Harmonizing Large Load Interconnection Requirements in the West

Large Load Industry Advisory Group

Kick-off Meeting

May 28, 2026

WIRAB
Western Interconnection
Regional Advisory Body

Meeting Logistics

Recording

This meeting is being recorded and **may be posted publicly**. By participating, you consent to your name, voice, and image being part of the recording.

How to Participate

Use the **"Raise Hand"** feature to ask questions or provide input

Feel free to use the **chat** for comments or clarifying questions

We will be using **Slido** later in the meeting to solicit feedback

Audio Etiquette

Everyone came into the meeting as an attendee

Hosts will have to allow you to unmute, so please raise hand if you wish to participate

Materials & Follow-Up

Slides and materials will be shared after the meeting and available on the webpage

Contact information will be provided at the end for follow-up questions or comments

Outline

Introductions and Background	Overview of WIRAB's role and motivation for this effort Explanation of the Industry Advisory Group's role
Technical Overview	Highlights from *NERC and other Industry Activities* Vision for Template Facility Interconnection Requirements
Interactive Discussion and Q&A	Open Discussion and Slido Polls
Closing and Next Steps	Confirming upcoming meeting dates and schedule Preview of next meeting topics and expected deliverables

Introductions

WIRAB AND WIEB STAFF
(OVERSIGHT AND FACILITATION)

ELEVATE ENERGY CONSULTING
(TECHNICAL EXPERTS)

INDUSTRY PARTICIPANTS
(FEEDBACK AND DISCUSSION)

Please Introduce Yourself on Chat to Everyone

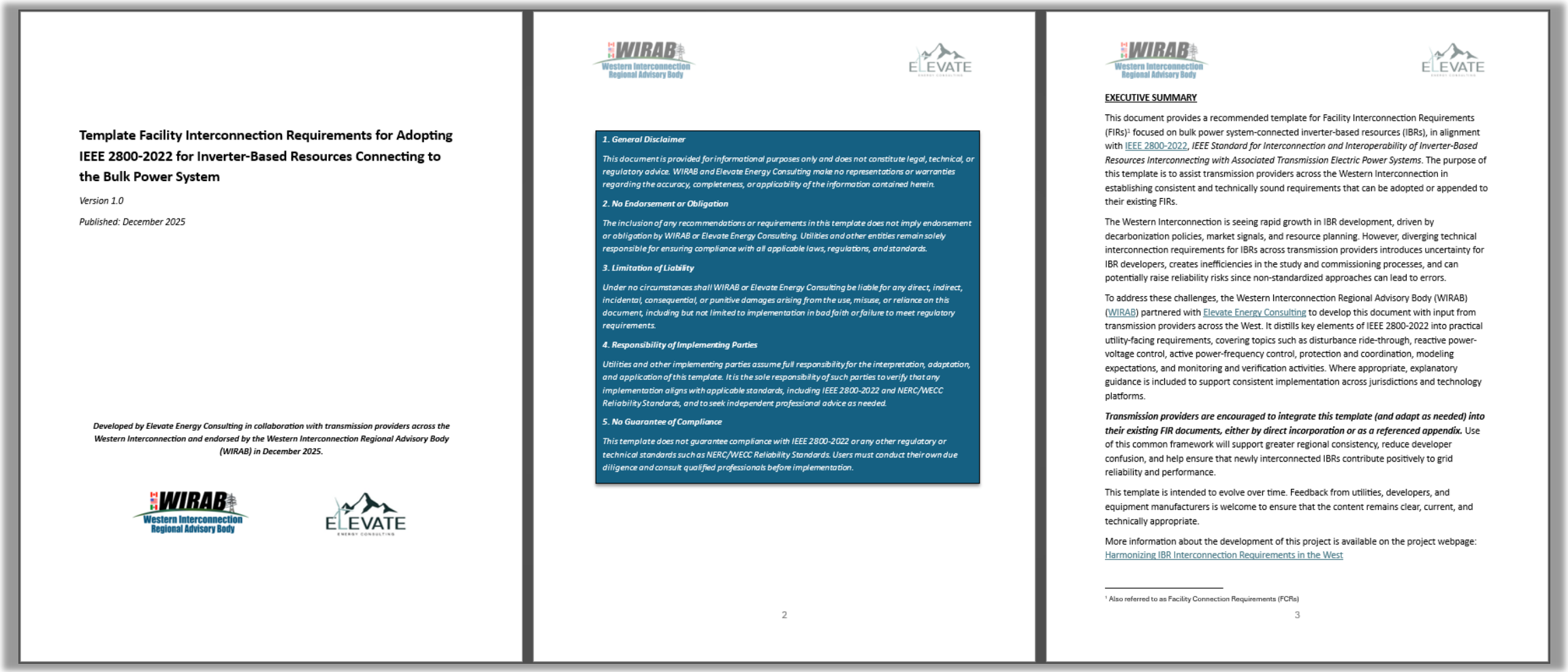
- Name
- Organization / Company
- Role or Title
- What is the biggest challenge you are facing with Large Loads in your role?

Who is WIRAB?

WIRAB
Western Interconnection Regional Advisory Body

- **Statutory Authority:** Established in 2005, as an independent body with statutory authority under Section 215(j) of the Federal Power Act to Advise FERC, NERC, and WECC on reliability matters in the Western Interconnection.
- **Membership:** All state and provinces with load served in the Western Interconnection
- **Funding:** Assessments approved by FERC to load serving entities under Section 215 of the Federal Power Act.

Template Facility Interconnection Requirements for IBRs



Template Facility Interconnection Requirements for Adopting IEEE 2800-2022 for Inverter-Based Resources Connecting to the Bulk Power System

Version 1.0

Published: December 2025

Developed by Elevate Energy Consulting in collaboration with transmission providers across the Western Interconnection and endorsed by the Western Interconnection Regional Advisory Body (WIRAB) in December 2025.

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5. No Guarantee of Compliance

This template does not guarantee compliance with IEEE 2800-2022 or any other regulatory or technical standards such as NERC/WECC Reliability Standards. Users must conduct their own due diligence and consult qualified professionals before implementation.

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EXECUTIVE SUMMARY

This document provides a recommended template for Facility Interconnection Requirements (FIRs)[1] focused on bulk power system-connected inverter-based resources (IBRs), in alignment with IEEE 2800-2022, *IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Electric Power Systems*. The purpose of this template is to assist transmission providers across the Western Interconnection in establishing consistent and technically sound requirements that can be adopted or appended to their existing FIRs.

The Western Interconnection is seeing rapid growth in IBR development, driven by decarbonization policies, market signals, and resource planning. However, diverging technical interconnection requirements for IBRs across transmission providers introduces uncertainty for IBR developers, creates inefficiencies in the study and commissioning processes, and can potentially raise reliability risks since non-standardized approaches can lead to errors.

To address these challenges, the Western Interconnection Regional Advisory Body (WIRAB) (WIRAB) partnered with Elevate Energy Consulting to develop this document with input from transmission providers across the West. It distills key elements of IEEE 2800-2022 into practical utility-facing requirements, covering topics such as disturbance ride-through, reactive power-voltage control, active power-frequency control, protection and coordination, modeling expectations, and monitoring and verification activities. Where appropriate, explanatory guidance is included to support consistent implementation across jurisdictions and technology platforms.

Transmission providers are encouraged to integrate this template (and adapt as needed) into their existing FIR documents, either by direct incorporation or as a referenced appendix. Use of this common framework will support greater regional consistency, reduce developer confusion, and help ensure that newly interconnected IBRs contribute positively to grid reliability and performance.

This template is intended to evolve over time. Feedback from utilities, developers, and equipment manufacturers is welcome to ensure that the content remains clear, current, and technically appropriate.

More information about the development of this project is available on the project webpage: Harmonizing IBR Interconnection Requirements in the West

[1] Also referred to as Facility Connection Requirements (FCRs)

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Available for Download:

[Harmonizing IBR Interconnection Requirements in the West - Western Interstate Energy Board]

WIRAB's 2026 Strategic Initiatives

Long-term Planning Data and Models

Initiative 1: Advise WECC to work with states, provinces, and planning entities to improve long-term planning assumptions, data, and models to meet evolving regulatory and reliability needs.

Large-load Performance Requirements

Initiative 2: Advise WECC, NERC, and stakeholders to develop common interconnection and performance requirements for large loads—especially data centers—to ensure reliable and secure integration into the Bulk Power System.

Resource Adequacy with Electrification and Large Loads

Initiative 3: Advise WECC to study the impacts of rapid electrification and large load growth on reliability, including regional and seasonal resource adequacy trends.

Energy Storage Reliability Standards

Initiative 4: Advise WECC and the ERO to assess whether reliability standards adequately reflect the growing role of energy storage technologies in supporting grid stability and essential reliability services

Large Load Industry Advisory Group Meeting Schedule

Western Interconnection Regional Advisory Body

Date	Topics
✅ May 28, 2026 (11:00 a.m.–12:00 p.m. MT)	Kickoff: Background, Goals, and Timeline
June 25, 2026 (11:00 a.m.–12:00 p.m. MT)	Large Load Interconnection Requirements Review
July 16, 2026 (11:00 a.m.–12:00 p.m. MT)	Large Load Interconnection Requirements Template Section #1
August 13, 2026 (11:00 a.m.–12:00 p.m. MT)	Large Load Interconnection Requirements Template Section #2
September 24, 2026 (11:00 a.m.–12:00 p.m. MT)	Large Load Interconnection Requirements Template Section #3
October 22, 2026 (11:00 a.m.–12:00 p.m. MT)	Template Review and Finalizing
November 12, 2026 (11:00 a.m.–12:00 p.m. MT)	Template Finalizing and Next Steps
December 3, 2026 (11:00 a.m.–12:00 p.m. MT)	Industry and Public Webinar

Thank You!

Next Industry Advisory Group Meeting

June 25, 2026 at 11:00 AM MT

Eric Baran

ebaran@westernenergyboard.org

720-897-4600 x 207

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Western Interconnection
Regional Advisory Body

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Harmonizing Large Load Interconnection Requirements in the West

Industry Advisory Group (IAG) Kickoff Meeting

Ryan D. Quint, PhD, PE, *President and CEO*
Kyle Thomas, PE, VP, *Engineering and Compliance Services*

May 28, 2026

Elevate Energy Consulting

Helping enable a reliable, resilient, affordable, and sustainable energy future for generations to come.

- ***Outstanding technical expertise*** in inverter-based technologies, grid interconnection, transmission planning and operations, protection system engineering, regulatory compliance, dynamic modeling and studies, data center modeling, etc.

  #trust

- ***Elevating our industry partners*** including large utilities, system operators, renewables developers, asset owner/operators, regulators, nonprofits, trade organizations, national laboratories, research institutes, and more to tackle complex challenges facing the electricity sector

  #impact

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Disclaimers

- These views reflect the insights of Elevate Energy Consulting and do not necessarily reflect the views of Elevate's industry partners and clients.
- These views reflect learnings from working on multiple projects and all results have been genericized and anonymized to ensure confidentiality.
- These views are solely for informational purposes, discussion, and *elevating* industry understanding of practical and pragmatic issues.

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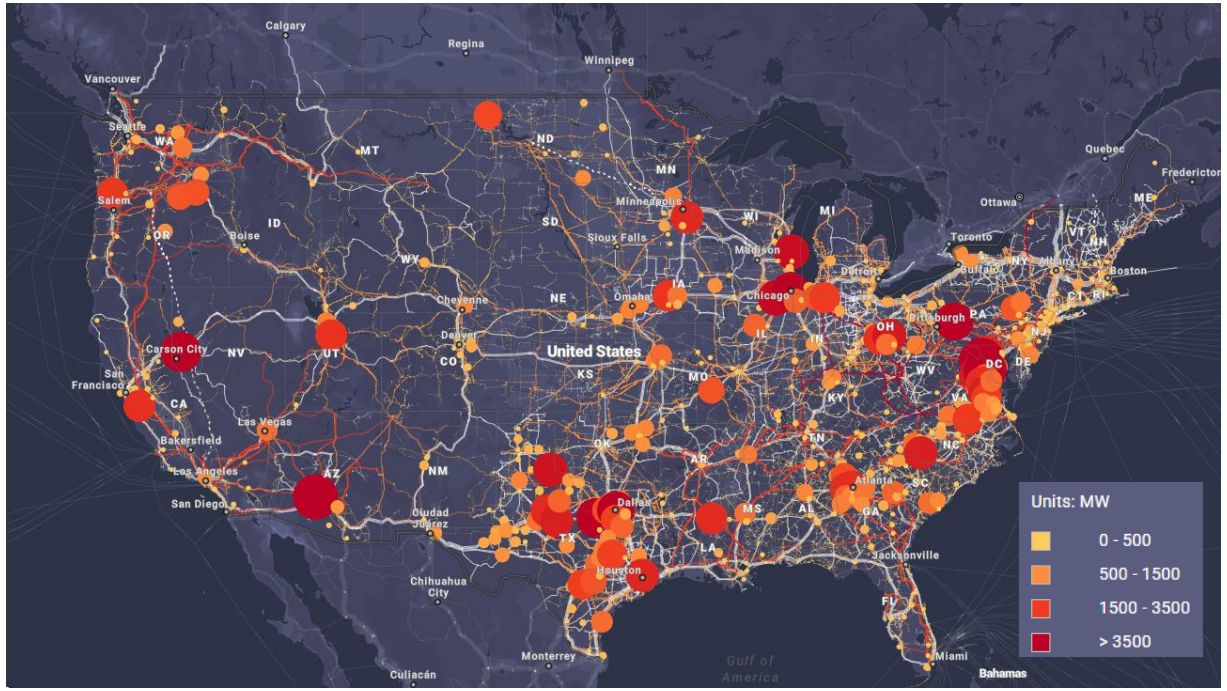
Slido Q&A and Polls

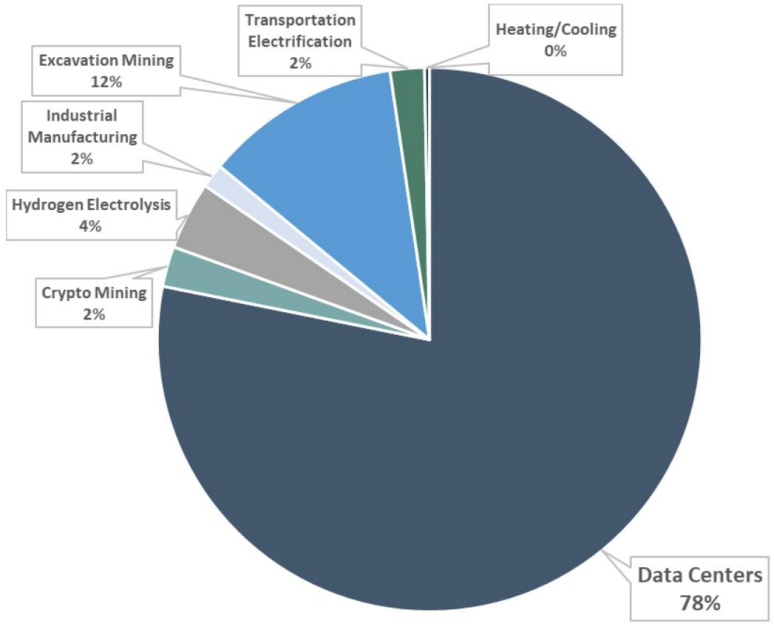
- Join Link: https://app.sli.do/event/9E3xDLg7RB6suDM32QcgXF
- www.slido.com
- Join Code: 2841263

Significant Large (Computational) Load Growth



Source: NREL

U.S. data center in operation, under construction, and in planning overlaid with major electric transmission infrastructure and fiber optic network



Source: WECC

- Data centers comprise nearly 80% of the large load interconnection queues in the West
- Total large load queue size for ten Western entity respondents was 44,650 MW – nearly equivalent to system peak demand level for those entities (48,425 MW)
- All utilities ranked data center impacts as “high”

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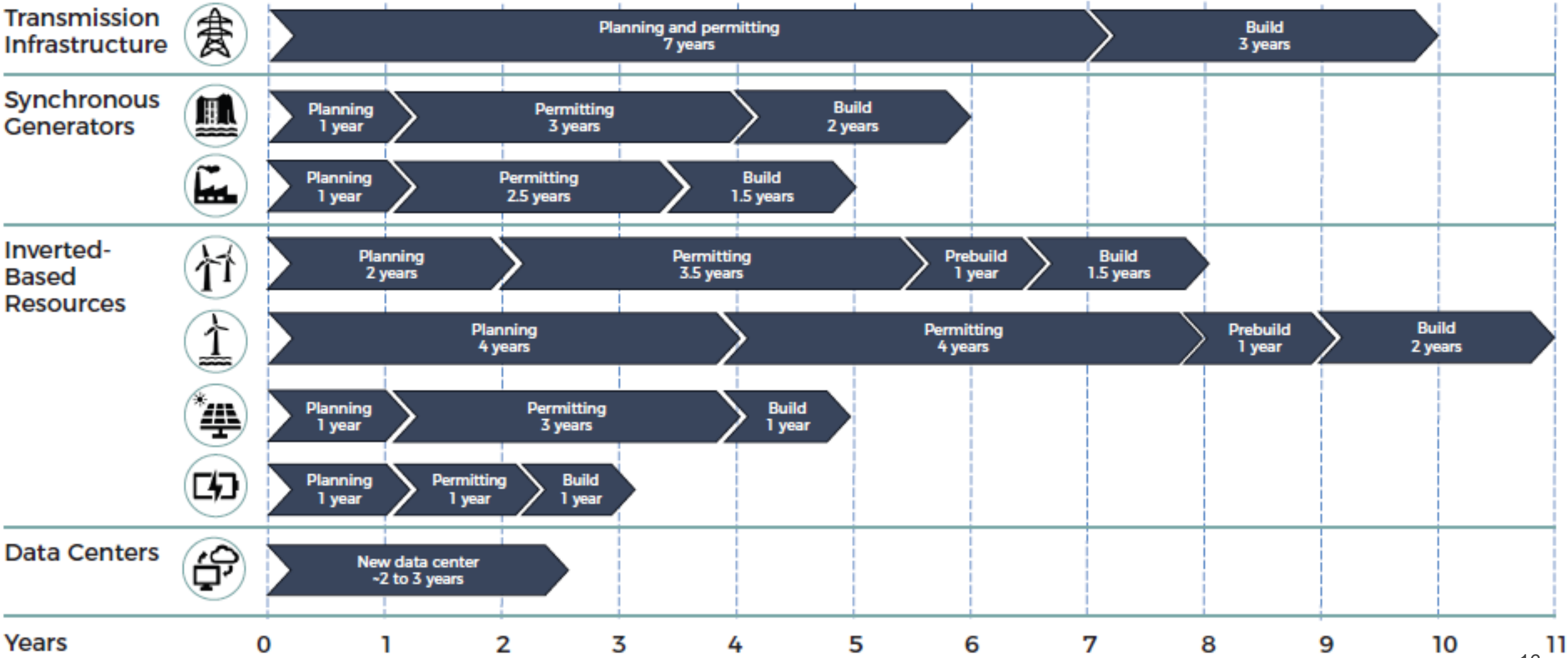
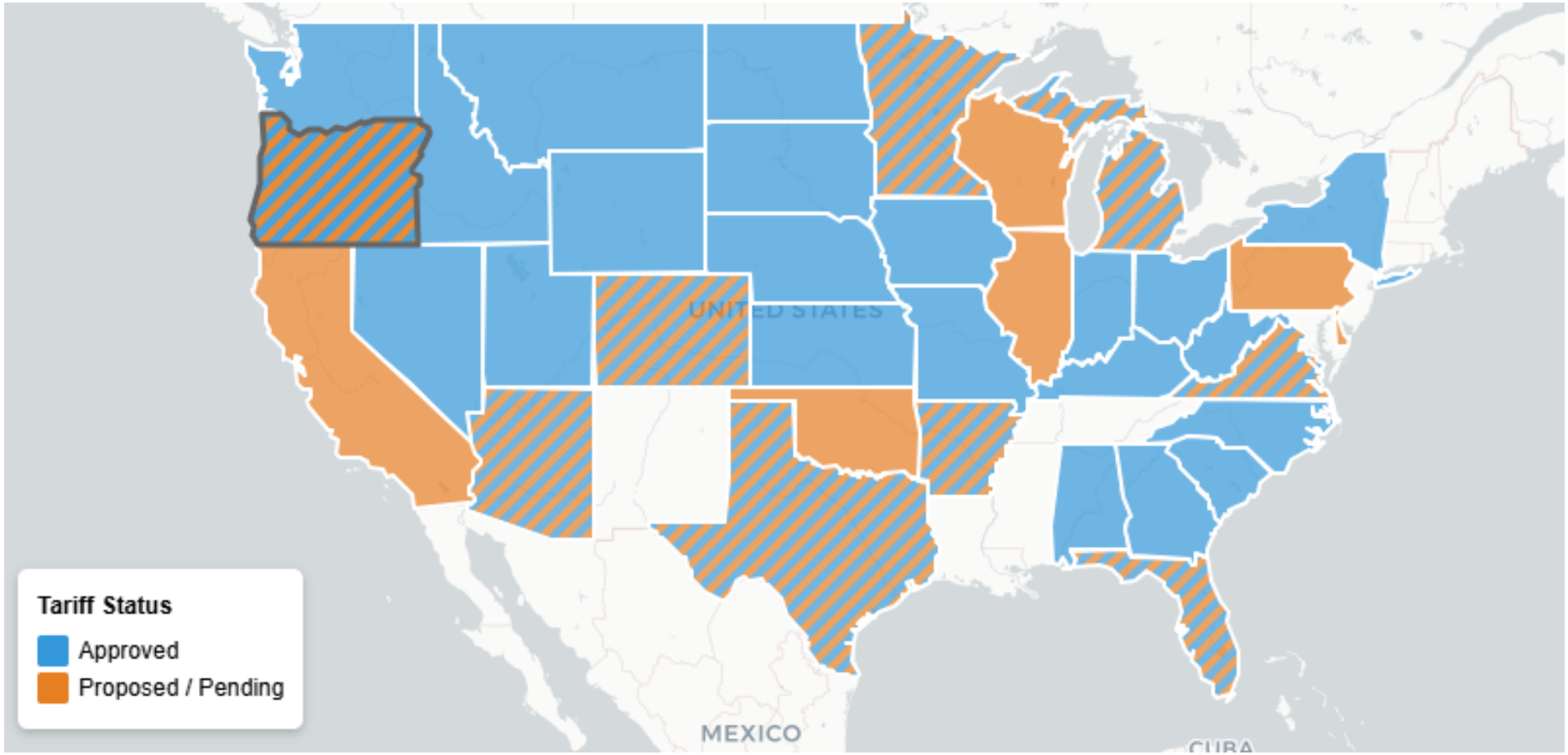
Timelines for Grid Infrastructure



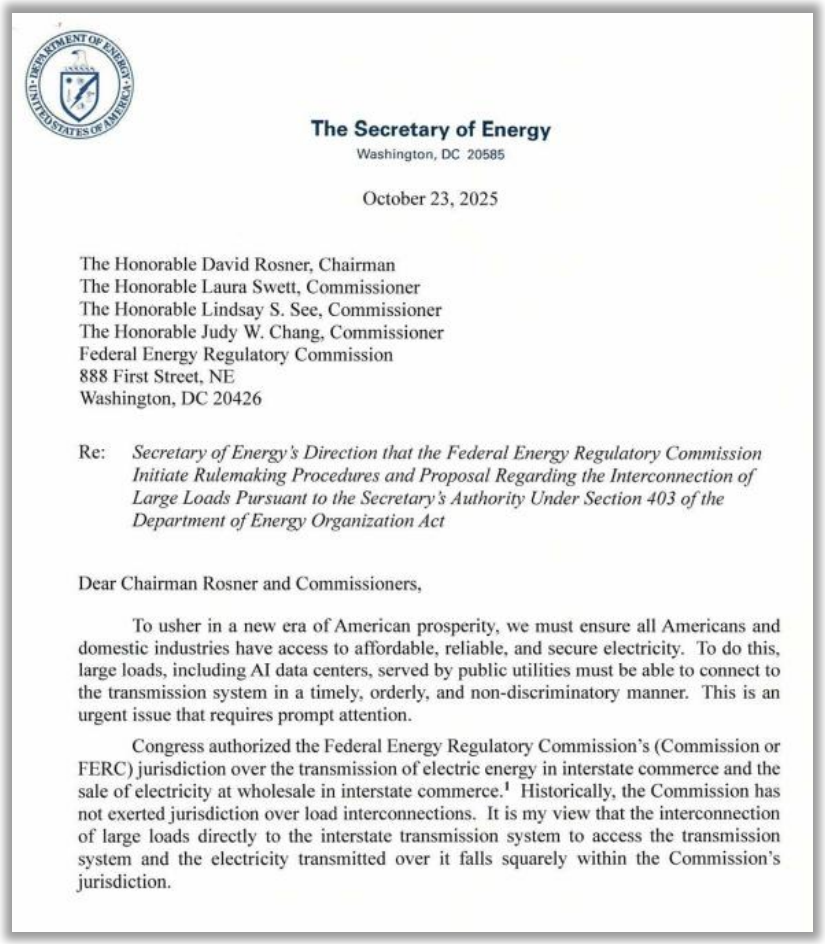
SOURCE: ADAPTED FROM S&P GLOBAL

Evolving Large Load Tariffs



Source: SEPA

FERC Advanced Notice of Proposed Rulemaking



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 Federal Energy Regulatory Commission Initiate Rulemaking Procedures and Proposal Regarding the Interconnection of Large Loads Pursuant to the Secretary's Authority Under Section 403 of the Department of Energy Organization Act*

Dear Chairman Rosner and Commissioners,

To usher in a new era of American prosperity, we must ensure all Americans and domestic industries have access to affordable, reliable, and secure electricity. To do this, large loads, including AI data centers, served by public utilities must be able to connect to the transmission system in a timely, orderly, and non-discriminatory manner. This is an urgent issue that requires prompt attention.

Congress authorized the Federal Energy Regulatory Commission's (Commission or FERC) jurisdiction over the transmission of electric energy in interstate commerce and the sale of electricity at wholesale in interstate commerce.[1] Historically, the Commission has not exerted jurisdiction over load interconnections. It is my view that the interconnection of large loads directly to the interstate transmission system to access the transmission system and the electricity transmitted over it falls squarely within the Commission's jurisdiction.

Key topics in DOE's letter to FERC & the corresponding FERC ANOPR:

- Limit FERC's role to transmission-connected loads, new large loads >20 MW
- Study large loads and co-located generation together
- Standardize deposits, readiness, and withdrawal rules
- Base hybrid studies on requested injection/withdrawal rights
- Require protection systems for hybrid facilities
- Faster studies for curtailable or dispatchable loads
- Make loads responsible for network upgrades they trigger
- Give loads the same "option to build" rights as generators
- Study any generator suspension (to serve load) like a System Support Resource / Reliability Must-run case
- Transmission service based on actual withdrawal rights
- Ancillary service charges tied to peak demand (no offsets)
- Define a clear transition plan for ongoing studies
- Ensure utilities serving large loads meet NERC/Open Access Transmission Tariff (OATT) obligations, and ensure NERC reviews standards for possible new registration categories

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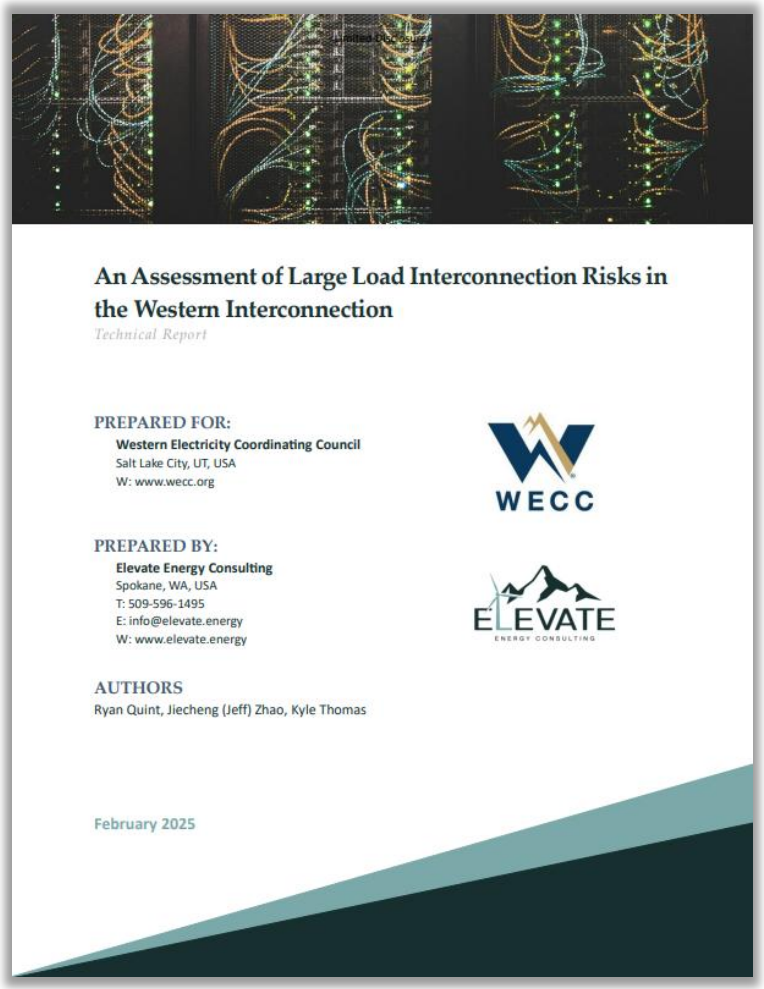
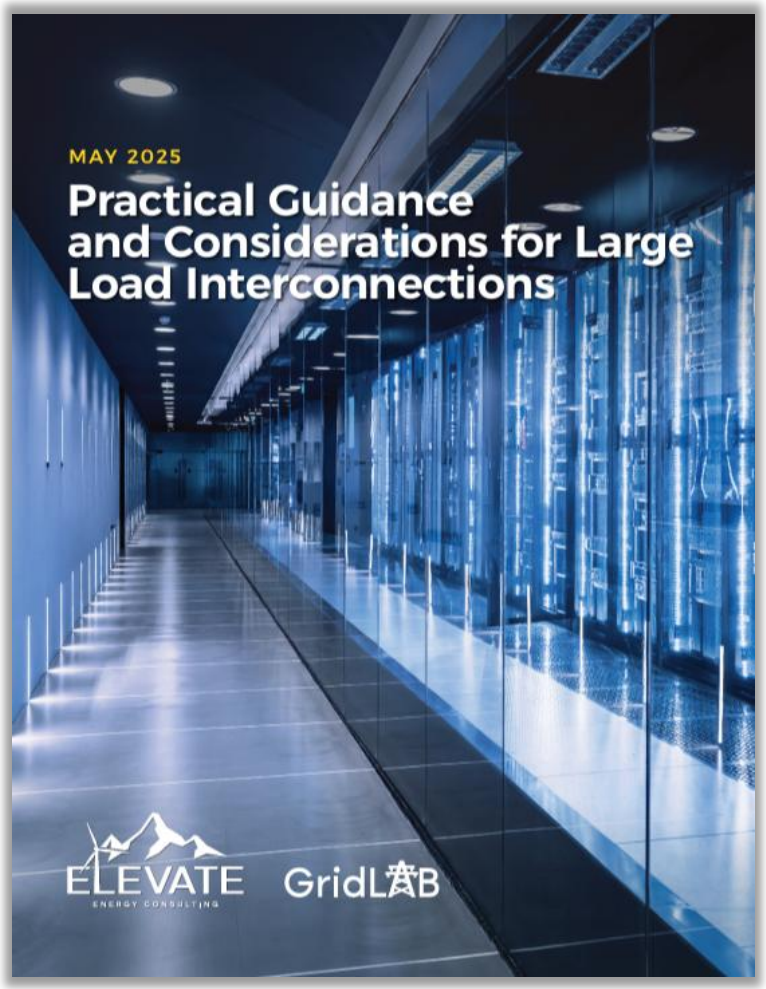
Large Load Interconnection References



Source: WECC



Source: GridLab

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Key Reliability Challenges with Data Centers

- Ramping, variability, and uncertainty
- Impacts on frequency response and voltage control
- Generator cycling and strain
- Transmission utilization constraints
- Ride-through performance and dynamic response
- Power quality issues
- Transient stability impacts
- Subsynchronous oscillations
- Protection system impacts

Source: APPA

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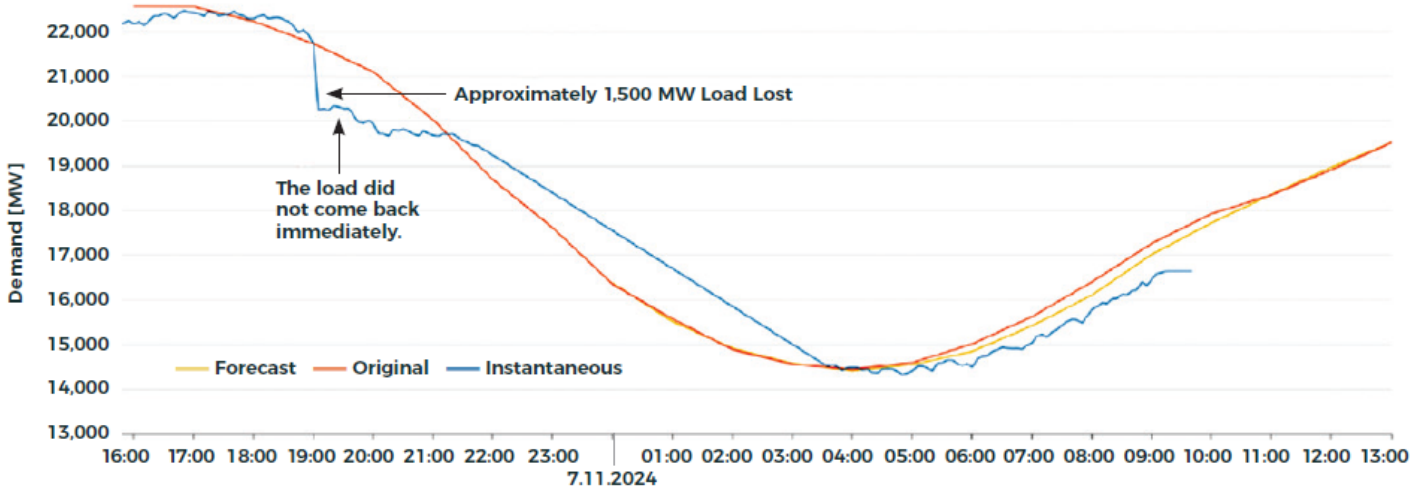
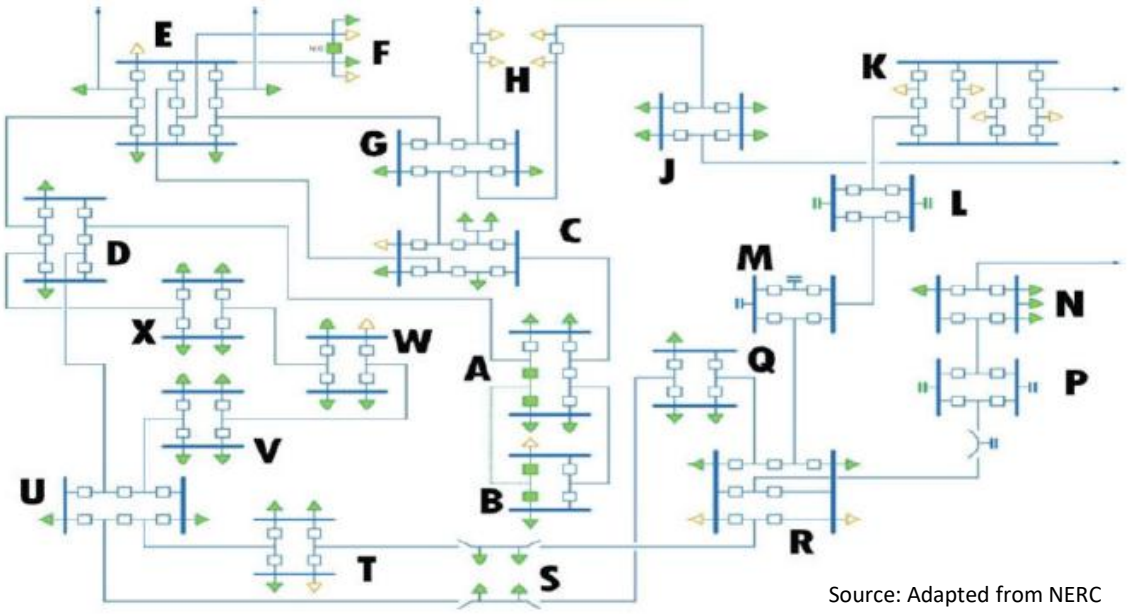
Faint Signals: Data Center Ride-Through

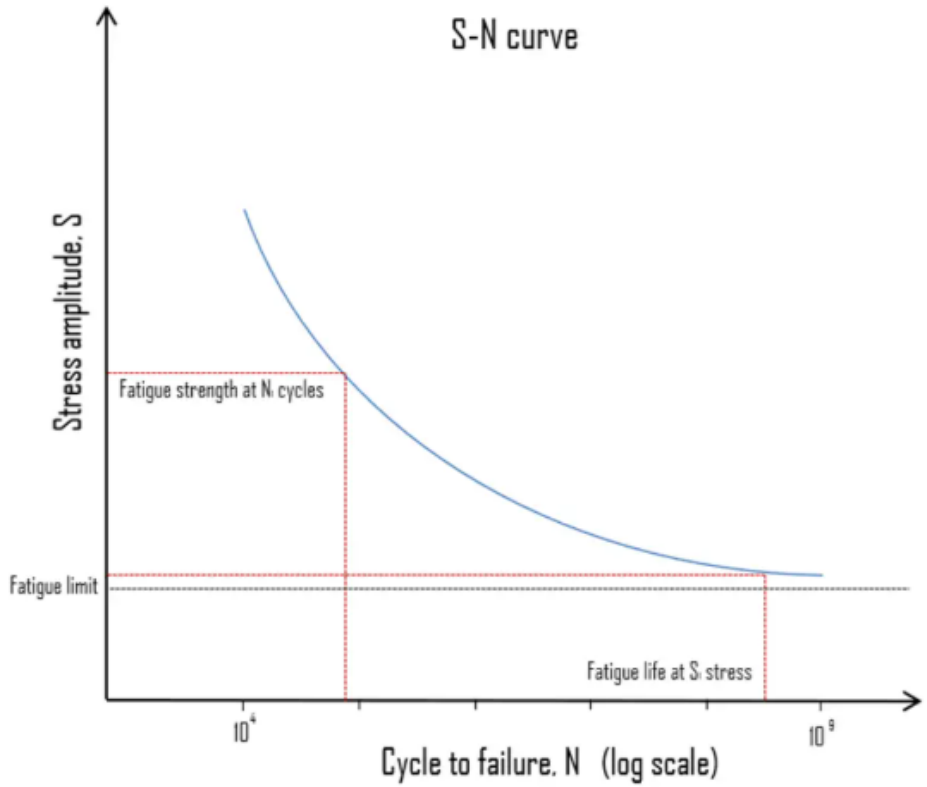
- Two large data center disconnection events in Northern Virginia
  - 1,500 MW reduction in July 2024
  - 1,800 MW reduction in Feb 2025
- Dozens of individual data centers disconnecting
- Caused by unknown and uncoordinated load-side protections within facilities



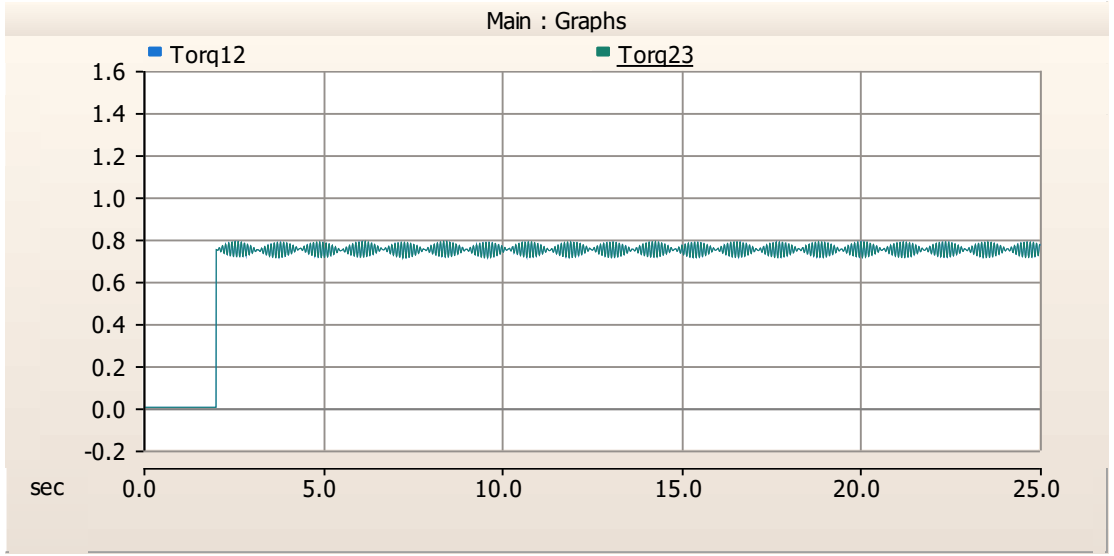


Source: Adapted from NERC

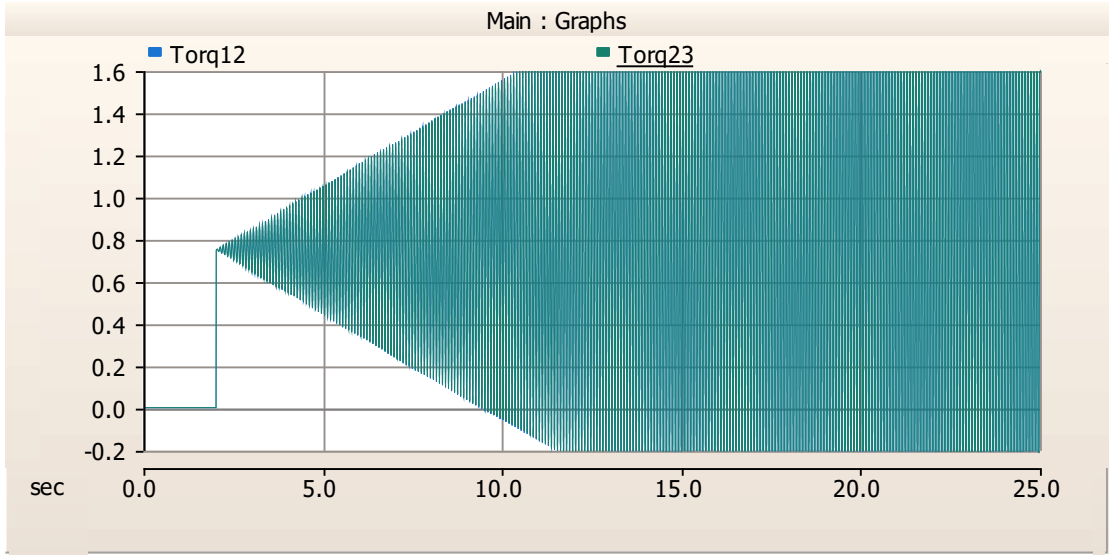
Cyclic Loading/Oscillations and Shaft Fatigue Limits



Source: material-properties.org



Off resonant frequency



On resonant frequency

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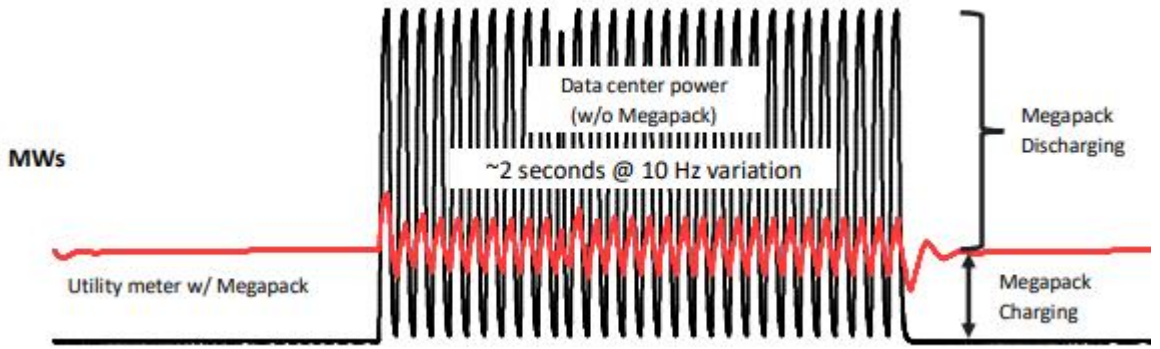
Mitigations and Reinforcements

- Grid Forming Battery Energy Storage Systems (GFM BESS)
- STATCOM and option with Energy Storage (E-STATCOM)
- UPS isolation – possible in future
- Server technologies



Source: Tesla presentation to ERCOT LLWG

- No silver bullet – transmission of load behavior to utility and generator responses *must* be evaluated
- Utilities issuing load requirements that will require mitigations
- Study coordinated system – verify fault ride through, etc.

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Benefits, Challenges, Limitations Across Platforms

- ✓ Suitable and best tool for the study
- ✓ Suitable for study; not ideal tool
- ! May be used but notable tool challenges
- X Insufficient for study; unable to represent phenomena

Study Categories	Phasor Domain *PSS®E / PSLF*	EMT *PSCAD / EMTP*	Realtime *RTDS / Opal-RT*
Powerflow	✓	!	!
Voltage stability	✓	✓	!
Transient stability	✓	!	!
Electromechanical oscillations	✓	!	!
Ride-through performance	!	✓	!
Electromagnetic transients	X	✓	✓
Controls stability	X	✓	✓
Controller interactions	X	✓	✓
AI ramping/variability impacts	X	✓	✓
Torsional impacts	X	✓	✓
Subsynchronous oscillations	X	✓	✓
HIL/CHIL testing and validation	X	X	✓
Protection validation	X	X	✓

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NERC Efforts Underway

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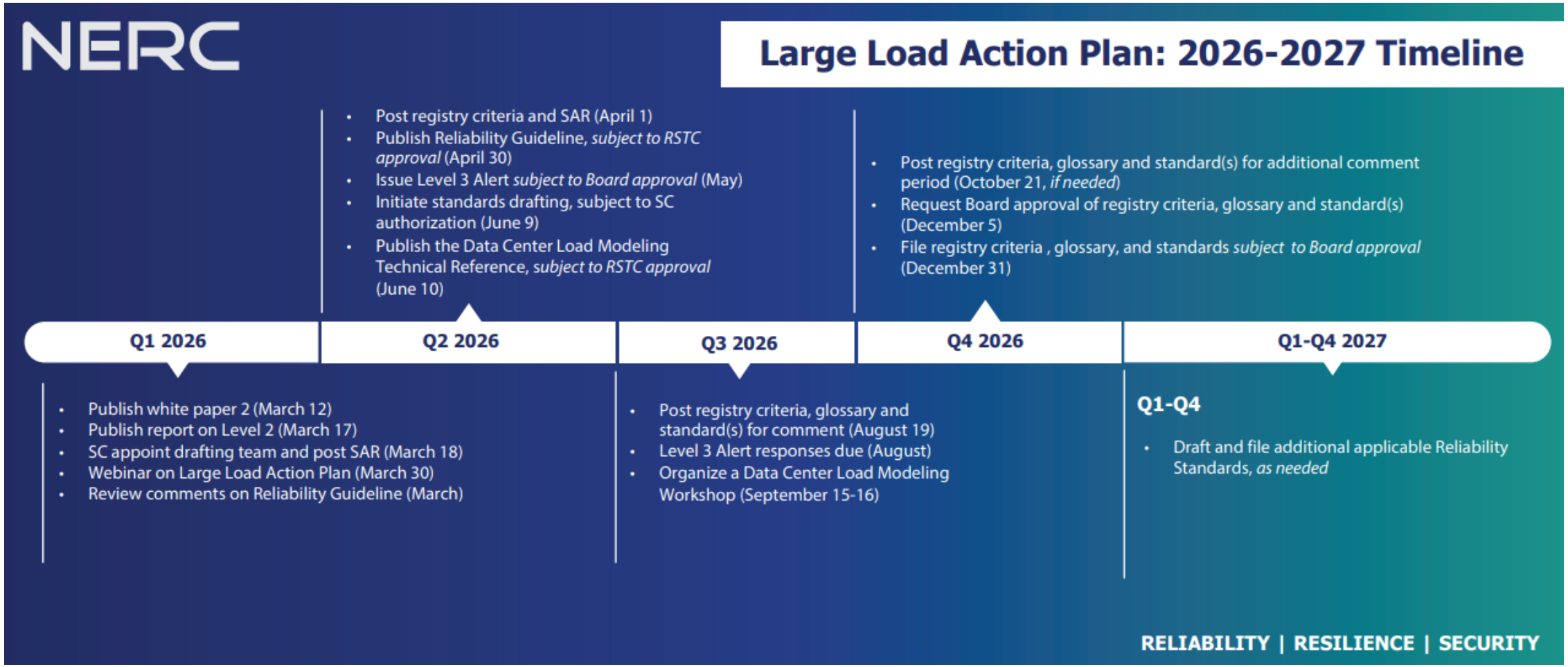
NERC ~~Large~~ Computational Load Action Plan: Q1 2026



Source: NERC

NERC Large Load and Load Modeling Working Group

Large Load Working Group (LLWG)

- White Paper 1: Characteristics & Risks of Emerging Large Loads (July 2025)
- White Paper 2: Assessment of gaps in existing practices, requirements, & Reliability Standards for Emerging Large Loads (March 2026)
- Reliability Guideline: Risk Mitigation for Emerging Large Loads *(planned for Q2 2026)*
- White Paper: Large Load Disturbance Performance – Impact Analysis and Ride-Through Recommendations *(planned for Q4 2026)*
- White Paper: EMT Modeling and Simulation Considerations for Large Loads *(planned for Q4 2026)*
- Review and Plan for SARs Necessary Based on LLTF White Paper #2 *(planned for Q3 2026)*

Load Modeling Working Group (LMWG)

- Released PERC1 (Power Electronic Reconnecting & Ceasing) Model in December 2025 for modeling aggregation of large number of power electronic loads (e.g., data center, cryptocurrency mining facility, EV charging)
- Data Center Load Modeling Technical Reference *(planned for June 2026)*
  - New approaches/refinements to modeling data centers
  - Potential approaches to differentiate between different types of computational facilities
- Data Center Load Modeling Workshop *(planned for Sept 2026)*

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NERC Alerts on Large Loads

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Industry Recommendation

Large Load Interconnection, Study, Commissioning, and Operations

Initial Distribution: September 9, 2025

The purpose of this alert is to address the risks observed from the analyzed large load behavior and to assess the status of industry preparedness in relation to large loads.

NERC, Regional Entities, and NERC registered entities have analyzed a series of disturbances that occurred on the bulk power system (BPS) resulting in widespread and unexpected customer-initiated load reduction of large loads. These disturbances involved multiple events during which 1,000+ MW of unexpected Large Loads output reduction occurred, with most events occurring in 2024 or 2025. The increase of Large Loads-related events coincides with an increase in Large Load penetration across the BPS.

To better understand the reliability impact(s) of emerging large loads on the BPS, NERC established the Large Loads Task Force (LLTF) in August 2024. In July 2025, NERC published a white paper titled *Characteristics and Risks of Emerging Large Loads*[1] that highlights characteristics of Large Loads such as rapid fluctuations in demand and cyclical ramping. That paper includes the following high-priority categories of risks: Long-Term Planning, Operations/Balancing, and Stability.

For this Alert, the term "Large Load" is consistent with the definition in the LLTF white paper referenced above:

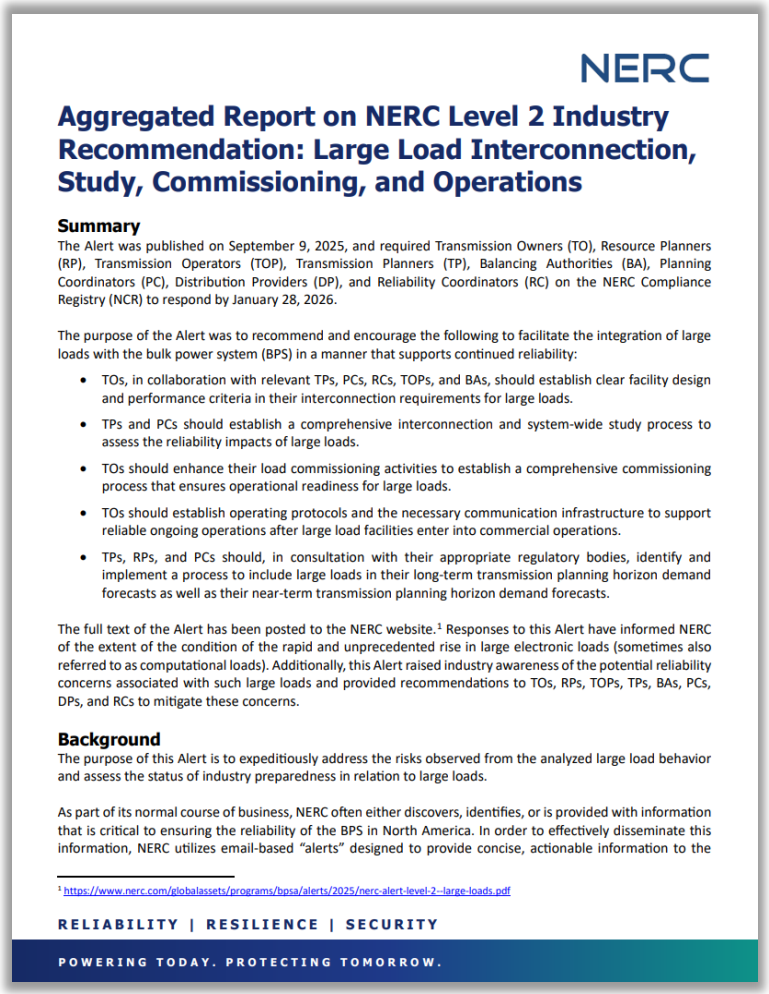
> **Large Load - "Any commercial or industrial individual load facility or aggregation of load facilities at a single site behind one or more point(s) of interconnection that can pose reliability risks to the BPS due to its demand, operational characteristics, or other factors. Examples include, but are not limited to, data centers, cryptocurrency mining facilities, hydrogen electrolyzers, manufacturing facilities, and arc furnaces."**

Rapid, major swings in load, experienced both in typical operations as well as in response to grid disturbances, can impact the BPS's ability to maintain frequency, regulate transmission voltage, and otherwise maintain stability. The comparatively large size, unique end-use operational characteristics, unique facility design, and unique operational performance of Large Loads necessitate enhancements to interconnection processes, BPS planning studies and models, validation of installed facility equipment, and operational communication with these customers. Accurate,

[1] "White Paper: Characteristics and Risks of Emerging Large Loads," NERC, Jul. 2025. Available: https://www.nerc.com/comm/RSTC_Reliability_Guidelines/Whitepaper%20Characteristics%20and%20Risks%20of%20Emerging%20Large%20Loads.pdf

RELIABILITY | RESILIENCE | SECURITY

Source: NERC



NERC

Aggregated Report on NERC Level 2 Industry Recommendation: Large Load Interconnection, Study, Commissioning, and Operations

Summary

The Alert was published on September 9, 2025, and required Transmission Owners (TO), Resource Planners (RP), Transmission Operators (TOP), Transmission Planners (TP), Balancing Authorities (BA), Planning Coordinators (PC), Distribution Providers (DP), and Reliability Coordinators (RC) on the NERC Compliance Registry (NCR) to respond by January 28, 2026.

The purpose of the Alert was to recommend and encourage the following to facilitate the integration of large loads with the bulk power system (BPS) in a manner that supports continued reliability:

- TOs, in collaboration with relevant TPs, PCs, RCs, TOPs, and BAs, should establish clear facility design and performance criteria in their interconnection requirements for large loads.
- TPs and PCs should establish a comprehensive interconnection and system-wide study process to assess the reliability impacts of large loads.
- TOs should enhance their load commissioning activities to establish a comprehensive commissioning process that ensures operational readiness for large loads.
- TOs should establish operating protocols and the necessary communication infrastructure to support reliable ongoing operations after large load facilities enter into commercial operations.
- TPs, RPs, and PCs should, in consultation with their appropriate regulatory bodies, identify and implement a process to include large loads in their long-term transmission planning horizon demand forecasts as well as their near-term transmission planning horizon demand forecasts.

The full text of the Alert has been posted to the NERC website.[1] Responses to this Alert have informed NERC of the extent of the condition of the rapid and unprecedented rise in large electronic loads (sometimes also referred to as computational loads). Additionally, this Alert raised industry awareness of the potential reliability concerns associated with such large loads and provided recommendations to TOs, RPs, TOPs, TPs, BAs, PCs, DPs, and RCs to mitigate these concerns.

Background

The purpose of this Alert is to expeditiously address the risks observed from the analyzed large load behavior and assess the status of industry preparedness in relation to large loads.

As part of its normal course of business, NERC often either discovers, identifies, or is provided with information that is critical to ensuring the reliability of the BPS in North America. In order to effectively disseminate this information, NERC utilizes email-based "alerts" designed to provide concise, actionable information to the

[1] https://www.nerc.com/globalassets/programs/bpsa/alerts/2025/nerc-alert-level-2--large-loads.pdf

RELIABILITY | RESILIENCE | SECURITY

POWERING TODAY. PROTECTING TOMORROW.

Source: NERC

NERC

Essential Action to Industry

Computational Load Modeling, Studies, Instrumentation, Commissioning, Operations, Protection, and Control

Initial Distribution: May 4, 2026

The purpose of this Level 3 NERC Alert is to ensure Essential Actions are taken by registered entities to address the risks posed by existing and new computational loads[1] interacting with the bulk power system (BPS), inclusive of computational load interconnecting with collocated generation.[2]

NERC issued a previous Level 2 Alert Industry Recommendation: *Large Load Interconnection, Study, Commissioning, and Operations*[3] that discussed the recommended practices that NERC deemed necessary to address the emerging risks from large loads. In the responses provided to the Alert, NERC found that entities generally did not have sufficient processes, procedures, or methods to address risks associated with computational loads. This contrasts with the robust historical experience with traditional non-power electronic non-computational load. As seen in the public report, NERC found specific deficiencies with the treatment of computational loads. Examples of this load include artificial intelligence training, cryptocurrency mining, and traditional data center uses.

As stated in the public report, NERC determined a set of immediate actions that registered entities should take to reduce the risk to the BPS that warrant issuance of this Level 3 alert. These actions relate to the modeling, study, installed fault recording or instrumentation, commissioning, operation, protection, and control of computational load.

NERC issues this Level 3 Alert for entities to implement specific changes[4] to handle critical risks. Additional actions are discussed as part of NERC's Large Loads Action Plan and include the draft registry criteria[5] and Standard Authorization Request (SAR) for computational load[6] posted on NERC's website on April 1, 2026. Responses will also help

[1] NERC is currently working to register a "Computational Load Entity" for these loads. Currently, this would include loads that are 20 MW and greater, connected at 60kV, and contain more than 1 MW of IT Load. More information is available on NERC's Rules of Procedure webpage.
[2] Colocation with generation is one significant way computational load is interacting and using the BPS.
[3] See *Aggregated Report on NERC Level 2 Industry Recommendation: Large Load Interconnection, Study, Commissioning, and Operations* to see the results of the previous Level 2 Alert.
[4] As indicated in the public level 2 alert report, entities that do not have and do not expect to integrate computational loads within two years may not find it useful to implement these Essential Actions. These Essential Actions are for those entities that have or could expect to have computational loads or that may include these loads in the next two years. This includes entities that do not have computational load in their territory but could feasibly receive a request for one. Entities should implement these Essential Actions prior to receiving a computational load interconnection request.
[5] More information is available on NERC's Rules of Procedure webpage.
[6] More information is available on the Project 2026-02 webpage.

RELIABILITY | RESILIENCE | SECURITY

POWERING TODAY. PROTECTING TOMORROW.

Source: NERC

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Applicable to **current Registered Entities*

NERC Level 3 Alert: Computational Loads

- Modeling Requirements
- System Studies
- Qualified Change Definition
- Commissioning Process and Checklist
- Non-Consequential Firm Load Loss
- Disturbance Monitoring
- Interpersponal Communications

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NERC Computational Load Registration + Standards

Computational Load: Load comprised of electric power demand from information technology equipment, such as servers, storage, and networking hardware.

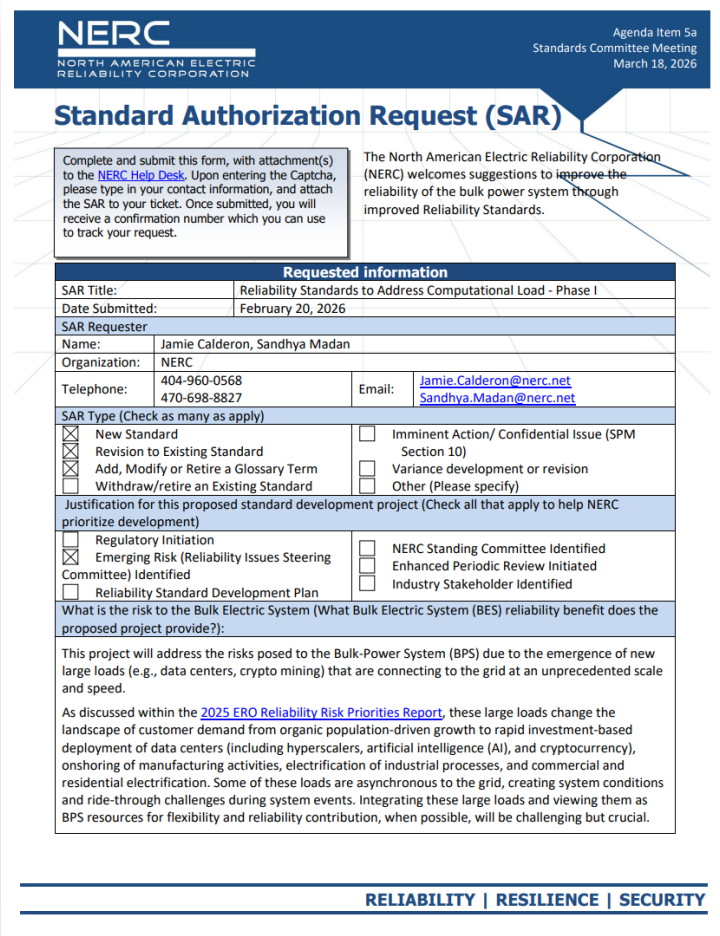
Computational Load Entity: the end-user or the entity that hosts end-users that receives electric power for Computational Load."

Must be registered with NERC if:

1) contributes to an aggregate connected Load capability **>= 20 MW**, and
2) at a single point of interconnection to the BPS at a voltage **>= 60 kV**, and
3) hosts **>= 1 MW of Computational Load.**

Result: if a 20 MW building has at least 1 MW of computational load, would be NERC Registered.

NERC's proposed definitions & registration criteria for Computational Loads



NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Agenda Item 5a
Standards Committee Meeting
March 18, 2026

Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information			
SAR Title:	Reliability Standards to Address Computational Load - Phase I		
Date Submitted:	February 20, 2026		
SAR Requester			
Name:	Jamie Calderon, Sandhya Madan		
Organization:	NERC		
Telephone:	404-960-0568 470-698-8827	Email:	Jamie.Calderon@nerc.net Sandhya.Madan@nerc.net

SAR Type (Check as many as apply)

- ☒ New Standard
- ☒ Revision to Existing Standard
- ☒ Add, Modify or Retire a Glossary Term
- ☐ Withdraw/retire an Existing Standard
- ☐ Imminent Action/ Confidential Issue (SPM Section 10)
- ☐ Variance development or revision
- ☐ Other (Please specify)

Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)

- ☐ Regulatory Initiation
- ☒ Emerging Risk (Reliability Issues Steering Committee) Identified
- ☐ Reliability Standard Development Plan
- ☐ NERC Standing Committee Identified
- ☐ Enhanced Periodic Review Initiated
- ☐ Industry Stakeholder Identified

What is the risk to the Bulk Electric System (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):

This project will address the risks posed to the Bulk-Power System (BPS) due to the emergence of new large loads (e.g., data centers, crypto mining) that are connecting to the grid at an unprecedented scale and speed.

As discussed within the 2025 ERO Reliability Risk Priorities Report, these large loads change the landscape of customer demand from organic population-driven growth to rapid investment-based deployment of data centers (including hyperscalers, artificial intelligence (AI), and cryptocurrency), onshoring of manufacturing activities, electrification of industrial processes, and commercial and residential electrification. Some of these loads are asynchronous to the grid, creating system conditions and ride-through challenges during system events. Integrating these large loads and viewing them as BPS resources for flexibility and reliability contribution, when possible, will be challenging but crucial.

RELIABILITY | RESILIENCE | SECURITY

SAR for NERC Standard(s) for Computational Loads

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SDT Alignment with L3 Essential Actions

Project 2026-02 Page

Data Sharing	***Focus: Type of data, clear and transparent data specs, etc.*** • CLE provide data to TOs, TPs, PCs, TOPs, BAs, RCs for entities to perform required reliability functions.
Interconnection Process & Req's	***Focus: Interconnection process, coordination, and requirements*** • TOs have interconnection requirements for CLs • CLEs coordinate with TO on requirements and studies • TOs have procedures to coordinate with TPs, PCs, TOPs, RCs, and BAs on req's
Modeling and Studies	***Focus: Studies for CLs and Requesting Data from CLEs for Studies*** • TPs/PCs have procedures for performing interconnection studies for CLs • Define Qualified Change for CLs • Appropriate modeling in studies for CLs (steady-state, dynamics, short-circuit, EMT)
Protection and Monitoring	***Focus: Coordinate settings and have high-resolution monitoring*** • CLEs, TOs, DPs communicate and coordinate protection settings and coordination • TOs have procedures to confirm high-resolution monitoring and recording for CLs; procedures for obtaining such data for event analysis
Commissioning	***Focus: Process and coordination of commissioning activities*** • TOs have procedures for commissioning CLs • Coordinating with TPs, PCs, TOPs, RCs, and BAs on commissioning needs • Procedures to obtain model, data, and info updates due to changes during commissioning
Operations Comms & Response	***Focus: Flexibility in preferred interpersonal communications*** • CLs have interpersonal communications with TOPs and BAs • Coordination for loss of comms between entities • CLs respond to Operating Instruction from TOPs, BAs, and RCs, with exceptions

CL: *Computational Load*
CLE: *Computational Load Entity*

**Shared in public SDT meeting. Subject to change based on SDT discussions and activities. Consult SDT for specific details.*

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Large Load Requirements Template

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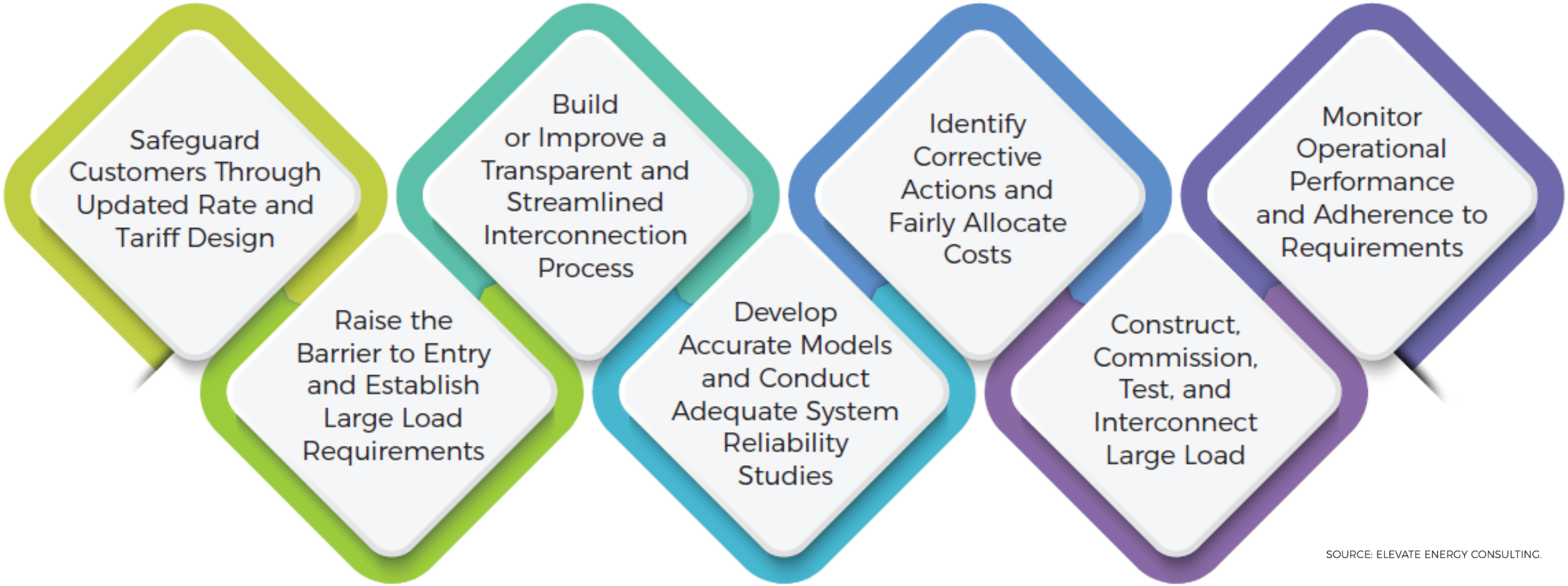
Large Load Interconnection Enhancements



SOURCE: ELEVATE ENERGY CONSULTING.

Raise the Bar:
Technical Requirements

- Load size limits
- Data and model sharing
- Data recording and monitoring
- Ride-through performance
- Power factor/reactive power
- Power quality
- Oscillation Damping
- Short-circuit and protection
- Operational control and communications
- Emergency response
- Operations and maintenance
- Demand response
- Utility right to monitor and enforce requirements

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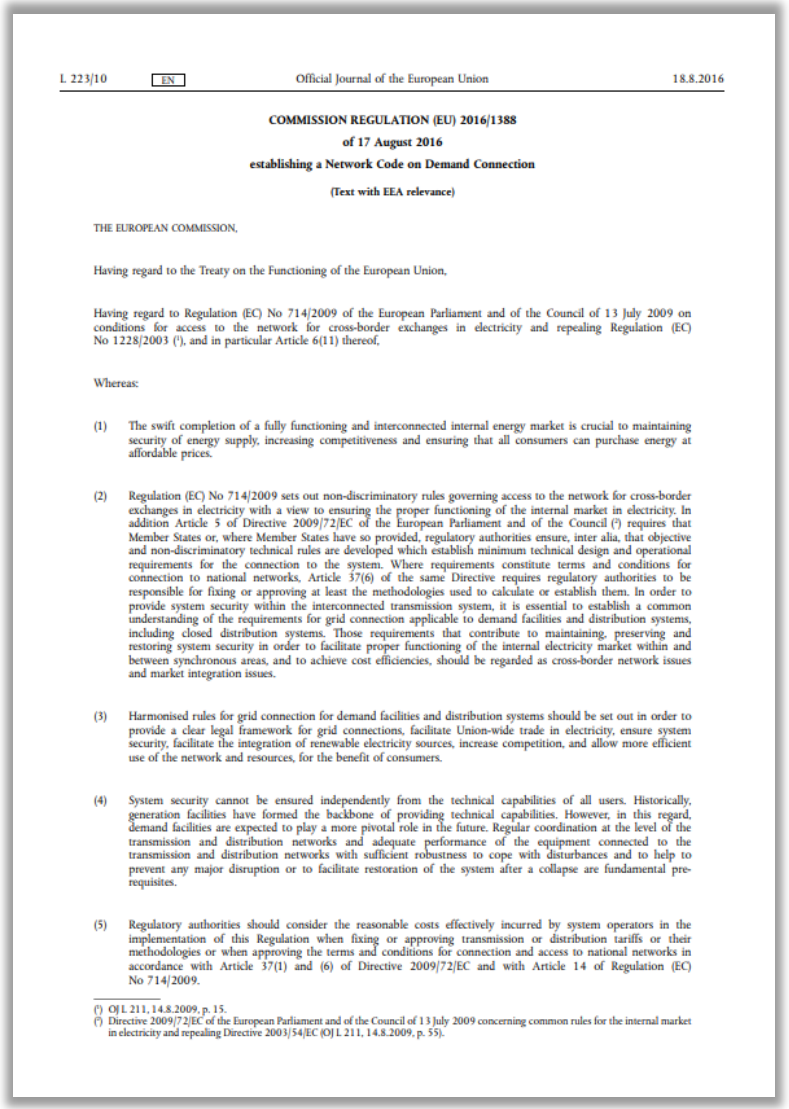
Gerville (iStockPhoto)

ENTSO-E Network Code on Demand Connection

- Disconnection and reconnection
- Limited frequency sensitivity mode
- Rate of change of frequency immunity
- Voltage ride-through
- Reactive power capability
- Voltage setpoint adjustments
- Blackstart contribution
- Islanded operation
- Frequency and voltage control demand response
- System balancing demand response
- Pre-connection compliance studies
- Real-time monitoring
- Periodic testing and reporting



L 223/10 EN Official Journal of the European Union 18.8.2016

COMMISSION REGULATION (EU) 2016/1388

of 17 August 2016

establishing a Network Code on Demand Connection

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003 (1), and in particular Article 6(11) thereof,

Whereas:

(1) The swift completion of a fully functioning and interconnected internal energy market is crucial to maintaining security of energy supply, increasing competitiveness and ensuring that all consumers can purchase energy at affordable prices.

(2) Regulation (EC) No 714/2009 sets out non-discriminatory rules governing access to the network for cross-border exchanges in electricity with a view to ensuring the proper functioning of the internal market in electricity. In addition Article 5 of Directive 2009/72/EC of the European Parliament and of the Council (2) requires that Member States or, where Member States have so provided, regulatory authorities ensure, inter alia, that objective and non-discriminatory technical rules are developed which establish minimum technical design and operational requirements for the connection to the system. Where requirements constitute terms and conditions for connection to national networks, Article 37(6) of the same Directive requires regulatory authorities to be responsible for fixing or approving at least the methodologies used to calculate or establish them. In order to provide system security within the interconnected transmission system, it is essential to establish a common understanding of the requirements for grid connection applicable to demand facilities and distribution systems, including closed distribution systems. Those requirements that contribute to maintaining, preserving and restoring system security in order to facilitate proper functioning of the internal electricity market within and between synchronous areas, and to achieve cost efficiencies, should be regarded as cross-border network issues and market integration issues.

(3) Harmonised rules for grid connection for demand facilities and distribution systems should be set out in order to provide a clear legal framework for grid connections, facilitate Union-wide trade in electricity, ensure system security, facilitate the integration of renewable electricity sources, increase competition, and allow more efficient use of the network and resources, for the benefit of consumers.

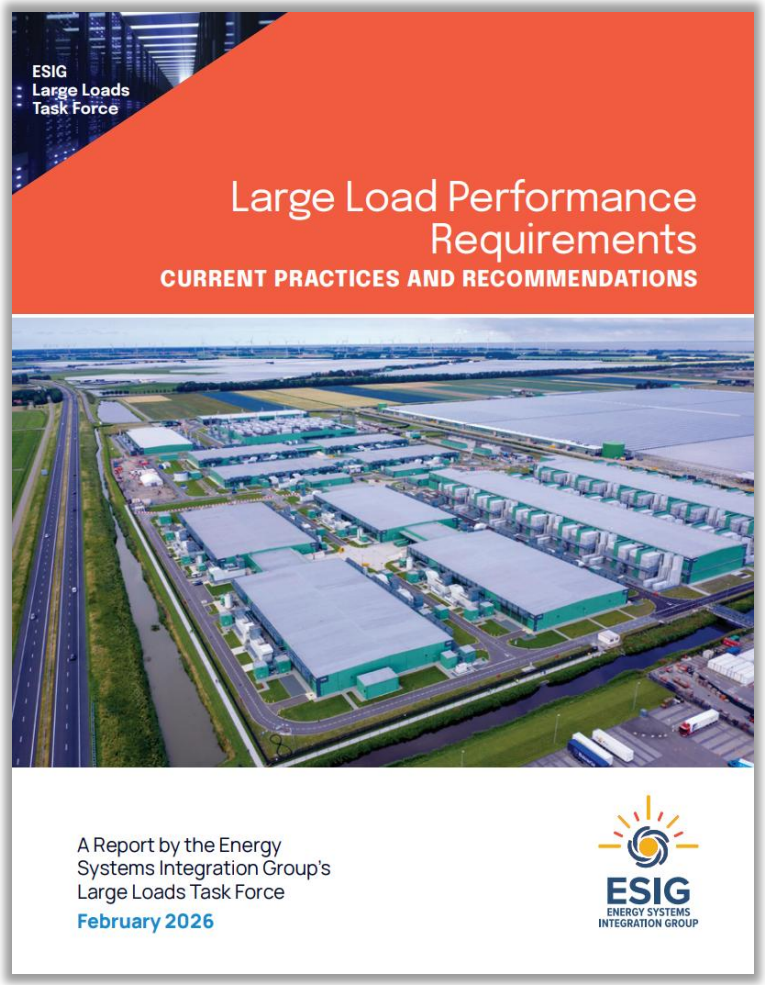
(4) System security cannot be ensured independently from the technical capabilities of all users. Historically, generation facilities have formed the backbone of providing technical capabilities. However, in this regard, demand facilities are expected to play a more pivotal role in the future. Regular coordination at the level of the transmission and distribution networks and adequate performance of the equipment connected to the transmission and distribution networks with sufficient robustness to cope with disturbances and to help to prevent any major disruption or to facilitate restoration of the system after a collapse are fundamental pre-requisites.

(5) Regulatory authorities should consider the reasonable costs effectively incurred by system operators in the implementation of this Regulation when fixing or approving transmission or distribution tariffs or their methodologies or when approving the terms and conditions for connection and access to national networks in accordance with Article 37(1) and (6) of Directive 2009/72/EC and with Article 14 of Regulation (EC) No 714/2009.

(1) OJ L 211, 14.8.2009, p. 15.
(2) Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC (OJ L 211, 14.8.2009, p. 55).

[ENTSO-E Demand Connection Code]

Large Load Interconnection References



Source: ESIG

- Voltage ride-through
- Multiple disturbance ride-through
- Active power recovery
- Frequency and ROCOF ride-through
- Ramp rates, variability, cycling
- Reactive power/power factor
- Phase jump
- Monitoring
- Modeling

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AESO Interconnection Requirements

Phase 1: Interim Measures

Set Interim Limit
- 1,200 MW connection limit (whole AESO) in 2027/2028 timeframe

Limit Assignment Process
- Qualification: ≥ 75 MW in study stage targeting 2027/2028 in service
- Capped at a size that does not require system reinforcement
- Need permits and financial security
- Pro rata assignment to developers (instead of projects)
- Area limit applies

Technical Requirements (draft)
- Capped ramping rate
- Enforced ride-through: voltage, frequency, ROCOF, phase angle jump, V/Hz
- Reactive power capability
- Portion trip for load shedding
- Modeling: CMLD, UDM, and EMT are required
- Monitoring: PMU, DFR, dual SCADA

Phase 2: Develop Sustainable Framework

NERC Standards
- Implement forthcoming NERC Large Load standards

ISO Tariff Redesign
- Interruptible rate classes
- Terms for load shed, demand response, and backup generation supply
- Cost causation for ancillary services and network upgrades

Transmission Planning
- Enhance Long-term Planning
- Forecasting to include data center growth

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Dominion Load Interconnection Requirements

Applicable Size

- > 50 MW
- Long-term projected demand

Power Quality

- Inst. voltage fluctuation < 3%
- Harmonic and voltage flicker meter
- Power quality data retention

Modeling Data

- CMLD, EV, or UDM
- EMT, if requested
- Site-specific load data
- As-planned and as-built load information

Ride-through

- Ride-through at least 6 consecutive automatic reclosing attempts

UFLS

- Participation required
- Appropriate relay and communication

Stability

- Signal injection requirement
- High-resolution transient disturbance recorder

Power Factor

- ± 0.95 power factor
- Coordinated PF range

Interconnections

- Guideline for redundancy schemes, inter-substation connectivity, shared transformer
- Load transfer prohibited

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ATC Load Interconnection Requirements

Applicable Size
• > 200 MW • Single end-use customer

Load Oscillation and Ramp Rates
• Repetitive ramps < 25 MW • Power oscillations < 25 MW • Ramps > 50 MW limited to 0.5 MW/s

Ride-through
• Ride-through at least 3 consecutive automatic reclosing attempts in 10 seconds • Voltage ride-through envelope

Load Return to Service
• Customer provide good faith schedule of load return

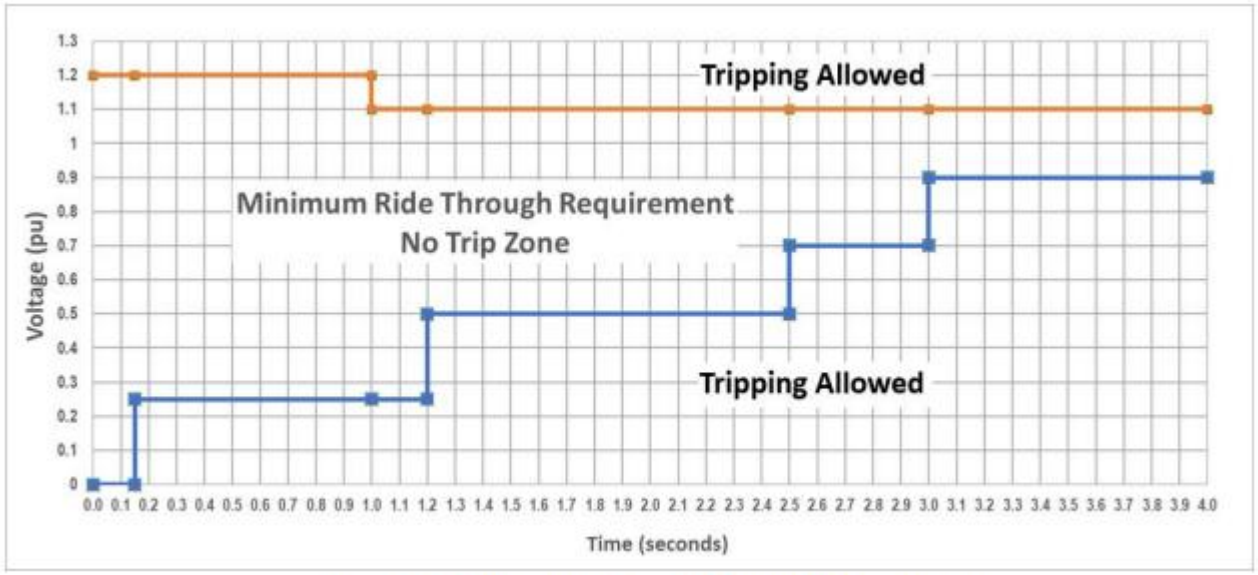

Figure 9.2-1: Voltage Ride Through Curve for Large Loads

ATC Planning Criteria V22.5
LIG Rev 15

Other Large Load Requirements Evolving

- ERCOT (pending)
- PSEG (in effect)
- SPP (in effect)
- Southern Company (in effect)
- IESO (proposed)
- MISO (proposed)

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**Not to be used for compliance guidance in any way. Informational only.*

Group Discussion

Overview, Discussion, and Next Steps

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This Industry Advisory Group (IAG) Initiative

- Create forum to share lessons learned, questions, findings, etc.
- Foster harmonization of interconnection requirements for large loads across the West, with adequate room for system-specific needs
- Support smaller entities or entities that may be further behind
- Consolidate industry practices across various transmission providers
- ***Goals:***
  - Develop and publish “template” Facility Interconnection Requirements (FIRs) that entities can adopt and adapt, as needed
  - Provide an open, engaging, informal, collaborative, and respectful environment to share and learn together

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Slido Q&A and Polls

- Join Link: https://app.sli.do/event/9E3xDLg7RB6suDM32QcgXF
- www.slido.com
- Join Code: 2841263

Future Meeting Discussions

- Technology-specific requirements
- Prioritizing risks and concerns (i.e., requirements to cover)
- Review latest working draft template requirements
- Technical discussion on requirements template
- Sharing industry efforts and activities
- Open Q&A and discussion

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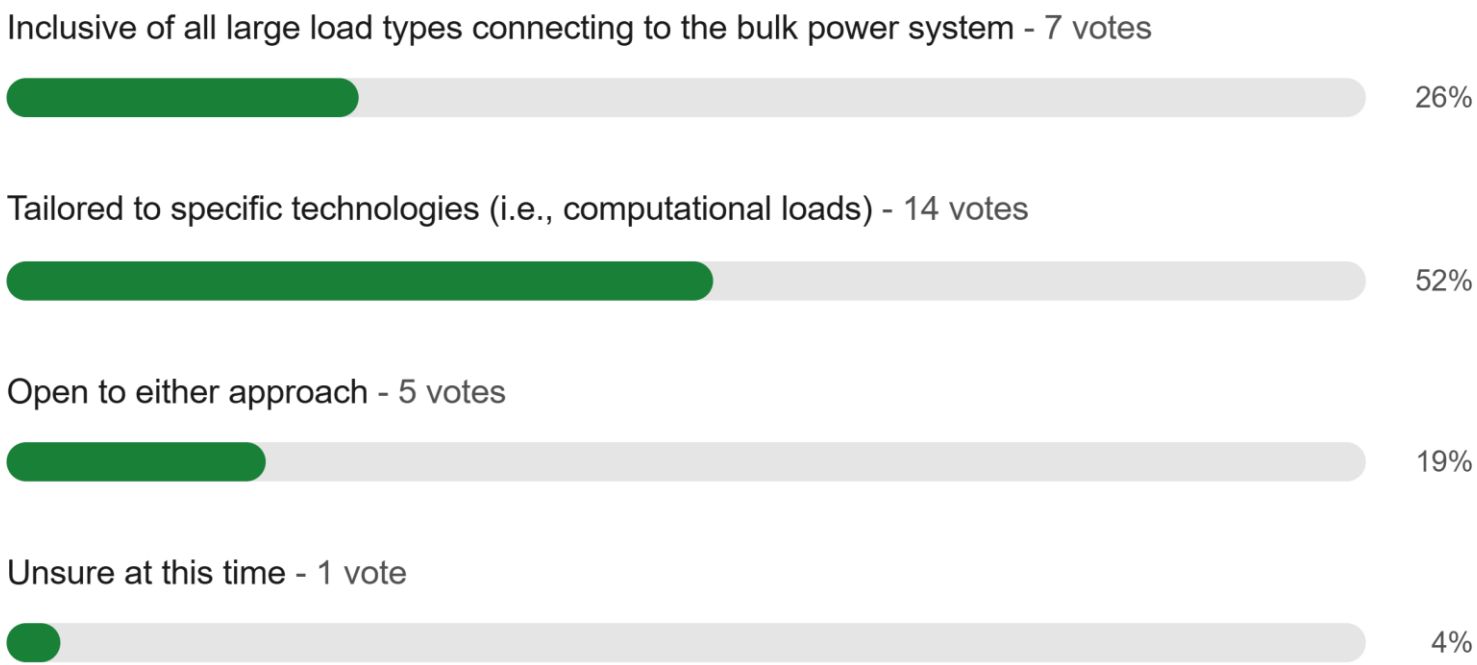
info@elevate.energy

Slido Responses

Would you prefer to see large load interconnection requirements inclusive of all large load types above a size threshold or should they be tailored to specific technologies (i.e., computational loads)?

Multiple Choice Poll | 27 votes | 27 participants



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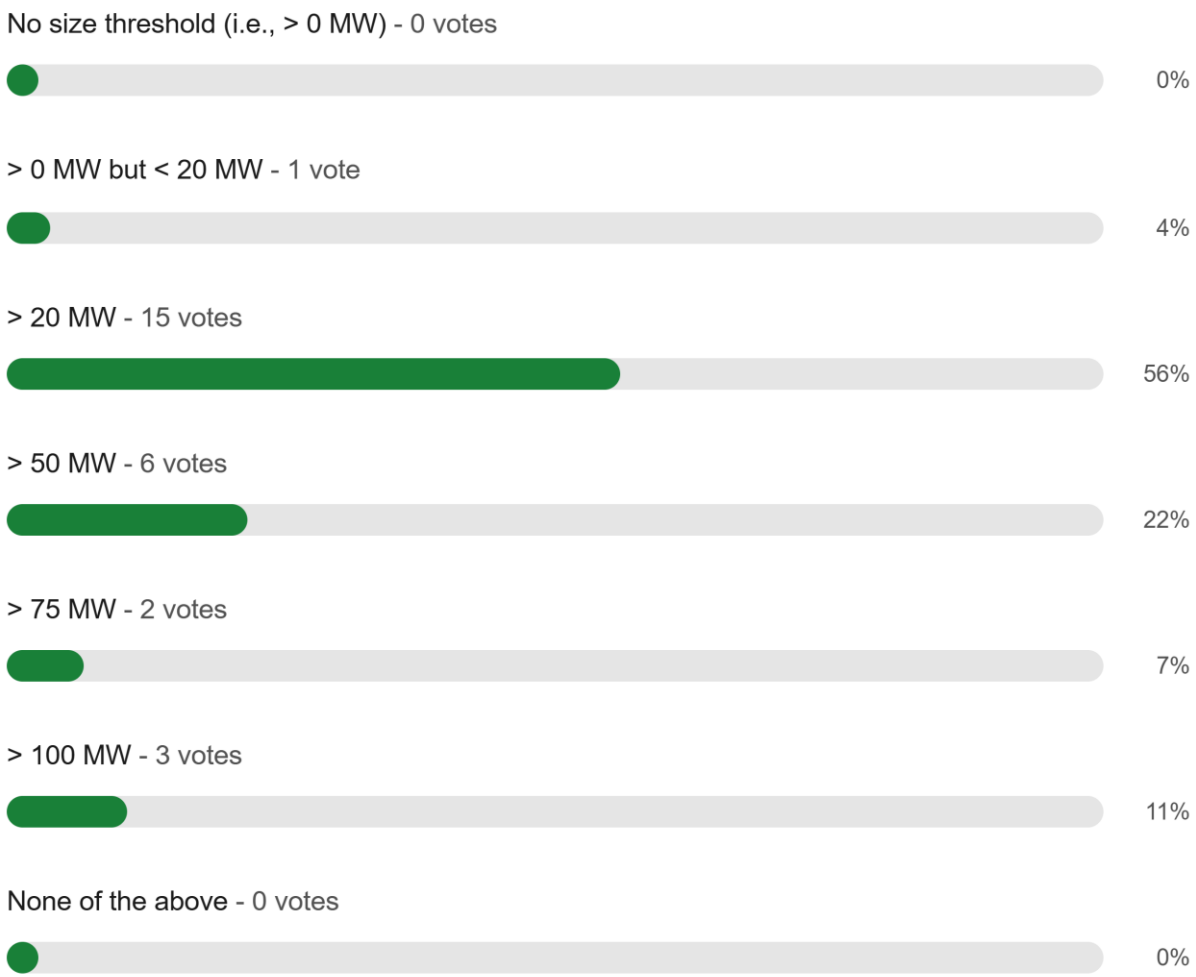
What size threshold (MW) do you believe suitable for establishing large load requirements for loads connecting to the bulk power system?

Multiple Choice Poll | 27 votes | 27 participants



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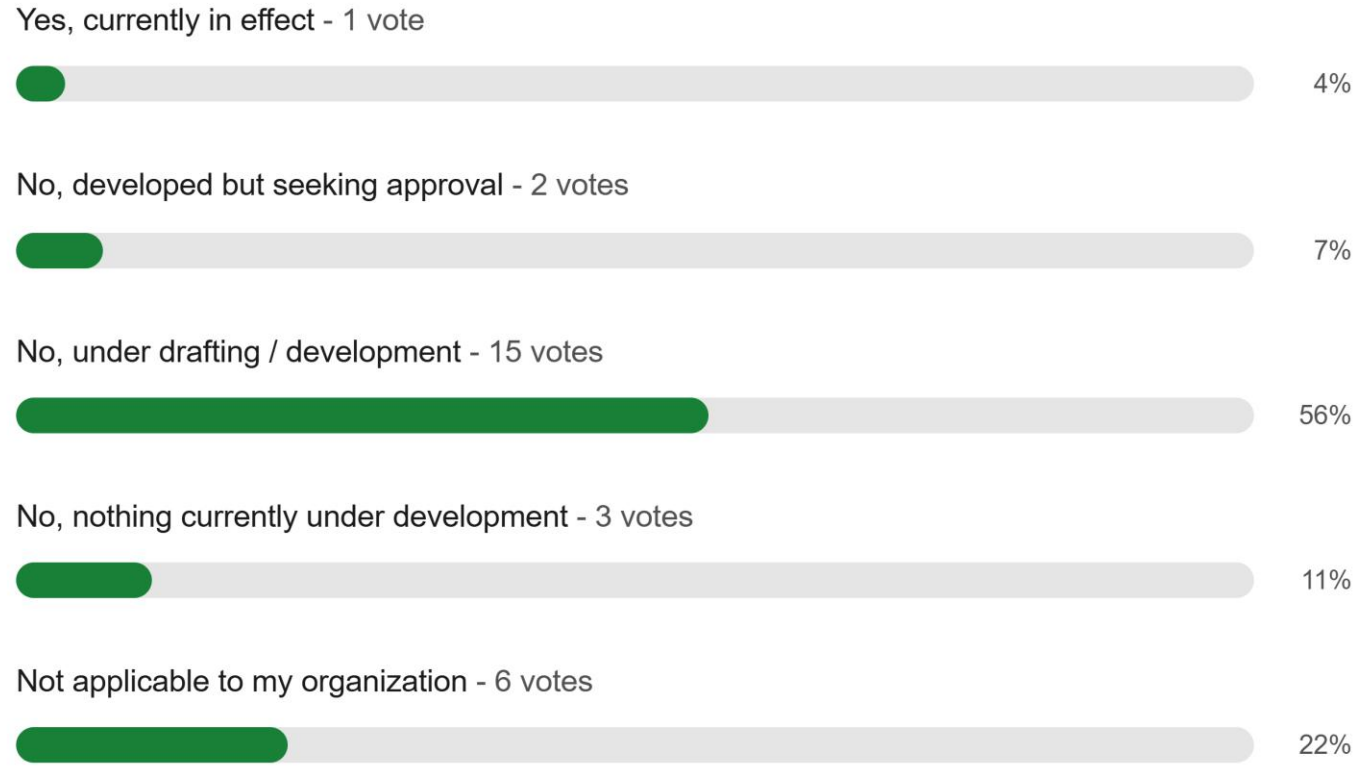
Does your organization currently have interconnection requirements in place for large loads connecting to the transmission system (bulk power system)

Multiple Choice Poll | 27 votes | 27 participants



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