CleanEnergyStatesAlliance

How States Can Address LOAD GROWTH While DECARBONIZING

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ABOUT THIS REPORT

This paper was produced by the Clean Energy States Alliance (CESA) to help state officials, as well as other stakeholders, understand how policymakers can respond to electric load growth in ways that continue to advance decarbonization of the electricity system. The paper first discusses the extent of current electricity system load growth and the reasons for that load growth. It then identifies a range of strategies for addressing load growth while still moving towards decarbonization.

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DISCLAIMER

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Introduction

Over the past few years, the United States has been increasing its use of electricity and that trend is expected to accelerate. In 2025, the Clean Energy States Alliance (CESA) published *Load Growth: What States Are Doing to Accommodate Increasing Electric Demand*, a survey of state actions to date to address load growth.[1] Although increased electricity demand has to date been met largely with increased use of fossil fuels, states have other options.

This paper aims to help state officials, as well as other stakeholders, understand how policymakers can respond to electric load growth in ways that continue to advance decarbonization of the electricity system. Understanding clean energy solutions will be important, especially for states that have adopted decarbonization or clean energy targets.[2]

Understanding Load Growth

For several decades, electricity consumption in the United States was relatively flat, but it has recently begun to rise and is expected to rise rapidly in the coming years and decades. The increased electrical load will not be distributed equally across the country but will instead vary significantly by region.[3]

How Fast is Electric Load Growing?

The U.S. Energy Information Administration found that net electricity generation and retail sales in July 2025 had increased 3.8 percent and 2.6 percent respectively from July 2024.[4] This finding supports various analyses projecting load growth over the coming years.

For example, the Electric Power Research Institute (EPRI) in 2024 predicted that annual US load growth will range anywhere from 3.7 percent to 15 percent.[5] In November 2025, Grid Strategies projected a 5.7 percent annual increase in electric demand over the next five years, while a May 2025 ICF report estimated that demand will grow by 25 percent by 2030 and 87 percent by 2050 compared to a

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[1] Ana Boyd and Todd Olinsky-Paul, *Load Growth: What States Are Doing to Accommodate Increasing Electric Demand,* CESA, July 2025, www.cesa.org/resource-library/resource/load-growth-what-states-are-doing.
[2] To learn about these state goals and associated programs, visit CESA's 100% Clean Energy Collaborative webpage at www.cesa.org/projects/100-clean-energy-collaborative.
[3] For a more extensive but still brief overview of load growth, see *Load Growth: What States Are Doing to Accommodate Increasing Electric Demand*, pp. 9-14.
[4] Meris Lutz, Analysts see possible early signs of demand growth in EIA's latest update, *Utility Dive*, September 24, 2025, www.utilitydive.com/news/demand-growth-data-center-eia-rates/760956.
[5] *Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption*, Electric Power Research Institute, May 28, 2024, www.epri.com/research/products/3002028905.

2023 baseline.[6] Increases of these magnitudes would require considerable development of new electricity generation, transmission, and distribution infrastructure, and a range of strategies to prevent sharply higher electricity costs.

What are the Primary Drivers of Load Growth?

Data Centers

Data centers for artificial intelligence (AI) applications and crypto mining have received the most attention in discussions of load growth. Data centers can significantly increase the load in the specific locations where they are sited and are collectively projected to comprise a significant share of the total electric load in the near future. The November 2025 Grid Strategies report estimated that data centers would account for about 55 percent of load growth between 2025 and 2030.[7] A December 2024 report from Lawrence Berkeley National Laboratory estimated that data center energy use could account for from 6.7 to 12 percent of total national electricity consumption by the end of 2028.[8]

However, there is considerable uncertainty around the future load from data centers, both globally and locally: globally, because it is difficult to know how fast the AI industry's needs will increase; and locally, because data center developers often scout several locations for their projects, causing a single facility to be incorporated into planning forecasts in multiple locations, most of which will not see actual data center development.[9] For example, the Grid Strategies report suggests that utility forecasts show aggregate load growth of 90 gigawatts (GW) through 2030, but that may overstate the actual demand by approximately 25 GW.[10]

There are also uncertainties about the shape of the load curve from data centers. It is often assumed that they will need constant power 24/7, but there may be some flexibility to shift load away from peak demand periods, at least for some data centers (see more on this below).

Data center load growth will be concentrated in two ways that are important for policymakers to consider and understand:

1. **Size:** An individual large data center can add a load of 10 megawatts (MW) up to 1 GW or more in a specific location, requiring upgrades to the local

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[6] John D. Wilson et al., *Power Demand Forecasts Revised Up for Third Year Running, Led by Data Centers*, Grid Strategies, November 2025, https://gridstrategiesllc.com/wp-content/uploads/Grid-Strategies-National-Load-Growth-Report-2025.pdf; Lalit Batra, et al, *Rising current: America's growing electricity demand*, ICF, May 2025, www.icf.com/-/media/files/icf/reports/2025/energy-demand-report-icf-2025_report.pdf?rev=c87f111ab97f481a8fe3d3148a372f7f.

[7] Wilson, *Power Demand Forecasts Revised.*

[8] Arman Shehabi, et al., *2024 United States Data Center Energy Usage Report*, Lawrence Berkeley National Laboratory, December 2024, https://escholarship.org/uc/item/32d6m0d1.

[9] Jeff St. John, "Utilities are flying blind on data center demand. That's a big problem," *Canary Media*, February 25, 2025, www.canarymedia.com/articles/utilities/utilities-are-flying-blind-on-data-center-demand-thats-a-big-problem.

[10] Wilson, *Power Demand Forecasts Revised.*

distribution system. In fact, GW-scale data centers are quickly becoming a significant share of total data center load.[11]

2. **Location:** Some parts of the country are receiving and will continue to receive a disproportionate share of data center development. A report surveying the data center construction market through 2030 projects that data center load growth will focus most heavily on Virginia, Texas, and Georgia, with additional concentrations in Arizona, Illinois, and Oregon.[12] Some parts of the country will have relatively few data centers, although the scale of data center development is causing developers to look at other parts of the country to find an adequate electricity supply. Variations in penetration of data centers reflect variations in electricity rates, capacity constraints, and regulatory regimes, as well as proximity to clusters of data center developers and workers.

Manufacturing

Expansion in manufacturing is likely to lead to industrial load increases, especially in the Southeast, Midwest, and West. It is hard to know how much additional electricity this manufacturing will consume, because the Trump administration's rollback of Inflation Reduction Act incentives is cancelling construction of some planned manufacturing facilities, while other manufacturing projects have been announced by major companies and foreign countries seeking to invest in the US. New tariffs may spur an increase in domestic manufacturing in some sectors, but the Trump administration's tariff announcements have been subject to frequent revisions, making it impossible to predict the tariff landscape in coming years. There will almost certainly be some increased demand from manufacturing, since even a few new factories in a state or region can have a large enough impact to affect utility and public utility commission planning, but the net impact remains difficult to predict.

Because of their local area impacts, manufacturing facilities and data centers are often lumped together and collectively referred to as new large load users.

Transportation Electrification

Despite the elimination of electric vehicle tax credits, the number of electric vehicles on the road will continue to grow. However, this increase is expected to be gradual and geographically distributed, so electricity system planners should be able to adapt to it relatively easily. The increase in load will be greater in states that are actively promoting and incentivizing the transition to electric transportation, such as California, New York, and the New England states.

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[11] Carolyn Davis, *Hungry,* "Hungry Data Center Efficiencies Easing Strain, but Complex Models Gobbling More Capacity," *Natural Gas Intelligence*, September 25, 2025, https://naturalgasintel.com/news/hungry-hungry-data-center-efficiencies-easing-strain-but-complex-models-gobbling-more-capacity.

[12] *U.S. Date Center Construction Market – Industry Outlook & Forecast 2025-2030*, Research and Markets, May 2025, www.researchandmarkets.com/report/united-states-data-center-construction-market.

It may be relatively easy to incentivize electric vehicle (EV) drivers to concentrate vehicle charging on off-peak demand periods, since many will likely charge their vehicles overnight in any case.

Building Electrification

As with electrification in the transportation sector, building electrification will occur gradually and will be greatest in states where technologies like heat pumps, induction stoves, and heat-pump water heaters are actively promoted and incentivized. It is more difficult to shift electricity use from building electrification to off-peak times than it is for electric vehicles, but heat pumps used for heating in cold climates tend to run most heavily during off-peak hours in the middle of the night. In New York and New England, increased use of heat pumps is likely to lead to the highest electricity demand occurring in the winter, which will not match well to solar energy generation, but will match better with wind energy output.

The increasing pairing of energy storage with solar and electrification in the building sector will enable shifting of demand from on-peak to off-peak periods, and the growth of battery virtual power plants provides a model whereby distributed energy resource owners can be incentivized to provide grid services, including peak demand reduction. At least 25 states have active battery VPP programs in at least some of their utility territories, and adoption of these programs continues to spread, with new pilot programs making their way through regulatory dockets in numerous states. Market penetration of battery storage is also likely to accelerate because it will remain eligible for federal tax credits through 2032.

What is the Relationship Between Load Growth, Peak Demand, and Decarbonization?

At first glance, current load growth does not seem to be primarily a peak demand problem, because a relatively small fraction of the increased electricity demand takes place during peak demand periods. Much of the new load, especially from data centers, is relatively steady throughout the day and the week, while transportation electrification demand may occur mainly during off-peak periods. It would not therefore appear that load growth would exacerbate concerns about peak demand, as long as new generation brought online is able to supply power steadily throughout the day.

However, there are three reasons to view load growth through the lens of peak demand.

1. **Excess capacity is lowest during peak hours.** During off-peak times, there is extra capacity available to meet additional demand, at least in many locations. In fact, 98 percent of the time, more than 10 percent of electricity generation capacity is unused and more than 95 percent of the time, more

than 20 percent of capacity is unused.[13] In 2022, the natural gas combined cycle power plant fleet ran at only 57 percent of its full potential.[14] Therefore, for many hours of the year, projected load growth could be accommodated by existing generators, transmission, and distribution infrastructure, and although it would require additional natural gas use by those generators and would increase emissions, reducing idle capacity during off-peak hours can be viewed as increasing the overall efficiency of the grid. It is only during peak periods, when there is little idle capacity in the existing grid, that load growth becomes difficult to accommodate.

2. **Peak power is the most expensive power on the grid.** Consumers' electricity bills are disproportionately affected by the high cost of providing power during peak demand times. A Massachusetts study showed that 40 percent of the overall cost of power over a year was attributable to just 10 percent of the hours.[15] And a study by Clean Energy Group found that peak electricity in New York City is priced up to 1,300 percent higher than the average cost of electricity in New York.[16] The high cost of serving peak loads is bundled into the cost of electricity for most residential customers; for commercial customers, these costs appear on the monthly bill in the form of "demand charges" that can comprise 50 percent or more – even up to 70 percent – of monthly electric bills.

3. **Fossil fuel peakers are highly polluting.** Fossil-fuel peaker power plants emit more air pollutants and greenhouse gases per unit of electricity generated than larger plants supplying baseload electricity. This is in part because they are often subject to less stringent environmental regulations than larger, continuously running (baseload) power plants, and in part because ramping thermal plants up and down to follow demand spikes is an inefficient way to run them. Moreover, peaker power plants are often sited in and near low-income communities and communities of color, disproportionately impacting the health of the residents of those communities as well as that of local ecosystems.[17]

For these reasons, policymakers should approach planning for load growth as an opportunity to reduce the difference between peak and off-peak demand and to reduce reliance on fossil-fuel peaker plants.

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[13] Tyler Norris, *Integrating Large Flexible Loads in US Power Systems*, NASEO-NARUC webinar on Data Center & Large Load Flexibility to Meet Demand Growth, August 7, 2025, https://naseo.org/Data/Sites/1/documents/tknaseo/rethinking-load-growth_naseo-naruc-webinar_8-7-25.pptx.pdf.
[14] Ibid.
[15] *State of Charge: A Comprehensive Study of Energy Storage in Massachusetts*, Massachusetts Department of Energy Resources and Massachusetts Clean Energy Center, 2016, www.mass.gov/info-details/energy-storage-study.
[16] Clean Energy Group et al., *Dirty Energy, Big Money*, Peak Coalition, May 2020, www.cleanegroup.org/publication/dirty-energy-big-money.
[17] *Phase Out Peakers*, Clean Energy Group, accessed January 2026, www.cleanegroup.org/initiatives/phase-out-peakers.

Strategies for Addressing Load Growth While Decarbonizing

Plan for Load Growth

Fossil fuel advocates argue that additional generating facilities powered by fossil fuels need to be developed and that fossil fuel power plant retirements need to be deferred. While this might be necessary in some locations, fossil fuel proponents are using concerns about load growth as a blanket argument for fossil fuel expansion nationwide. The only way to know what new generation will be necessary, if any, is to conduct careful studies of the likely load growth in a specific location, with attention to the timing and seasonality of increased demand; and then to determine how much of that load growth can be met with actions other than new fossil fuel generation. The resulting information should be incorporated into state energy planning documents and programs, such as decarbonization roadmaps, comprehensive energy plans, renewable portfolio standards (RPS), distributed energy resource (DER) incentive programs, and energy storage procurement targets; and should inform utility integrated resource plans (IRPs).

Minimize Load Growth Through Efficiency, Where Possible

Because of the rush to implement AI, developers may be most concerned about the speed with which they can build data centers. Similarly, tariffs and other market forces may prompt manufacturers to build onshore manufacturing facilities quickly in order to avoid steep import fees. Under these conditions, developers may be less motivated to make data centers and factories as energy efficient as possible, despite the potential for cost savings from energy efficiency.

States can implement regulations and incentives to encourage more energy-efficient design of new large load facilities. For example, a bill filed in Virginia in 2024 proposed providing sales and use tax exemptions for data centers that meet stringent energy efficiency standards.[18] And Texas SB888 makes state tax incentives for data centers contingent on implementation of specific energy efficiency and conservation measures, such as efficient cooling systems and Energy Star-certified servers.[19] California's 2019 Building Energy Efficiency Standards include energy efficiency requirements specific to computer room cooling systems in Title 24, Part 6.[20] And the American Society of Heating, Refrigerating and Air-Conditioning

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[18] Virginia General Assembly, *HB 116: Retail sales and use tax; exemption for data centers*, January 1, 2024, https://legacylis.virginia.gov/cgi-bin/legp604.exe?241+sum+HB116.

[19] SB 888: An act relating to the temporary sales and use tax exemptions for certain tangible personal property related to data centers and large data center projects, Texas Legislature, April 7, 2025, https://capitol.texas.gov/BillLookup/History.aspx?LegSess=89R&Bill=SB2888.

[20] *Computer Rooms & Data Centers*, California Energy Commission, January 2020, www.energy.ca.gov/sites/default/files/2021-01/2019_CEC-Computer%20Rooms%20Data%20Centers-ADA.pdf.

Engineers (ASHRAE) has developed energy standards for data centers that have been incorporated into some state and municipal building energy codes.[21]

There have been some legislative attempts to more aggressively regulate data center energy use, but none of these have yet been enacted into law. For example, New York Senate Bill S6394A, which was introduced in 2025, would regulate energy consumption by data centers, require a data-center-specific annual reporting framework, and set surcharges, discounts, and minimum requirements related to whether data centers purchase fossil fuel-generated or renewably generated energy.[22]

Similarly, states can apply efficiency standards to building and transportation electrification efforts. For example, Cape Light Compact's Cape and Vineyard Electrification Offering in Massachusetts offers free and discounted solar PV, heat pumps and batteries to income-eligible residential customers; eligible customers must participate in a home energy efficiency audit and complete all recommended efficiency upgrades, including replacing fossil-fuel appliances such as heating, cooling, and cooking appliances.[23]

Two common methods states and municipalities use to regulate building energy use and emissions are building energy codes (BEC) and building performance standards (BPS). The difference is that BECs set minimum requirements for energy-efficient construction and renovation, while BPS are designed to ensure existing buildings meet specified levels of performance over their lifetime. Typically, a BPS requires benchmarking to establish baseline energy use and emissions; regular improvements in building systems to meet increasingly stringent performance targets over time; and reporting at regular intervals to document progress. BPS have been enacted by several states including Colorado, Maryland, Oregon, and Washington, as well as by cities such as Washington DC, Boston, and New York City.

The U.S. Department of Energy (DOE) offers information and technical assistance to develop BEC and BPS through its Building Energy Codes Program.[24]

For an approach that might not require legislation, states could potentially emulate the European Union's data center reporting requirements. The European Commission Energy Efficiency Directive includes a section specifically focused on data centers

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[21] *Fact Sheet - ANSI/ASHRAE Standard 90.4-2022: Energy Standards for Data Centers*, ASHRAE, 2023, www.ashrae.org/file%20library/about/government%20affairs/advocacy%20toolkit/virtual%20packet/standard-90.4-2022-fact-sheet.pdf.

[22] SB S6394A: Sustainable Data Centers Act, New York State Senate, March 13, 2025, www.nysenate.gov/legislation/bills/2025/S6394/amendment/A.

[23] Olivia Tym, *Solar+Storage+Electrification: A Clean Energy Equity Model For Massachusetts*, Clean Energy Group, March 2025, www.cleanegroup.org/publication/solar-storage-electrification-cveo-massachusetts.

[24] *Building Energy Codes Program*, U.S. Department of Energy, accessed January 2026, www.energycodes.gov/BPS.

that creates a database and requires data centers to report regularly on their energy efficiency and sustainability.[25]

Address Peak Load

As discussed above, even without load growth, it is important to address peak load as part of a decarbonization strategy and to constrain or even reduce consumers' electric bills.

States can implement a range of policies and programs to mitigate increased electricity demand at peak times.

User Flexibility

It becomes much easier to reduce the peak load associated with increased use of electricity if new large load users, such as data centers and manufacturing facilities, have flexible demand, meaning some of their electricity consumption can be curtailed during peak demand hours.

A recent study from Duke University looked at the benefits of flexible large load demand across 22 of the largest balancing authorities in the US, which serve 95 percent of the country's peak load. It found that 76 GW of new load—equivalent to 10 percent of the nation's current aggregate peak demand— could be served with existing infrastructure provided that new large load users could accommodate an average annual load curtailment rate of 0.25 percent. At a curtailment rate of 0.5 percent, 98 GW of new load could be served, and at a 1 percent curtailment rate, 126 GW of new load could be served using existing generation and infrastructure.[26]

However, there is considerable uncertainty about the ability of data centers to exercise demand flexibility. Here are a few characteristics of data center load and flexibility:

- Different types of data centers may have varying degrees of flexibility. For example, crypto mining facilities can be highly flexible and their revenue model tolerates rapid curtailment to avoid peak electricity prices. On the other hand, AI data centers are typically less flexible. However, all data centers have at least a little flexibility because some of their electricity use goes to non-critical functions that can be temporarily curtailed. Despite their tendency to be relatively inflexible, there are some examples of AI data centers being willing to exercise load flexibility in return for expedited grid interconnection.[27]

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[25] *Energy Efficiency Directive*, European Commission, accessed January 2026, energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en.

[26] Tyler Norris et. al., *Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems*, Duke University, February 2025, https://nicholasinstitute.duke.edu/publications/rethinking-load-growth

[27] Elizabeth Ouzts, "North Carolina mulls how to manage power demand from data centers," *Canary Media*, October 23, 2025, www.canarymedia.com/articles/utilities/north-carolina-load-flexibility-data-

- A large company like Google or OpenAI that owns many data centers may be able to temporarily shift some of its power use between data centers in different locations.[28] By contrast, third party-owned data centers that process data for client companies may have less flexibility.
- Data centers usually have some backup power capability, most frequently diesel generators, so they can shift to backup generation when the grid is overstressed or in the case of grid failure. But backup diesel generators are highly polluting and usually permitted to run for only a limited number of hours (e.g., up to 100) per year. Battery storage is an alternative backup power source that is not restricted in how many hours it can run annually (although batteries are limited in the number of hours they can run continuously without recharging). Depending on how they are charged, batteries can also be cleaner than diesel generators. Combining on-site batteries with solar can both provide clean power and allow depleted batteries to recharge during the day.

It is important for states to continue to work to understand data centers' load curves and to incentivize data centers to increase their demand flexibility and/or switch some of their regular electricity use away from peak demand times.

In addition to working with individual data center developers, states can implement policies and programs that aim to reduce peak demand generally, which would allow the grid to accommodate load growth without having to add new generation. Peak demand reduction programs may include demand response (DR) and virtual power plants (VPPs), time-of-use rates (TOU), active managed EV charging, and energy storage procurement or incentive programs.

Demand Response and Virtual Power Plants

Utility DR programs traditionally target large load customers such as manufacturing facilities, which are offered an incentive in return for shedding load in response to a utility signal or at specific times of the day and year. To the extent that data centers and new manufacturing facilities have flexible loads, they may be able to participate in this traditional form of DR. At least one real-world demonstration of data center DR has been conducted.[29] Data centers may also be able to install energy storage in order to participate in DR.

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centers; Jeff St. John, "Google's new plan to keep its data centers from stressing the grid," *Canary Media*, August 28, 2025,
www.canarymedia.com/articles/utilities/google-ai-data-center-flexibility-help-grid.

[28] Varun Mehra and Raiden Hasegawa, "Supporting power grids with demand response at Google data centers," Google Cloud Blog, October 3, 2023,
https://cloud.google.com/blog/products/infrastructure/using-demand-response-to-reduce-data-center-power-consumption.

[29] Philip Colangelo et al., *Turning AI Data Centers into Grid-Interactive Assets: Results from a Field Demonstration in Phoenix, Arizona*, Nature Energy, December 2025,
https://static1.squarespace.com/static/681cdff1ffdde1576b29a12d/t/6863c210c8ceb468a0f7b94e/1751368211624/Colangelo+et+al+-+July+1+2025.pdf.

DR can be made mandatory for new large load customers as a condition of grid interconnection. For example, a new law in Texas combines both mandatory utility shut-offs and incentivized DR for new customers with loads of 75 MW or greater. The law allows the utility to cut off these customers during firm load shed events; there is also an incentive program that allows utilities to procure reliability services from new large load customers.[30] Under this law, shutoff equipment must be installed by these customers as a condition of grid interconnection.[31]

Over the past decade, the rise of VPPs has brought DR opportunities to residential and small commercial customers as well. In at least 25 states, customers in select utility territories are able to enroll behind-the-meter (BTM) equipment such as batteries, HVAC and thermostats, water heaters, EVs and EV chargers into VPP programs that offer incentives in return for allowing these DERs to be aggregated and dispatched via a utility signal, usually to achieve peak demand reductions.

A key difference between traditional utility demand response programs and VPPs is that traditional programs are usually aimed at achieving customer load shedding, while many (though not all) VPPs also allow power export onto the grid from BTM resources.[32] Allowing power export enables maximum use of BTM resources, because it is not limited to reducing the host facility's load. For example, a home or small business may reduce its load to zero but still have power reserves in BTM batteries or EVs; exporting this remaining reserve maximizes grid benefits as well as allowing full customer monetization of resources.

For more information on battery VPPs, see CESA's forthcoming issue brief on the subject and the associated summary table of VPP programs.

Time-of-Use Rates

TOU rates are an electricity pricing structure which changes based on time of day, season, and peak demand periods. By giving price signals about the actual cost of electricity at different times, TOU rates incentivize consumers to shift some of their electricity use away from peak demand hours. For that reason, utility regulators have increasingly supported their implementation and TOU rates are being adopted more widely.

Studies of the impacts of TOU rates show varied results, generally ranging from a 1 to 10 percent reduction in peak load. Factors in these different results include whether only the consumption of voluntary participants in the program is being measured as

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[30] Reliability services are essential electricity services that keep power grids stable and ensure reliable and high-quality power flow. They include voltage control, frequency support and balancing/ramping. These are sometimes referred to as ancillary services.
[31] Brian Martucci, "Texas law gives grid operator power to disconnect data centers during crisis," *Utility Dive*, June 25, 2025, www.utilitydive.com/news/texas-law-gives-grid-operator-power-to-disconnect-data-centers-during-crisi/751587.
[32] These distinctions are beginning to blur as some DR programs are starting to allow power export, and in some states VPPs are housed within DR programs. There are also some VPP programs that do not allow power export.

opposed to the utility's entire load and how great the difference is between off-peak and on-peak rates. In general, TOU rates are more effective if there is a sharp distinction between off-peak and on-peak rates, reflecting the electricity supplier's actual costs. That requires considerable consumer education to make sure customers understand and accept the pricing structure. Unsurprisingly, more customers participate if they have to opt out of TOU rates rather than proactively opt in.

Sample results of TOU rate structures include a four-year ComEd pilot in Illinois in which participants reduced peak demand between 6.5 percent and 9.7 percent each summer,[33] and a peak load reduction ranging from 1.4 percent to 6.1 percent from California programs.[34] A report from the American Public Power Association included case studies of a Fort Collins, Colorado pilot that produced a 7.5 percent reduction in coincident peak hour demand during the summer and a 1.9 percent overall reduction in energy use, and a Sacramento Municipal Utility District default opt-out TOU program that yielded an 8 percent peak load reduction.[35]

If peak demand is being pushed up by new large load customers and other load growth drivers, TOU rates can incentivize other customers to shift their demand away from peak hours, with the result that net increases may be reduced or eliminated.

A specific type of TOU rate plan, critical peak pricing, is also becoming more popular as utilities seek new ways to incentivize customers to shift usage to off-peak periods. Customers who opt in to a critical peak pricing plan agree to pay a much higher rate than usual during critical peak events – as much as double the usual rate in some cases – in exchange for discount pricing during the rest of the season. Utilities generally notify participating customers about critical peaks a day ahead, and these peaks tend to occur over a period of a few hours during the hottest days of the year.

Active Managed Charging of Electric Vehicles

There are strong reasons for states interested in decarbonization to give close attention to EV charging. In part, this is because EV load is highly flexible in timing and is more easily moved outside peak demand periods than other electric loads. Moreover, because a primary motive for states to promote EVs is decarbonization, policymakers should try to ensure that EVs are not charged at times when they require power from polluting fossil fuel power plants, especially peakers.

While TOU rates influence when people charge their EVs, active managed charging is more effective. With active managed charging, which is also called direct load

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[33] Kari Lydersen, "Time-based rates convince Chicago-area residents to shift electricity use," *Canary Media,* March 12, 2025, www.canarymedia.com/articles/utilities/time-based-rates-convince-chicago-area-residents-to-shift-electricity-use.

[34] "CEC Adopts Standards to Help Consumers Save Energy at Peak Times," California Energy Commission, October 12, 2022, www.energy.ca.gov/news/2022-10/cec-adopts-standards-help-consumers-save-energy-peak-times.

[35] *Moving Ahead with Time of Use Rates,* American Public Power Association, accessed January 2026, www.publicpower.org/resource/moving-ahead-with-time-use-rates.

control, a utility control center or energy management system determines when the vehicle will be charged. The intelligent managed charging system can modify the charging schedule as necessary to minimize electricity costs and fossil fuel use, and to shift charging to low-demand periods. A 2021 report by the Smart Electric Power Alliance reviewed over 90 utility-managed charging pilots and programs and showed the potential for direct load control to yield significant benefits.[36] Some of the programs focus on vehicle fleets while others seek to reach household vehicles.

Some states, such as California and Massachusetts, are taking managed charging further and are seeking to implement two-way, vehicle-to-grid interactions for school buses and other fleets. EVs and EV chargers have also been incorporated into VPPs in some states, meaning they are aggregated with other DERs such as solar, battery storage and controllable loads, and dispatched to achieve an objective established by the state, utility or grid operator (usually to lower peak demand).

Energy Storage for Peak Demand Reduction

States can adopt programs to incentivize or mandate energy storage deployment for specific purposes, such as peak demand management. Procurement programs are usually directed toward utilities, while incentives are usually directed toward customers. Procurement and incentive programs can work well together. For example, California combines an energy storage procurement mandate with the Self Generation Incentive Program (SGIP), which offers rebates and performance incentives to customers installing energy storage.

It is important to understand that while peak demand reduction may represent a valuable application for energy storage, installed storage will not necessarily be used in this way unless required or incentivized to do so. Therefore, state programs should not aim simply to increase installed energy storage capacity, but also to ensure that storage is used to address demand peaks, both immediately and in the future. This is usually achieved either through regulatory requirements or through customer incentives and contracts.[37]

Energy storage is not only a valuable tool for peak reduction on its own, but can also make variable renewable generation, such as solar and wind energy, more dispatchable, and therefore more valuable as a peak capacity resource. For example, in the Midcontinent Independent System Operator (MISO) wholesale capacity market, solar generators are derated by at least 50 percent, and sometimes are subject to as much as 95 percent derating, depending on the season (i.e. they are credited for a fraction of their nameplate capacity due to their inability to be dispatched at need and their decreased production during the winter). However, solar combined with storage can achieve a higher rated capacity value.

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[36] Brittany Blair et al., *The State of Managed Charging in 2021*, Smart Electric Power Alliance, November 2021, https://sepapower.org/resource/the-state-of-managed-charging-in-2021.
[37] Olivia Tym and Todd Olinsky-Paul, *Energy Storage Program Design for Peak Demand Reduction*, Clean Energy States Alliance / Clean Energy Group, December 2024, www.cleanegroup.org/publication/energy-storage-program-design-for-peak-demand-reduction.

A unique approach was taken by Massachusetts with its Clean Peak Energy Standard. This program is similar to a traditional RPS but focuses renewables and storage on peak demand hours, requiring utilities to meet an increasing percentage of peak power demand with clean resources.[38]

Promote Clean Energy Technologies

States may promote the direct procurement of clean generation to supply new loads, preventing at least a portion of their added demand from impacting the grid. States may also support scale-up of clean energy in general, with the goal of supplying new grid demand through clean generation.

Incentivizing Clean Generation at New Large Load Facilities and in Electrification Programs

Some states are considering incentives or requirements for data center operators to source at least some of their power directly from clean generators. For example, a recent bill in California would provide tax cuts to data center operators if 70 percent of their energy comes from zero emissions sources.[39]

Data centers represent a natural market for BTM battery storage, which can allow these large load customers to run around the clock while still reducing their impact on peak demand hours. Because data centers put a high value on power quality, uninterruptible power, and backup power supplies, installing batteries to provide these services may be appealing to these customers apart from any added incentive. Battery storage combined with renewable generation, either installed on-site or procured through a power purchase agreement, can represent a high value investment, although the sunsetting of the federal investment tax credit for solar may reduce the economic attractiveness of solar+storage hybrid systems.

Similarly, states may wish to link building electrification with on-site clean generation in order to minimize the amount of new supply-side investment needed to accommodate electrification. For example, states could bundle incentives for building electrification with those for rooftop solar, battery storage, and traditional efficiency, and provide VPP opportunities for customers to enroll these resources for aggregated, targeted dispatch.

To What Extent Can DERs Be Used to Address Load Growth?

The potential for distributed energy resources to contribute substantially toward meeting load growth has been amply demonstrated. According to a 2016 report from the National Renewable Energy Laboratory (NREL; now the National Laboratory of the

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[38] "Clean Peak Energy Standard," Massachusetts Department of Energy Resources, accessed January 2026, www.mass.gov/clean-peak-energy-standard.

[39] Khari Johnson, "Crackdown on Power-Guzzling Data Centers May Soon Come Online in California," *CalMatters*, February 18, 2025, http://calmatters.org/economy/technology/2025/02/data-center-crackdown-to-protect-california-electricity-rates.

Rockies), the US technical potential for rooftop solar PV alone is 1,118 GW of installed capacity and 1,432 terawatt-hours (TWh) of annual energy generation (equivalent to 39 percent of national electric-sector sales in 2016).[40] This does not include other common DERs, such as energy storage, efficiency, and demand response. A 2023 DOE report estimates peak-coincident DER technical potential at 315 GW by 2030.[41]

Technical potential is not market potential, however, and national estimates will not shed much light on how much DER capacity can be installed in a specific state within a specified period of time. States facing significant increases in peak demand will need to conduct their own analysis to determine what role DERs can reasonably play.

As discussed above, one strategy to maximize the impact of DERs is to focus on peak demand growth rather than overall load growth. Existing VPP programs have proven that aggregated DERs can provide peak demand reduction, while simultaneously conferring other benefits such as improved energy reliability and resilience, increased investment in communities, energy cost savings for program participants and improved health outcomes for communities if clean DERs displace fossil fuel peaker plants. The impressive spread of battery VPPs across the country, which has taken place mostly in the past six years, shows that these programs are popular with both customers and utilities, and have consistently won the support of regulators.

Current commercial battery technology (largely four-hour lithium-ion batteries) is sufficient to provide peak demand reduction in current wholesale capacity markets, and the combination of batteries with other DERs (such as rooftop PV, building HVAC, and hot water systems) provides expanded capability for a lower per-unit cost. Note, however, that future changes in wholesale market capacity accreditation methods, combined with the advance of electrification, may somewhat devalue four-hour capacity resources in favor of longer duration resources.[42] The commercialization of medium- and long-duration energy storage will be important in meeting broader future demand peaks, for example, in some areas where grids are predicted to flip from summer to winter peaking.

To What Extent Can Battery Storage Be Used to Address Load Growth?

Battery storage is a valuable tool to address peak demand increases, and to some degree the value of storage for this purpose increases as more renewable generation is added to the grid. A 2019 NREL report found that, under current grid conditions and market rules, about 28 GW of four-hour battery storage has the practical

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[40] Pieter Gagnon et al., *Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment*, National Renewable Energy Laboratory, January 2016, https://docs.nrel.gov/docs/fy16osti/65298.pdf.

[41] Jennifer Downing, et al., *Pathways to Commercial Liftoff: Virtual Power Plants*, U.S. Department of Energy, September 2023, https://kevinjkircher.com/wp-content/uploads/2025/03/DOE-LPO-VPP-Liftoff-2023.pdf.

[42] Paul Denholm, et al., *Moving Beyond 4-Hour Li-Ion Batteries: Challenges and Opportunities for Long(er)-Duration Energy Storage*, National Renewable Energy Laboratory, September 2023, https://docs.nrel.gov/docs/fy23osti/85878.pdf.

potential to provide peaking capacity in the US However, the report also concluded that if solar PV deployment were scaled up to supply just 10 percent of the nation's electricity demand, this would increase the practical potential for four-hour storage to 50 GW of peaking power or beyond.[43]

Note however, that as discussed above, four-hour storage is likely to be less valuable in future capacity markets than it is at present, meaning that longer duration storage technologies will be needed.

What About Small Modular Nuclear Generators?

There has been a lot of talk about small modular nuclear reactors (SMRs), which have been touted as a powerful new carbon-free energy source. However, although SMRs may have long-term potential, they are unlikely to be commercialized widely for at least another decade, meaning they will not be available quickly enough to supply immediate and near-future load growth. They are also likely to be expensive compared to both legacy fossil fuel generators and renewables. A third barrier SMRs will have to overcome is the natural reluctance of some stakeholders to step into a new nuclear future given the memory of past nuclear disasters (e.g., Three Mile Island, Chernobyl and Fukushima).

For these reasons, although states may be interested in SMR research and development, SMRs seem an unlikely candidate to address immediate load growth.

Conclusion

While some new investment in fossil fuel generation, transmission and distribution infrastructure may be needed in some areas to accommodate rapid load growth, states can minimize harmful impacts and continue to advance decarbonization by focusing on a few simple precepts. These include advance planning for load growth, efficiency requirements for new large load facilities, a focus on peak demand management and the development of clean peak capacity resources, increased reliance on distributed energy resources, and faster scaling of clean energy technologies including renewables and energy storage.

To date, these strategies have not been the primary response to load growth.[44] Instead, the focus has been on increased investments in fossil fuel infrastructure, mainly natural gas. A concerted effort to bend the investment curve toward clean energy resources will be needed to avoid a massive surge of fossil fuel investment in the electricity sector, the effects of which would likely persist for many decades after load growth levels off.

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[43] Paul Denholm et al., *The Potential for Battery Energy Storage to Provide Peaking Capacity in the United States*, National Renewable Energy Laboratory, June 2019, www.nrel.gov/docs/fy19osti/74184.pdf.
[44] Ana Boyd and Todd Olinsky-Paul, *Load Growth: What States Are Doing to Accommodate Increasing Electric Demand*, Clean Energy States Alliance, July 2025, www.cesa.org/resource-library/resource/load-growth-what-states-are-doing.

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

ABOUT CESA

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

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