling in the BVPP. Up to 6,000 systems may enroll through 10-year contracts with Duke Energy. Incentives comprise a one-time \$0.36/watt-AC payment for solar panel installation up to 10 kW-AC, plus a one-time \$400/kWh for battery storage installations up to 13.5 kWh (up to \$5,400). Customers agree to provide a reliable internet connection and complete the steps necessary to provide access to operating data. Qualifying PowerPair installations that also enroll in Power Manager® Battery Control (allowing Duke to remotely control and discharge batteries) may be eligible for an additional monthly bill credit based on battery capacity, up to a maximum of 20 kW per home. Grid benefits from the program include peak demand reduction, increased solar adoption, and carbon emissions reductions.

### **TEXAS: Aggregate Distributed Energy Resource Pilot (ADER)**

In July 2022, the Public Utility Commission of Texas (PUCT) directed grid operator the Electric Reliability Council of Texas (ERCOT) to begin development of an Aggregate Distributed Energy Resource (ADER) Pilot Project. Phase 1 of the pilot was approved by the ERCOT Board in October 2022; the pilot is currently in Phase 3 and is anticipated to continue until wholesale market rules allow full participation by distributed resources. The pilot allows aggregations of residential distributed generation, storage and demand response resources to participate. There are currently three aggregated resources qualified to participate, with nine others in various stages of registration and qualification. The resources currently enrolled provide 5.5 MW of energy, 8.6 MW of non-spinning reserve service, and 8.8 MW of capability for ERCOT's Contingency Reserve Service.

Two BVPPs administered by Tesla Energy are active in the pilot: one aggregates Houston-area CenterPoint Energy customers and the other aggregates Dallas-area customers served by Oncor Electric Delivery Company. Tesla customers receive \$400 per year per enrolled Powerwall, plus \$0.05/kWh for energy exported to the grid through the Texas Sellback program (net metering). Tesla plans to move from a fixed annual credit to a monthly performance-based credit in the future.

### **UTAH: Wattsmart Battery Program**

Rocky Mountain Power participates in the Wattsmart Battery Program, which is also offered in Idaho, Oregon, Washington, and Wyoming. Both residential and commercial customers may enroll through a 4-year contract. Residential battery incentives include a \$400/kW enrollment incentive with a cap of \$2,000 per household, plus \$15/kW participation incentive beginning in year two. Commercial battery incentives include \$125/kW multiplied by the annual commitment term (formerly \$150/kW times the annual commitment term), plus \$15 per kW participation incentive beginning in year two. Grid services provided include solar shifting and voltage management.

### **VERMONT: Green Mountain Power Battery Leasing Program**

Launched in 2020, the Green Mountain Power (GMP) Battery Leasing Program is one of only a few BVPPs in which the utility owns the batteries. Residential customers host



batteries and make lease payments to the utility in return for backup power during grid outages. (GMP also offers a BYOD program for customers who own their own batteries, or lease from third party providers).

To participate in the program, GMP customers sign a 10-year lease with the utility. Payments are \$55/month or a single payment of \$5,500 (about one-third the installed cost for a single battery). In return, customers get a “whole home” resilience system (two batteries per home to provide long-term resilience) at a steeply discounted rate. This “resilience subscription” model is similar to other subscription services such as cable television and internet services. GMP installs and maintains the batteries, discharging them for peak demand reduction and frequency regulation. At the end of the useful life of the batteries, GMP removes and recycles them.

This program model has proved to be very popular: GMP had placed more than 4,800 batteries behind residential meters and the program had a 2-year waiting list before the regulator lifted the enrollment cap. In 2024, the Vermont PUC approved GMP’s new Energy Storage Access Program, which offers free 10-year battery leasing for low-income customers.<sup>2</sup>

## Best Practices

Some BVPP best practices have emerged from program experience to date. Discussion of some of these items follows.

- Programs should incorporate affordability provisions (carve-outs, incentive adders and low/no-cost financing) to ensure broad accessibility.
- Programs should employ both up-front rebates/enrollment incentives and performance payments.
  - Up-front payments help defray capital costs.
  - Performance payments ensure batteries are dispatched optimally to achieve desired benefits.
- Contracts should be 7-10 years with locked payment rates, to make projects financeable; if shorter contracts are used, a renewal option should be offered.
- A variety of ownership options should be allowed (utility owns, customer owns, customer leases).
- Programs should allow participation by third-party aggregators.
- Programs should allow as wide a variety of equipment options as possible, to avoid shutting out customers who choose off-list equipment.

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<sup>2</sup> For more information on the pilot program that established the BVPP model for GMP, see: *McKnight Lane Redevelopment Project*, Clean Energy Group, accessed February 2026, [www.cleanegroup.org/initiatives/technical-assistance-fund/featured-installations/mcknight-lane](http://www.cleanegroup.org/initiatives/technical-assistance-fund/featured-installations/mcknight-lane).



- When possible, programs should incorporate other existing BTM resources (solar, controllable loads, EVs/managed charging, etc.) to make the program more accessible and cost-effective.
- Program administrators should provide remote dispatch of enrolled resources, or a signal to alert participating customers when to dispatch their systems, with an opt-out option.
- Programs should offer battery decommissioning/recycling options for leased or utility-owned systems.

## Discussion

### Customer Compensation

Every BVPP includes some form of customer compensation; however, the forms of compensation vary from program to program. The most used forms of compensation are *rebates* and *performance incentives*.

*Rebates* reward participating customers for installing energy storage and/or for enrolling that storage resource into the BVPP. Rebates can take various forms including a single up-front payment and/or several annual payments. Up-front rebates are especially useful in helping customers overcome cost barriers to participation, essentially buying down the cost of battery storage. Rebates are also a good place to apply equity adders, since capital costs are a major barrier to participation by low-and moderate-income (LMI) and historically underserved communities.

*Performance payments* reward participating customers for the services they provide to the grid. This type of incentive is usually calculated seasonally based on actual kilowatt-hours of power delivered during events (when the BVPP administrator calls upon enrolled systems to deliver power). Performance payments are especially useful in directing energy storage services to serve grid needs and/or policy goals, such as peak demand reduction, GHG emissions reduction, or distribution grid investment deferral.

**Best practice:** Some of the most effective BVPPs combine a rebate with a performance payment. This lowers the cost barrier to participate while ensuring that battery services are provided at the most advantageous times, optimizing their value. Many BVPP programs achieve the same results by using rebates and contracts that spell out performance requirements.

Other forms of compensation include: free or discounted equipment, resilient/back-up power for the host's home or business, capacity incentives (based on the enrolled capacity of the battery), and locational incentives (based on the location of the resource on the distribution grid).



## The Role of Aggregators

Most BVPPs include an aggregator. The aggregator's job is to pull together numerous distributed energy resources into a program where they can be dispatched in a coordinated fashion.

In some cases, the aggregator is a developer who markets the program to customers, installs equipment, and enrolls blocks of customers into the BVPP. In other cases, the utility itself acts as an aggregator. A third-party aggregator may handle battery dispatch in some cases. In other cases, the roles of enrollment and dispatch are handled separately.

Numerous BVPP programs are the product of collaboration between an electric utility and one or more third-party developers/aggregators. For example, Peak Power Rewards is a partnership between Sunrun and utility PG&E. Southern California Edison's Emergency Load Reduction Program allows multiple aggregators, including Tesla, Sunrun, Swell Energy, and AutoGrid.

**Best practice:** Utilities and regulators should consider allowing third-party aggregators to participate in BVPP programs. They bring private money to the program and can extend the reach of the utility by marketing the program to customers, developing pipelines of projects, offering leasing and financing, and even handling dispatch in some cases. In programs that include commercial systems, which can require project-specific engineering and design, developers/aggregators can be useful in helping customers select and right-size the equipment that will meet both the needs of the customer and the requirements of the utility.

## Affordability

A subset of existing BVPP programs includes affordability provisions. These provisions are designed to make the program more accessible to all interested customers, including those who have lower incomes, home health needs, or who live in outage-prone areas. Affordability provisions are usually extended to residential customers, but some programs also offer them to commercial customers serving qualifying communities – for example, a school, church, municipal facility or first responder located in an historically underserved community and providing services, such as emergency services during grid outages, to members of that community.

Typical affordability provisions may include budget carve-outs, incentive adders and low- or no-cost financing.

### Budget Carve-Outs

Carve-outs, or “set-asides,” are basically a portion of the program budget that is dedicated to a specific purpose, in this case making the program more equitable by helping to overcome barriers that may prevent some groups of customers from enrolling. Budget carve-outs usually include the program incentive budget but may also include other budget areas such as education, outreach, and program marketing. A carve-out is a way of ensuring that a portion of the program budget remains available to underserved customers; without a carve-out, programs may be fully subscribed by wealthier early-



adopters, who can better afford to participate, probably have more ability to finance a solar+storage system, likely have better-quality building wiring, may be served by a more robust and modern distribution grid circuit, and likely have received more information about clean energy options.

### **Incentive Adders**

Incentive adders or multipliers are a way to increase the monetary subsidy for “equity”-qualifying customers, thereby reducing cost barriers. Incentive adders may be applied to various types of incentives. For example, a 50% rebate incentive adder would increase the rebate by 50% for qualifying customers, while a 50% performance payment adder would increase performance payment rates by 50% for those same customers. While adders don’t ensure qualifying customers will access the program, they do recognize and address cost barriers and can make projects and project pipelines in underserved communities more financeable for developers/aggregators.

### **Low- or No-Cost Financing**

Not everyone wants to or can own a battery, but for those who do want to own one, the availability of financing on good terms can make a crucial difference in their ability to purchase one. Developers may offer financing, but states should also consider offering no- or low-cost financing for customers who may not be able to qualify for or afford standard loan offerings. This is usually done through a green bank (for example, the Connecticut Green Bank co-administers Connecticut Energy Storage Solutions) or other state-sponsored program (for example, the Massachusetts HEAT loan program, which offers zero-interest loans for purchases of efficiency measures, including batteries, through the statewide energy efficiency program).

**Best Practice:** All three types of affordability provisions discussed above should be offered, since they each bring an important element to the table; but they are not the only types available. Other measures that have been used in BVPP programs include optional on-bill financing, and allowing multifamily affordable housing to qualify for residential LMI adders.

### **Ownership**

There are three basic models for battery ownership in current BVPP programs: customer-owned and third-party owned, both grouped under the “Bring Your Own Device (BYOD)” designation; and utility-owned, sometimes referred to as the utility leasing model.

- **Customer-owned:** In this model the customer owns the storage device enrolled in the program. If required, customer ownership will restrict enrollment, because it excludes those customers who lease battery systems (often as part of a hybrid solar+storage system).
- **Third party-owned:** This refers to batteries that are owned by a third party, such as a developer or aggregator, but sited behind the customer’s meter. Usually this means the customer is leasing the battery or has engaged in some other sort of contract with the third-party owner.



- **Utility-owned:** In this model the utility retains ownership of the battery, which is sited behind the customer’s meter. In some cases, the customer in this scenario leases the battery from the utility, essentially paying the utility for resilience services. In other cases, the utility provides the battery for free, on the condition that it is allowed to discharge it at need to provide grid services.

**Best practice:** Ideally, the broadest possible set of ownership models should be eligible to participate in the BVPP, meaning customers should be able to choose between owning, leasing, or hosting a utility-owned battery. (This third option may not be possible in states where utilities are barred from owning energy generation and storage.) For an example of multiple ownership options, see GMP’s BYOD and leasing programs in Vermont.

### Load Reduction Versus Power Export

Energy storage BVPPs may also include other technologies, such as controllable loads, which can increase the overall load-reducing capacity the BVPP is able to provide. For example, electric water heaters can stop drawing power during peak periods; thermostats can be turned up a few degrees to reduce air conditioning loads during peak summer hours; and EV chargers can be programmed to charge during the night, when electric demand is low. These controllable loads operate similarly to a traditional demand response program, with the exception that demand response has traditionally targeted very large commercial and industrial customers, while BVPPs tend to focus more on residential and small commercial customers. Because they are usually already paid for, controllable loads can represent a highly cost-effective addition to BVPPs.

If controllable loads are so cheap, why include batteries and solar in a BVPP? The answer is that while controllable loads can reduce demand behind the meter, solar can generate and export power to the grid, and batteries can both reduce demand behind the meter and export power. While power export and load reducing capacity may at first appear to be equivalent, there are important differences between the two:

- **Backup power:** While both batteries and controllable loads can be used to reduce the host facility’s demand for grid power, only batteries and solar can provide backup power to the host facility during a grid outage. To do this, the system must be configured so that it can “island” or disconnect from the grid during outages. Batteries can provide some islanded capacity by themselves, but adding solar PV to the system can extend the battery’s ability to provide backup power by allowing it to recharge during daylight hours.
- **Grid services:** Peak load reduction is an important grid service that can be provided by controllable load systems. However, there are other valuable grid services that cannot be provided simply by reducing demand behind the meter. For example, services that require power export, such as black start and some voltage regulation services, cannot be supplied by reducing load. Renewable power shifting is another grid service that batteries can provide, by storing excess energy during peak renewable generation periods, for example at midday when



the sun is high, and discharging that energy in the evening, when demand is high but solar is no longer producing.

- **Hosting capacity:** Distribution grids cannot accommodate unlimited amounts of power exported to the grid from behind customer meters. The grid’s ability to absorb and transmit such power is called “hosting capacity,” and there is always an upper limit. Hosting capacity can be increased through distribution grid upgrades, but the cost of these upgrades usually falls on the proposed project or projects that threaten to exceed the grid’s current hosting capacity. For this reason, the interconnection of new large BTM batteries and generators often requires a study to determine whether there is sufficient remaining hosting capacity in the local grid to accommodate them without additional investment. Small batteries, such as for residential and small commercial use, generally do not require a hosting capacity study because of their limited capacity. Controllable loads and batteries configured to prevent export never require a hosting capacity study because they do not increase the carrying capacity of the local grid.
- **Cost:** A key difference between batteries and controllable loads is that batteries usually require a capital investment, while controllable loads are often already paid for. This means that systems combining new costs (for batteries and solar PV, for example) with sunk costs (for HVAC systems or water heaters, for example) provide more dispatchable capacity for a smaller investment. Allowing existing controllable loads to be enrolled in a BVPP is a good way to make the program more accessible and reduce the payback period for customer investments.
- **Host facility load limitations:** One characteristic of controllable loads is that they can never be reduced to below zero. In other words, turning off an appliance can reduce its load to zero, but that is the limit of its capacity. Similarly, BTM batteries configured to prohibit power export to the grid can only reduce the host facility’s load to zero. If power remains in the battery at this point, there is no way to monetize it. By comparison, batteries configured to allow power export can reduce the host facility load to zero and then export their remaining energy to the grid, thereby exceeding the host facility load limit and allowing monetization of the battery’s full capacity. This becomes important when a host facility with minimal electric demand, such as a house or small commercial building, installs a larger battery, for example to ensure longer duration islanding during grid outages. In this case, the battery may be capable of storing more than the host’s peak load. If the BVPP program allows power export, the battery will be able to monetize its full capacity; this may not be the case if the BVPP allows load reduction only.



## Conclusion

In just ten years, BVPPs have become a fast-growing new model for adding distributed electrical capacity and supporting grid services in the United States. Adding to the momentum is the projected rapid growth of peak electricity demand in many areas of the country over the coming decade, which will likely accelerate the scale-up of BVPPs in these areas.

Although still in the formative stages, the BVPP model has matured sufficiently that common practices have emerged, and some best practices can be identified.

In the next few years, BVPPs will not only continue to spread, they will increasingly be combined with other distributed energy resources and strategies being pursued by states and utilities. These include electrification in the building and transportation sectors; energy efficiency in the building sector; grid modernization; transmission and distribution investment deferral; increasing demand for energy resilience in communities; and increasing use of BTM controllable loads as distributed demand response resources.

The intersection of BVPPs with these technologies, trends and strategies will require further work to ensure that the full potential of distributed energy resources is realized, and that resource aggregations operate efficiently, effectively and accessibly.



## Further Reading

Links to program webpages and documents can be found in the Virtual Power Plant Programs Summary Table on the [CESA website](#). Below are links to selected BVPP analysis and program evaluation resources.

### **Cost-Effectiveness of BVPPs:**

- [Real Reliability: The Value of Virtual Power](#), Brattle, May 2023.
- [The Demand Side Grid Support Program: An Assessment of Scale and Value](#), Brattle, December 2025.

### **National Survey of BVPP Programs by State:**

- [50 States of Virtual Power Plants and Supporting Distributed Energy Resources: 2024 State Policy Snapshot](#), Smart Electric Power Alliance, February 2025.

### **Select BVPP Program Reports and Analysis:**

- [California SGIP Evaluation Reports](#), California Public Utilities Commission, accessed February 2026.
- [Connecticut Energy Storage Solutions Performance Report](#), Energy Storage Solutions, accessed February 2026.
- [Energy Storage Pilot Program Interim Report](#), Maryland Public Service Commission, July 2024.
- [Massachusetts Connected Solutions Resource Page](#), Clean Energy Group, accessed February 2026.
- [Lessons Learned from Puerto Rico's First Virtual Power Plant](#), Clean Energy States Alliance, February 2026.

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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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