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New ESIG Report Documents Real-World Grid Disturbances Involving Large Loads

ESIG Large Loads Task Force report shows how careful tracking of large load disturbance events can inform the interconnection practices needed to maintain reliable and secure grid operations.

Reston, VA — The Energy Systems Integration Group (ESIG) has released [Large Load Disturbance Events](#), a new technical report documenting recent grid disturbance events in which large, power electronics–based loads played a significant role, either in triggering instability or in complicating grid recovery. The report points to a set of systemic gaps for the industry to address as large loads continue to grow in size, concentration, and electrical complexity.

The report was produced by ESIG’s [Large Loads Task Force](#), which was formed to assist the power industry in addressing new challenges introduced by the rapid proliferation of large electronic loads such as data centers, crypto mining, and advanced manufacturing.

“In recent years, the number of power system disturbances involving large loads, both power electronic–based loads and industrial loads have been on the rise across North America and Europe,” said Eric Meier of the Electric Reliability Council of Texas and a lead author of the report. “This report documents these large-load-related disturbances and the lessons we can learn from them to improve power grid reliability.”

Today’s large loads are fundamentally different from those the grid was designed to serve. Many are unprecedented in scale, geographically concentrated, and inverter-based—making them highly sensitive to the kinds of voltage and frequency excursions that are routine during grid disturbances. When these loads trip offline suddenly or trigger power oscillations, the consequences can extend far beyond a single facility.

The report draws a parallel to the lessons of the 2003 North American blackout, where individual generator protection settings—each rational in isolation—collectively caused massive amounts of generation to drop offline simultaneously, cascading into widespread outages. The same dynamic is now emerging with large loads, many of which rival or exceed the size of large nuclear generators.

“As large power electronics–based loads such as data centers and advanced industrial facilities continue to grow, real-world disturbance events are becoming an invaluable source of insight for



the industry,” said Julia Matevosyan, associate director and a chief engineer at ESIG. “The report highlights that careful tracking of these events, supported by high-fidelity monitoring, provides the foundation for better models, more informed planning studies, and the evolution of interconnection requirements needed to maintain reliable and secure grid operations.”

The report focuses on two categories of disturbance: **ride-through failures**, in which a large load trips offline during a voltage or frequency excursion rather than staying connected and riding through the event, and **load-driven oscillations**, in which the rapid, large-scale power consumption changes of facilities like AI training clusters—or electronic signals from back-up power equipment—trigger power oscillations on the grid that can damage equipment, disconnect load and generators on the grid, and initiate cascading outages.

The report identifies four areas where action is needed from system operators, utilities, regulators, and load developers:

- Mandatory ride-through requirements
- High-resolution metering at the facility level, not just feeders
- Earlier, more systematic coordination between transmission operators and load owners on protection settings
- Consistent collection of performance and modeling data during the interconnection process.

This report is part of a set of four interrelated reports on large load interconnection performance requirements. Together, the series is intended to help system operators, utilities, and developers understand large load behavior, assess reliability risks, and develop interconnection performance requirements tailored to their jurisdictions. The series aims to ensure that as new large load classes expand, they do so in ways that strengthen—not compromise—the reliability and resilience of the grid.

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About Energy Systems Integration Group

ESIG began in 1989 as the Utility Wind Interest Group, an organization created to educate utilities about wind power. Within ten years, it developed into a significant technical educational organization and convener of peer-to-peer workshops to assist utilities, system operators, project developers and equipment manufacturers from around the world with the integration of wind power, and then by 2011, also with the integration of solar power. With renewables becoming the mainstream sources of new generation and reliability services, the organization expanded its mission, branding and international participation in 2018 through a merger with the International Institute of



Energy Systems Integration (IIESI) to become the Energy Systems Integration Group (ESIG), taking on not just the planning and operations of electricity systems and power markets, but also the growing issues for other energy vectors, including the electrification of transportation, buildings and industry for decarbonizing the entire energy supply.

ESIG now serves as a resource for a broad cross-section of the global energy industry, including utilities, ISOs, independent power producers, project developers, manufacturers, forecasters, consultants, educational institutions, and government agencies, including regulatory bodies.

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