Load Flexibility's Role in Servicing Large Load Demand

IURC IRP Contemporary Issues Technical Conference

Tim Profeta
Executive in Residence, Nicholas Institute

September 3, 2026

ALIGN: Equipping State Leaders to Build a Reliable, Affordable, and Clean Energy Future

- Our grid faces a perfect storm: surging electricity demand, aging infrastructure, rising energy costs, and unprecedented pressure from emerging large energy users such as data centers.

- States are caught in the middle — tasked with ensuring reliable, equitable access to electricity while enabling national security priorities and economic growth.

- With the right approaches, states do not have to choose between affordable, clean energy and accommodating new energy-intensive industries — ALIGN helps them think through ways to responsibly pursue both.

Duke NICHOLAS INSTITUTE *for* ENERGY, ENVIRONMENT & SUSTAINABILITY

PARTNER ORGANIZATIONS

Nicholas Institute — Duke University

Advanced energy systems modeling, policy analysis, and policymaker engagement in the Southeast and PJM regions.

GRACE Lab — Duke University

A Grid that is Risk Aware for Clean Electricity: ARPA-E-funded research developing a risk-aware Energy Management System that optimizes reserve targets and resource scheduling under uncertainty — demonstrated to improve costs, emissions, and reliability on the nation's largest vertically integrated utility system.

Center for the New Energy Economy — Colorado State University

Bipartisan legislative education and engagement across the U.S.; Western state convenings on energy policy, electricity markets, and energy transitions; energy policy research and analysis.

Georgetown Climate Center

State and local regulatory law and policy expertise; Mid-Atlantic and Northeast convenings; state playbooks and deep-dive analyses.

SENIOR CONSULTANTS

Allison Clements — 804 Advisory

Former FERC Commissioner (2020–2024); nationally recognized expertise in transmission planning, interconnection reform, and electricity market design.

Roselle LLP

Boutique energy law firm whose team includes former senior officials from FERC, DOE, NRDC, the White House, and the D.C. Circuit.

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Solutions to Growing Energy Demand

- ALIGN helps states navigate the implications of high-impact actions, including:
  - Load flexibility - Incentivizing large load users to shift energy usage during peak demand — avoiding excessive buildout of new infrastructure.
  - Deploying grid enhancing technologies (GETs) and other solutions to modernize an aging grid and maximize existing infrastructure.
  - Enacting large load tariffs that protect all ratepayers — and clean energy targets — from the impacts of new large load additions.
  - Helping communities negotiate community benefits agreements and clean energy funds when a new large load is proposed, including the deployment of a virtual power plant (VPP) program, sponsored by hyperscalers.

ALIGN's three verticals

Additional Analysis	Policy and Market Design	Direct Policymaker Engagement
Duke **GRACE Lab** *A Grid that is Risk-Aware for Clean Electricity*	NICHOLAS INSTITUTE *for* ENERGY, ENVIRONMENT & SUSTAINABILITY Grove Climate Group Est. 2021 804 ADVISORY	CENTER FOR THE NEW ENERGY ECONOMY COLORADO STATE UNIVERSITY GEORGETOWN CLIMATE CENTER

Load flexibility – what are we talking about, exactly?

- What is large load flexibility? Ability to prevent drawing power from the grid automatically or promptly at the grid operators' signal
- How is it achieved technically? Shifting usage in space and time, IT interventions, on-site generation, curtailing nonessential functions
- Why does it matter for affordability and speed-to-power? Avoids distribution, transmission and generation infrastructure
- Are you talking about interruptibility? Not exactly.

Initial concepts developed in Rethinking Load Growth

- Support regulators and stakeholders in identifying strategies to accommodate load growth without compromising reliability, affordability, or progress on decarbonization
- Provide informational resources and a first-order estimate of the potential for accommodating new loads while mitigating or deferring capacity expansion
- Motivate additional analysis to more precisely quantify headroom in each balancing authority

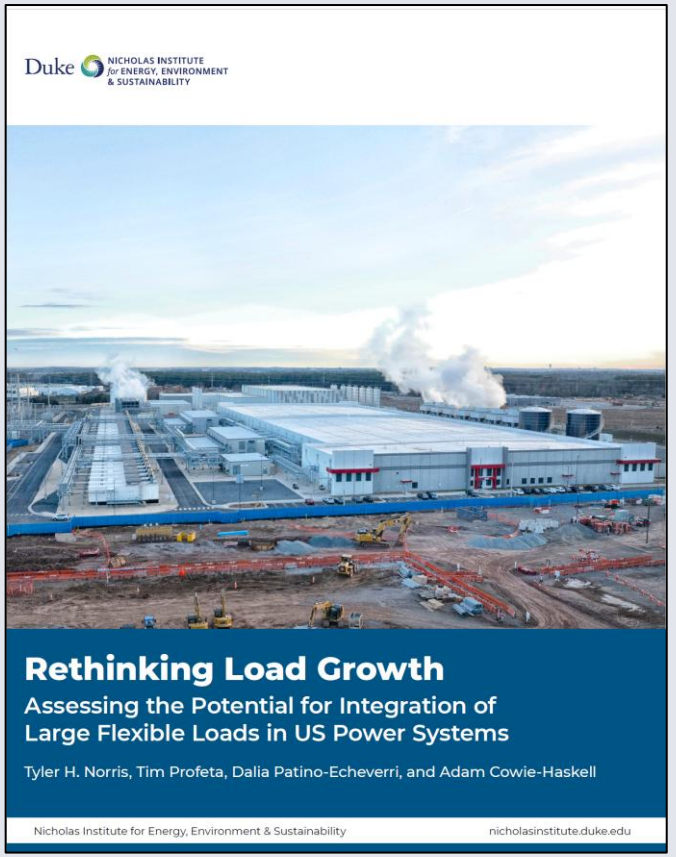

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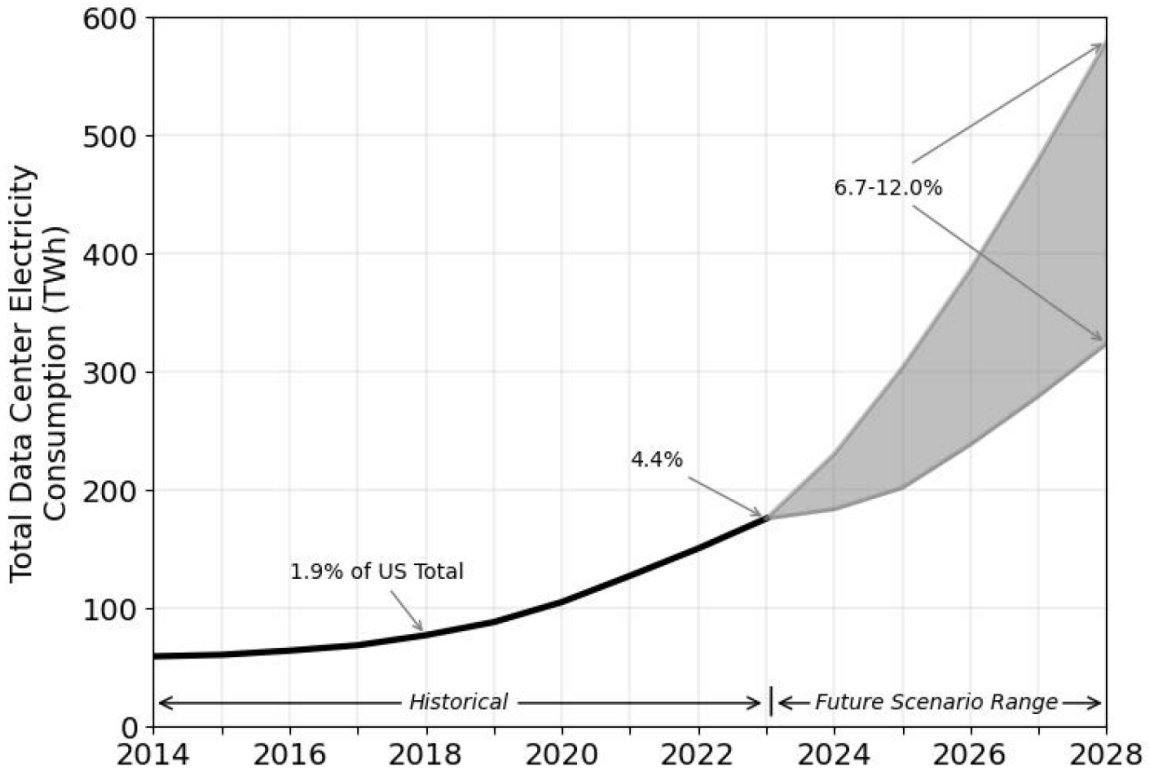
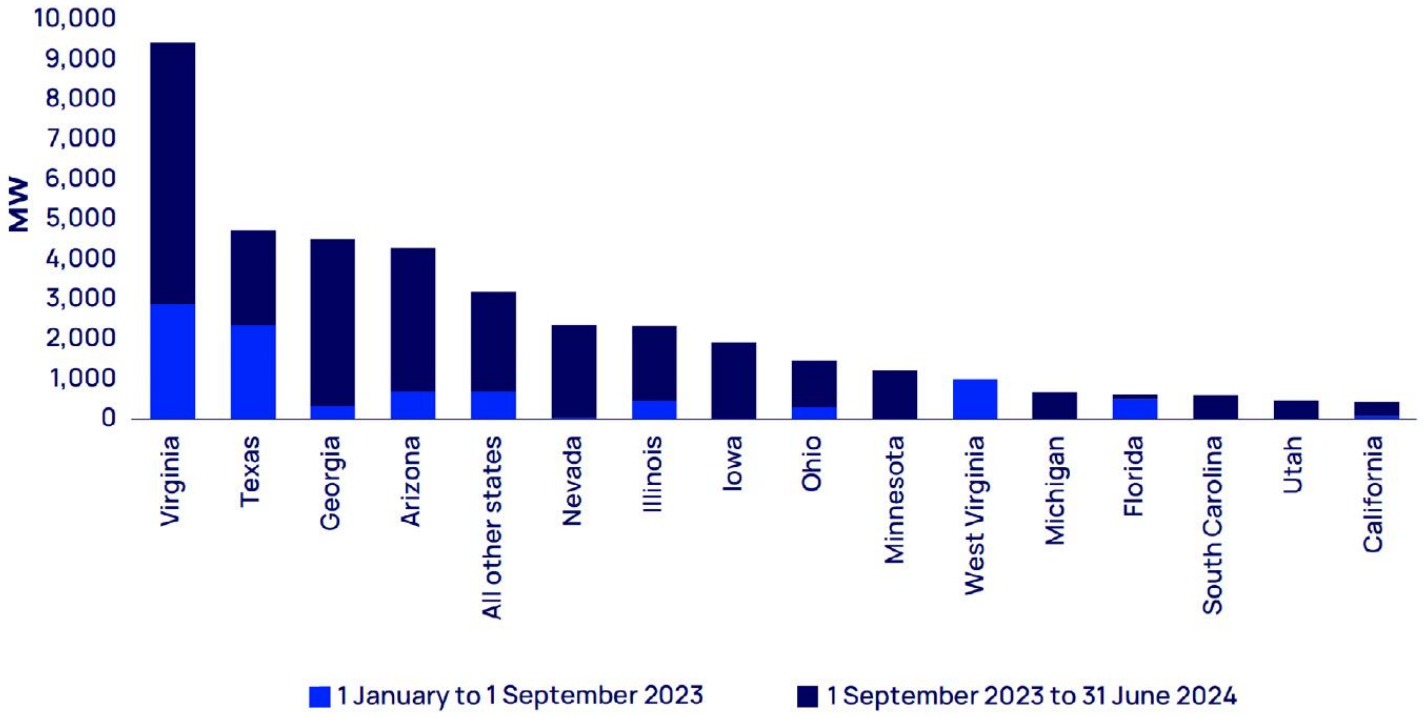
Figure 5. Range of uncertainty of future data center load growth



Note: US data center load growth from 2000 to 2024. The shaded gray area indicates uncertainty based on range of projections of energy consumption.

Source: Shehabi et al. (2024)

Figure 4. Increased rate of announced data centers in select US states from January 2023 to June 2024

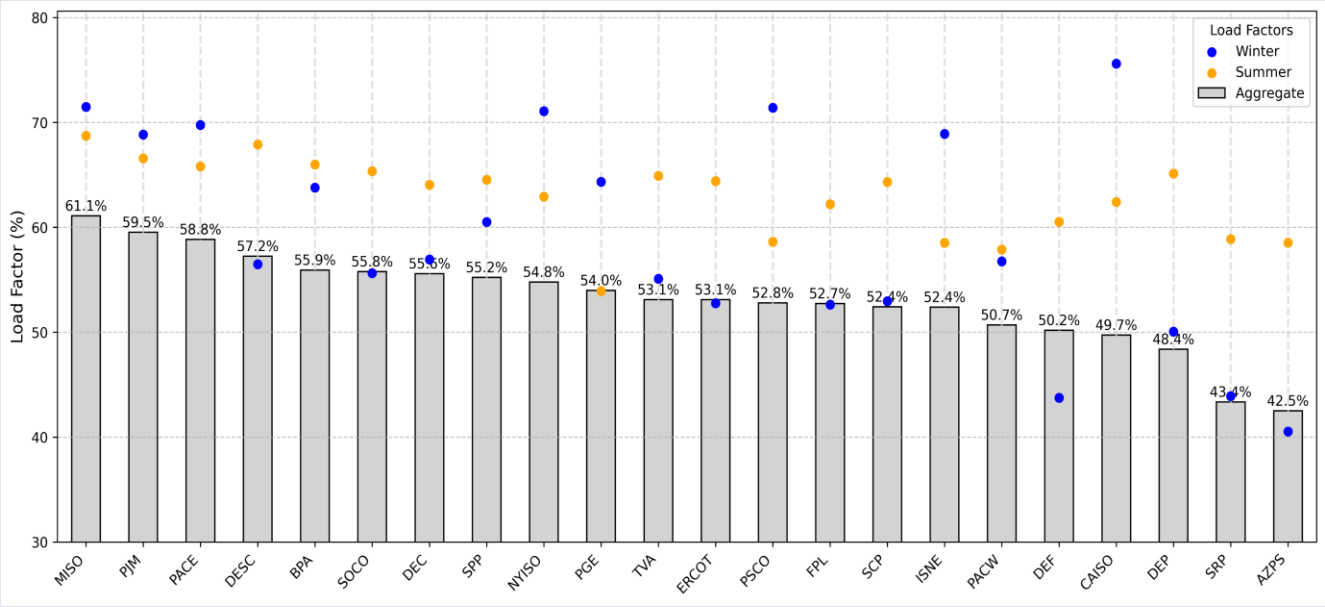


Courtesy Wood Mackenzie (2024)

US power systems operate at 53% avg. load factor

- Load factor is the ratio of average demand to peak demand and is an indication of system utilization
- Aggregate load factors range between 43% to 61%, with an average and median value of 53%
- Winter load factors were notably lower than summer (59% vs. 63% average)

Load Factor by Balancing Authority and Season, 2016–2024



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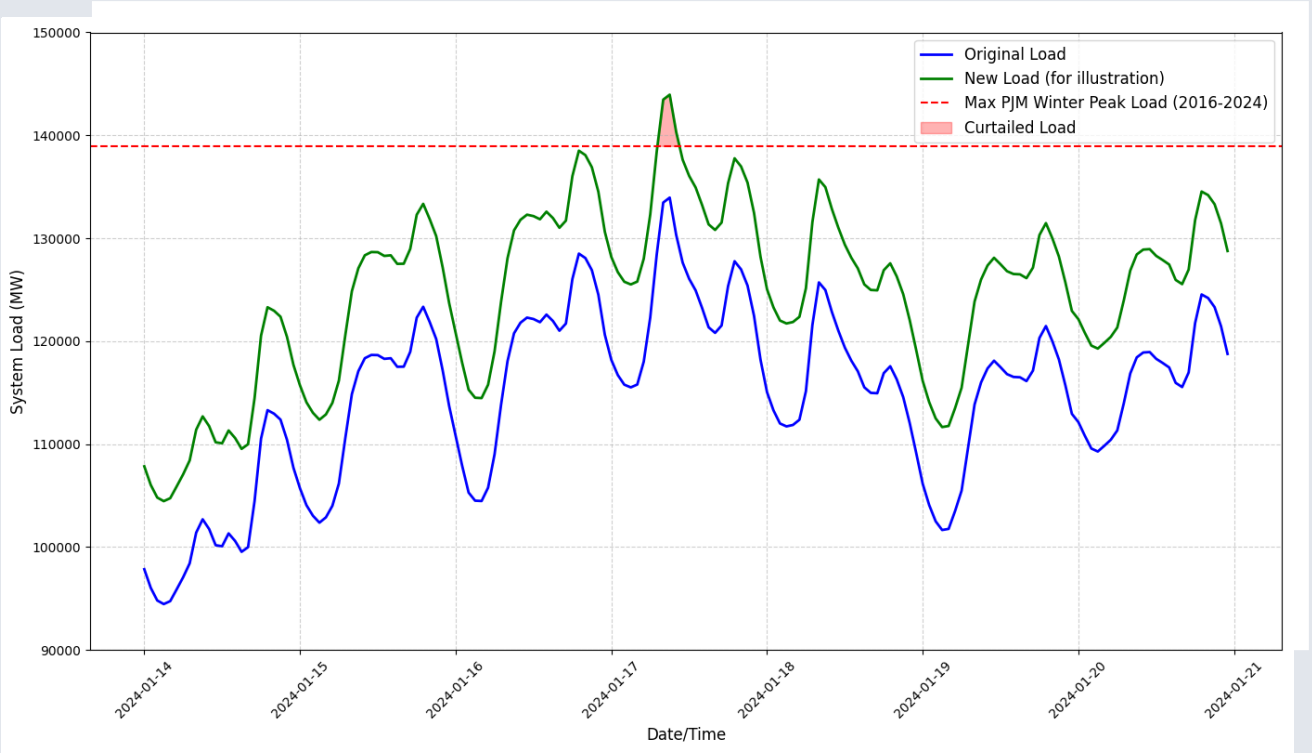
Method:

- New, constant load was added in all hours
- Headroom was calculated as the difference between the new load and the seasonal peak threshold in each hour, summed across all hours in a year
- The flexibility rate for each load increment was defined as the total annual curtailed MWh divided by the new load's max potential annual consumption

Illustrative Load Curtailment in PJM (Jan. 14–21, 2024)



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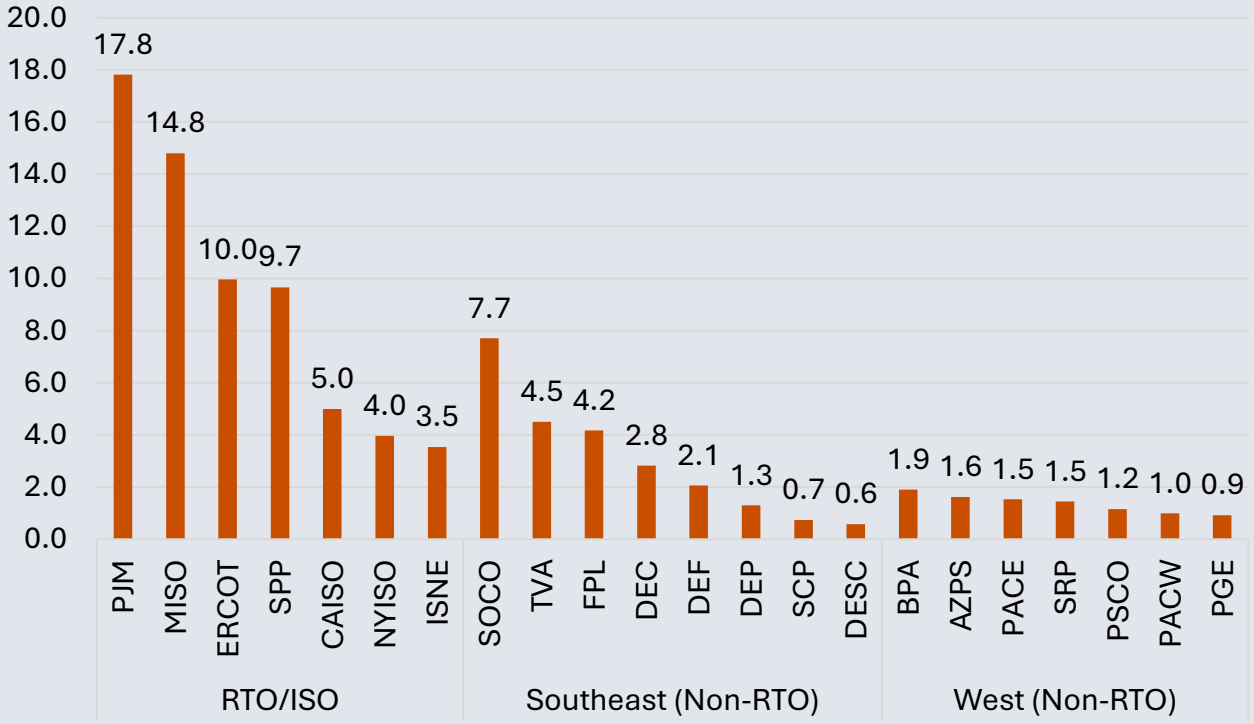
Results: Flexibility-Enabled Headroom

- Headroom across the 22 analyzed balancing authorities is between 76 to 215 GW, depending on the applicable load flexibility commitment
- 76 GW of headroom is available at an expected load flexibility rate of 0.25%
- This headroom increases to 98 GW at 0.5% flexibility, 126 GW at 1.0%, and 215 GW at 5.0% flexibility

Headroom Enabled by 0.5% Load Flexibility Commitment by Balancing Authority, GW



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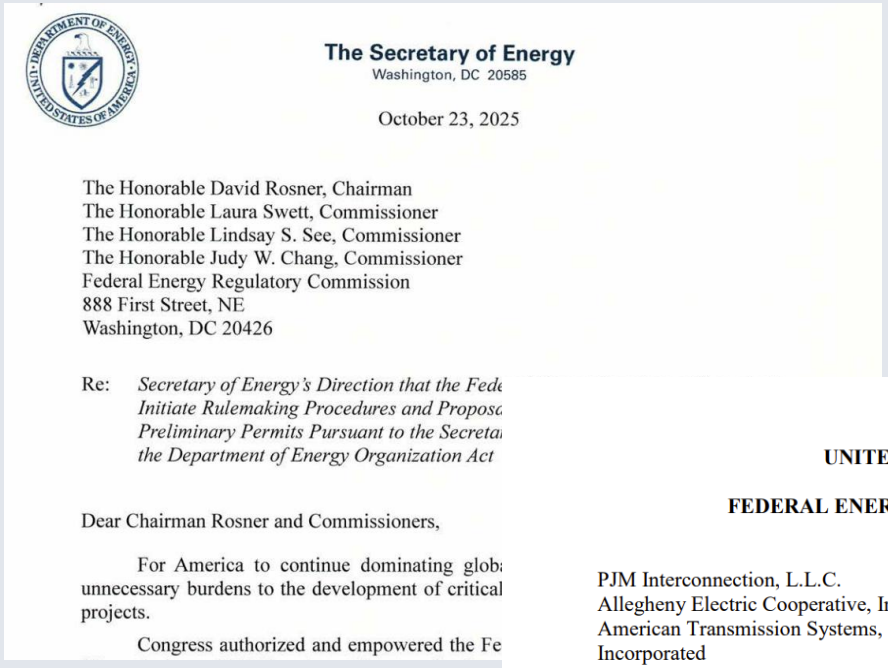
Moving forward:
How do we enable this headroom?



The Secretary of Energy
Washington, DC 20585

October 23, 2025

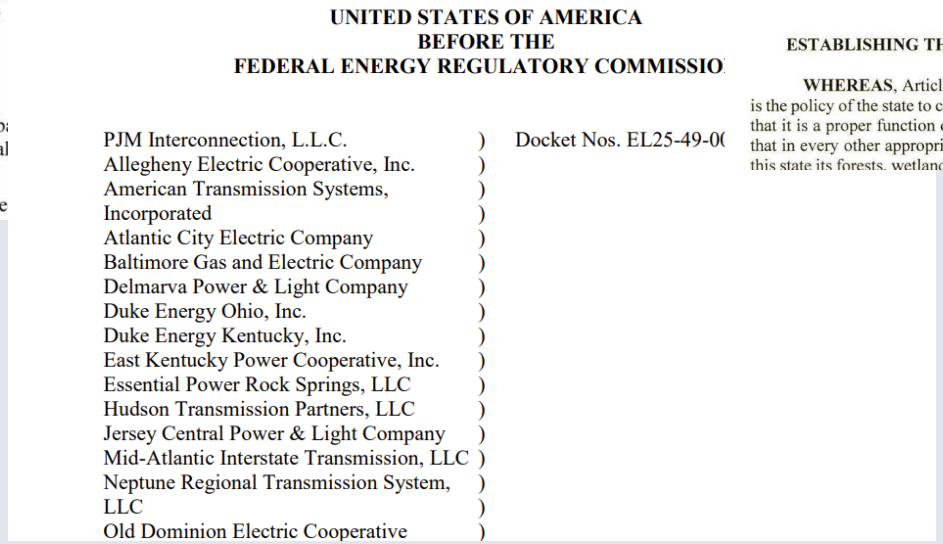
The Honorable David Rosner, Chairman
The Honorable Laura Swett, Commissioner
The Honorable Lindsay S. See, Commissioner
The Honorable Judy W. Chang, Commissioner
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: *Secretary of Energy's Direction that the Fede*
Initiate Rulemaking Procedures and Proposa
Preliminary Permits Pursuant to the Secreta
the Department of Energy Organization Act

Dear Chairman Rosner and Commissioners,

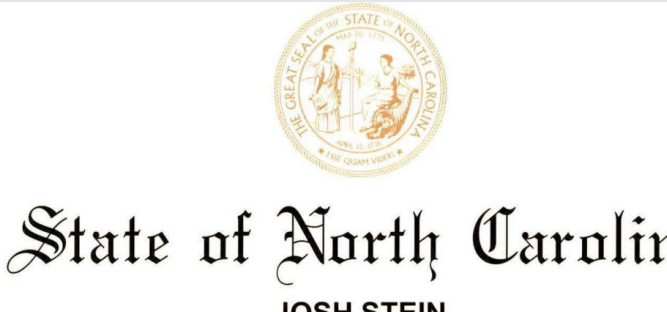
For America to continue dominating glob
unnecessary burdens to the development of critical
projects.

Congress authorized and empowered the Fe



UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSIO

PJM Interconnection, L.L.C.	)	Docket Nos. EL25-49-0(
Allegheny Electric Cooperative, Inc.	)	
American Transmission Systems, Incorporated	)	
Atlantic City Electric Company	)	
Baltimore Gas and Electric Company	)	
Delmarva Power & Light Company	)	
Duke Energy Ohio, Inc.	)	
Duke Energy Kentucky, Inc.	)	
East Kentucky Power Cooperative, Inc.	)	
Essential Power Rock Springs, LLC	)	
Hudson Transmission Partners, LLC	)	
Jersey Central Power & Light Company	)	
Mid-Atlantic Interstate Transmission, LLC	)	
Neptune Regional Transmission System, LLC	)	
Old Dominion Electric Cooperative	)	



State of North Carolin

JOSH STEIN
GOVERNOR

August 26, 2025

EXECUTIVE ORDER NO. 23

ESTABLISHING THE NORTH CAROLINA ENERGY POLICY TASK FORCE

WHEREAS, Article XIV, Section 5 of the North Carolina Constitution establishes t
is the policy of the state to conserve and protect its lands and waters for the benefit of all its pe
that it is a proper function of the state to control and limit the pollution of our air and water
that in every other appropriate way the state should preserve as a part of the common herita
this state its forests, wetlands, estuaries, beaches, historical sites, open lands, and places of be

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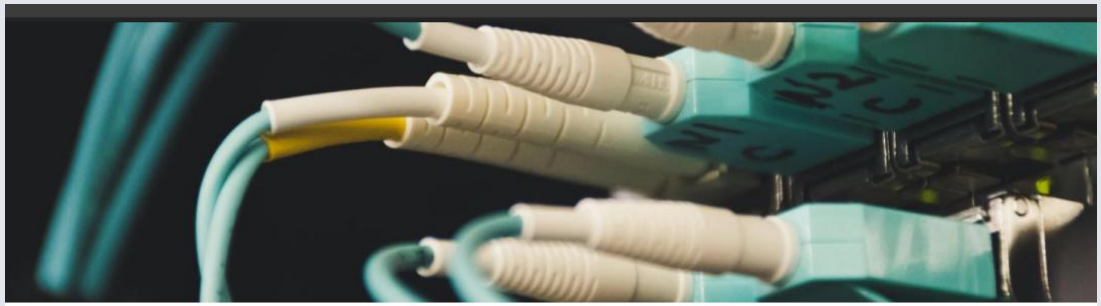
Most recent ALIGN focus: “Tool Kit” for State Leaders



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Leveraging Large Load Flexibility to Facilitate Access to Power While Protecting Customers

Considerations for State Regulators

Sam Walsh, Miles Farmer, Kim Smaczniak, Avi Zevin, Nathan Lobel, Gabe Daly, Roselle LLP

Tim Profeta, Nicholas Institute for Energy, Environment & Sustainability, Duke University

Acknowledgments

The authors gratefully acknowledge the contributions of Allison Clements (804 Advisory), Jennifer Gardner (Envision Energy), and Rebecca Kasper (Nicholas Institute for Energy, Environment & Sustainability, Duke University).

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Steps for Execution at State Regulatory Level –

- Formally define “Flexible Large Load”
- Detailed counsel on how to incorporate into utility regulatory processes:
  - Interconnection
  - Rates
  - Planning
  - New “bring your own capacity” frameworks

States have robust authority to enable large load flexibility

States' existing authority

- Distribution-level interconnections
- Retail service terms and tariffs
- State planning processes (e.g. integrated resource planning) and associated load forecasting inputs

Even if FERC asserts jurisdiction over transmission-level interconnection…

- Distribution interconnections remain state-regulated
- Interconnection of loads below threshold size (proposed to be 20 MW) continues to be overseen by states
- Retail service authority is unaffected
- States acting *now* can shape a large volume of in-flight transmission system interconnection requests

The DOE proposed that FERC assert jurisdiction over large load interconnection to the transmission system — FERC acted in June with show-cause orders targeting the 6 organized markets.

Scope: the orders reach only the RTO/ISO regions

RTO/ISO regions only

FERC targeted only the six organized markets. It did not order utilities outside RTO/ISO regions.

Chairman Swett: the challenges are not "somehow unique to the RTO/ISO regions"; she encouraged providers "outside RTO/ISO regions to make individual filings," and the orders "do not foreclose the possibility of a future rulemaking."

...but non-RTO action is invited

- Swett (concurrence): the orders do not "prevent us from acting on filings made under sections 205 and 206 of the FPA," and she encourages providers "outside RTO/ISO regions to make individual filings to address the issues we discuss today."
- Rosner (concurrence): "I also encourage public utilities outside of RTO/ISOs across the country to do the same" — i.e., file § 205 proposals.

Rulemaking is still on the table. FERC chose six region-specific orders "rather than a proposed final rule *at this time*" (LaCerte) — signaling further action, including a rulemaking, could follow.

Sources: Commissioners' separate statements (Swett, Rosner, LaCerte).

What the orders ask the RTOs to address (1/2)

1

Large-load transmission service & study process

- New “large load” definition (≥ 50 MW, > 69 kV)
- A dedicated transmission-service-request study process, modeled on SPP
- Rolling applications, non-refundable fees, and escalating readiness deposits to deter speculative requests
- Mandatory review of alternative (grid-enhancing) technologies before traditional Network Upgrades;
- 60–90 day study deadline
- Ongoing operational requirements (telemetry, ramp-rate limits, remote disconnect)

2

Cost-shifting protection

- Public, searchable posting of large-load additions and Network Upgrade costs by pricing zone
- A *pro forma* cost recovery agreement (RTO, transmission owner, and “Eligible Customer”) requiring a minimum contribution secured by credit support
- Designed to protect against wholesale cost shifting if a large load fails to materialize — e.g., across zones where planned infrastructure goes unused
- Directs further briefing on whether cost recovery agreements between large load customer and transmission owner (voluntary or state required) may substitute for the new FERC cost recovery agreement requirement, if the agreement with the large load customer provides comparable or greater protection against cost shifting among transmission customers

What the orders ask the RTOs to address (2/2)

3 Co-location & behind-the-meter generation (modeled on PJM Co-location Order)

- Clear rates, terms, conditions, and study procedures for interconnection customers serving co-located load
- Ancillary-service charges (regulation and black start) on a gross-demand basis
- Consistent with the PJM Co-Location Order — co-located load pays for the wholesale services it uses

4 New transmission services for flexible loads (modeled on PJM Co-location Order)

- Interim non-firm network service (interim NITS) while Network Upgrades are built
- Permanent firm and non-firm contract-demand service
- Lets flexible loads connect faster and pay for the service they actually take, reducing unnecessary buildout

5 Interconnection for proximate / co-located generation

- A tailored, expedited generator-interconnection study and service
- For generation serving an electrically proximate (within ~two substations) or co-located large load
- Modeled on SPP's HILLGA, but Commission signals opportunity for regional variation
- Goal is to let loads come online more quickly with a "bring-your-own-generation" approach, while full network upgrades are being studied / built

Procedural posture — deadlines and the abeyance branch

Each order is an FPA § 206 show-cause proceeding on the Commission's own motion. Within 60 days, each RTO/ISO and its transmission owners must either (1) show cause why the tariff remains just and reasonable, or (2) explain remedial changes — and are strongly encouraged to instead file under FPA § 205.

Baseline schedule (from June 18, 2026)

Interventions — 21 days	**Jul 9**
Informational report — 30 days	**Jul 20**
Abeyance requests due — 45 days	**Aug 4**
Show cause / replacement — 60 days	**Aug 17**
Reply comments — +30 days	**~Sep 16**
Refund effective date	**FR notice**

If FERC grants abeyance (up to 90 days)

FERC may hold the proceeding — including the 60-day response deadline — in abeyance for up to 90 days, beginning at that deadline:

Response moves from Aug 17 → as late as Nov 15

Reply comments shift to ~Dec 15, 2026 (30 days after)

Requests are due within 45 days (~Aug 2) and must show a planned § 205 filing and specific timing.

Not granted reflexively; capped at 90 days; extensions disfavored. Interventions (21 days) and the informational report (30 days) are not deferred.

The starting point: define a flexible large load class

- A **flexible large load** makes a binding, enforceable commitment to curtail consumption when directed by the utility or grid operator
- Qualifying commitments should be **voluntary** — not mandated — and made **up front**, in the interconnection process or as a condition of retail service
- Commitments must be **long-term** to support infrastructure planning; temporary commitments have value but do not qualify for the full set of benefits
- Commitments must guarantee minimum performance across four parameters:

DEPTH	SPEED	DURATION	AVAILABILITY
Min. % of contract capacity flexed *e.g., 50%+*	Response time to operator signal *e.g., 5–10 minutes*	Min. hours per flexibility event *e.g., 4 hours*	Min. hours available per year *e.g., 2%+ of annual hours*

Four policy domains where states can enable flexibility

Domain	What states can do	Why it matters for utilities
Interconnection	(1) Prioritize study queue for flexible loads; (2) Require utilities to model flexibility commitments in interconnection studies	Avoids overbuilding infrastructure; reduces study costs and timelines; speed-to-power is the strongest incentive for load participation
Ratemaking	Directly assign network upgrade costs; adjust demand charges and minimum billing provisions to reflect lower cost causation of flexible loads	Protects existing ratepayers; sends accurate price signals; reduces stranded asset risk
Load forecasting & planning	Require utilities to disaggregate large load forecasts and embed flexibility commitments in long-term resource and transmission plans	Allows planners to quantify and rely on flexibility; reduces risk of costly overbuilds or underbuilds
Bring-your-own-capacity (BYOC)	Exempt qualifying flexible loads from BYOC obligations, or count flexibility capability as eligible capacity	Avoids inadvertently penalizing investment in flexibility; preserves commercial incentive to flex

Emerging ALIGN workstreams, building on and complementary to load flexibility

- **Community integrated Virtual Power Plants (VPPs)**
  - How can hyperscalers be better grid neighbors? What if they led the charge in deploying VPPs at scale?
  - Forthcoming paper from Duke exploring this
- **The Battery Bridge: How Batteries Help Large Electric Loads Become a Grid Asset**
  - Batteries add grid capacity fast and flexibly – deferring costly generation and transmission buildouts while enabling peak shaving, VPP/demand response participation, and pollution-free backup and islanding power for large loads and residential customers alike
  - Unlocking benefits requires policy tailored to market structure – vertically integrated and restructured states face distinct regulatory paths to deploying batteries at scale for large-load growth
  - Two levers stand out: (1) bring-your-own-clean-energy tariffs and (2) energy procurement reform, which align state clean energy goals with the regulatory incentives utilities need to act
  - Forthcoming paper from Georgetown and Duke on this issue

VPPs give hyperscalers an offsite path to flexibility

A VPP aggregates distributed energy resources (batteries, smart thermostats, EVs, backup generators, and other flexible load) into a single resource that a utility or grid operator can dispatch like a power plant.

Onsite flexibility (the load itself)

- Data center curtails compute or shifts workloads (e.g., delaying AI training) during system stress
- Behind-the-meter batteries or backup generation offset grid draw
- Requires the hyperscaler to accept operational risk directly

Offsite flexibility (a VPP does the work)

- Hyperscaler funds or contracts a third-party VPP that reduces demand elsewhere on the grid
- Residential batteries, thermostats, and C&I demand response substitute for the data center's own curtailment
- Frees up headroom for faster interconnection without touching compute operations

Up to 200 GW of potential U.S. demand response capacity could be unlocked through flexible DERs and other flexible load according to a Brattle Group analysis.

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Three models connect VPPs to hyperscaler flexibility

1

Utility-Funded VPP Sponsorship

A data center funds or sponsors a utility-operated VPP — directly, or by contributing to the utility's demand-side management budget. In return, the utility grants expedited interconnection.

Model outlined in RMI's 2026 policy brief on VPPs and large loads

2

Bring Your Own Capacity (BYOC)

A data center developer contracts directly with a VPP operator to bring dispatchable, offsite DER capacity online — positioning the load as a capacity enabler rather than just a consumer.

Voltus's BYOC product, launched with partner Cloverleaf

3

VPP-Backed Flexible Interconnection

A utility connects a data center faster in exchange for agreeing to reduce demand during specific hours, with reliability backstopped by contracted VPP capacity instead of onsite curtailment alone.

Aligned Data Centers / Pacific Northwest utility battery deal

Hyperscalers are already putting VPPs to work

100 MW	**Google + Voltus**	Three-year agreement to aggregate 100 MW of flexible DER capacity on the PJM grid, with Google funding the project to support regional data center growth.
16.8 GW	**Sunrun + Tesla + Renew Home**	Aggregated home batteries and over 8 million smart thermostats into what the partners call the largest distributed power plant in the country — explicitly marketed as a way to avoid throttling data centers during peak hours.
	Voltus "Bring Your Own Capacity"	New product (with partner Cloverleaf) lets data center developers position offsite flexible load as a capacity enabler, helping accelerate interconnection approval.
+33%	**Wood Mackenzie, 2025**	Year-over-year jump in VPP deployments driven by data center demand – a signal that hyperscaler-linked flexibility is now a primary driver of VPP market growth.

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Virginia: the first statutory flexibility mandate

Nov. 2025

SCC approves a new data center rate class

Dominion customers drawing 25+ MW must sign 14-year contracts, pay a minimum of 85% of reserved transmission/distribution capacity and 60% of generation capacity, and post $1.5 million of collateral per MW. Takes effect January 1, 2027.

Dec. 2025

Dominion files a 450 MW VPP pilot tariff

Under the 2025 Community Energy Act (Va. Code § 56-585.1:16), Dominion begins a VPP pilot aggregating residential and C&I distributed energy resources, with third-party aggregators eligible to participate. Ramps through August 2026; runs to July 2028.

2026

HB 284 / SB 371 signed — first flexibility statute

Directs Dominion and Appalachian Power to file voluntary demand-flexibility programs for customers 25 MW and above by January 2027 (load-shifting, dynamic voltage, storage, bill credits), with costs not shifted to other ratepayers. Cooperatives follow by 2029.

Aug. 2026

SCC orders a direct-assignment transmission tariff

Regulators direct Dominion to develop a tariff that assigns transmission costs tied to large-load interconnections directly to those customers, rather than spreading them across all ratepayers.

New Jersey: an executive-order-driven push to VPPs

Jan. 2026

Gov. Sherrill's Executive Order No. 2

Signed on her first day in office, EO2 declares a statewide energy emergency and directs the NJ Board of Public Utilities (BPU) to stand up a Virtual Power Plant program within 180 days.

May 2026

Sherrill's "Comprehensive Plan" on data centers

Shifts cost burden from ratepayers to data centers, requires biannual usage reporting, and pushes large loads toward flexibility and clean-energy commitments as a condition of growth.

July 2026

S731/A796 signed — data-center-specific tariff law

Requires utilities to build a tariff for data centers of 100+ MW that includes demand-response and efficiency programs, binding flexibility commitments, and priority curtailment of large data centers ahead of residential customers in emergencies.

July 2026

NJBPU releases its VPP "Straw Proposal"

A two-year, technology-neutral, utility-administered VPP program (home batteries, smart thermostats, EV chargers) launching in 2027, transitioning to a market-based, open-access VPP tariff from 2029 onward.

Georgia: negotiated commitments drive flexibility

Dec. 2025

PSC stipulation on Georgia Power's ~9,885 MW buildout

In approving Georgia Power's generation expansion, the PSC requires the utility to engage large-load customers on load-flexibility contract terms and cost-saving opportunities, and to report flexibility-program recommendations back to the Commission.

2026

Speculative pipeline underscores the stakes

PSC staff testimony finds only ~1,900 MW of Georgia Power's large-load pipeline backed by executed contracts; 33 data-center projects (11,332 MW) have been removed since 2023 — the case for firmer, flexibility-linked commitments.

June 2026

CIR program reopens – an early bring-your-own-capacity step

Georgia Power's Customer Investment in Renewables program lets large-load developers fund and bring their own clean generation (up to 3 GW total) in exchange for bill credits, similar in spirit to “bring your own capacity” models.

Ongoing

Base rate freeze keeps pressure on ratepayer protection

A base rate freeze through 2028 and required quarterly cost-allocation reporting keep scrutiny on whether large-load flexibility — not just new generation — is genuinely protecting residential customers.

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Key takeaways

- **States can act now** — regardless of what FERC does on transmission-level interconnection, states retain broad authority over distribution connections, retail service, rate design, and planning
- **Define Flexible Large Load** — once regulators establish a clear, binding definition of a flexible large load, consistent treatment across all four policy domains follows naturally

- **Rewarding flexibility is not a subsidy** — the goal is accurate cost causation: flexible loads that avoid infrastructure investment should pay less; inflexible loads that trigger it should pay more

- **Speed-to-power is the strongest incentive** — interconnection queue priority is the most commercially powerful tool states and utilities have to encourage voluntary flexibility commitments
- **Urgency matters** — status quo processes will trigger unnecessary infrastructure spend and prevent economic development; states and utilities that act first will shape load that influences their systems for decades

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