Large Load Task Force Kick-off Webinar

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Webinar Agenda

- Opening remarks and background for the LLTF – Sam Morris, ERCOT
- Data collection and load forecasting – Julietta Giraldez, EPE
- Interconnection process – Kyle Thomas, Elevate Consulting
- Interconnection requirements – Ahmed Rashwan, EPE
- Modeling – Parag Mitra, EPRI
- Market aspects – Erik Ela, ESIG
- Transmission planning – Hannes Pfeifenberger, Brattle
- Resource Adequacy aspects – Derek Stenclik, Telos Energy
- LLTF Logistics – Julia Matevosyan, ESIG
- Q&A

Large Load Task Force Kick-off: Intro

Sam Morris

Manager of Load Forecasting & Analysis

ERCOT

12/17/2024

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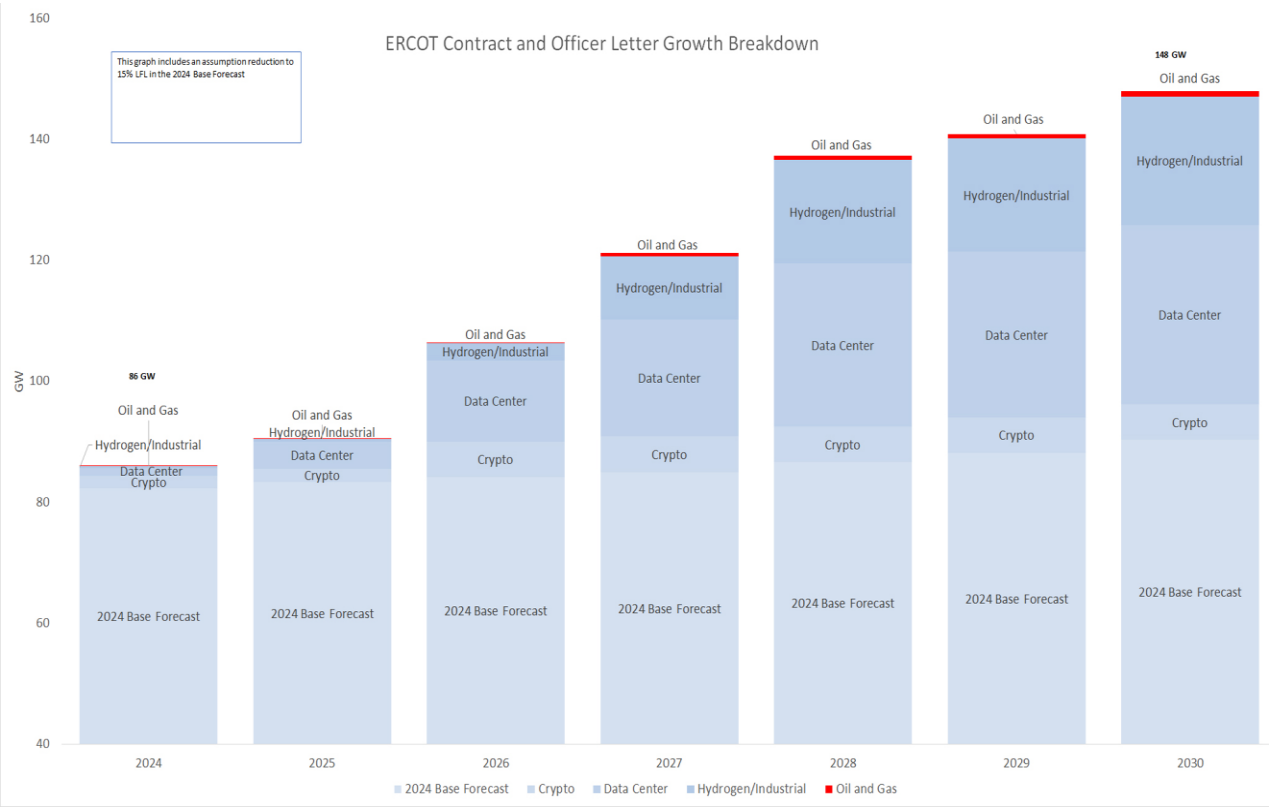
Why are We Here?

- The LLTF is being established to collaborate as large load request and interconnection have grown at an exponential rate.
- The goal is to bring together members across the energy industry to share and help navigate the impacts of these loads.

Acknowledgement: The U.S. Department of Energy Office of Energy Efficiency and Renewable Energy and Meta are helping to fund this effort.



Large Load Task Force: Topical Areas / Project Teams

- Data collection on characteristics of AI and other data centers and other large loads.
- Load forecasting
- Interconnection process
- Interconnection performance requirements
- Modeling requirements for interconnection
- Wholesale market options for large loads; co-location of generation and load
- Transmission planning with high shares of large loads
- Resource adequacy with high shares of large loads
- Additionally, LBNL will be leading an effort on regulatory and contractual aspects – tariffs, flexible interconnections and curtailment, contracts.

Large Load Data Collection & Forecasting

Julietta Giraldez

Director of Integrated Grid Planning

Electric Power Engineers (EPE)

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Large Load Data Collection

High-level Plan

- Data collection on characteristics of data centers and other large loads through interviewing large load owners/developers and collect information from public literature
  - Investigate size, location, siting considerations, flexibility, timing, load profiles, and other pertinent characteristics of different large load types
  - Investigate electrical characteristics of the facilities including properly modeling the facilities and performance (e.g., AC/motor loads, power electronics settings, ramping capabilities, multi-facility coordination, etc.) to model impacts on grid planning and operations of different large load types

Engagement

ISO/RTOs, transmission and distribution utilities, large load developers, large load facility designers

Large Load Forecasting

High-level Plan

- Leverage existing Long-term Load Forecasting TF and coordinate with the Transmission Planning and other project teams; as well as with EPRI's DCFlex and load forecasting initiatives
  - Collect existing forecasting practices for large loads (location, size, modularity, speed, flexibility, etc.)
  - Explore how to consider speculative requests and certainty of the projects, as well as any lessons learned from the generation interconnection process that could apply to large loads forecasting
  - Develop recommended best practices, in collaboration with the other project teams, to standardize large loads modeling for long-term forecasting in collaboration with large load customers to improve forecasting methods

Engagement

ISO/RTOs, transmission and distribution utilities, large load developers, large load facility designers, regulators

Large Load Interconnection Process

Kyle Thomas

Vice President of Engineering & Compliance Services

Elevate Energy Consulting

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Large Load Interconnection Process Improvements

Goal

Improve the processes for large load interconnections at the transmission and distribution level to create more streamlined, standard, milestone-based processes

Key Topics

- **Provide an overview** of existing load interconnection processes and queues for loads at the transmission and distribution level from industry surveying
- **Identify gaps and key issues** with existing processes that lead to inefficient processes & highly speculative projects moving forward in the process
- **Develop recommended processes, including key milestones and checkpoints** during interconnection processes that can be used at all large load project requests on the T&D system
- **Develop recommendations on what information, data, and studies** are needed during large load interconnections from initial application to commissioning and commercial operation, coordinating with other LLTF topic areas
- **Highlight any unique processes for LL interconnections that may exist** between transmission and distribution interconnections, and between different LL interconnection arrangements (BTM, FTM, flexible vs. non-flexible, etc.)
- **Provide recommendations and lessons learned** from the interconnection of inverter-based resources (IBRs), including FERC Order 2023 requirements and implementations

We Need Your Expertise

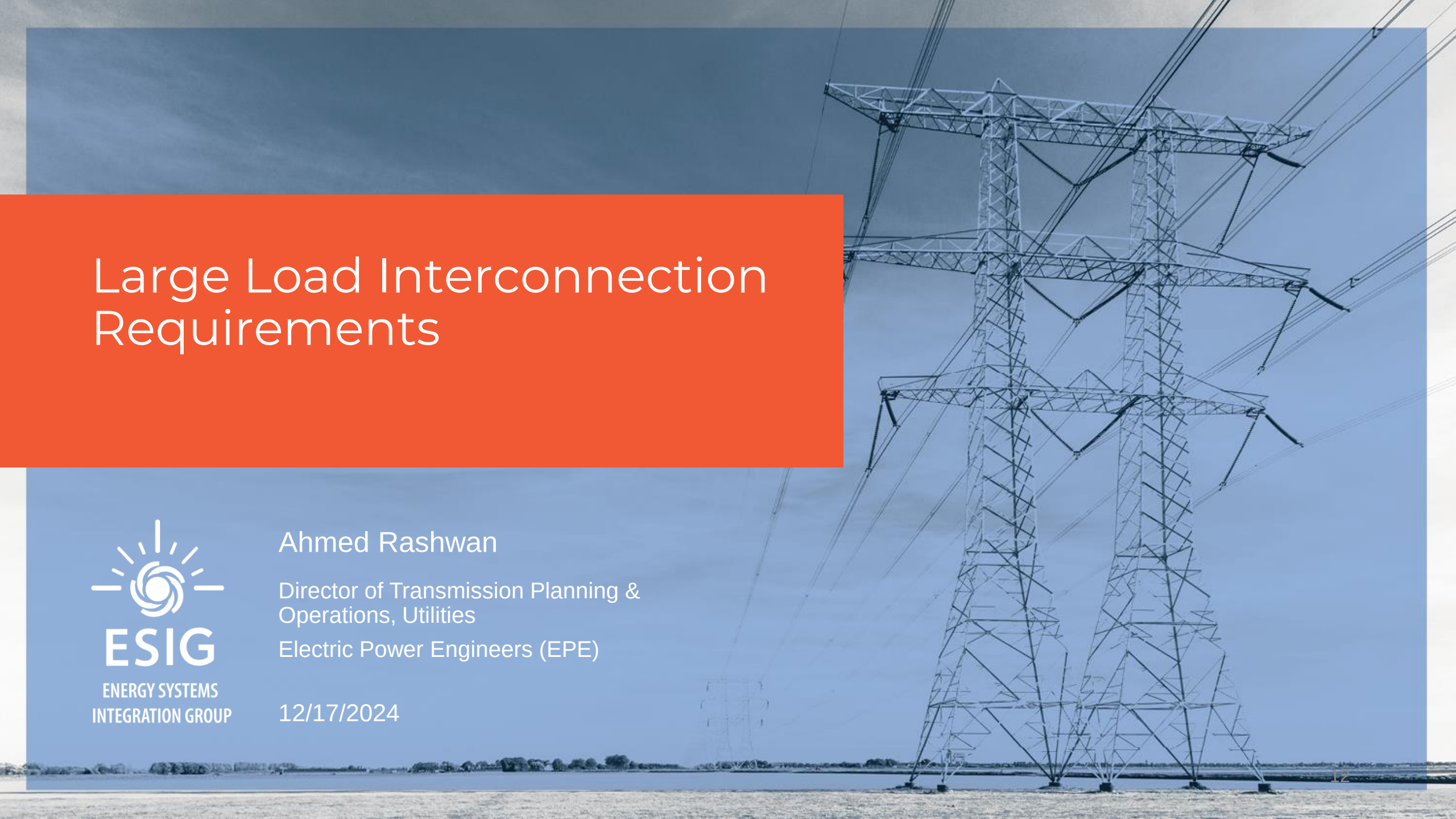
Who should join?

- Interconnection Engineers and Project Managers (PMs) working with large load interconnections on the transmission and/or distribution grid
- Regulators involved with interconnection processes, including state regulators and those at the Federal Energy Regulatory Commission (FERC) and the North American Electric Reliability Corporation (NERC)
- Engineers and PMs at large load facility developer organizations, including those involved with load site electrical designs or involved with the grid interfaces and interconnections in coordination with grid owners/operators
- Utility large load business development and key account personnel
- Third-party consultants that work with above stakeholders
- Personnel at Independent system operators (ISOs), regional transmission organizations (RTOs), and vertically integrated utilities working on the above areas involving large load interconnection processes

Leads:

- Kyle Thomas (Elevate Energy Consulting)

Large Load Interconnection Requirements



Ahmed Rashwan

Director of Transmission Planning & Operations, Utilities

Electric Power Engineers (EPE)

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Large Load Interconnection Requirements

High-level Plan

- Determine behaviors impacting reliability (e.g. ride-through, variability, predictability, ramp speed, controllability, reactive power considerations)
- Identify and analyze system events related to large load behaviors
- Summarize international load performance requirements
- Large Load Capabilities and Limitations
- Recommend Interconnection Requirements for Large Loads

Engagement

ISO/RTOs, transmission and distribution utilities, large load developers, large load facility designers, regulators

Modeling Requirements for Interconnection of Large Loads

Parag Mitra

Principal Technical Leader

Electric Power Research Institute (EPRI)

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Improve Modeling Practices Around Emerging Large Loads

Goal

Improve the state-of-the-art of modeling of emerging large loads for power system reliability studies

Key Topics

- **Provide an overview** of emerging loads and how these are different from existing system loads
- **Review existing modeling practices and potential new modeling needs** for emerging loads globally (with a strong focus on North America)
- **Develop guidelines on modeling of emerging loads** for reliability studies including guidance on phasor domain and electromagnetic transient (EMT) modeling
- **Develop model quality test protocols and guidelines on model parameterization** to ensure that developed models are suitable for use
- **Demonstrate through case studies** the value of using properly validated and parameterized load models
- **Develop actionable recommendations** to ensure that appropriate model development practices are in place for emerging large loads.

We Need Your Expertise

Who should join?

- Transmission Planners and Operators
- Load facility owners and engineers (focusing on power supply O&M)
- Third-party consultants that work with above stakeholders
- Independent system operators, regional transmission organizations, and vertically integrated utilities
- The North American Electric Reliability Corporation (NERC) and the Regional Reliability Corporations, the Federal Energy Regulatory Commission

Leads:

- Parag Mitra (EPRI)

Wholesale Market Options for Large Loads

Erik Ela

Director of System Operations & Market Design

ESIG

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Objectives and Topics

Large Load Participation Models

Energy, Ancillary Service, and Capacity Market

Existing Participation Experience

Co-located Load Design in Wholesale Markets

What other Topics or Goals should this team have?

We Need Your Expertise

Who should join?

- **ISOs/RTOs:** Folks involved in market design and market/system operation (energy and capacity)
- **Large Load Energy Suppliers:** Utilities and independent power producers supplying energy of different technology types
- **Large Load Operators and Coordinators:** Knowledge of flexibility options, consumption profiles, and price sensitivity
- **Regulators:** Wholesale as well as state/retail
- **Industry Experts and Researchers**: with interest in large load integration challenges, existing and potential participation options, and different large load configuration options

Leads:

- **We are exploring options of one or more leads to help with facilitation and report writing**

Transmission Planning

Hannes Pfeifenberger

Electricity Markets and Energy Policy Expert

Brattle

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Develop Proactive, Holistic, and Scenario-Based Transmission Planning Processes

Goal

Support timely, flexible, cost-effective integration of large loads and associated generation.

Key Topics

- **Investigate Current Processes** for transmission, load, and generation interconnection
- **Document Best Practices** for transmission, load, and generation interconnection
- **Demonstrate Scenario-Based Planning** to identify highest value, least regrets solutions
- **Explore Grid-Enhancing Technologies** to maximize existing infrastructure potential
- **Develop Actionable Recommendation** to achieve benefits of holistic and proactive planning.

We Need Your Expertise

Who should join?

- **Transmission Planning Engineers:** From ISOs, RTOs, utilities.
- **Large Load Developers:** Expertise in project sizing, siting, and timelines.
- **Large Load Operators:** Knowledge of operational cycles and site profiles.
- **Regulators:** Federal and state-level insights.
- **Technology Experts:** Grid-enhancing technologies and advanced planning tools

Leads:

- Hannes Pfeifenberger (Brattle)
- Warren Lasher (Lasher Energy)

Large Loads in Resource Adequacy Assessments

Derek Stenclik

Founding Partner

Telos Energy

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What's in Scope?

Differentiating Large Loads
Segment large loads based on their operating characteristics, such as hourly and seasonal demand profiles, price sensitivity, and flexibility options.

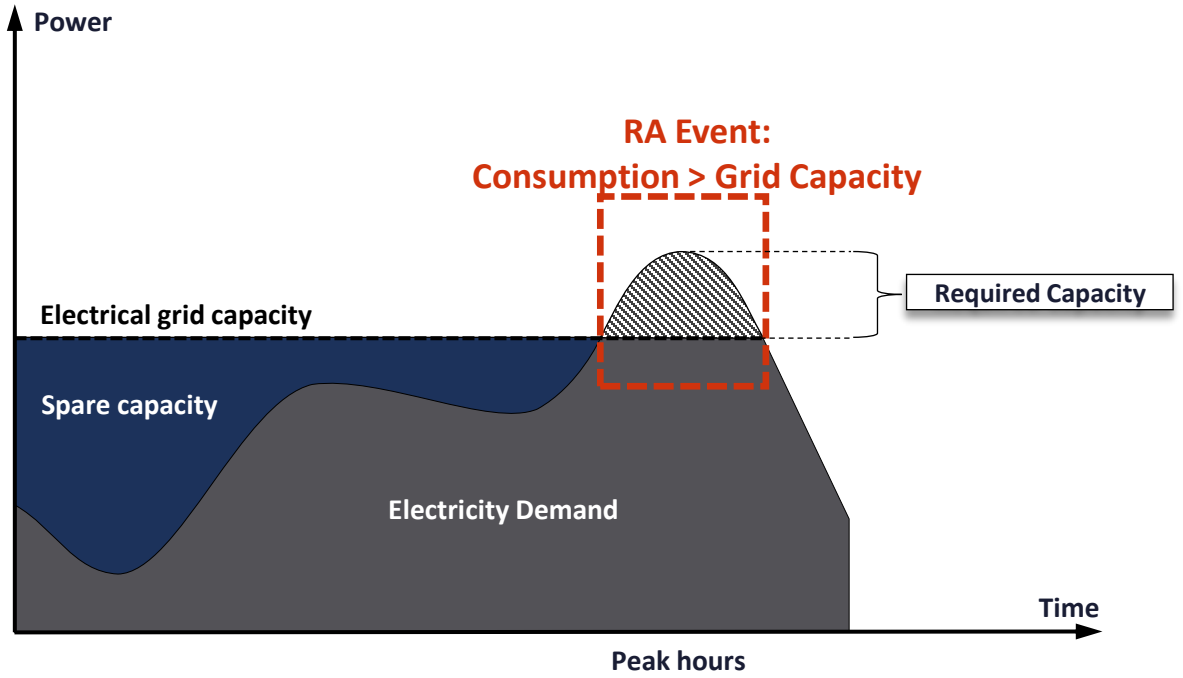
Voluntary Load Curtailments and Flexibility
can effectively mitigate resource adequacy risk but will need to increase in frequency as large load adoption increases.

Resource Additions due to economic drivers (increased prices) or renewable contracting can create important feedback loops for improving reliability.

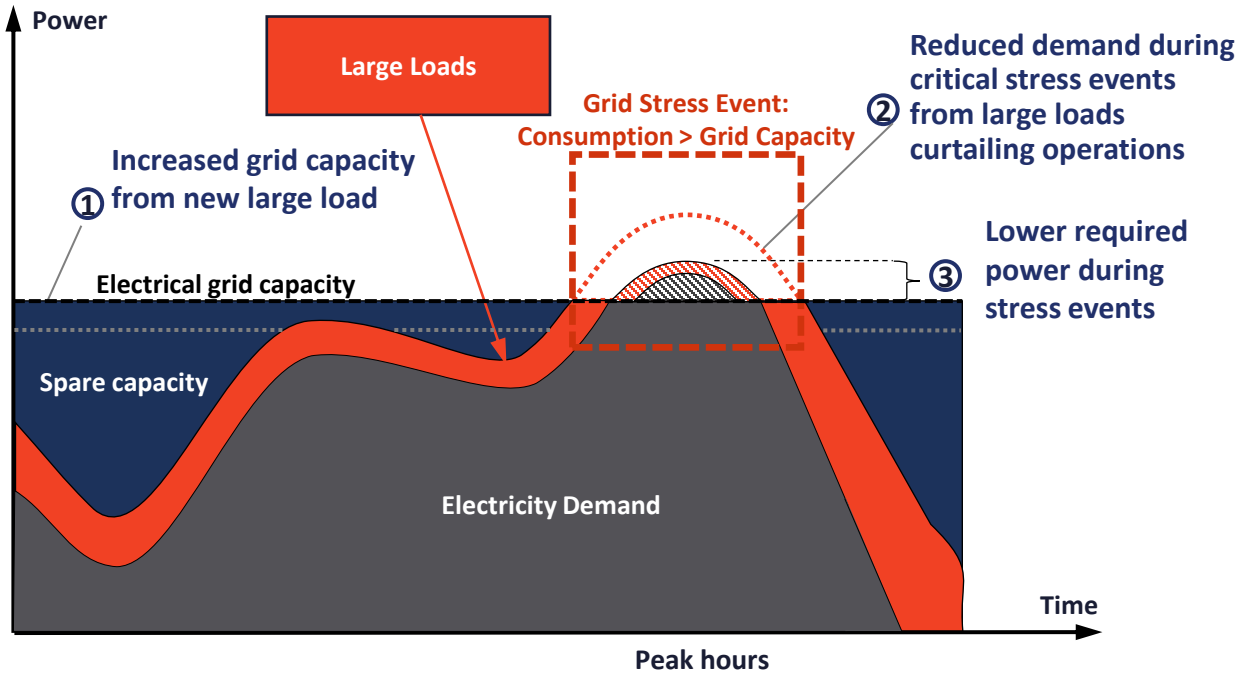
Managing Uncertainty
Consider how large load forecast uncertainty affects capacity requirements in future IRPs and capacity markets.

Do Large Loads Have a Beneficial, Detrimental, or Neutral Impact on Resource Adequacy?

Illustrative Electrical Grid Supply/Demand: Without Large Loads



Illustrative Electrical Grid Supply/Demand: With Large Loads



Source: HODL Ranch Limited, ERCOT Large Flexible Load Task Force April 2022 Meeting

Are large loads beneficial to Resource Adequacy by incentivizing the addition of new generation capacity while fully curtailing during grid stress events?

Key Objectives and Research Questions

Do large loads have a beneficial, detrimental, or neutral impact on RA?

- How much flexibility is required? How often would load curtailment be necessary?
- How do different large load operating assumptions impact resource adequacy?
- Would large loads increase demand for renewables and/or deferred retirements, thus improving resource adequacy?

Recommendations for resource adequacy modeling?

- How to incorporate operating profiles and flexibility options in RA assessments
- What new metrics can be used to quantify the incremental resource adequacy contributions (or requirements) introduced by large loads
- How can we consider on-site generation of large loads to reduce system-wide capacity needs.

Large Loads in Resource Adequacy Assessments

Objective

Establish comprehensive frameworks and best practices for incorporating large loads into resource adequacy assessments and determining their impact on capacity requirements

Key Topics & Sessions

1 Segmenting the Load	2 Representing Flexibility	3 PPAs and Contracting	4 Modeling Recommendations	5 RA Impacts of Large Loads	6 Regulatory and Market Design
Elasticity of large loads during high price events and under grid stress Compare loads by data center type, H2, industrial demand, fleet electrification	How flexible are these loads and how often would flexibility be required? Consider the potential for on-site generation of large loads to reduce system-wide capacity needs.	How to incorporate additional generating resources and PPAs that also bring capacity 24/7 load matching and locational considerations	How to model different large loads in RA assessments, including operating profiles and flexibility. How to handle uncertainty in forecasts and assumed flexibility	Are large loads beneficial, detrimental, or neutral to RA? New metrics to quantify the incremental RA contributions (or requirements)	Interconnection agreements to support deployment in exchange for flexibility. Ensuring proper cost allocation for new capacity

Who's Involved

Consortium of industry leaders, grid operators, utilities, researchers, regulators, large load operators and developers, including data centers, H2, fleet electrification

Timeline

ESIG LLTF Logistics

Julia Matevosyan

Associate Director & Chief Engineer

ESIG

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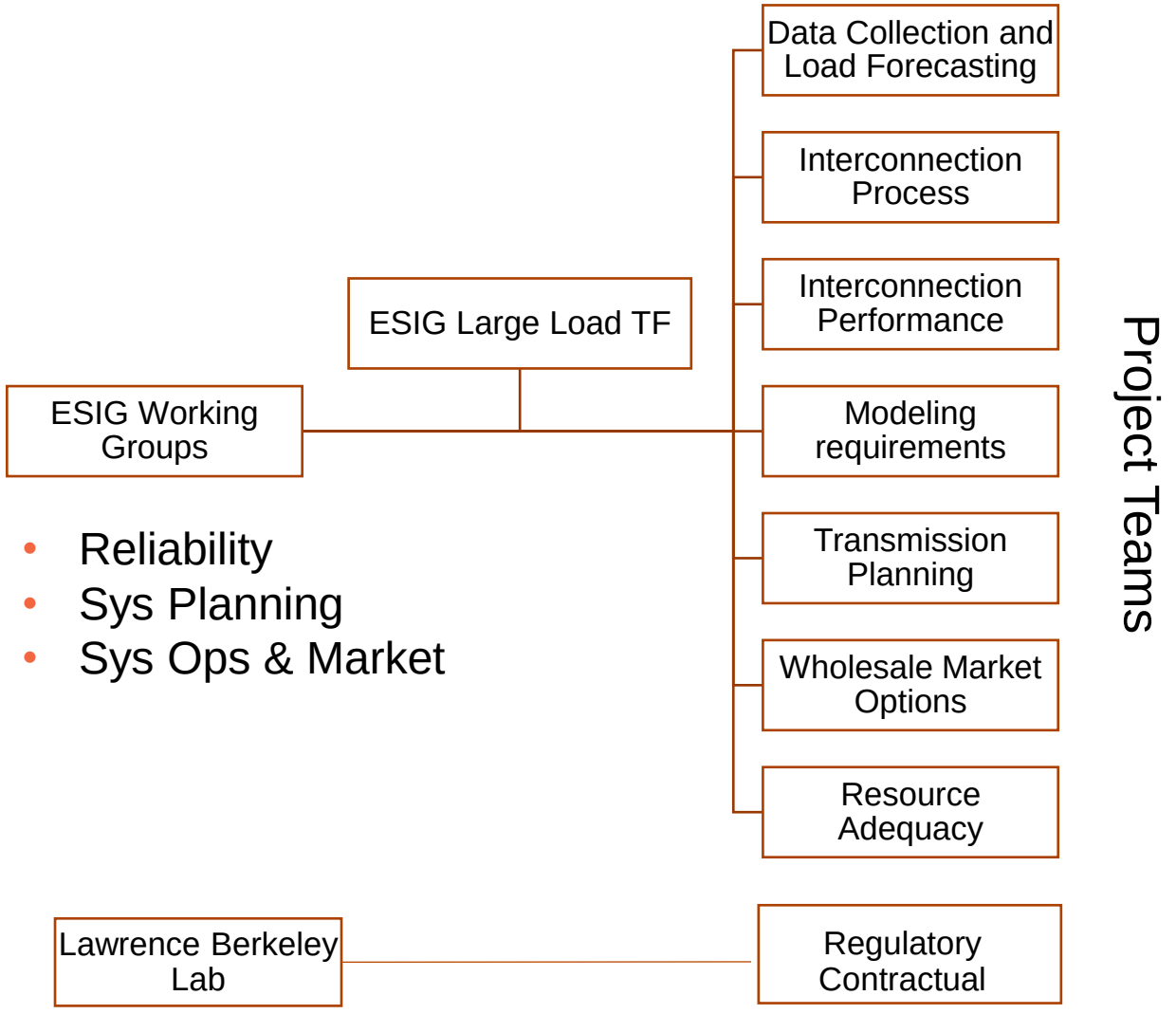
ESIG LLTF Logistics

- **Participation in ESIG Task Forces is limited to ESIG members.** However, all final reports will be publicly available on the ESIG website and disseminated through workshops and webinars.
- All current members can be found on esig.energy, click **Membership** in the top menu. All employees of member organizations are eligible to participate in member activities.
- If you would like to join ESIG please contact us after the webinar on esig.energy, click **Contact Us** in the top menu
- If you are interested in actively participating in ESIG LLTF, please complete the survey and select the key area(s) most relevant to your expertise and interests.

How does LLTF Fit within ESIG's WGs Structure?



- Reliability
- Sys Planning
- Sys Ops & Market

ESIG LLTF Logistics: Project Teams Work

- After the webinar ESIG will compile a distribution list for each Project Team based
- Project Team leads will reach out to their respective teams with more information
- Project Teams will meet separately or will have joint meetings, as needed.
- Project Team meetings will include stakeholder presentations and structured discussions
- Each Project Team will take 8-16 month to conclude
- The expectation from Project Team members:
  - Engage in discussions
  - Share relevant experience: deliver a presentation, provide references or share during the discussions
  - Volunteer to contribute to the report writing
  - Listen and learn
  - Review the draft report

ESIG LLTF Logistics: Workshops

ESIG LLTF will organize three workshops in 2025 to inform the Project Teams' work and disseminate the results:

1. During ESIG Spring Technical Workshop in Austin, on March 20th, focused on
   - Interconnection process
   - Interconnection performance requirements
   - Modeling requirements for interconnection
2. During ESIG Markets and Forecasting Workshop, in June, potentially focused on
   - Data collection & Load forecasting
   - Wholesale market options for large loads; co-location of generation and load
   - Resource adequacy with high shares of large loads
3. During ESIG Fall Technical Workshop, in October, potentially focused on
   - Transmission planning with high shares of large loads

THANK YOU