

ESIG Spring Technical Workshop



ESIG
ENERGY SYSTEMS
INTEGRATION GROUP

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Executive Director, ESIG

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Austin, TX

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Whiplash

- Industry has been running as fast as it can to power new data centers, and then Deepseek said it could meet our AI performance with a fraction of the computational power
- Executive Order removes federal waters for offshore wind and stops approvals, permits, and loans for onshore & offshore wind.
- Executive Order freezes funding for Inflation Reduction Act and Infrastructure Investment and Jobs Act programs with huge uncertainty looming on tax credits
- 25% tariffs on Ontario electricity exports to the US, that were suspended the next day



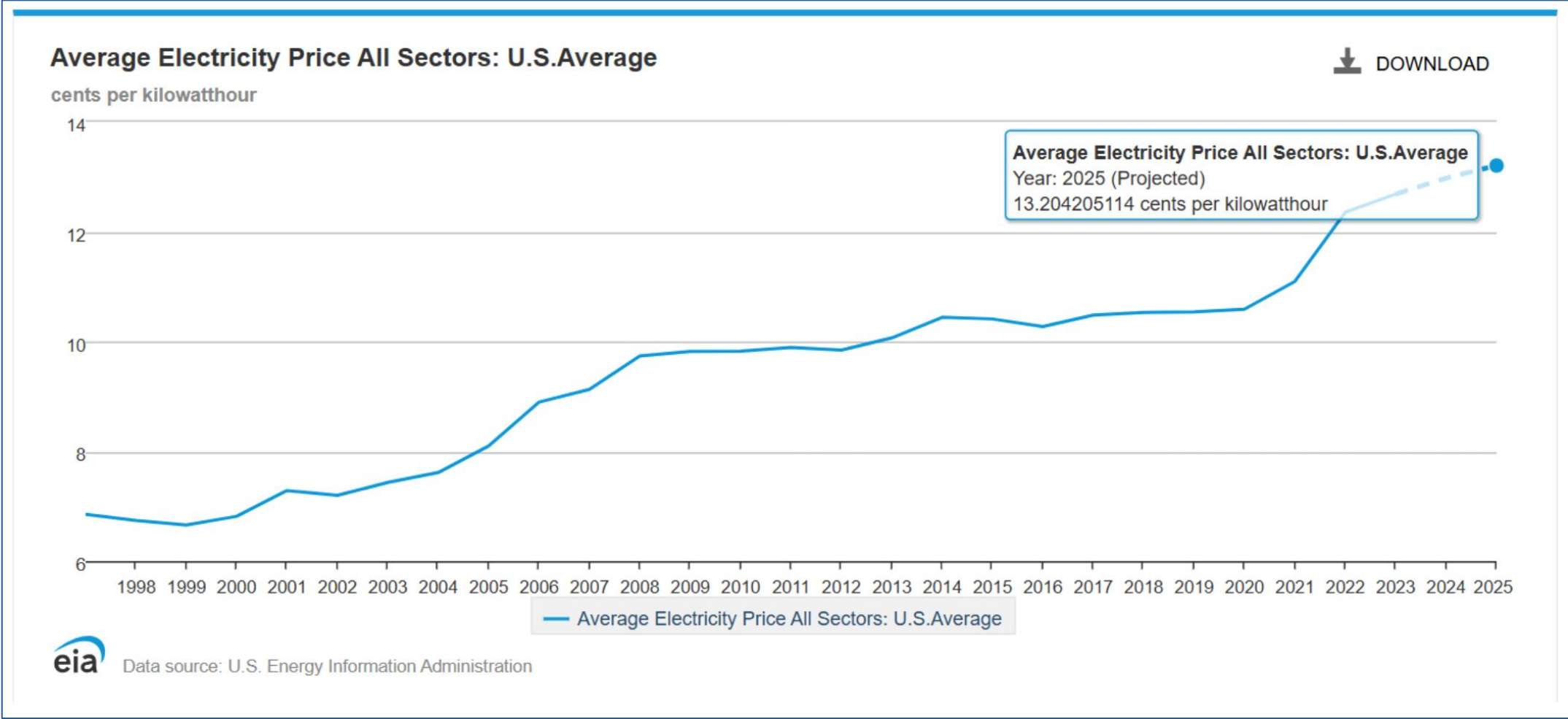
What keeps grid operators up at night?



- We've already had retirements of thermal plants, clogged interconnection queues, transmission is slow to build, supply chain issues, high cost of capital
- Now data centers, electrification and other load growth on top of those challenges
- PJM capacity auction - \$269.92/MW-day compared to \$28.92/MW-day in last auction (\$14.7B/yr cost to ratepayers compared to \$2.2B in last auction)
- At least 5 years to build a new gas plant and they cost >3x what they cost a few years ago
- Renewed interest in virtual power plants



Electricity prices are increasing which puts pressure on new infrastructure



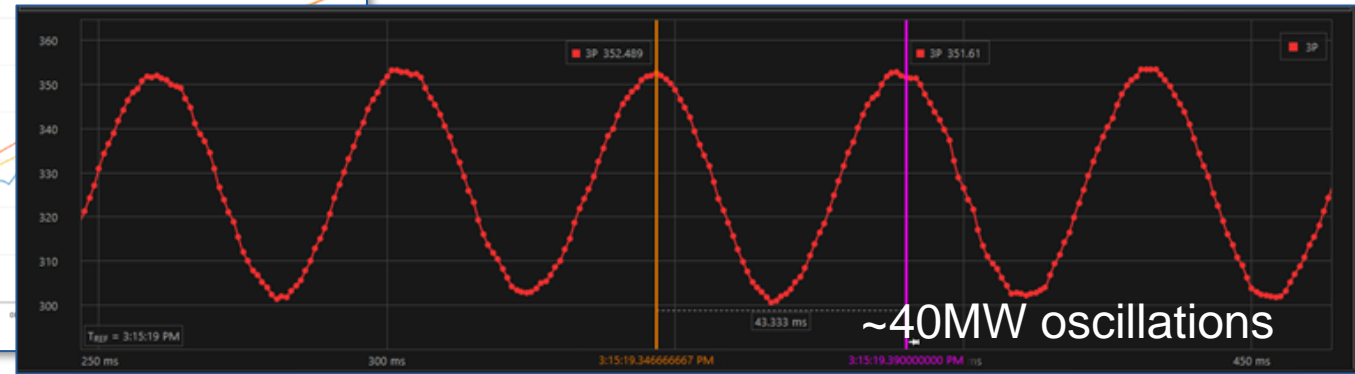
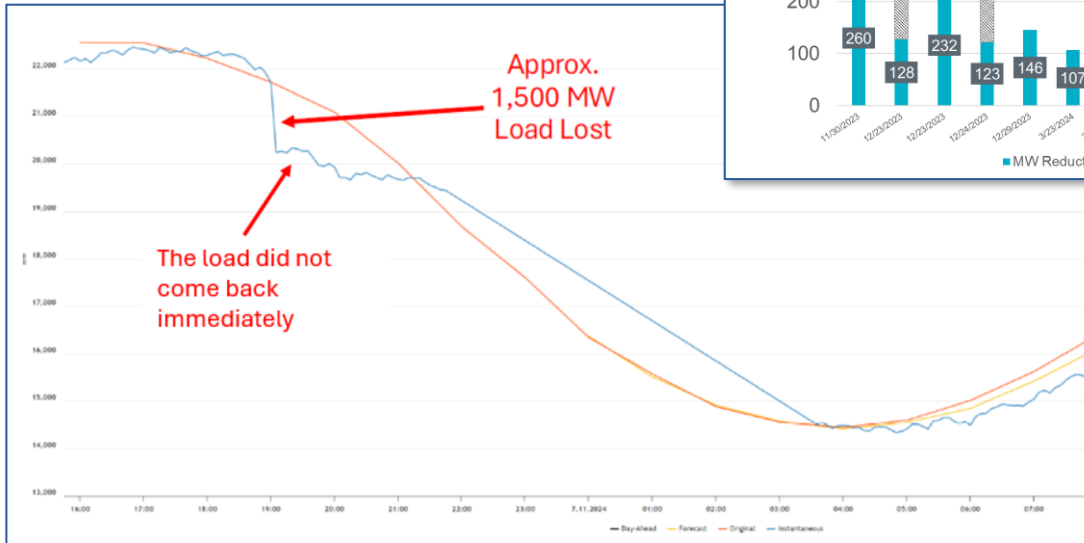
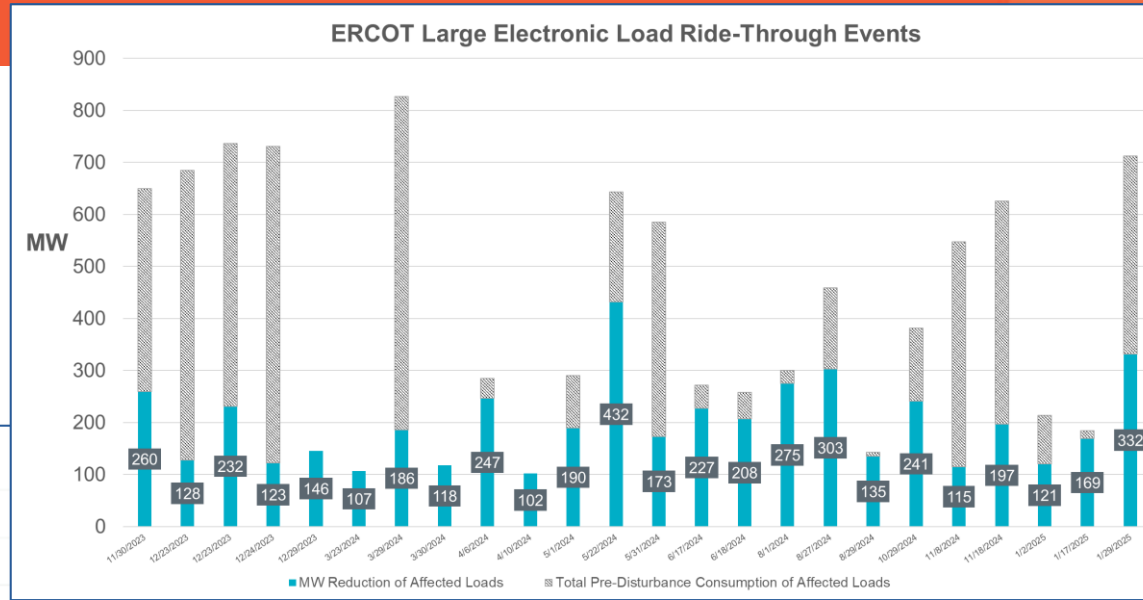
Is AI leading to a nuclear renaissance?



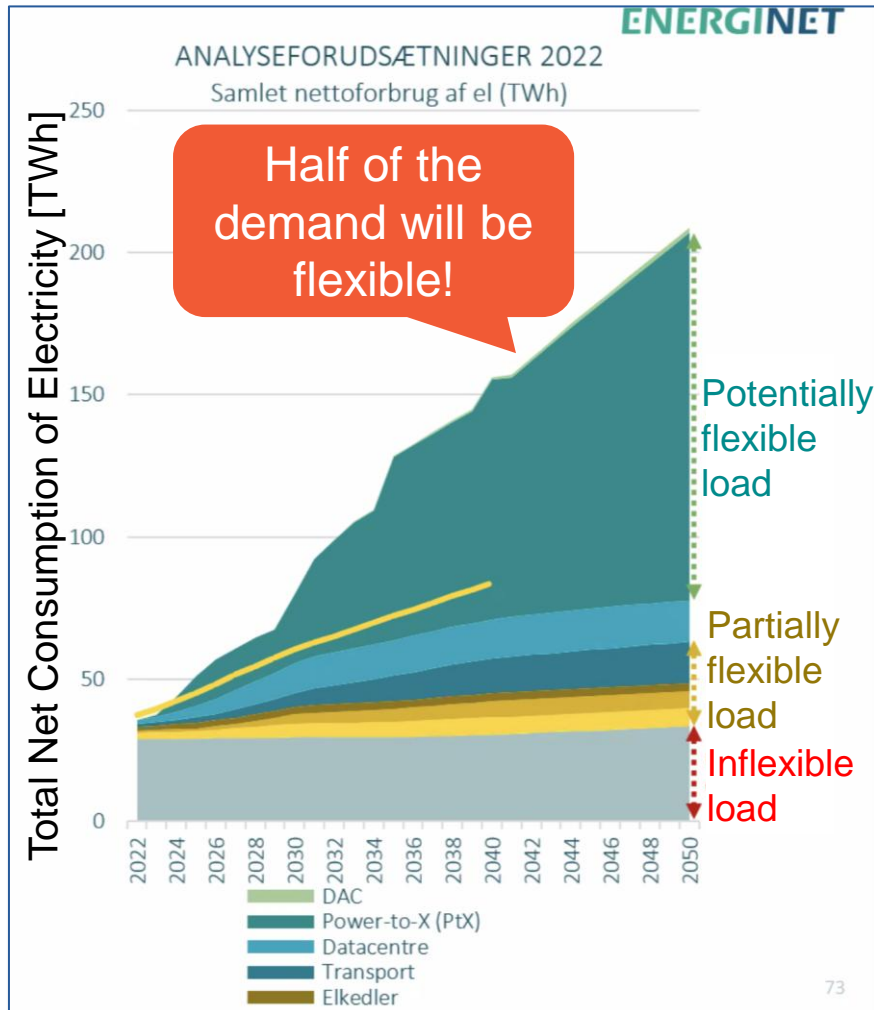
- Microsoft – Three Mile Island unit 1
- Gates/TerraPower invested \$1B in a sodium-cooled 345 MW technology that has 5 hours of storage
- Amazon is investing in X-Energy SMRs
- Google will purchase power from Kairos Power SMRs
- Oklo is chaired by OpenAI's CEO Sam Altman. Reported 14 GWs of orders.
- NuScale's SMR has NRC design approval
- Ontario Power Group is building four 300 MW SMRs from GE Vernova. Planning to commission in 2029.
- Meta's RFP targeting developers for 1-4 GW capacity
- Nano is working on 1-2MW microreactors based on nuclear submarine technology
- Constellation is looking at adding SMRs to existing nuclear sites
- Recent pledge of Google, Amazon, Meta and others to triple nuclear capacity by 2050



Grid events from large loads



Large loads as grid assets



- Data centers all have storage and backup generation. Hyperscalers will likely build 10 GW of onsite generation in the next 2 years.
 - Fortum Spring aggregates uninterruptible power supply capacity of data centers into a virtual battery to provide Fast Frequency Response in Scandinavia.
 - Stack Infrastructure peak shaves using their BTM batteries.
 - System operators can disconnect power in extreme situations. All Nordic system operators are developing terms for interruptible agreements.
 - In Cheyenne, Microsoft's backup gas generation can be used by Black Hills Energy
 - Google prioritizes computing tasks and can respond to demand response events, e.g. winter 2022 in Europe
- Large loads like cryptocurrency or industrial heat electrification that WANT exposure to spot prices. These can be dispatched, can provide sizable, fast flexibility, and can curtail during grid stress events

Large Loads Task Force is underway (another reason to join ESIG!)



Project Team Meetings:

- Interconnection process (Kyle Thomas) – April 4, June 6, Aug 1, Oct 3, Dec 5
- Modeling requirements (Parag Mitra) – March 11
- Transmission Planning (Warren Lasher and Hannes Pfeifenberger) – March 27
- Resource Adequacy (Derek Stenclik) – March 28
- Markets (Erik Ela and Beth Garza) – March 13
- Interconnection performance requirements (Ahmed Rashwan) – June 9, Aug 7, Oct 7
- Load Forecasting (John Wilson) – March 27
- Interconnection process, performance requirements, and modeling requirements joint meetings – March 25, May 27, July 29, Sep 30, Nov 18
- Data Collection (Drew Siebenaler)

Webinars

- Jon Koomey, formerly LBNL, on data center forecasting – March 24 4pm ET
- Briana Kobor, Google, on proposed interconnection process
- Rich Bauer, NERC, and Patrick Gravois, ERCOT, on data center event in VA and other events
- Sai Gopal Vennelaganti, Tesla, on using BESS to mitigate oscillations and voltage ride through
- Shane Lunderville, Grant PUD, on interconnection processes at smaller utilities
- Nihal Mohan, NextEra, on large load studies for transmission planning
- Tyler Norris, Duke University, on ability to accommodate new flexible loads
- Kevin Steinberger and Kushal Patel, E3, on JLARC report examining impacts of data center growth in VA

Reports completed end 2025/early 2026

Working Groups and Task Forces Structure



System Planning WG Josh Novacheck	System Ops & Market Design WG Justin Sharp	DER WG Obadiah Bartholomy	Reliability WG Dustin Howard	Research & Education WG Tom Acker
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Resilience Benefit Quantification for Transmission Planning TF
 Warren Lasher

Integrated Planning TF (joint with DER&RWG)
 Aaron Burdick

Planning for 100% Clean Energy TF
 Elaine Hart

Long-term Load Forecasting TF (joint w/ DER)
 Julieta Giraldez

Integrating Across Siloes of Transmission Planning
 Tim Kopp

Resource Adequacy TF
 Derek Stenlik

Markets for 100% Clean Electricity TF
 Robin Hytowitz

Flexibility TF
 Aidan Tuohy

Large Loads TF (joint with SPWG, SOMDWG and RWG)
 Sam Morris

Demand Response Project Team
 Derek Stenlik

Buildings TF
 Sean Morash

EV Load Forecasting Guide
 Matt Schuerger

High Share of IBR TF
 Julia Matevosyan

GFM Testing Project Team
 Shahil Shah

Oscillations Project Team
 Nick Miller

Services Project Team
 Matt/Julia/Deepak

Benefits of GFM BESS Project Team
 Ryan Quint

i2X Forum for Implementation of Reliability Standards for Transmission
 Julia Matevosyan

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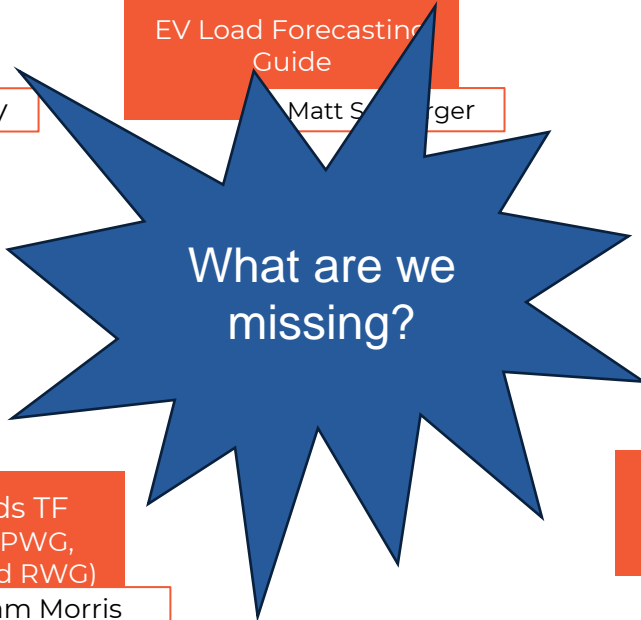
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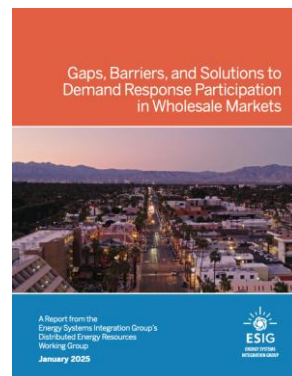
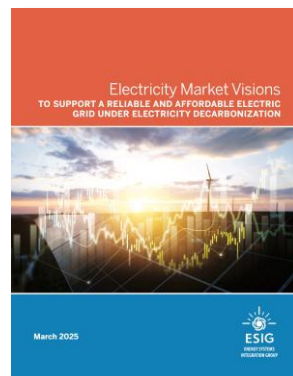
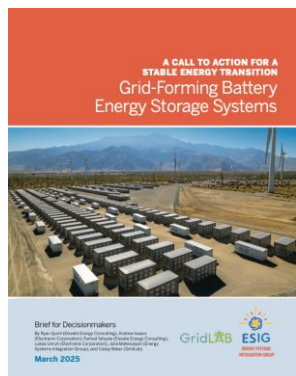
Publications in 2025



- [Grid-Forming Battery Energy Storage Systems](#) – benefits of making batteries grid-forming
- [Electricity Market Visions](#) – visions for electricity markets to realize clean, affordable, reliable energy
- [Demand Response Participation in Wholesale Markets](#) – why demand response participation remains limited and how to unlock its potential

To be published by June:

- Grid Stability Services
- Stress Testing Methods for Evaluating Resilience to Extreme Events
- Long-term Load Forecasting
- Grid-Enhancing Technologies
- Integrating Siloes of Transmission Planning
- EV Load Forecasting Guide
- Integrated Planning Guidebook
- Optimization for Integrated Planning
- Net Zero Electricity Planning



This week's agenda (Mon/Tues)



- i2X FIRST workshop: Interconnection Standards with a Focus on Post-commissioning Conformity Assessment
- Venkat Tirupati, Vice President of Grid Transformation, ERCOT
- Plenary on Large Loads – Challenges and Solutions

Tuesday

- 1A: Grid-Forming Inverters
- 1B: Demand Flexibility
- 2A: Control Room of the Future and System Operations
- 2B: DER Integration for Transmission and Distribution Services
- 12:15-12:35pm Annual Membership Meeting
- 3A: FERC 901
- 3B: Integrated Planning
- 3:30-5:30pm Hiking, kayaking, architectural tour with rooftop view
- 5:30pm Student/Young Professionals Networking Reception
- 6:30-8pm Excellence Awards and Main Reception

This week's agenda (Wed/Thurs)



Wednesday

- 4A: Oscillations and Stability
- 4B: Unlock Expansion of the Grid to Facilitate Large Loads
- 5A: Grid-Enhancing Technologies Case Studies
- 5B: Improved Modeling for System Planners
- 6A: Transmission Planning
- 6B: Resource Adequacy
- Closing Plenary on Scale, Speed and Supply Chains

Thursday (*ESIG members only*)

- 8-5pm Large Loads Workshop – Interconnection process, performance specifications, modeling needs
- 8-9:45am DER/System Operations and Market Design Working Group joint session
- 10:15-noon DER Working Group
- 10:15-noon System Operations and Market Design Working Group
- 1:15-3:15pm Research & Education Working Group
- 1:15-3:45pm System Planning Working Group

Propose what you think ESIG should work on next!

Welcome to our International Participants!



- Australia
- Belgium
- Canada
- Chile
- China and Hong Kong
- Colombia
- Finland
- Germany
- Ireland
- Japan
- Netherlands
- South Korea
- United Kingdom



+ Welcome to those from the Great Nation of Texas!