Large Load Flexibility

National Association of State Utility Consumer Advocates Webinar

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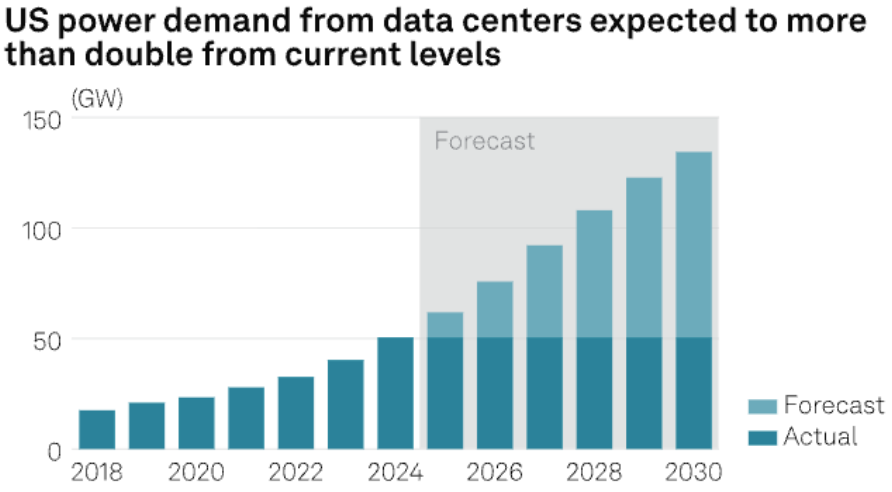
Agenda

- Context
- Large load flexibility approaches in utility planning
  - Tariffs, special contracts
  - Interconnection
  - Programs and pilots
  - Load forecasting
- Opportunities for flexibility in data center facilities

Context

Large load forecasts continue to grow



Source: S&P

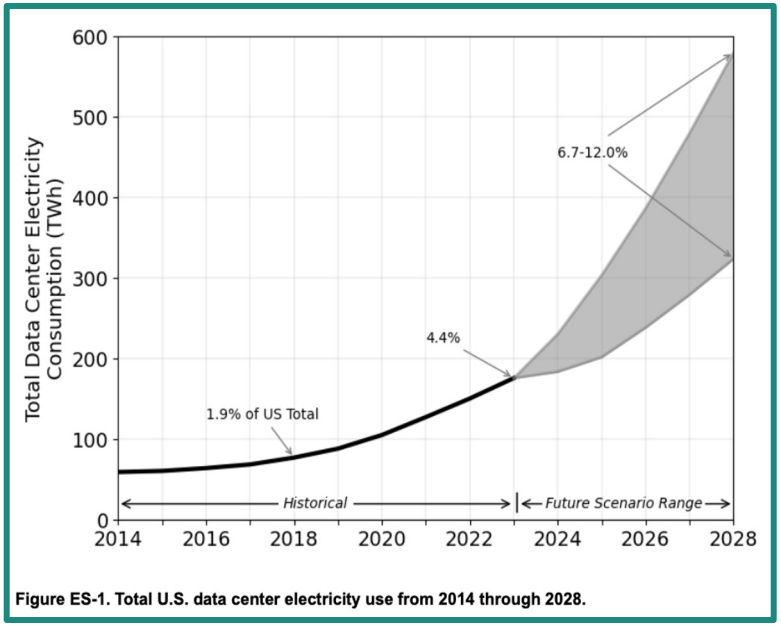
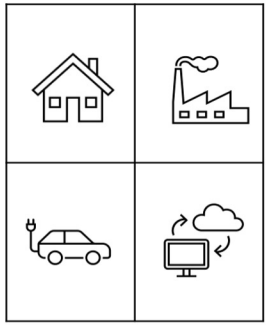


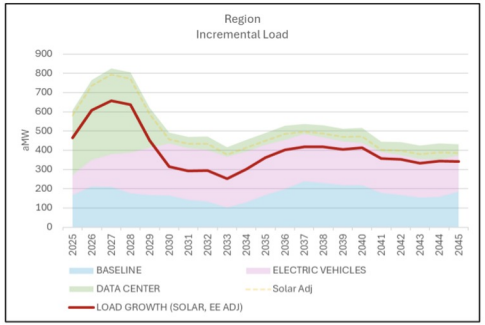
Figure ES-1. Total U.S. data center electricity use from 2014 through 2028.

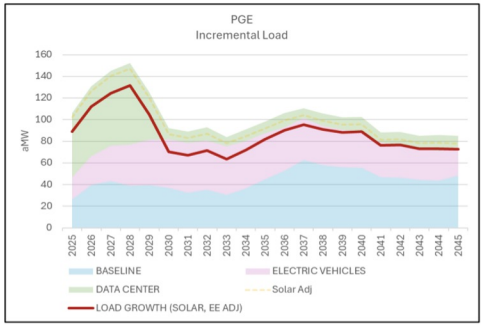
Source: LBNL

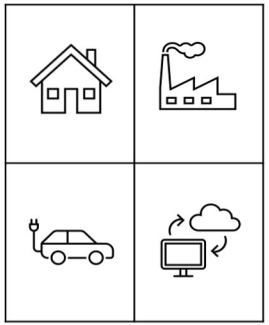
Type and timing

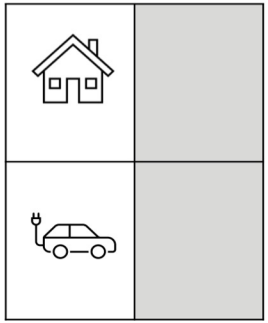
Load growth from data centers, manufacturing, building electrification and EV charging will occur at different times (daily, seasonally and annually) and locations on the grid.

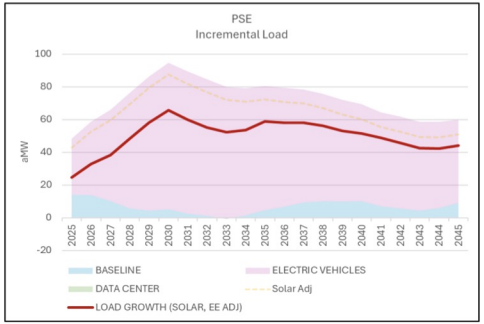


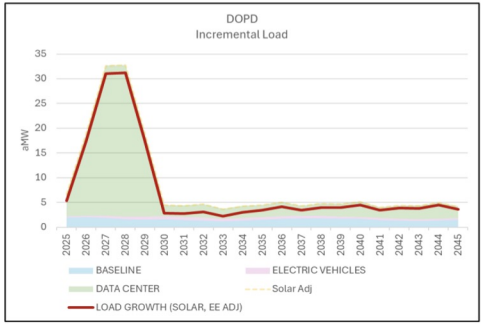


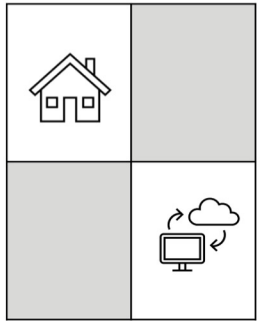










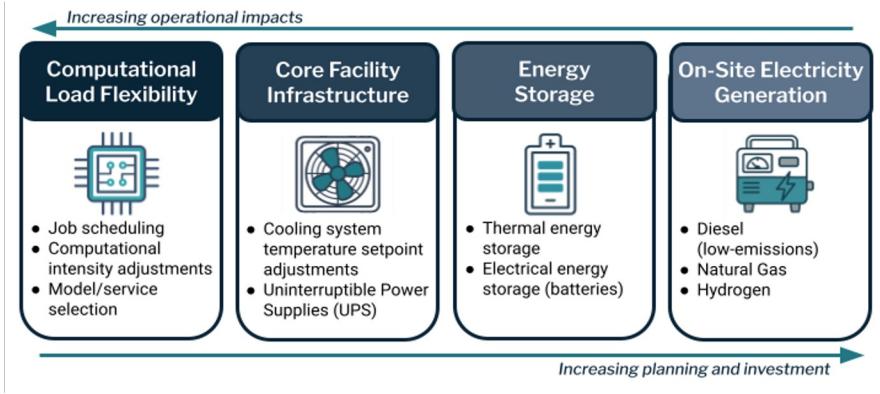


Source: Northwest Power and Conservation Council

Demand flexibility in data centers

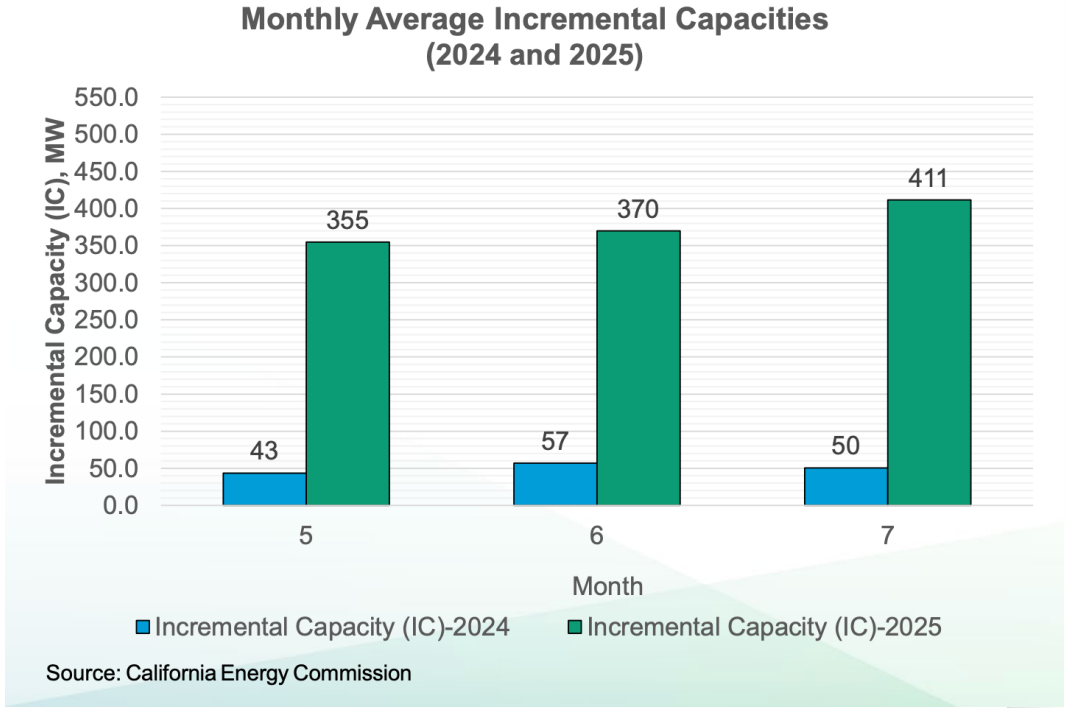
- Demand flexibility is the practice of adjusting load (or energy usage) to match the supply of electricity. Electricity customers can shift their energy usage to when electricity usage is less costly and use less energy when the grid is under stress. (CEC)

- Data centers are primed to provide demand flexibility
  - On-site energy resources for reliability
  - Core services that are often dispatchable across space and time
  - Large thermal loads; creating opportunities for energy storage



Demand flexibility can also occur off-site

- For example, California's demand side grid services storage VPP had 89 MW of incremental capacity in September 2024.
- As of October 2025, California's residential VPP program had incremental capacity exceeds 400 MW (see chart).
- Business models to advance aggregated DERs off-site are being discussed.



Incremental capacity is the locational marginal price-weighted average of hourly incremental discharge relative to measured baselines.

Source: CEC

Flexibility can occur at multiple points in planning

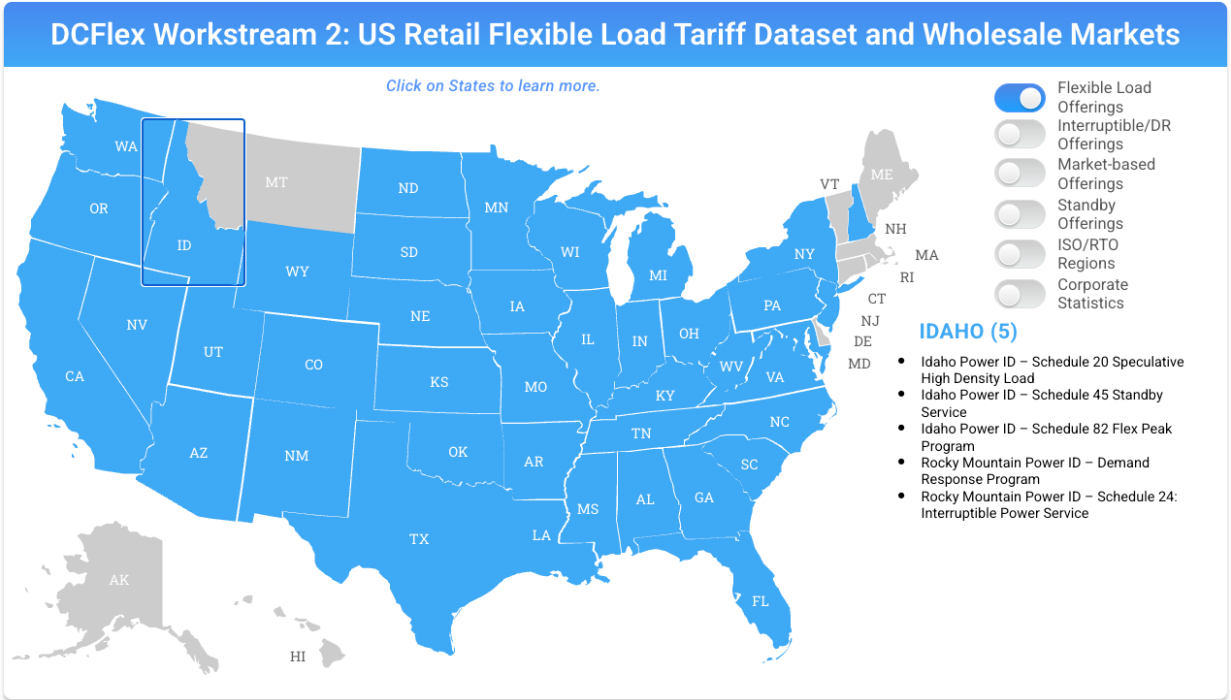
- Tariff
- Interconnection
- Programs and pilots
- Forecasting

Tariffs, Special Contracts and Flexibility

Demand flexibility tariffs

The Electric Power Research Institute has identified flexible load tariffs in almost every state.

Many of the examples are optional interruptible service or load curtailment which are not focused on data centers but can apply to large loads.



Mandatory demand flexibility tariffs examples

- Idaho Power can call interruption events and remotely disconnect electric service to Speculative High Density Load customers up to 225 hours annually:
  - June 15- September 15
  - 1-11 pm; M-F
  - Max 10 hour interruption
  - 2 hour notification
- Entergy Arkansas requires Large Power High Load Density customers to enter into a customer service agreement for interruptible service as part of the tariff. Maximum interruptions range from 10-20 events per year depending on curtailment notice time.

Demand flexibility tariff offering example - Minnesota (proposed)

- Minnesota PUC required Xcel Energy to develop rate classes, sub rate classes or a tariff to address super-large loads.
- Xcel Energy proposed the Large General Time of Day Service and Large Peak Controlled Time of Day Service (Docket 25-289)
- Large General Time of Day Service
  - On peak (9am-9pm) and off peak electricity rates
- Large Peak Controlled Time of Day Service
  - Reduced demand charge for providing interruptible load
  - Four groups of controllable demand, based on performance factor or notice time
  - No minimum interruptible threshold

Tariff guidance on flexibility - Pennsylvania

- The Pennsylvania Public Utility Commission (PUC) discussed the role of interruptible tariffs as part of its en banc proceeding.
- One of the PUC's November 2025 tentative order findings is:
  - Taking interruptible service is equivalent to a reduction in the total request for firm service.
  - Large load tariff minimum demand charges could be reduced proportionally as an incentive for large load customers willing to opt-in to interruptible service.

Demand flexibility special contracts example - Indiana

- Google and Indiana Michigan Power (I&M) filed a special contract -- that is complimentary to I&M's large load tariff -- with the Indiana Utility Regulatory Commission on July 30, 2025 that has two components:
  - Clean Capacity Arrangement (CCA) – an agreement to transfer clean long-term generation capacity from Google to I&M
  - Demand response – Google will provide interruptible capacity to I&M

PJM Critical Issue Fast Path

- PJM's Critical Issue Fast Path (CIFP) process is an accelerated stakeholder process that is being used to inform a PJM board decision on a December FERC filing (in progress prior to FERC's request for comments on the proposed ANOPR.)
- One of the CIFP process objectives is to increase demand flexiblity.
- In their stage 4 CIFP package, PJM has proposed refinements to their load forecasting, demand response and interconnection requirements.
- They also propose a second phase of the CIFP that focuses more narrowly on incentivizing load flexibility when PJM is capacity deficient.
  - Follow-on work to enhance the existing manual load shedding allocation methodology.

Interconnection and Flexibility

Large load interconnection and flexibility

- There number of large load interconnection requests is rapidly increasing.
- Interconnecting large loads can be complex, intersecting with distribution system planning, integrated resource planning and utility or RTO transmission planning.
- Often, there is not a publicly available description of a standardized process to interconnect a large load to a utility system. Information may be available, with varying degrees of specificity in a variety of proceedings (e.g., integrated resource plan, rulemaking, tariff).
- Speculative load interconnection requests have contributed to difficulties in developing load forecasts.
- Standardized and transparent processes can assist with incorporating large load service requests into load forecasts.

States are beginning to explore expedited interconnection approaches for flexible loads.

Interconnection - Examples

California	PG&E offers Flex Connect and SCE offers Load Control Management System pilots that provides quicker, limited interconnection to loads in return for flexibility when the system is constrained.
Pennsylvania	The Pennsylvania PUC discussed the role of interruptible tariffs and interconnection as part of its en banc proceeding. Advocates and industry commented on the opportunity to accelerate interconnection for flexible loads.
Texas	The Texas PUC is implementing SB6, which requires utilities to develop protocols to install equipment before loads are interconnected for remote disconnection during firm load shed event, starting in 2026. It also requires ERCOT to develop a threshold at which a large load customer with an on-site backup generator may be called upon to curtail load in the event of an emergency.
North Carolina	The North Carolina Utilities Commission (NCUC) held a technical conference on large loads in October and included presentations from advocates discussing expedited interconnection for flexible loads.
Michigan	Advocates recommend the Michigan Public Service Commission (PSC) direct a working group process to update load interconnection standards, including discussion of expedited interconnection pathways for large loads which would bring their own clean generation resources and commit to participate in interruptible load or demand response programs (Consumer Energy's data center tariff proceeding).

Proposed Advanced Notification of Proposed Rulemaking

- FERC issued a Notice Inviting Comment on a DOE proposed advanced notice of proposed rulemaking (ANOPR) on large load interconnection.
- Several organizations discuss flexibility in their comments. Suggestions include:
  - Clarifying the interconnection process for flexible large loads
  - Enabling expeditied interconnection for flexible loads
  - Advancing flexible load integration through FERC led stakeholder processes
  - Recognize flexibility for capacity or resource adequacy
  - Automate flexible interconnection through hosting capacity data and standardized flexible options (e.g., non-firm service)

Programs and Pilots

Programs and Pilots - Examples

EmeraldAI, Arizona	AI demand flexibility simulation/field test – EmeraldAI, APS and SRP simulated the performance of EmeraldAI's algorithim to show that AI compute power load can provide meaningful relief when the grid is stressed.
NVIDIA, Virginia	AI Factory – Flexible data center designed from the bottom up to provide services to the grid and will serve as a "reference design and certification standard."
Dominion, Virginia	Dominion recently developed and is operating a pilot program called CapFlex, which is a large load curtailment pilot program that seeks to meet growing data center demand while maintaining and promoting a strong, reliable transmission grid.
Voltus	Voltus offering a Bring Your Own Capacity product •Aggregated distributed energy resources deliver market accredited capacity •Announced in September

Forecasting

Flexibility and Forecasting

- There are limited examples of load forecasting including flexibility.
  - The New York ISO assumed that ~1200 MW of cryptocurrency and hydrogen production large loads will be flexible during peak load conditions in their 2024 reliability needs assessment.
  - Outside of data centers, price based rates for managed electric vehicle charging are an example of flexibility in load forecasts.
- The ESIG Large Load Task Force has two forthcoming reports that will discuss opportunities for advancing flexibility in forecasting.

On-site data center flexibility

- For a copy of the slides associated with on-site data center flexibility, please contact nfrick@lbl.gov

Resources

Resources for more information

- Large Load Literature Review - summaries of ~80 reports and large load resources, grouped into 12 categories (Load forecasting, Reliability and resource adequacy, Large load interconnection, Demand flexibility, Generation, Co-location, Data center location/infrastructure, Large load tariffs, Policy options, Maps and tools, Design and operations)
- Electricity Rate Design for Large Load: Evolving Practices and Opportunities
- Center of Expertise in Data Centers – datacenters.lbl.gov

Thank you

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