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Lessons from 2022

Powering States in 2023 and Beyond: Local Solar and Batteries as a Roadmap to Resiliency

Lessons from 2022: How States Must Put Local Solar & Batteries to Work in 2023 to Help Solve Capacity Constraints & Support the Grid

Increasing electricity demand is pushing our energy grids to the brink, increasing costs and risks for millions of Americans. Weather related power outages are leaving hundreds of thousands in the dark, with disproportionately high impacts to the most vulnerable populations. These grid events are costing us billions of dollars annually. To address this worsening crisis, we need to put every electron to work for the grid to minimize these risks and reduce the costs to citizens. Distributed Energy Resources (DERs), like rooftop and community solar paired with battery storage, offer a critical opportunity to leverage local electricity in a way that is affordable and increases resilience for millions of families and businesses. By aggregating these Distributed Energy Resources, in programs sometimes called Virtual Power Plants (VPPs) or Bring-Your-Own-Device (BYOD), states can increase resilience and reliability while lowering costs for all residents.

State regulators and elected offices need to act now to put DER programs in place before we are faced with yet another series of power outages.

The Problem is Widespread and Affects Millions. Now is the Time to Use Every Local Electron.

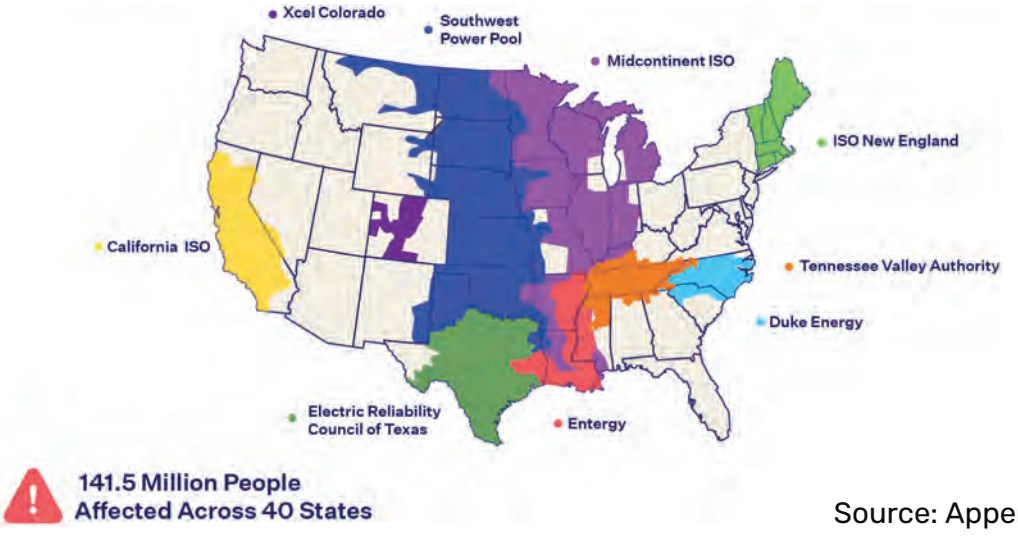
Capacity Constraints Require Grid Reliability to Avoid Outages and Lower Costs. The strained electric grids in many states face supply capacity constraints that are increasing energy costs and outages. In 2022, multiple energy markets and grid monitors warned of the potential for outages and blackouts due to capacity constraints, load growth, and extreme weather conditions. **Across the United States, more than 141 million people in more than 40 states, who were impacted by calls for conservation of electricity during times of peak use, face increased energy costs, or even blackouts.**[1] Regional Transmission Operators (RTOs) including the Midcontinent Independent System Operator (MISO), California Independent System Operator (CAISO), the Electric Reliability Council of Texas (ERCOT), ISO-New England (ISO-NE) and the Southwest Power Pool (SPP) issued warnings to energy customers in anticipation of grid capacity shortages for 2022 and beyond. Additionally, due to Winter Storm Elliot in December 2022, more than 1.2 million customers in the Tennessee Valley Authority (TVA), Entergy service territory, and Duke

[1] See Appendix 1

service territory in North and South Carolina lost power during rolling blackouts due to insufficient power on the grid to meet cold weather demand.[2] Further, the Midwest regional grid operator's initial report finds that more than one-fourth of natural gas generation went offline during Winter Storm Elliot, driving the Midwestern grid operator to take emergency steps to maintain reliability.[3] Notably, outages do not impact everyone equally. For instance, people who are food insecure are particularly harmed if food spoils during an outage. Those who rely on electricity for medical equipment or to refrigerate medical supplies are particularly vulnerable during outages. Unfortunately, the most vulnerable members of society often have no recourse during outages, even if they bear disproportionate harm from the outages.[4]

A particularly troubling example of racial and income disparities in electricity reliability comes from Minnesota. Researcher Garbriel Chan determined that Northside and Southside Green Zones in Minneapolis – areas with low-wealth individuals and communities of color – have a higher incidence of long-duration outages than other Xcel customers in Hennepin County (between 59% and 85% increased incidence) and in Xcel's overall service territory (between 32% and 35% increased incidence).[5] Additional research is necessary to determine if electricity reliability disparities based on racial and/or income exist elsewhere.

RTO & Utility Warnings and Blackouts in 2022 Due to Capacity Constraints



Source: Appendix 1

During a California heat wave in Fall of 2022, CAISO called on people to conserve their power from September 1 through September 8, and the grid narrowly avoided blackouts. This success was due in large part to the contribution of local solar and batteries. More than 80,000 distributed batteries are connected to the California grid, and these batteries can provide 900 MW of capacity to the grid, the equivalent of several natural gas power plants.[6] Due to existing policy constraints, only three quarters of the capacity of these batteries was exported to the grid during this time period, which still represented 684 MW of power.[7]

[2] Ibid.
[3] https://subscriber.politicopro.com/article/eenews/2023/01/18/midwest-power-plants-ran-out-of-gas-in-winter-storm-miso-00078153
[4] One exception is Connecticut, where in 2020 the Connecticut General Assembly passed Public Act No. 20-5 which requires electric distribution companies to compensate residential customers for harm due to outages (§§ 10-11).
[5] Minnesota Public Utilities Commission Docket No. E002/GR-21-630; Exhibit JSC-6 at 21.
[6] https://calssa.org/press-releases/2022/9/8/distributed-sun-charged-batteries-helped-grid-during-california-heat-wave-again
[7] https://calssa.org/press-releases/2022/9/8/distributed-sun-charged-batteries-helped-grid-during-california-heat-wave-again

Distributed Energy Resources (DERs) help manage costs caused by these capacity constraints. The tight oil and gas market could pose problems for grid operators, especially with the war in Ukraine sending fossil energy prices rocketing, with experts saying this is the most uncertain global geopolitical situation impacting energy in decades.[8] DERs like rooftop and community solar with battery storage offer an opportunity to utilize every electron in a way that is affordable and increases resilience for families and businesses. This is not just about potential outages. Utility bills are increasing as well from reliance on natural gas, which has increasing price volatility. All three of Florida's investor owned utilities, for example, requested rate increases due to this volatility.[9] Similar rate hikes have taken place across the United States, including in Connecticut and New England.[10]

Weather Outages Demand Local Resilience

In 2022, the United States suffered more than fifteen natural disasters which cost more than $1 billion each.[11] Many of these disasters led to extended power outages. The US experienced the most power outages of any developed country, and in 2020, utility customers experienced 1.33 billion outage hours.[12] In 2022, Hurricane Fiona left 3.3 million Puerto Ricans in the dark, with tens of thousands enduring an extended outage for two weeks.[13] But 50,000 solar and battery systems helped communities keep electrical devices charged and critical services running.[14] In Florida, Hurricane Ian took out power to 2.1 million customers and devastated entire communities in the southern part of the state.[15] These outages can be fatal, disrupt people's lives, and cost consumers an estimated $44 billion per year.[16] Local solar and batteries provide energy when needed most; for example, more households, businesses and community centers can also stay online when there are outages - helping reduce emergency calls. These outages are happening more frequently and from coast to coast, not just hurricane-prone states. They are impacting families and business in Ohio,[17] Wisconsin,[18] and Michigan where regulators called for investigations after major outage events.[19] This challenge will become more serious and widespread as extreme weather increases over the coming decades.

[8] https://www.nhpr.org/nh-news/2022-12-05/new-englands-grid-is-expected-to-be-reliable-this-winter-but-a-cold-snap-could-cause-issues
[9] https://cleanenergy.org/blog/florida-power-bills-to-spike-again-reliance-on-fossil-gas-largely-to-blame/
[10] https://www.ctpublic.org/news/2022-11-29/a-yale-professor-says-blame-vladimir-putin-for-big-eversource-and-u-i-electric-rate-hikes, https://www.wbur.org/news/2022/09/08/new-england-electricity-prices-natual-gas-utility-auctions
[11] https://www.noaa.gov/news/ian-is-15th-billion-dollar-disaster-year-so-far
[12] https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/us-power-outages-jumped-73-in-2020-amid-extreme-weather-events-62181994
[13] https://www.reuters.com/world/americas/about-746000-still-without-power-puerto-rico-after-hurricane-fiona-2022-09-26/#:~:text=About%20746%2C000%20still%20without%20power%20in%20Puerto%20Rico%20after%20Hurricane%20Fiona,-Reuters&text=Sept%2026%20(Reuters)%20%2D%20An,its%20roughly%203.3%20million%20residents, https://www.npr.org/2022/10/02/1126462352/puerto-rico-hurricane-fiona-luma-energy-power-outages
[14] https://www.npr.org/2022/09/21/1124283621/puerto-rico-is-in-the-dark-again-but-solar-companies-see-glimmers-of-hope
[15] https://floridapolitics.com/archives/561999-hurricane-ian-power-outages-largely-limited-to-four-counties/
[16] https://eecoordinator.info/wp-content/uploads/2018/10/Improving-the-estimated-cost-of-sustained-power-interruptions-to-electricity-customers.pdf
[17] https://ohiocapitaljournal.com/2022/07/13/state-regulators-to-question-aep-over-columbus-blackouts-today/
[18] https://www.tmj4.com/news/local-news/wisconsin-ranks-among-the-slowest-in-the-country-to-restore-power-after-a-storm
[19] https://www.clickondetroit.com/news/michigan/2022/10/05/michigan-commission-orders-audit-of-dte-consumers-on-power-outages-downed-lines/

More issues Coming in 2023

And the warning bells are already ringing for 2023 across the country.[20] Colorado utilities have stressed key projects needed to meet summer demands in 2023.[21] SPP and ISO-NE have raised concerns about winter peaking demands. For example ISO-NE expects peak demand for electricity in the winter of 2023 will be 20,009 megawatts if it sees normal weather conditions, higher than last winter's peak. While planned outages are not anticipated, ISO-NE has warned it will call for customers to reduce electricity usage in order to conserve energy supplies.[22]

Texas A&M Researchers estimate that ERCOT significantly underestimates the needed capacity to meet peak demand. "Prior to the 2021 winter blackout, ERCOT forecasted an extreme peak load of 67 GW. In reality, we estimate hourly peak demand was 82 GW, 22% above ERCOT's most extreme forecast and about equal to the best-case available power." DERs must be part of the solution to equitably and affordably meet these enormous capacity needs.[23] Additionally, state regulators, like in Iowa, are asking utilities for how they plan to manage the grid reliably under these warnings.[24]

In fact, the Smart Electric Power Alliance, a utility member organization, indicated they are now seeing clear signals from utilities of their interest in distributed energy resources, because of the increased interest in resilience from customers.[25] Encouraging pathways to customer-owned, market-driven DER participation in the program lowers the costs of solar & battery systems so that more households can benefit from solar resiliency.

This issue is not going away, and elected officials and regulators now must do everything in their power to make sure the lights stay on.

[20] https://wisconsinexaminer.com/2022/12/05/reliability-watchdog-warns-of-potential-electric-shortfalls-this-winter/
[21] http://coloradosun.com/2022/10/04/xcel-solar-energy-summer-peak-demand/
[22] https://www.iso-ne.com/static-assets/documents/2022/12/20221205_pr_winteroutlook_final.pdf
[23] https://eartharxiv.org/repository/view/2694/
[24] https://www.ktiv.com/2022/12/09/iowa-utilities-board-electric-grid-risk-not-having-enough-power-this-winter/
[25] https://sepapower.org/knowledge/clean-ders-to-the-rescue-solarstorage-as-back-up-generation/

DERs: Solutions Just Waiting to Be Deployed

Today, there are more than 51 Gigawatts (GW) of distributed solar installed across the United States, the equivalent of the power generated by about 51 nuclear power plants.[26] Local solar and batteries can reduce peak energy supply constraints and add reliability to the grid.

There is growing momentum across the country to utilize local solar and batteries as regulators, elected officials, and utilities recognize the ability of this technology to provide clean energy when we need it most. We need to ramp up our use of this cost-effective, dispatchable grid solution. This technology increases resilience on the grid and reduces localized pollution - all at a savings for ratepayers compared to costly centralized infrastructure and transmission. DER programs can be ramped quickly in the existing built environment. The delays facing large scale projects should be addressed, but in parallel. Commissions should be deploying localized solutions that can also benefit the entire grid. In conjunction with hosting capacity analyses, incentivizing distributed storage paired to solar and smart inverters in key locations can help address grid congestion and reduce the need for more expensive infrastructure upgrades. None of the old centralized infrastructure can offer the additional benefits to ratepayers of increased backup power in the event of outages and help to manage increasing energy bills. We don't have time to wait.

Virtual Power Plant

Virtual Power Plants use local power to share stored engergy with the community. The increase resilience and descrease cost for all.

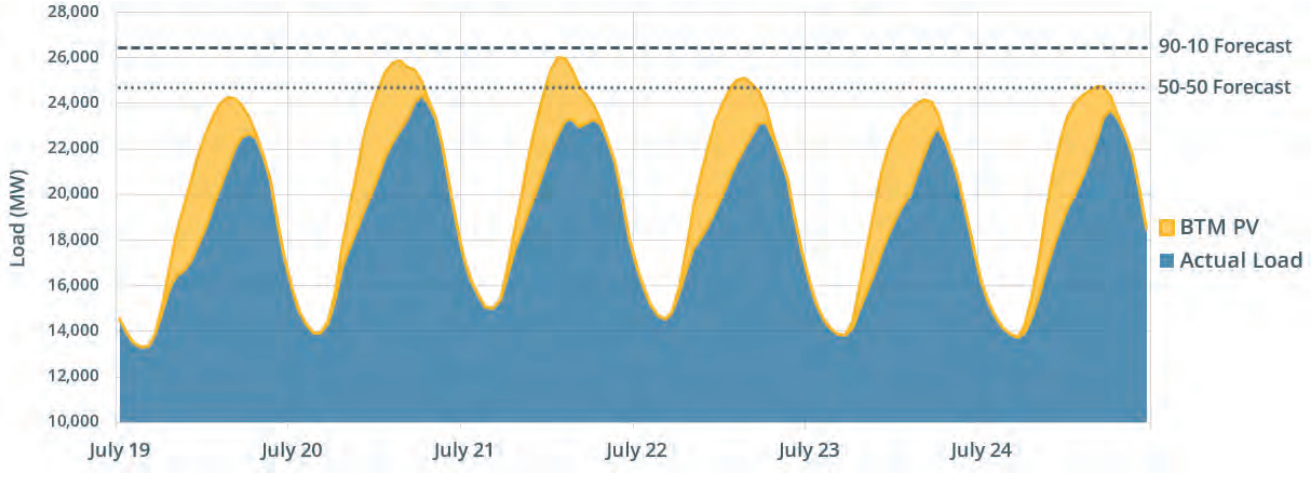
[26] https://www.woodmac.com/industry/power-and-renewables/us-solar-market-insight/

Proven Grid solutions

Already, home solar and battery customers are providing energy capacity, peak reduction and grid resilience and support in over 30 battery programs across the country, but these programs combine to access only a small fraction of the total available storage capacity.[27]

For example, in August 2022, ISO-NE released a report that showed that local solar helped reduce peak demand throughout their system, noting that, "behind-the-meter solar (BTM PV), meanwhile, tempered mid-day demand for grid electricity throughout the heat wave. On July 19, BTM PV generation reduced system demand by roughly 4,000 MW. Without contributions from BTM PV, system demand would have approached levels forecast for weather much hotter and more humid than average."[28]

ISO-NE System load and behind-the-meter solar, July 19-24, 2022



[27] Appendix 2

[28] https://isonewswire.com/2022/08/10/new-englands-power-grid-operates-reliably-during-six-day-july-heat-wave/

Recommendations Policy Makers Can Enact in 2023

The alarm bells have rung for over 141 million residents. Every state representing these impacted families and businesses must develop ways to use every electron to lower energy costs and keep the lights on. Millions of DERs are sitting on rooftops and in buildings across the U.S. just waiting to be deployed. By aggregating these Distributed Energy Resources (DERs) together, in programs sometimes called Virtual Power Plants (VPPs) or Bring-Your-Own-Device (BYOD) programs, states can increase resilience and reliability while lowering costs for all residents.

Aggregated DER programs enable utilities to reduce costs for all ratepayers by providing a participation pathway for customer-sited, non-utility owned batteries to provide the same grid service that the utility would otherwise provide or procure, but for less cost. For example, in many energy markets, transmission charges, capacity, or other wholesale market costs are attributed to each utility according to the percentage of the utility's regional load during a peak hour. Those costs are passed on to customers through rates. An Aggregated DER program designed to target peak demand reduction provides the utility a load management resource to help reduce its peak load and thereby lower costs for its customers. Because customers and their storage providers/aggregators finance and own the systems, ratepayer capital is not put at risk. Moreover, "pay-for-performance" programs ensure that participating devices are paid only for verified performance, further reducing ratepayer risk. Because customer-sited batteries are typically paired with solar, programs such as Bring-Your-Own Device target peak load reduction also contribute to a "cleaner peak" by reducing reliance on high emission rate "peaker" fossil fuel generating plants, thus providing cost savings and environmental and public health benefits.

Policymakers and regulators have a responsibility to citizens, who are also ratepayers, to develop pathways to leverage these resources. For example, the Public Utilities Commission of Texas (PUCT) approved a pilot program to use aggregated DERs to help meet grid needs.[29] The PUCT brought together stakeholders, utilities and market monitors, and in less than a year, created a pilot program which will demonstrate how an energy market can maximize all the electrons that are sitting in solar-paired batteries across the state. That is the kind of speed and partnership needed in other states.

RTOs and ISOs should recognize these benefits and create rules and pathways for DERs to serve wholesale capacity and reliability needs (following FERC order 2222). However, most RTO/ISO plans for complying with 2222 won't be implemented for years.[30] MISO is proposing a plan that will make it hard for aggregated DERs to participate by requiring load aggregation by node and will not implement it until 2030, further highlighting the need for state action.[31] While regional authorities can create opportunities such as those mentioned above, states are uniquely positioned and critical in program development - and importantly can implement policies and programs quickly.
It is up to the states to act. Here is what they can do:

[29] https://interchange.puc.texas.gov/search/filings/?UtilityType=A&ControlNumber=53911&ItemMatch=Equal&DocumentType=ALL&SortOrder=Ascending
[30] https://www.canarymedia.com/articles/policy-regulation/ferc-order-2222-experts-offer-cheers-and-jeers-for-first-round-of-filings
[31] https://www.renewableenergyworld.com/solar/miso-surprises-with-ferc-order-2222-implementation-date/

State Elected Officials

Governors and state legislators should direct public utility commissions to create programs as outlined below that leverage DERs to meet the state's capacity needs. Legislative directives can make policy intent clear and provide direction to the Commission to increase reliability, resiliency, and lower costs for customer-battery adoption. State legislatures can also ensure that there is a smooth transition for clean energy solutions by maintaining fair, reliable policy for solar-only resources, while creating pathways to use solar+battery resources. Some examples include:

Connecticut: SB 952[32] established Connecticut's energy storage deployment targets and requires the Public Utilities Regulatory Authority (PURA) to initiate a proceeding to implement programs, and associated funding, for customer-sited electric energy storage connected to the grid. PURA was directed to consider one or more programs and rate designs to incentivize energy storage connected to the grid that effectively leverage the storage value and achieve objectives including: provide positive net present value to all ratepayers; provide multiple types of benefits to the electric grid, including, but not limited to, customer, local, or community resilience, ancillary services, leveling out peaks in electricity use or that support the deployment of other distributed energy resources; foster the sustained, orderly development of a state-based electric energy storage industry; and maximize the value from the participation of energy storage in capacity markets. PURA must also consider configurations, programs and rate designs to incentivize the use of energy storage connected to the system that avoid or defer investment in traditional electric distribution system capacity upgrades.

Illinois: SB 2408,[33] known as the Climate and Equitable Jobs Act, is an expansion omnibus piece of legislation that among other things establishes a rebate for solar-paired storage that uses a smart inverter of $250/kWh or $300/kWh depending on the project configuration. Initially, projects must participate in programs designed to meet peak reduction and flexibility needs, and/or participate in a peak time rebate program, hourly pricing program, or time-of-use rate program offered by the applicable electric utility. The bill also directs the Illinois Commerce Commission to contemplate the establishment of compensation structures for additive services separate and apart from the rebate, that leverage the benefits of customer-sited solar paired storage for locational benefits, grid services, and peak capacity benefits.

[32] https://www.cga.ct.gov/2021/ACT/PA/PDF/2021PA-00053-R00SB-00952-PA.PDF
[33] https://www.ilga.gov/legislation/billstatus.asp?DocNum=2408&GAID=16&GA=102&DocTypeID=SB&LegID=135062&SessionID=110

Colorado: SB 261[34] is broad legislation that addresses numerous issues related to distributed generation (DG), and also requires the Public Utilities Commission adopt rules that accommodate aggregation and interconnection of retail DG like rooftop solar, including directing the development of programs and tariffs that support the adoption and use of dispatchable renewable DG and storage to provide grid benefits, such as enhancing the efficiency, capacity, and resilience of the grid and reducing GHG emissions.

New Hampshire: SB 91,[35] passed in 2021, directs the Public Utility Commission to investigate ways to enable energy storage projects to receive compensation for avoided transmission and distribution costs, including avoided regional and local network service charges, while also participating in wholesale energy markets; and then report its findings and recommendations back to the legislatures in two years. The Commission must investigate how this might be done for behind-the-meter storage and front-of-the-meter storage. Directs Commission to report its findings and recommendations to the standing committees of the house of representatives and senate with jurisdiction over energy and utility matters no later than 2 years after initiating the proceeding. The Commission must consider issues such as what public policy can best establish accurate and efficient price signals for energy storage projects that avoid actual transmission and distribution costs or reduce wholesale electricity market prices; and how best to encourage both utility and non-utility investments in energy storage projects. The Commission must also evaluate the costs and benefits of a potential bring your own device program; how such a program might be implemented; any statutory or regulatory changes that might be needed to create, facilitate, and implement such a program; and whether such a program should include all distributed energy resources or be limited to distributed energy storage projects.

[34] https://leg.colorado.gov/bills/sb21-261
[35] https://www.gencourt.state.nh.us/bill_status/legacy/bs2016/billText.aspx?sy=2021&id=936&txtFormat=html

Regulators

Public utility commissions should bring stakeholders together to create a market program to aggregate DERs and utilize for grid benefits each state needs most. This should be done as soon as possible, and can be started as a pilot program and evolve over time as utilities and stakeholders learn how to maximize the benefits from these resources.

Use the Regulatory Sandbox Model to Drive Collaboration & Meet State-Specific Needs Commissions should bring utilities, DER providers, community leaders, and ratepayer advocates together, using a 'regulatory sandbox' model, to craft a pilot program that can evolve with time and experience. With an aggregated DER program like a Bring-Your-Own-Device program, there are no rate design changes required, just a new pathway for enrolling customers. Customers can participate in programs through their underlying tariff (e.g.residential net metering tariff) without the need for rate design changes or enrolling in a separate rate class. This reduces regulatory complexity and increases customer participation, and means it can be created outside of a traditional, general rate case. A DER program structure combines the core competencies of electric utilities with those of the competitive battery and DER industry to develop the best program that can efficiently and effectively deliver ratepayer benefits.

Test Multiple Grid Benefits Commissions should consider a DER program that can test both demand response to peak capacity signal, but can also allow and test exports from home batteries to use every electron to benefit the grid. While many programs target system wide peak reduction, a DER program can be tailored to meet locational needs and provide other capacity, energy and ancillary grid services. State Commissions should determine what is best for its grid, and allow the program to grow over time. For example, the Public Utility Commission of Texas' aggregated DER program is starting in a Phase 1, with expansion and evolution of the program expanded as the market, utilities and stakeholders better understand the opportunities.

Do Not Recreate the Wheel Take elements from programs already in existence that make it easy to enroll resources and track benefits. Over 30 aggregated DER programs exist today in many states across the country. Commissions can pull best practices and frameworks, and use them to create straw proposals in DER dockets. See Appendix 2 for a list of programs, but here are a few examples:

- **Massachusetts:** the statewide Connected Solutions program[36] provides utilities a summer peak demand reduction resource from coordinated discharge of customer-sited battery storage during forecasted summer peak events. Residential customers enroll eligible behind-the-meter storage devices through an approved aggregator, for a 5-year term. Participating devices are discharged between 30-60 times over the course of the summer event season. The performance payment amount is fixed at the time of enrollment for the 5-year term. Customers may unenroll at any time, but must participate through an entire event season to be eligible for payment for that season. The program is open to customers across each utility and incorporates batteries as an active demand reduction measure in the utility energy efficiency program and budgets.

[36] National Grid Massachusetts. Program Materials for Connected Solutions for Small Scale Batteries, available at https://www.nationalgridus.com/media/pdfs/resi-ways-to-save/ma_resi_battery_program_materials.pdf.

- **Vermont:** In the Green Mountain Power Bring-Your-Own-Device Program[37] there is a peak demand reduction from the coordinated discharge of residential customer energy storage devices during forecasted peak demand events. Participating storage devices are discharged on average 5 to 8 times per month for an average of 3 to 6 hours per event. Customers enroll for a 10-year term and receive an upfront payment to enroll capacity for participation over the program term. Additional compensation is available for customers located in grid constrained areas (i.e., an "adder" for locational services).

- **Hawaii:** Hawaiian Electric's Battery Bonus Program[38] provides a year round peak load reduction and energy supply resource on the islands of Oahu and Maui. Customers who add an energy storage device to a new or existing solar installation can enroll. Participating devices are discharged daily based on a preset schedule for two hours during the evening peak period. Customers enroll for a 10-year term and receive an upfront enrollment payment, as well as an additional monthly peak reduction payment.

  Customers not already enrolled in the utility's net energy metering program receive an additional fixed monthly bill credit equivalent to the respective retail rate for electricity exported during the two-hour period. The Battery Bonus program was adopted by the Hawaii Public Utilities Commission to enable customer-sited battery storage to meet impending emergency capacity shortfalls on the islands. The Commission subsequently adopted a successor Bring-Your-Own-Device program scheduled to launch in July 2023, which is anticipated to offer scheduled as well as remote dispatch capabilities to provide energy, capacity and ancillary grid services.

Start Today, but Commit to Evolving. Commissions should make any program simple to begin, but it is key to start and take the first step. Commissions should avoid a stop/start program or pilot, but rather commit to having it evolve and expand as DERs prove themselves and as utilities gain comfort with performance and opportunities.

- Starting simple with technology capabilities, batteries can participate based on a pre-set schedule for discharge to deliver a specified service (e.g., peak reduction), with no utility software upgrades needed to dispatch the battery. When ready, the utility can incorporate additional capabilities, such as remote dispatch and include additional capacity, energy or ancillary grid services, including locational services into the program offerings.

- Creating the program can also be simple, as most utilities have energy efficiency or other demand management programs. These programs often include measures to target load reduction through the installation of more efficient appliances, fixtures and other technologies, such as smart thermostats. An aggregated DER program is a simple pathway for the utility to incorporate battery storage technology into their energy efficiency or demand management strategies. Because batteries are controllable and dispatchable (i.e., programmed to dispatch on a set schedule or remotely dispatched at varying times of need), they can add additional flexibility and reliability to maximize energy efficiency measures and significantly enhance the utility's load management capabilities as a demand and/or supply side resource.

[37] https://greenmountainpower.com/rebates-programs/home-energy-storage/bring-your-own-device/battery-systems/
[38] Hawaiian Electric Company, Customer Renewable Programs – Battery Bonus, available at https://www.hawaiianelectric.com/products-and-services/customer-renewable-programs/rooftop-solar/battery-bonus.

- Customer compensation can be simple as well, and can be structured as an upfront payment, as periodic (e.g., monthly) payments, or a combination of both. Payment is typically based on the customer's enrolled capacity commitment (i.e., $ per kW). Under an upfront payment structure, compensation is tied to the anticipated performance over the program term. Under a periodic payment structure, compensation is tied to verified performance over the payment period throughout the program term. Both structures are designed to pay for performance of service delivered (e.g., peak load reduction, frequency response, etc.).

- Enrollment and proof of performance should and can be simple. Customers participating in the program install an eligible battery storage system and enroll with the utility either individually or through an aggregator. The aggregator delivers the communication signal from the utility to all of the customer devices in its portfolio to respond to the utility called event (i.e., peak demand event) and otherwise provide the interface for program administration between the utility and the customers. The enrollment typically includes a verification process that confirms the participating device and aggregator meet program participation requirements. This can be as simple as confirming the device is discharging at prescribed time periods for pre-set or "scheduled dispatch" configurations or that the device and/or aggregator are properly integrated into the program communication platform for more sophisticated remote dispatch configurations. Once the enrollment and integration processes are complete, the device can begin to provide the target service and receive participation payments. For customers who enroll with an aggregator, the participation payment remits directly to the aggregator, which manages the customers' batteries and value proposition.

APPENDIX 1: Capacity Constraints & Statistics for RTOs & Utilities Across the United States in 2022

Southwest Power Pool (SPP)
19 million customers across 17 states
Source: 2021 Financial Audit
https://www.spp.org/documents/67347/2021%20southwest%20power%20pool%20audit%20report.pdf

- Capacity Constraints:
  https://www.spp.org/newsroom/press-releases/southwest-power-pool-sees-record-wintertime-electricity-use-issues-advisories-in-response-to-extreme-cold/

Independent System Operator - New England (ISO-NE)
7.2 million retail electricity customers, population 15.1 million
Source: Company Key stats
https://www.iso-ne.com/about/key-stats/

- Capacity Constraints:
  https://www.iso-ne.com/static-assets/documents/2022/12/20221205_pr_winteroutlook_final.pdf

Midcontinent System Operator (MISO)
42 million customers across 15 states
Source: Company fact sheet
https://www.misoenergy.org/about/media-center/corporate-fact-sheet/

- Capacity Constraints:
  https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2022.pdf

California Independent System Operator (CAISO)
32 million consumers
Source: 2021 Key Statistics
http://www.caiso.com/Documents/Key-Statistics-Jul-2021.pdf

- Capacity Constraints:
  http://www.caiso.com/Documents/caiso-posts-analysis-september-heat-wave-summer-market-performance-report-september-2022-stakeholder-call-111722.html

Electric Reliability Council of Texas (ERCOT)
25 million customers (90% of state's load)
Source: company about section
https://www.ercot.com/about

- Capacity Constraints:
  https://www.ercot.com/files/docs/2021/12/23/2021_Report_Existing_Potential_Electric_System_Constraints_Needs.pdf

Xcel in Colorado
1.5 million electric customers in Colorado
Source: Denver Post
https://www.denverpost.com/2022/09/12/xcel-energy-rate-hike-request-blowback/

- Capacity Constraints:
  http://coloradosun.com/2022/10/04/xcel-solar-energy-summer-peak-demand/

Tennessee Valley Authority (TVA)
500,000 customers impacted by rolling blackouts
The Tennessee Valley Authority provides electricity for 153 local power companies serving 10 million people in Tennessee and parts of six surrounding states, as well as directly to 58 large industrial customers and federal installations.
Source: company about section
https://www.tva.com/about-tva#:~:text=What%20We%20Do,industrial%20customers%20and%20federal%20installations

- Capacity Constraints:
  https://www.tva.com/newsroom/press-releases/tva-accepts-responsibility-starts-full-review,
  https://www.tva.com/newsroom/press-releases/tva-local-power-companies-manage-record-setting-power-demand

Duke (North Carolina and South Carolina)
500,000 customers impacted by rolling blackouts
Source: Duke Energy
https://news.duke-energy.com/releases/duke-energy-updates-north-carolina-utilities-commission-on-winter-storm-elliott-emergency-outage-event?utm_source=twitter&utm_medium=social&utm_content=twitter_dukeenergy_36966_post_8543308401_20230103_spr&utm_campaign=storm&utm_term=8543308401

- Capacity Constraints:
  https://news.duke-energy.com/releases/duke-energy-updates-north-carolina-utilities-commission-on-winter-storm-elliott-emergency-outage-event?utm_source=twitter&utm_medium=social&utm_content=twitter_dukeenergy_36966_post_8543308401_20230103_spr&utm_campaign=storm&utm_term=8543308401

Entergy
50,000 customers impacted by rolling blackouts
Entergy provides electricity to 3 million utility customers in Arkansas, Louisiana, Mississippi and Texas.
Source: company about section
https://www.entergy.com/operations/#:~:text=Entergy%20operates%20more%20than%2040,%2C%20Louisiana%2C%20Mississippi%20and%20Texas.

- Capacity Constraints:
  https://www.entergynewsroom.com/article/entergy-storm-restoration-update-12-23-22-3-p-m/

APPENDIX 2: Aggregated Distributed Energy Resources, Virtual Power Plants, & Bring Your Own Device Programs as of December 2022

State	Utility	Program	Compensation	Call Window
Arizona[1]	Arizona Public Service (APS)	Residential Energy Storage Pilot	This pilot provided a $500/kW upfront performance payment with total available payment of $2,500-$3,7500 per home (lower incentive for providing data only, higher incentive for providing data + allowing APS to manage battery). 10-year program commitment. *Pilot program filled and closed as of January 2023.	1-4 hours; 6-9 PM (non-holiday weekdays) or 9AM – 9PM (weekends/holidays)
California[2]	Pacific Gas & Electric, Southern CA Edison, San Diego Gas & Electric	Distribution Investment and Deferral Framework Partnership Pilot	Tiered payment structure based on value of distribution infrastructure avoided or deferred by use of DERs.	TBD
California[3]	Pacific Gas & Electric, Southern CA Edison, San Diego Gas & Electric	Demand Response Auction Mechanism	A pay-as-bid solicitation issued by each IOU for monthly demand response capacity. Winning bidders from each auction are required to bid aggregated demand response directly into the CAISO energy market. IOUs acquire the capacity and receive resource adequacy credit from the bids, but have no claim to the revenues that bidders may receive from the energy market.	

[1] Arizona Public Service Commission, Docket No. E-01345A-19-0148, Decision No. 77762, p. 7 (Oct. 2, 2020). See also https://www.solaredge.com/us/aps-residential-program.

[2] Pacific Gas & Electric, Distribution Investment and Deferral Framework Partnersship Pilot, available at https://www.pge.com/en_US/for-our-business-partners/energy-supply/electric-rfo/wholesale-electric-power-procurement/didf-partnership-pilot.page; see also California Public Utilities Commission, Decision 21-02-006 (Feb. 11, 2021) available at https://www.pge.com/pge_global/common/pdfs/for-our-business-partners/energy-supply/electric-rfo/wholesale-electric-power-procurement/DIDF%20Partnership%20Pilot/365628213.PDF.

[3] California Public Utilities Commission, Decision 19-12-040 (Dec. 23, 2019), available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M322/K796/322796293.PDF. See also, Pacific Gas & Electric, 2022 Demand Response Auction Mechanism (DRAM), available at https://www.pge.com/en_US/large-business/save-energy-and-money/energy-management-programs/demand-response-programs/2022-demand-response/2022-demand-response-auction-mechanism.page?WT.mc_id=Vanity_dram.

State	Utility	Program	Compensation	Call Window
California[4]	Pacific Gas & Electric, Southern CA Edison, San Diego Gas & Electric	Emergency Load Reduction Program	$2/kWh for every kWh of electricity consumption the customer reduces voluntarily during an ELRP event.	1-5 hours between 4-9PM; May to October. Up to 60 hours per year.
California[5]	Pacific Gas & Electric, Southern CA Edison, San Diego Gas & Electric	Demand Side Grid Support Program	Option 1 - Energy Payment Only $2/kWh of verified incremental load reduction provided during a dispatch period. Option 2 - Standby & Energy Payment $2/kWh of verified incremental load reduction provided during a dispatch period + $0.25/kWh standby payment for each hour or portion thereof in which the committed load reduction during the standby period is not dispatched. Option 3 - Capacity Payment & Bid Monthly capacity payments at the following rates, up to $76.50/kW-year: $10.50/kW (June), $17.50/kW (July), $18.50/kW (August), $19.50/kW (Sept.), and $10.50/kW (October). To be eligible, resources must be registered as proxy demand resources and be bid into the	4-9 PM (7 days a week), June - October Options 1 & 2- Dispatch events 1-5 hours. Option 3 - Dispatch events maximum of 4 hours.

[4] California Public Utilities Commission, Emergency Load Reduction Program, available at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/emergency-load-reduction-program.

[5] California Energy Commission, Demand Side Grid Support (DSGS) Program Guidelines - First Edition (Aug. 2022), available at https://www.energy.ca.gov/publications/2022/demand-side-grid-support-dsgs-program-first-edition.

State	Utility	Program	Compensation	Call Window
			CAISO day-ahead market in 4 consecutive hours between 4-9 PM at a rate no greater than $0.50/kWh during each participating month until the participant has been dispatched the maximum 20 hours/month or 60 hours/year.	
California[6]	SMUD	My Energy Optimizer Program	Partner Level $150/kWh up to $1,500 Partner+ Level	Partner Level Summer months only; peak period window & duration undefined Partner+ Level Year-round, peak period window & duration undefined
Colorado[7]	Xcel	Battery Connect	$1,250 upfront incentive in exchange for discharge of up to 80% of battery energy up to 100 times per year. *In 2023, terms are being updated to include increased upfront incentive and lower battery commitment. (See 21A-0625EG)	Year-round, 1-4 hours; no specific window but generally afternoon and early evening.
Connecticut[8]	Eversource	Connected Solutions – Targeted Seasonal	$225/kW-summer (avg. per peak event), locked in for five years.	3 hours, between 2-7 PM, June 1 – Sept. 30, between 30-60 events per season
Connecticut[9]	Eversource UI	Energy Storage Solutions (ESS) Program for Homes	Upfront Incentive: $200/kWh (Standard), $300/kWh (Underserved), $400/kWh (Low-Income) for 10-year commitment.	Passive Dispatch: 5 hours between 3-8 PM, each non-holiday weekdays from June to

[6] SMUD, Battery Storage for Homeowners, available at https://www.smud.org/en/Going-Green/Battery-storage/Homeowner.
[7] Xcel Energy Colorado. Battery Connect, available at https://co.my.xcelenergy.com/s/renewable/battery-connect.
[8] Eversource Connecticut. Application for ConnectedSolutions: Small Scale Batteries, available at https://www.eversource.com/content/ct-c/residential/save-money-energy/manage-energy-costs-usage/demand-response/battery-storage-demand-response.
[9] Energy Storage Solutions - Contractor Resources, Program Manual (Jan. 1 2023), available at https://energystoragect.com/contractor-resources/.

State	Utility	Program	Compensation	Call Window
			Performance Payment: $200/kW (summer), $25/kW (winter), based on average kW-AC contribution during the season, determined by actual system performance during called events.	August. Passive events are canceled on days in which an active event is called. Active Dispatch:1-3 hours between 12-9 PM, June 1 - Sept. 30, 30-60 events per summer season. 1-3 hours between 12-9 PM, Nov. 1 - March 31, 1-5 events per winter season.
Connecticut[10]	Eversource UI	Energy Storage Solutions (ESS) Program for Businesses	Upfront Incentive: $200/kWh (Small Commercial), $175/kWh (Medium Commercial), $100/kWh (Large Commercial) for 10-year commitment. Performance Payment: $200/kW (summer), $25/kW (winter), based on average kW-AC contribution during the season, determined by actual system performance during called events.	Passive Dispatch: 5 hours between 3-8 PM, each non-holiday weekdays from June to August. Passive events are canceled on days in which an active event is called. Active Dispatch:1-3 hours between 12-9 PM, June 1 - Sept. 30, 30-60 events per summer season. 1-3 hours between 12-9 PM, Nov. 1 - March 31, 1-5 events per winter season.

[10] Energy Storage Solutions - Contractor Resources, Program Manual (Jan. 1, 2023), available at https://energystorageCT.com/contractor-resources/.

State	Utility	Program	Compensation	Call Window
Hawaii[11]	Hawaiian Electric Companies	Scheduled Dispatch Program / Battery Bonus Program	50 MW cap on Oahu. Upfront payment of $850/kW for first 15 MW, $750/kW for next 15 MW, and $500/kW for last 20 MW. 15 MW cap on Maui with upfront payment $850/kW for the entire 15 MW cap. Monthly bill credit of $5/kW. Non-NEM customers receive a fixed bill credit equivalent to the retail rate for electricity exported during the two-hour dispatch period. Allows additional solar installation of up to twice the capacity of the participating battery.	Daily 2 hour dispatch as determined by utility between peak window of 6:00 - 8:30 PM
Hawaii[12]	Hawaiian Electric Companies	Bring Your Own Device	BYOD Level 1: Scheduled Capacity Load Reduction Service; BYOD Level 2: Remote Dispatch Capacity Load Reduction Service; and BYOD Level 3: (a) Remote Dispatch Capacity Load Reduction Service and (b) Capacity Load Build Service. Program commitment of 10 years under each level. Compensation for each level consisting of an upfront payment and monthly payment is currently under development along with final program participation parameters. Program launch: August 14, 2023.	Level 1: Daily 2-hour dispatch during a window selected by the customer from options provided by utility. Level 2: 1-2 hour dispatch with minimum 24-hour day-ahead notice for up to 156 events per year. Customers may opt out of up to 3 events. Level 3: 2-4 hour dispatch with minimum 24-hour day-ahead notice for up to 365 events per year.

[11] Hawaiian Electric Company, Customer Renewable Programs – Battery Bonus, available at https://www.hawaiianelectric.com/products-and-services/-customer-renewable-programs/rooftop-solar/battery-bonus.
[12] Hawaii Public Utilities Commission, Docket No. 2019-0323, Decision and Order No. 38681 (Oct. 30, 2022), Order No. 38787 (Dec. 22, 2022).
[13] National Grid Massachusetts. Program Materials for Connected Solutions for Small Scale Batteries, available at https://www.nationalgridus.com/media/pdfs/resi-ways-to-save/ma_resi_battery_program_materials.pdf.
[14] Eversource Massachusetts East. Application for ConnectedSolutions: Small Scale Batteries, available at https://www.eversource.com/content/ema-c/residential/save-money-energy/energy-efficiency-programs/demand-response/battery-storage-demand-response.
[15] Eversource Massachusetts East Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.eversource.com/content/ema-c/business/save-money-energy/manage-energy-costs-usage/demand-response; Cape Light Compact, Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.capelightcompact.org/business/commercial-connectedsolutions/.
[16] Unitil, Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://unitil.com/sites/default/files/2022-05/-CI-DemandResponse-ProgramMaterials-Unitil-FINAL-04-04-2022.pdf;
National Grid, Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.nationalgridus.com/MA-Business/Energy-Saving-Programs/ConnectedSolutions.

State	Utility	Program	Compensation	Call Window
Massachusetts[13]	National Grid, Cape Light Compact	Connected Solutions – Residential	$275/kW-summer, locked in for five years.	3 hours, between 2-7 PM, June 1 – Sept. 30, between 30-60 events per season
Massachusetts[14]	Eversource	Connected Solutions – Residential	$225/kW-summer, locked in for five years.	3 hours, between 2-7 PM, June 1 – Sept. 30, between 30-60 events per season
Massachusetts[15, 16]	Eversource, Cape Light Compact	Connected Solutions – Daily Dispatch (Commercial)	$200/kW for dispatch on a daily basis (summer only), locked in for five years.	2-3 hours, between 2-7 PM, June 1 – Sept. 30, between 30-60 events per season
Massachusetts[17]	Eversource, Cape Light Compact	Connected Solutions – Targeted Dispatch (Commercial)	$100/kW-summer	3 hours, between 2-7 PM, June 1 – Sept. 30, up to 8 events
Massachusetts[18]	Unitil, National Grid	Connected Solutions – Targeted Dispatch (Commercial)	$35/kW-summer; $10/kW weekend bonus.	3 hours, between 2-7 PM, June 1 – Sept. 30, between 1-8 events per season

[17] Eversource Massachusetts East Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.eversource.com/content/ema-c/business/save-money-energy/manage-energy-costs-usage/demand-response; Cape Light Compact, Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.capelightcompact.org/business/commercial-connectedsolutions/.

[18] Id.

State	Utility	Program	Compensation	Call Window
New Hampshire[19]	Unitil	Connected Solutions – Targeted Dispatch Pilot (Commercial)	$35/kW-summer	3 hours, between 2-7 PM, June 1 – Sept. 30
New Hampshire[20]	Eversource	Connected Solutions – Daily Dispatch (Commercial)	$200/kW for dispatch on a daily basis (summer only), locked in for five years.	2-3 hours, between 2-7 PM (non-holiday weekdays), June 1 – Sept. 30, up to 60 events per season
New Hampshire[21]	Eversource	Connected Solutions – Targeted Dispatch (Commercial)	$100/kW-summer	3 hours, between 2-7 PM (non-holiday weekdays), June 1 – Sept. 30, up to 8 events per season
New York[22]	Consolidated Edison NY	Commercial Demand Response Programs	$/kW-month capacity reservation payment (May – September) differentiated by location & number of event calls per peak season. Rates may change annually. Minor $/kWh payment during events.	4+ hours, May 1 – Sept. 30

[19] Unitil, Program Materials for Connected Solutions for Commercial / Industrial Customers, Appendix A, available at https://unitil.com/sites/default/-files/2022-04/CI-DemandResponse-ProgramMaterials-Unitil-FINAL-04-04-2022_0.pdf.
[20] Eversource New Hampshire Program Materials for Connected Solutions for Commercial / Industrial Customers, available at https://www.eversource.com/content/ema-c/business/save-money-energy/manage-energy-costs-usage/demand-response.
[21] Eversource New Hampshire East Program Materials for Connected Solutions for Commercial / Industrial Customers.
[22] Consolidated Edison New York. Schedule for Electric Delivery Service, Rider T, available at https://cdnc-dcxprod2-sitecore.azureedge.net/-/media/-files/coned/documents/save-energy-money/rebates-incentives-tax-credits/smart-usage-rewards/rider-t.pdf?rev=1Furfhe8BFbkEhXn1xcYPr8jYAACNpfV7p and Demand Response (Rider T) Program Guidelines, available at https://www.coned.com/-/media/files/coned/documents/save-energy-money/rebates-incentives-tax-credits/smart-usage-rewards/smart-usage-program-guidelines.pdf?la=en#:~:text=The%20Commercial%20System%20Relief%20Program,their%20respective%20assigned%20call%20window.&text=CSRP%20Unplanned%20Event%2C%20and%20participation%20is%20voluntary.
[23] PSEG LI, Commercial System Relief Program, https://www.psegliny.com/businessandcontractorservices/businessandcommercialsavings/csrp.
[24] Long Island Power Authority, Electric Tariff, pp. 470-496, available at https://www.lipower.org/about-us/tariff/.
[25] Commercial System Relief Payment amounts are available at: https://www.lipower.org/wp-content/uploads/2016/09/Stat_CSRP3.pdf.
[26] Distribution Load Reduction Payment amounts are available at https://www.lipower.org/wp-content/uploads/2016/09/Stat_DLRP3.pdf.
[27] Rhode Island Energy, Residential ConnectedSolutions Battery Program, available at https://www.rienergy.com/RI-Home/ConnectedSolutions/BatteryProgram.
[28] Rhode Island Energy, Business ConnectedSolutions Battery program, available at https://www.rienergy.com/RI-Business/Energy-Saving-Programs/ConnectedSolutions.

State	Utility	Program	Compensation	Call Window
New York[23,24]	PSEG LI	Dynamic Load Management Tariff: Commercial System Relief Program (CSRP) and Distribution Load Relief Program (DLRP)	$/kW per monthly capacity reservation payment and $/kWh performance payment for load relief.[25,26]	Up to 4 hours on weekdays, May 1 - Sept. 30 (CSRP) 4-6 hours, May 1 - Sept. 30. Load relief is not required between 12-6 AM. (DLRP)
Rhode Island[27]	Rhode Island Energy	Connected Solutions – Residential	$400/kW-summer season (avg. per peak event), locked in for five years.	3 hours, between 2-7 PM, June 1 – Sept. 30, no more than 60 events per season
Rhode Island[28]	Rhode Island Energy	Connected Solutions – Summer Targeted Dispatch (Commercial)	$35/kW-summer season (avg. per peak event), locked in for five years. Extra $10/kW-summer for weekend events.	3 hours, 2-7 PM, from June 1 – Sept. 30, 2-8 events per season
Rhode Island[29]	Rhode Island Energy	Connected Solutions – Daily Dispatch (Commercial)	$300/kW-summer season (avg. per peak event), locked in for five years.	2-3 hours from June 1 – Sept. 30 (Primarily July and August), approximately 50 events per season
Texas[30]	ERCOT	Aggregated DER Pilot	80 MW System wide pilot, with no more than 40 MW of ADERs to be	4 hours as enrolled and called on

[29] National Grid, Daily Dispatch, available at https://www.rienergy.com/RI-Business/Energy-Saving-Programs/Daily-Dispatch.

[30] Aggregated Distributed Energy Resource ERCOT Pilot Project, Public Utility Commission of Texas Project 53911. Available at: https://interchange.puc.texas.gov/search/filings/?UtilityType=A&ControlNumber=53911&ItemMatch=Equal&DocumentType=ALL&SortOrder=Ascending

State	Utility	Program	Compensation	Call Window
			used for axillary, non-spin services. DERs to be aggregated through Load Serving Entities (LSEs), with values to customers determined by participating LSEs.	
Vermont[31]	Green Mountain Power	Bring Your Own Device (Grid Charging)	Up-front payment of $850/kW for 3-hour storage discharge capability or $950/kW for 4-hour discharge capability (10% event performance tolerance subject to clawback, $100/kW adder for systems installed in grid-constrained locations). 10-year program commitment.	3-6 hours
Vermont[32]	Green Mountain Power	Bring Your Own Device (Solar Only Charging)	Up-front payment of $650/kW for 3-hour storage discharge capability or $750/kW for 4-hour discharge capability (10% event performance tolerance subject to clawback) for systems installed for backup power only option,; $650 (no kW multiplier) for systems installed under solar self-consumption option, additional $100/kW for systems installed in grid-constrained locations. Additional $100 (no kW multiplier) for for systems installed in grid constrained areas. 10-year program commitment.	3-6 hours

Lessons from How States Must Put Local Solar and Batteries to Work in 2023 to Help Solve Capacity Constraints & Support the Grid was published by Vote Solar and Solar United Neighbors with contributions from Sunrun.

[31] Green Mountain Power. BYOD – Terms and Conditions, available at https://greenmountainpower.com/rebates-programs/home-energy-storage/bring-your-own-device/battery-systems/, see also https://greenmountainpower.com/wp-content/uploads/2020/11/BYOD-Customer-Agreement-11-2-20.pdf.

Green Mountain Power, BYOD – Solar Charging Program Tariff, V.P.S.B. No. 9, available at http://epuc.vermont.gov/?q=downloadfile/576554/167385.

About Vote Solar

Since 2001, Vote Solar has been working to lower solar costs and expand solar access across the United States. A 501(c)3 nonprofit with more than 94,000 members nationwide, Vote Solar advances state policies and programs needed to repower our electric grid with clean energy and achieve a more environmentally just society. By identifying and accelerating solar solutions in legislatures and public utility commissions in over 20 states, Vote Solar works to combat the climate crisis, lower energy costs for ratepayers, reduce harmful pollution, and build a brighter, cleaner, more equitable future. Learn more at www.votesolar.org.

About Solar United Neighbors

Solar United Neighbors is a national non-profit organization that helps people and communities go solar, join together, and fight for their energy rights. SUN represents the needs and interests of solar owners and clean energy supporters, and we advocate for policies that broaden access to the benefits of distributed solar resources. Learn more at solarunitedneighbors.org

Contributor: Sunrun

Sunrun is the nation's leading home solar, battery storage, and energy services company. Founded in 2007, Sunrun pioneered home solar service plans to make local clean energy more accessible to everyone for little to no upfront cost. Sunrun's innovative home battery solutions bring families affordable, resilient, and reliable energy. The company can also manage and share stored solar energy from the batteries to provide benefits to households, utilities, and the electric grid while reducing our reliance on polluting energy sources. For more information, please visit www.sunrun.com.

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