INTELLIGENCE UPDATE

Draft grid rules position data centers as active grid participants

Jay Dietrich 15 Jul 2026

The number of data centers is increasing with new campuses projected to have power demands of 0.5-2.5 GW or more, and many clustered around fiber hubs and metropolitan areas. As a result, these data centers can account for a significant fraction of average electricity demand (sometimes as much as 20%) in locations such as Virginia (US), Dallas (Texas, US), Chicago (Illinois, US), Ireland, Amsterdam (Netherlands) and Frankfurt (Germany). In these areas, data centers can exacerbate grid instability because many are programmed to disconnect rapidly from the grid during voltage and frequency disturbances.

Several serious grid events have occurred in the last four years, primarily in Virginia (US) and Ireland, when a significant portion of the data center load disconnected simultaneously. The transmission system operators (TSOs) had to act quickly to rebalance supply and demand to prevent a blackout. As a result of these events, at least six initiatives led by TSOs and related standard bodies have been launched to develop requirements for managing large, grid-connected computational loads (see *Power companies act to stop data center-induced blackouts*). After consultation with data center operators and other stakeholders, Eirgrid has released a final standard, the *Fault ride-through overview document*, which now awaits formal publication by the Irish Commission for Regulation of Utilities (CRU).

Use of terminology

Transmission system operators (TSOs) are the primary entity responsible for managing the grid. Organizationally, they are supported by six associated entities:

Balancing authority (BA).

Distribution provider (DP).

Generator operator (GO).

Planning coordinator (PC).

Reliability coordinator (RC).

Transmission owner (TO).

Transmission operator (TOp).

Transmission planner (TP).

These bodies are responsible for managing specific aspects of the grid operation. This report uses the term TSO to refer collectively to the TSO and the above six entities.

The North American Electric Reliability Corporation (NERC) has initiated Project 2026-02 Computational Loads to establish standards to address the concerns raised in a recently issued Level 3 alert (see *NERC alert points to the future of the grid*) and ensure that data centers and their on-site generation systems are properly integrated into the grid.

The project has provided three preliminary draft standards (see report attachments for more information):

- Computational Load Interconnection, Studies & Modeling Data (CLE-001-1).
- Computational Load Operational Data and Communications (CLE-002-1).
- Computational Load Protection Coordination and Disturbance Monitoring (CLE-003-1).

These have been sent for comment to internal working groups of interested parties, such as TSOs, data center operators and data center hardware manufacturers. Uptime Intelligence is part of this process and has provided comments (see report attachment *Uptime Intelligence Discussion points for Short Term Advisory Groups*).

This proposal would radically alter the relationship between TSOs and data centers by creating new standards for computational loads, based on those that currently apply to electricity generation assets. This creates some tension, as generation assets are stable (they generate a specific MW capacity with known voltage, frequency, and capacity characteristics), while IT infrastructure is refreshed and remade on a 3- to 7-year cycle. NERC is designing its regulatory framework to assign data center operators a new, more active role in managing grid reliability and stability, albeit one distinct from that of generation assets.

Definitions

The draft standards propose three new definitions aimed at involving operators in maintaining grid reliability during interconnection and operations:

- **Computational load**. NERC has not defined computational load within the three draft standards, but earlier communications referred to computational loads exceeding 20 MW, connected at 60 kV and including at least 1 MW of IT demand. This is estimated to capture 95% of grid-powered data centers. A firm definition will be proposed in the draft standard.
- **Generation owner**. The standards treat on-site, grid-connected standby or primary generation, whether owned by the operator or contracted through a third party, as a

distinct interconnectable asset. These assets must be modeled in the interconnection study to assess their grid impact when operating as primary power or in demand response.

- **Qualified change**. The standard will define a "qualified change" as a modification to the IT or electrical infrastructure that affects its voltage, frequency, harmonics and/or demand characteristics. A qualified change will trigger additional modeling and study to confirm it will not affect grid stability. Similarly to computational load, this definition is a work in progress. The criteria could be set at the grid/data center interface — at the high- and/or load-side of the transformer pad or at the UPS, battery energy storage system (BESS), capacitors, condensers, pre-engineered synchronous condensers and other power quality systems. It could also be based on IT infrastructure characteristics, including compute type and installed firmware and software.

In its comments, Uptime Intelligence encouraged NERC to assess qualified changes at the grid/data center interface, where power-quality infrastructure has well-defined characteristics. Specific thresholds for voltage, frequency and harmonic variation can be set to trigger reassessment of the interconnection study. With few exceptions, IT infrastructure changes will not alter a data center's electrical characteristics; if they do, those changes can be identified and mitigated through the electrical systems managing power quality between the grid connection and the IT infrastructure.

Data center electrical performance

The standards call for the development of general and site-specific data center models to study steady-state, short-circuit, and dynamic performance under normal and contingency conditions. To build these models, data center operators must provide at least the following data (CLE-01 Section 8.1):

- Electrical system equipment parameters, settings, and capabilities related to tripping (the removal of the data center from the grid connection during periods of grid instability), ride-through and recovery.
- The quantity or percentage of IT infrastructure by infrastructure type. The types are not defined, but Uptime Intelligence has recommended the following infrastructure categories: (a) standard compute/cloud; (b) standard compute and ASIC-based AI inference; (c) GPU-based inference; (d) high-performance computing (HPC, most if not all of which is GPU based); and (e) AI training.
- The expected use/behaviors of the IT infrastructure, including the level of detail to which equipment behavior should be modeled. Data updates should be provided at least every 13 months.
- Although not mentioned in the standard, data submissions will likely also be required for specific electrical system operating parameters of the equipment that mitigate and prevent propagation of IT infrastructure-generated voltage and frequency variations and harmonics.

Initially, the TSO will need to collect general data from operating data centers and electrical equipment manufacturers to create general electrical performance models for data centers. These models will be integrated into the broader grid models used to assess the impacts of connecting a new computational load to the data center. The NERC level 3 alert, issued in May 2026, recommended the creation and use of these general models as one of its seven "essential actions." TSOs may start their data collection efforts in advance of the final issuance of these standards.

Data centers will be expected to provide facility-specific data and information before connection — and continue to provide it once the facility is operational. The standard suggests that the TSO and operator will jointly maintain and verify a site-specific model for each computational load. The operator will be responsible for demonstrating that the configurable, site-specific parameters of the model(s) are representative of the design and settings of the in-service equipment of each facility.

These models will be maintained, with the assistance of the data center operator, for the site-specific model. The entities supporting the connection (TO, TOp, GO, DP, TP and PC: see **Use of terminology**) will use them to monitor and assess the overall stability and reliability of the grid as generating and load assets are added and removed.

Interconnection and operation

Recognizing the high computational load demand and its impact on grid performance, standard CLE-02 broadens the requirements for collaboration and communication between the TSO and the computational load operator during a facility's interconnection and operational phases. The requirements shift computational load facilities from passive to active grid participants. Computational load operators will have broader responsibilities for supporting grid stability and reliability through participation in grid operating processes, information exchange, active two-way communications during grid events, and regular review. If necessary, data center operators may be required to update equipment settings and operational sequences based on data and experience gathered during responses to grid events.

Interconnection

The transmission planner (TP), planning coordinator (PC), transmission operator (TOp), balancing authority (BA), and reliability coordinator (RC) will establish the procedures and information/data reporting requirements to facilitate the efficient connection of the data center to the grid. The standard is silent on how these entities should develop and coordinate their requirements. Ideally, the TSO will establish an integrated process that defines a clear path to interconnection and avoids duplicating process steps and information requests. The data center operator is responsible for managing and meeting the procedural steps and information submissions needed to complete the interconnection process.

Operations

The TOp, BA, and RC will create and maintain documented specifications of the data and information that a data center operator will need to collect and report, either through real-time or periodic data submissions. The data will be used to perform operational planning analysis and system balancing. The specifications will dictate the data format, submission periodicity, precision and accuracy, and the conditions for resubmitting the facility model due to qualified changes in the monitored data.

The TOp, BA, and RC shall also issue operating instructions and two-way communications protocols for use during grid events. The operating instructions will outline the steps and ongoing communications involved in disconnecting and reconnecting the site load to the grid. Computational load operators will be responsible for delivering and refreshing training for their employees in line with these requirements. They must certify and report a list of employees responsible for responding to grid events and their training status to the TO and BA. At least one certified employee must be present at the facility during a grid event.

The data center operator will establish and maintain a process to regularly assess and, if necessary, revise the electrical system hardware settings that govern the sequencing of equipment responses to a grid voltage/frequency or loss-of-power event. Operators will use routinely collected operational data and disturbance monitoring data to perform the assessment.

Disturbance monitoring and reporting

In conjunction with the operational data collection required in standard CLE-02, the computational load operator must also install equipment to record and report system performance during grid events (see **Table 1**). All monitoring systems will be time-synchronized to Coordinated Universal Time with an accuracy of ±1 millisecond. The data will be retrievable for 20 calendar days, although Uptime recommends that operators maintain data collected during grid events for at least 3 years.

Table 1 Data collection during grid events

Monitoring type	Equipment type	Monitored element	Data recorded	Sampling and recording requirements	Required triggers
Sequence of event recording (SER)	Main power transformer(s)	Circuit breaker(s) position	Fault codes and alarms	Not applicable	Execution of a ride-through operation or grid disconnection
		Bus(es)			
	Back-up generator				
	Shunt static and dynamic reactive device(s)				
Electrical quantities at fault occurrence	High side of main power transformers or common point of connections	Three phases of power supply	Phase-to-neutral voltage (mega-volts)	Minimum recording rate of 64 samples per cycle	(1) Neutral (residual overcurrent) (2) AC phase over- and under-voltage (3) Over- and under-frequency
			Phase current (amps)		
			Residual or neutral current (amps)		
			Real power (megawatts)		
			Reactive power (mega-volts ampere reactive)		
Continuous dynamic disturbance recording and storage	High side of main power transformers or common point of connections	Three phases of power supply	Phase to neutral voltage	Input sampling rate of at least 960 samples per second Output recording of at least 60 times per second	None (recording is continuous)
			Phase current		
			Residual or neutral current		
			Real power flow		
			Reactive power flow		
		Any phase	Frequency		

(Note: The table includes an interpretation of some requirements. See standards for precise requirements.)

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Next steps

The three standards are an important first step in NERC's efforts to improve the management of computational loads during interconnection and operation. They outline a framework for model development and availability, operational and emergency response processes, and information monitoring, collection and reporting. TSOs will need to implement this framework to manage the impacts computational loads pose to grid reliability and stability. The standards will be released for formal public comment in September of 2026; NERC intends to issue final standards before the end of 2026. Data center operators should plan to review and comment on the final draft documents, as these will significantly affect their operations.

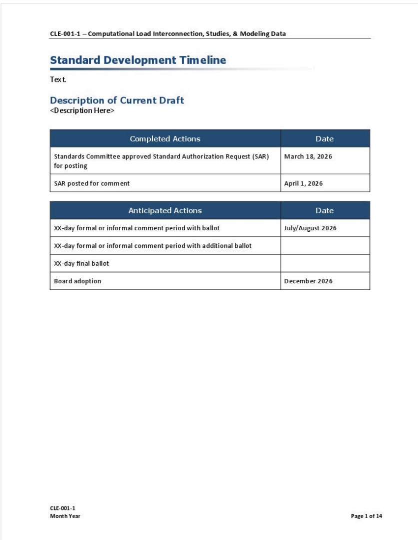
These standards do not, however, fully define the management of computational loads. They do not describe the specific process flows and actions that data center operators must follow, the characteristics and associated changes that trigger a qualified change, or specify the exact information that must be collected, managed and reported. Either NERC will provide implementation guidance in a follow-on project or TSOs will issue their own specific guidance on how to meet the standards after their issuance toward the end of 2026. Because these activities will set the detailed operational requirements that data center facilities must follow, operators should make it a priority to monitor and engage in future activities — at NERC and in the grid regions — as these three standards are turned into actionable mandates.

The Uptime Intelligence View

Transmission system operators worldwide are taking steps to mitigate the risks that large, concentrated data centers pose to grid stability and reliability. The three draft NERC standards represent the most comprehensive effort to date to manage computational loads, establishing data collection, reporting, and modeling requirements to facilitate the assessment and interconnection of new data centers and the ongoing monitoring of active data centers. In addition, standby generation systems will receive greater scrutiny during the interconnection process because their generating capacity will, in many cases, be equal to that of a primary power system, and new grid-balancing requirements will bring them into use more frequently.

Data centers will no longer be connected to the grid with minimal monitoring. Instead, operators will be expected to actively engage with TSOs to manage grid stability by regularly exchanging operational data and participating in demand response programs. This change will introduce operational complexities that will further challenge operators in their efforts to provide IT infrastructure with five nines reliability.

FILE ATTACHMENTS



CLE-001-1 – Computational Load Interconnection, Studies, & Modeling Data

Standard Development Timeline

Text.

Description of Current Draft

<Description Here>

Completed Actions	Date
Standards Committee approved Standard Authorization Request (SAR) for posting	March 18, 2026
SAR posted for comment	April 1, 2026

Anticipated Actions	Date
XX-day formal or informal comment period with ballot	July/August 2026
XX-day formal or informal comment period with additional ballot	
XX-day final ballot	
Board adoption	December 2026

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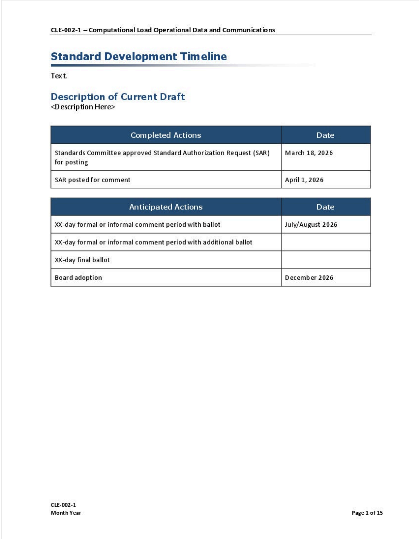

CLE-002-1 – Computational Load Operational Data and Communications

Standard Development Timeline

Text.

Description of Current Draft

<Description Here>

Completed Actions	Date
Standards Committee approved Standard Authorization Request (SAR) for posting	March 18, 2026
SAR posted for comment	April 1, 2026

Anticipated Actions	Date
XX-day formal or informal comment period with ballot	July/August 2026
XX-day formal or informal comment period with additional ballot	
XX-day final ballot	
Board adoption	December 2026

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Month Year
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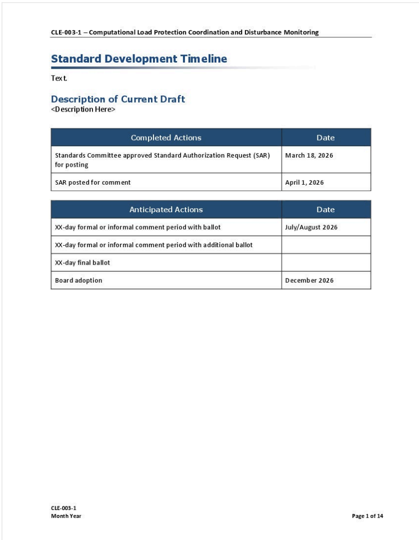

CLE-003-1 – Computational Load Protection Coordination and Disturbance Monitoring

Standard Development Timeline

Text.

Description of Current Draft

<Description Here>

Completed Actions	Date
Standards Committee approved Standard Authorization Request (SAR) for posting	March 18, 2026
SAR posted for comment	April 1, 2026

Anticipated Actions	Date
XX-day formal or informal comment period with ballot	July/August 2026
XX-day formal or informal comment period with additional ballot	
XX-day final ballot	
Board adoption	December 2026

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Uptime Intelligence Discussion points for Short Term Advisory Groups.docx

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15 Jul 2026

Jay is the Research Director of Sustainability at Uptime Institute. Dietrich looks beyond the hype to analyze the transformations required in energy and IT systems, data centers and software management systems, and intra-organizational collaboration, both within and between companies, to deliver sustainable data center operations.

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