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What NERC Reliability Guideline Means For Large Loads

By **Stephen Spina, Arjun Ramadevanahalli and Robert Goldfin** (June 23, 2026, 5:45 PM EDT)


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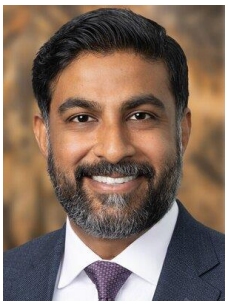
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Last month, the North American Electric Reliability Corp. issued the final version of its new reliability guideline.[1]

The guideline provides a detailed framework to address reliability issues associated with rapidly growing large loads such as data centers, cryptocurrency mining facilities, hydrogen production facilities, manufacturing facilities and arc furnaces.

The guideline is voluntary and does not create a binding reliability standard. But it represents a significant shift, as it is directed not only to NERC-registered entities but also to large load developers, owners, operators and original equipment manufacturers, or OEMs.

The guideline reflects NERC's continued focus on how emerging large loads may affect bulk power system, or BPS, planning, operations, stability, resilience and security.

And it hints at possible expansion of reliability registration beyond current compliance requirements, especially where NERC sees reliability risks that arise from entities not previously subject to direct registration or reliability standards obligations, including large loads.

The New Reliability Guideline

NERC released the reliability guideline in response to significant shifts in electric demand caused by emerging large loads.

NERC has observed customer-initiated large load reductions and rapid oscillations occurring within seconds, which pose a risk to the reliability of the BPS by leaving little to no room for real-time response by system operators.

NERC also identified longer-term risks relating to transmission planning and resource adequacy, including risks that may arise if large load growth is not accurately modeled or incorporated into transmission and resource planning processes.

The reliability guideline provides immediate nonbinding — yet strongly urged — guidance for all entities involved in large load integration.

It defines "large load" broadly as a commercial or industrial individual load facility, or an aggregation of load facilities at a single site behind one or more points of interconnection, that can pose reliability risks to the BPS due to demand, operational characteristics or other factors.

The guideline identifies data centers, cryptocurrency mining facilities, hydrogen electrolyzers, manufacturing facilities and arc furnaces as nonexclusive examples.

Notably, NERC describes the guideline as a bridge while it continues to consider potential changes to registry criteria and reliability standards for large load integration.

Entities Covered by the Reliability Guideline

NERC reliability standards generally apply to entities that are registered in NERC's compliance registry.

Registration is typically based on the reliability functions an entity normally performs — e.g., transmission planning and/or operations, balancing authority functions, generation ownership or operation, distribution provider functions — and whether the entity meets applicable registration criteria.

Registered entities are responsible for complying with mandatory reliability standards applicable to their registered functions.

The reliability guideline, by contrast, does not impose binding obligations on any existing registered entities. But NERC strongly encourages that all entities interacting with large loads review the guideline and consider whether internal processes or procedures should be adjusted.

Beyond that group, NERC expressly states that the reliability guideline is intended to provide reliability-enhancing guidance for entities not historically involved in NERC compliance, including large load entities and OEMs.

Overview of the Guideline

Data Collection, Modeling and Information Sharing

A central theme of the reliability guideline is that grid planners and operators require accurate, timely and updated information about large load facilities to model and operate the BPS reliably.

NERC describes data collection and sharing as foundational, noting that, without proper data to simulate and characterize large loads, planners and operators may make decisions based on inaccurate analysis.

The guideline recommends that relevant registered entities establish processes for collecting and sharing large load data across three stages: load interconnection evaluation, load integration and commissioning, and operations.

The recommended data that registered entities are urged to collect from large load entities includes:

- Peak net real power demand;
- On-site generation plans;

- Facility expansion and buildout schedules;
- Power factor information;
- One-line diagrams;
- Reactive devices;
- Protection and control settings;
- Voltage and frequency disconnection and reconnection thresholds;
- Ramp rates;
- Subhourly demand profiles;
- Harmonics;
- Backup generation or battery energy storage information; and
- The type and expected operation of the large load facility.

NERC also recommends that large load entities develop and maintain site-specific dynamic models and, where appropriate, electromagnetic transient models in coordination with OEMs, and provide those models to the interconnected registered entity utilities.

The reliability guideline further recommends that registered transmission owners, in coordination with registered transmission providers and planning coordinators, establish model quality assessment, model verification and model validation processes.

The guideline emphasizes that under those processes, large load entities should provide accurate, verified and updated data at various stages of the project life cycle, including as-designed, as-built and as-left information.

NERC also recommends that registered transmission owners use high-speed monitoring devices capable of supporting model validation, performance evaluation, event analysis and oscillation detection.

Interconnection Studies and Restudy Triggers

NERC recommends that transmission planners and planning coordinators establish comprehensive interconnection and near-term systemwide study processes using steady-state, dynamic and short-circuit models to assess large load impacts.

The guideline suggests that transmission owners, in coordination with transmission operators, balancing authorities, transmission planners, planning coordinators and reliability coordinators, establish and publish interconnection processes.

These processes should include data collection, readiness criteria, interconnection study agreements, dynamic studies, short-circuit studies, commissioning processes and consideration of impacts on underfrequency and undervoltage load-shedding programs.

The guideline also recommends that transmission planners and planning coordinators establish criteria for when a large load facility should be restudied.

NERC notes that large load characteristics can change materially as design decisions evolve, including changes in equipment vendors or the mix of computational processes. These changes may introduce stability risks that were not identified in earlier studies.

As a result, NERC recommends clear policies for handling significant post-study changes, including

situations where mitigation may be needed before energization or where operational restrictions may be appropriate until mitigations are in place.

Long-Term Planning and Resource Adequacy

The reliability guideline addresses the risk that large load growth may outpace transmission and generation. NERC recommends that planners incorporate large load interconnection requests into reliability assessments and resource adequacy analyses, including scenarios involving delayed generation additions, transmission constraints, fuel supply constraints and different levels of load flexibility.

NERC recommends that resource adequacy models capture the operational constraints and flexibility of large loads, including dispatchability, ramp rates, internal generation or storage, technical constraints, operating limits, and distinctions between firm and interruptible demand.

The reliability guideline notes that traditional models may not adequately reflect large loads with rapid ramp rates, behind-the-meter generation, colocated storage, or operating schedules tied to industrial or computational processes.

The guideline also recommends location-aware analysis. Because large loads may cluster in areas with favorable commercial or infrastructure conditions, planners should assess local transmission constraints and locational loss-of-load risks rather than relying solely on systemwide reserve margins.

NERC recommends use of multiple probabilistic resource adequacy metrics to capture dimensions of risk such as event duration, magnitude and severity.

Operations, Balancing and Real-Time Coordination

For operations, the reliability guideline recommends enhanced commissioning, real-time monitoring, short-term forecasting, balancing reserve management and communication protocols among large load entities and registered entities.

NERC notes that certain large loads may be highly variable, and may exhibit second-to-second or minute-to-minute oscillations and fast ramping capabilities. Without adequate information from large load entities, balancing authorities and other operators may undercommit generation or lack sufficient visibility into operational risks.

The guideline recommends that large load entities provide near-term forecasts, operating plans, real-time telemetry, operational contacts and advance notice of substantial load changes. It also recommends that balancing authorities, transmission operators and reliability coordinators incorporate large load variability into reserve planning, operational studies and real-time tools.

For customer-initiated load reduction events, NERC recommends that balancing authorities identify the largest credible sudden reduction in load on their systems and account for that risk in unit commitment and reserve considerations, similar in concept to how generator contingencies are considered under existing reliability frameworks.

NERC also recommends that large load operators develop communication capabilities, training and processes to respond to operating instructions from reliability coordinators, balancing authorities and

transmission operators.

This recommendation is particularly notable because the reliability guideline states that large loads were not registered entities at the time of the guideline's publication, and therefore were not obligated to establish real-time communications with utility operators under existing requirements.

Stability, Ride-Through and Oscillation Risks

NERC devotes substantial attention to stability. The reliability guideline states that some large loads, including data centers and cryptocurrency mining facilities, are voltage sensitive, and documented incidents have involved large loads unexpectedly reducing demand during and after normally cleared faults.

It further states that at certain megawatt thresholds, customer-initiated load reduction can contribute to cascading outages on a cycles-to-seconds time frame.

To address these risks, NERC recommends accurate dynamic models reflecting voltage and frequency disturbance performance, including tripping, switchover, demand reduction and reconnection behavior.

It further recommends that transmission owners, transmission planners, planning coordinators, balancing authorities and reliability coordinators coordinate to determine local and systemwide thresholds for rapid demand changes and establish appropriate ride-through, protection and mitigation requirements.

The guideline also addresses voltage stability, frequency stability, oscillation mitigation and angular stability. NERC notes that certain large loads with variable or cyclical profiles, including AI data centers and electric arc furnaces, may introduce forced oscillations into the BPS.

NERC recommends monitoring and mitigation provisions in interconnection agreements, high-resolution monitoring, oscillation detection, postevent analysis and potential software or hardware mitigations such as GPU power smoothing or rack-level energy storage where appropriate.

Power Quality, Physical Security, Cybersecurity and Resilience

While existing power quality standards are not mandatory, the reliability guideline recommends that transmission operators and distribution providers include harmonic limits and power quality requirements in interconnection requirements for large loads.

NERC's concern is that large loads with significant power electronics, adjustable speed drives, rectifiers or similar equipment may inject harmonics or cause voltage fluctuations that can affect the surrounding grid, including by contributing to misoperations and degraded voltage performance at or near the point of interconnection.

The guideline also recommends processes for addressing design changes that may affect harmonic emissions or voltage fluctuations, including potential reperformance of interconnection studies if projected harmonic emissions materially increase. NERC further recommends high-resolution power quality monitoring at the point of interconnection.

For physical and cybersecurity, NERC recommends registered entities and large load entities integrate

security considerations into planning, design and interconnection processes.

The reliability guideline covers holistic risk assessments, security-by-design, operational interdependencies, collaboration and information sharing, site selection, equipment protection, surveillance, network segmentation, encrypted and authenticated communications, supply chain risk management, vulnerability management, incident response, documentation, periodic review, and personnel training.

The guideline further addresses resilience, system restoration and load shedding. NERC recommends consideration of large loads in manual load shedding, underfrequency load shedding, undervoltage load shedding, dynamic load shed monitoring and system restoration studies.

It notes that large loads may affect traditional assumptions due to their size, dynamic characteristics and the fact that load operators may not have previously interacted with system operators.

Recommended Timing for Implementation

While the reliability guideline is voluntary and nonbinding, NERC recommends that applicable entities implement the identified risk mitigation actions and processes while it continues to evaluate updates to registry criteria and reliability standards.

In practice, many of the recommendations are most useful when considered early in the project life cycle — before interconnection studies are complete, before equipment and control decisions are finalized, and before energization.

Current registered entities may wish to evaluate whether interconnection requirements, study processes, operating procedures, telemetry requirements, model validation processes, and restoration or load-shedding plans should be updated.

Large load developers, owners, operators and OEMs may wish to consider the guideline during site selection, design, procurement, interconnection negotiations, commissioning and ongoing operations.

Looking Ahead

NERC's new reliability guideline is an important development for both traditional registered entities and nonregistered large load participants, including data centers and other high-demand industrial or commercial facilities.

While the reliability guideline does not itself impose mandatory obligations, it provides a detailed road map for practices that NERC views as important to reliable large load integration.

It also represents another concrete step in NERC's broader initiative to address reliability risks associated with large loads, including the potential for increased expectations and potentially future obligations for large load owners, operators, developers and equipment providers.

In that respect, the reliability guideline may also signal areas of reliability regulation that could expand beyond the current scope of mandatory compliance, particularly where NERC identifies reliability risks arising from entities or activities that have not historically been subject to direct NERC registration or reliability standard obligations.

Current NERC-registered entities and large load participants should closely review the reliability guideline and consider how its recommendations may affect interconnection strategy, operational coordination, technical modeling, facility design and future compliance planning.

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[1] https://www.nerc.com/globalassets/our-work/guidelines/reliability/RG_Risk-Mitigation-For-Emerging-Large-Loads.pdf.