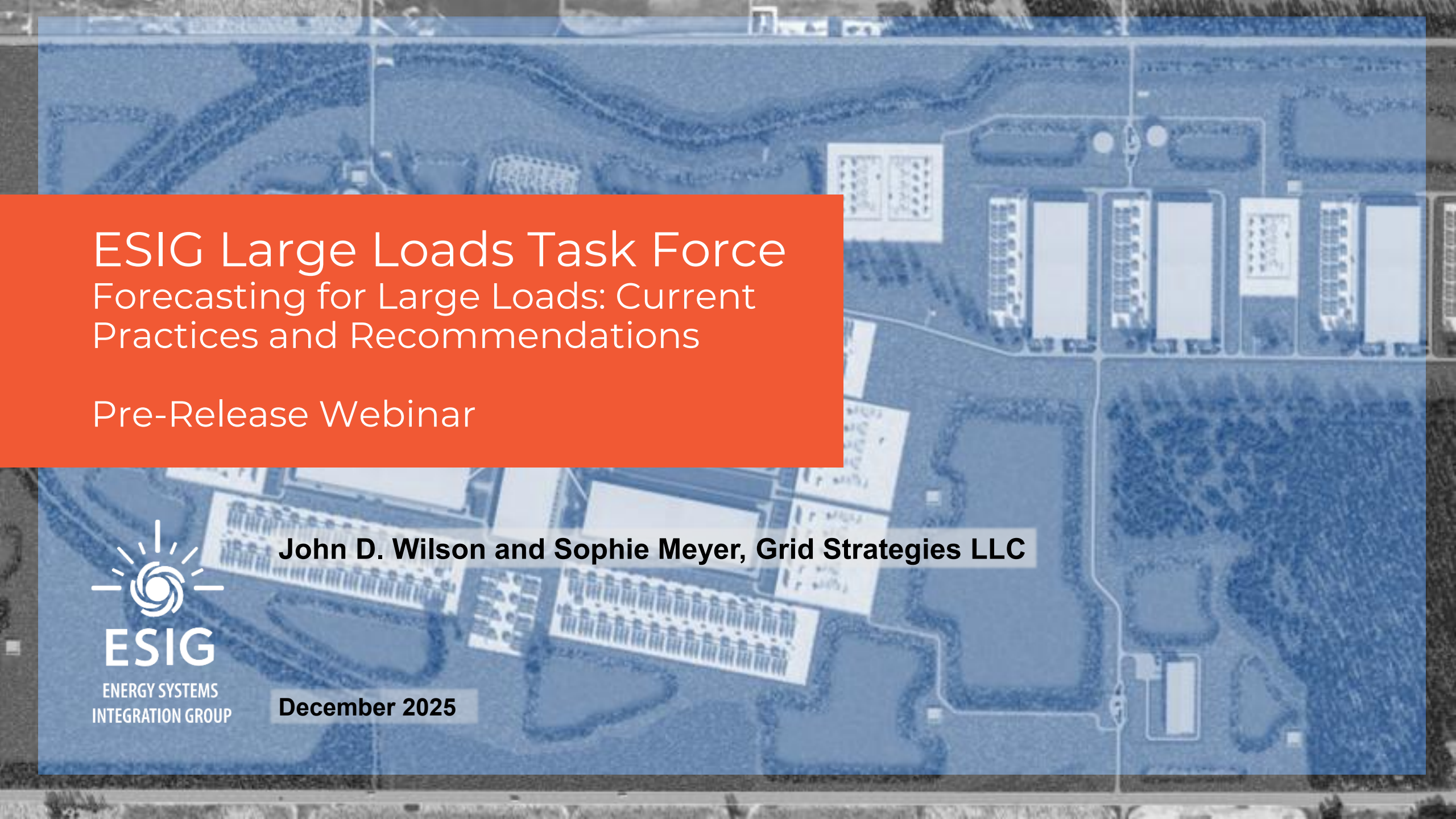


ESIG Large Loads Task Force

Forecasting for Large Loads: Current Practices and Recommendations

Pre-Release Webinar

John D. Wilson and Sophie Meyer, Grid Strategies LLC

ESIG
ENERGY SYSTEMS INTEGRATION GROUP

December 2025

Load Forecasting Project Team

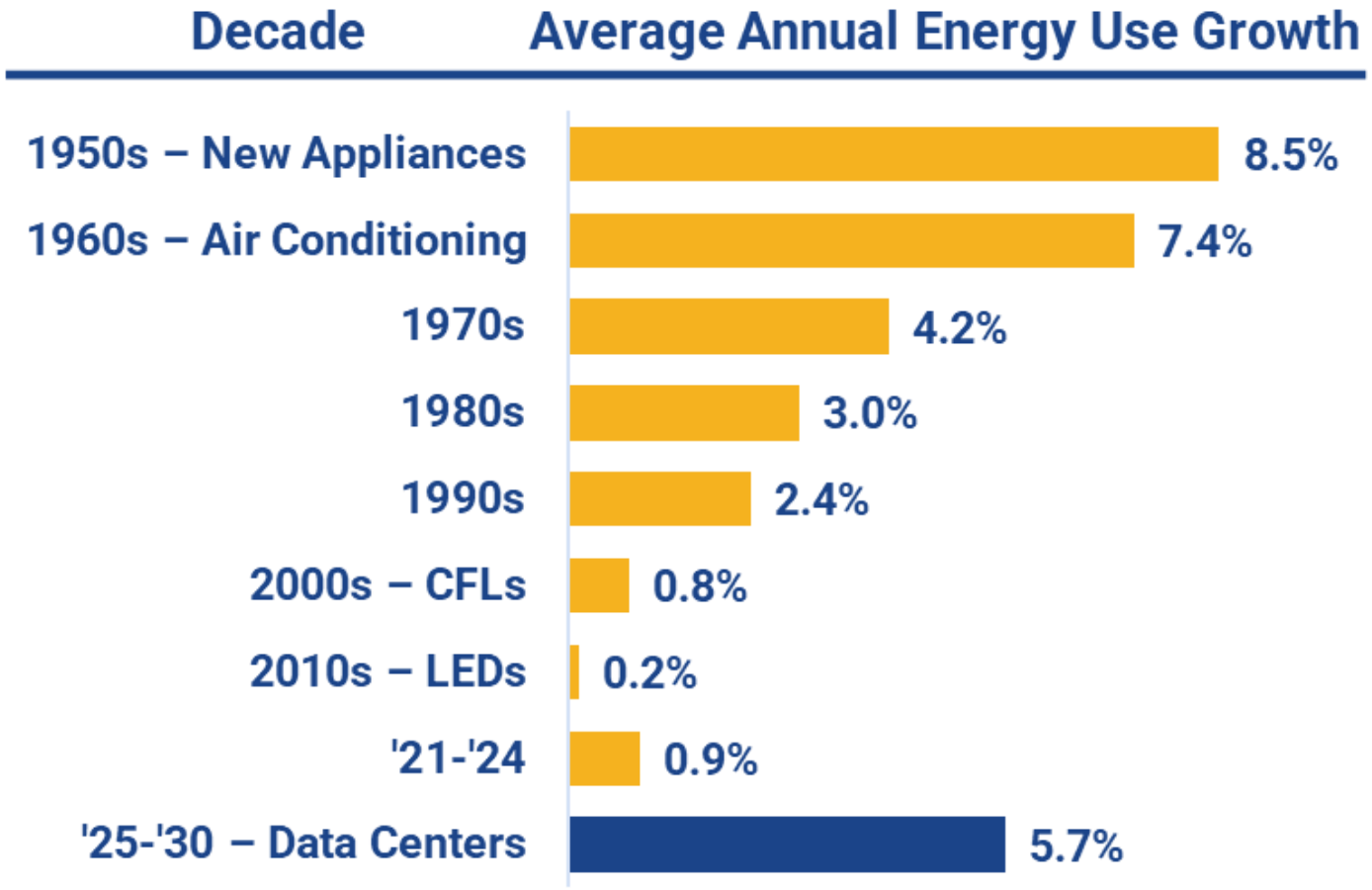
Background

- Met 6 times, from scope development through to final report review, plus an in-person workshop in October
- Also hosted 17 webinars to better understand existing practices used in load forecasts
- Most active participants were on the editing committee, with substantial content and editorial input from the initial report outline through the final draft

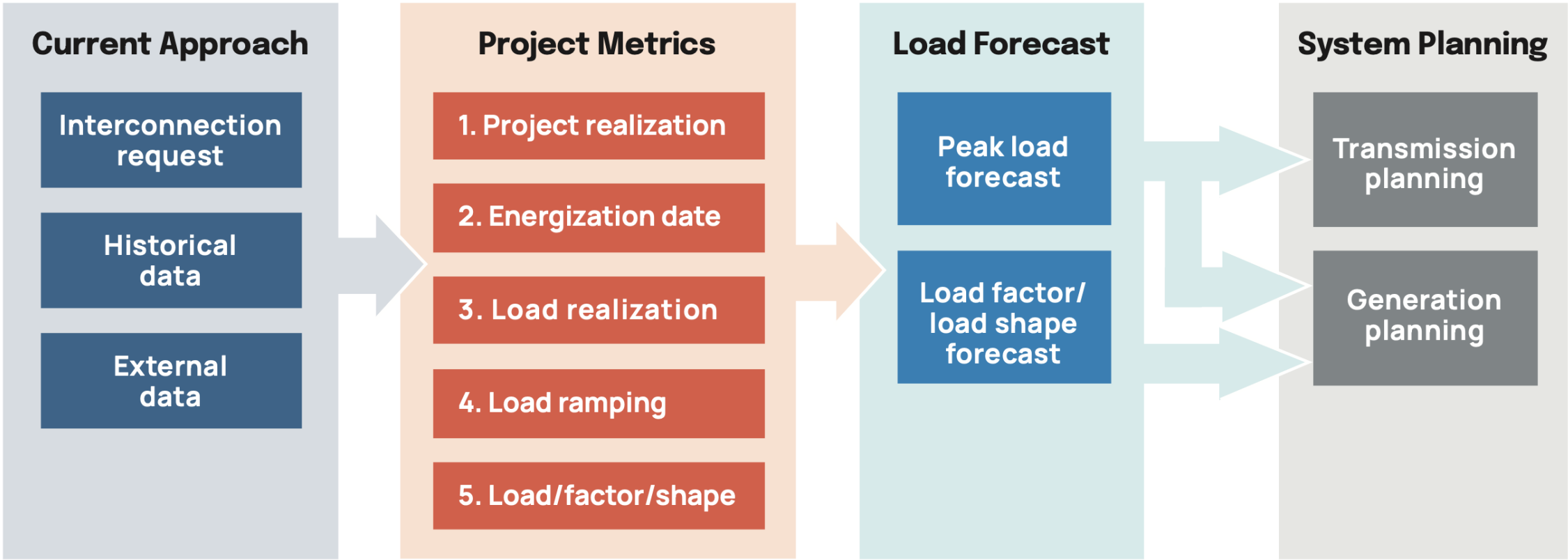
Editing Committee

- Jenny Conde, PG&E
- Jeffrey Deason, LBNL
- Natalie Mims Frick, LBNL
- Christopher Gonzales, SRP
- David Farmer, NRECA
- David Larson, EPRI
- Luke Lavin, NREL
- Molly Mooney, PJM
- Matteo Muratori, PNNL
- Shivani Nathoo, Ontario IESO
- Nina Peluso, Energy Futures Group
- Isabelle Riu, E3
- Lauren Shwisberg, RMI
- Anna Sommer, Energy Futures Group
- Priya Sreedharan, GridLab
- Jeff Sward, RMI
- ESIG Team

Load Growth Over the Decades



From Data to Planning



Report Recommendations

1. Use all five large load metrics to create a large load forecast.
2. Develop a consistent framework to differentiate among large load types.
3. Account for uncertainty.
4. Increase certainty through large load financial requirements.
5. Reduce uncertainty in regional large load forecast practices.
6. Improve geographic detail.
7. Seek continuous improvement through forecast validation.
8. Collect large load forecast data in a shared database.
9. Apply consistent load weighting and modeling practices.
10. Adopt forecast standards for load flexibility.

Go to slido.com and enter code ESIG17

What's Going Well

Large load forecasts are almost never the same as the large load pipeline

… there may be exceptions at smaller utilities

Large load forecasting practices are almost all under active reform

… new practices, in most cases just a few years old

In many cases, forecast practices are aligned with large load type

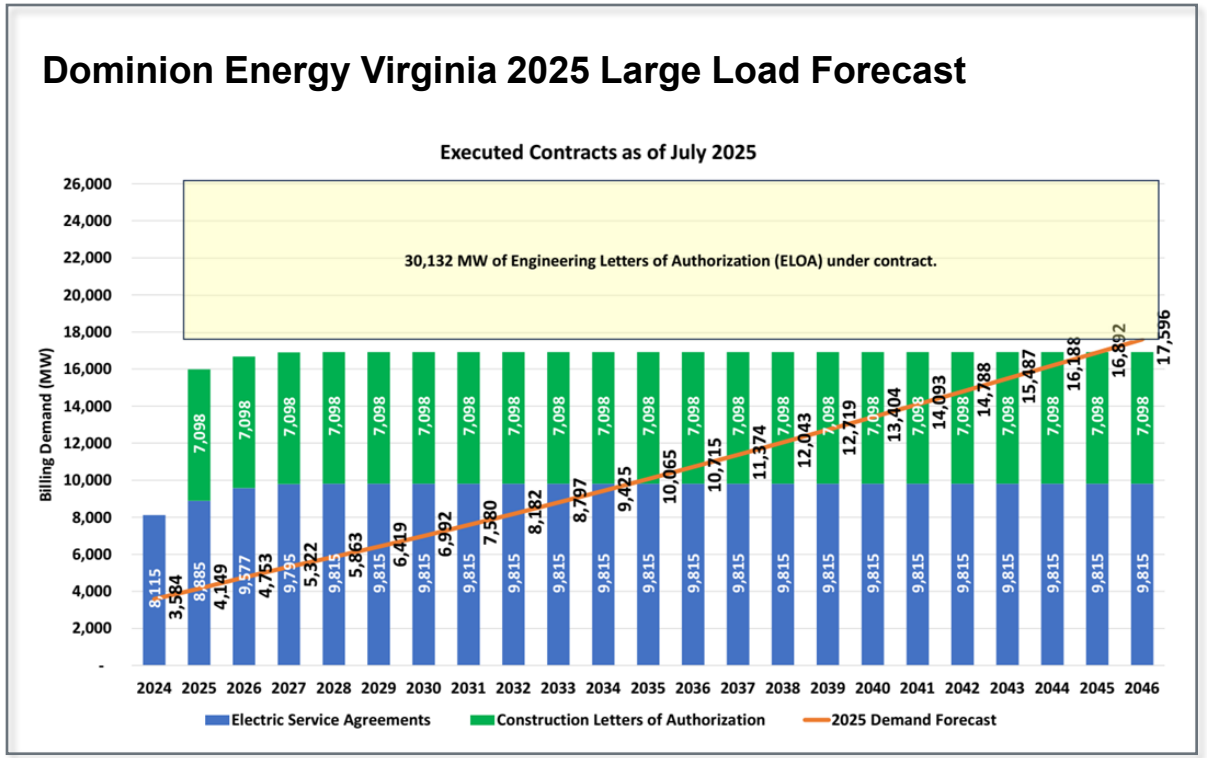
… industrial and data center loads are forecast differently

Substantial investments in studying data center loads

… top priority is operational risk, but front-end planning risk is also a priority

Utility rate tariff reforms are helping to reduce uncertainty

… these reforms do not reduce all sources of risk



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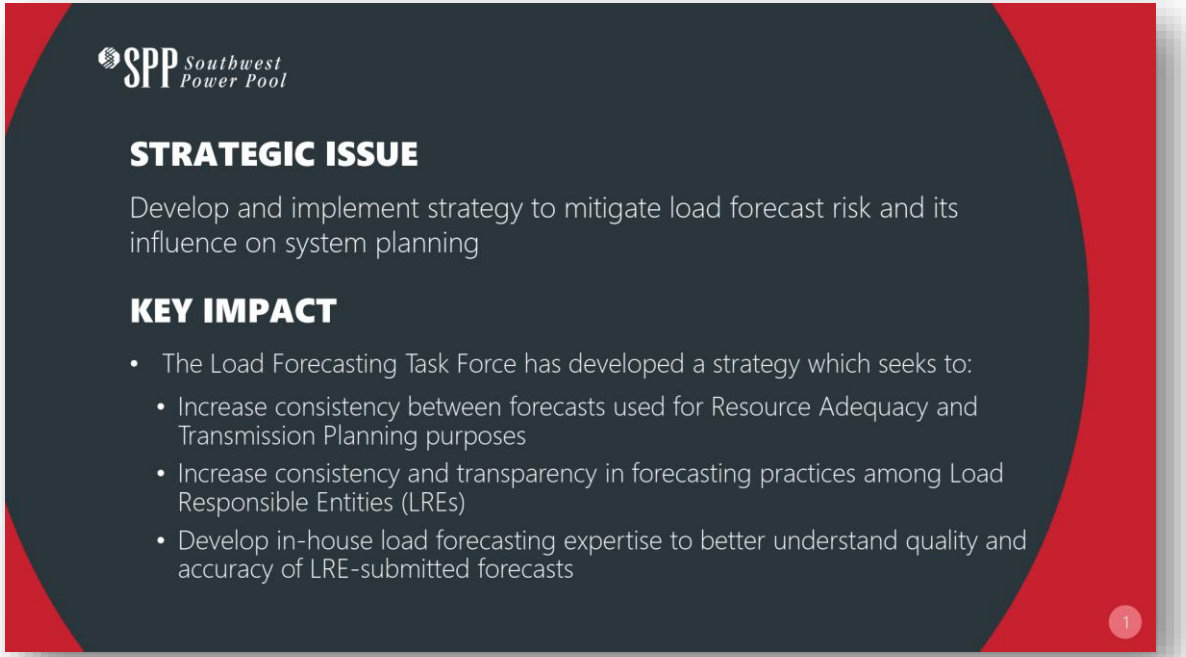

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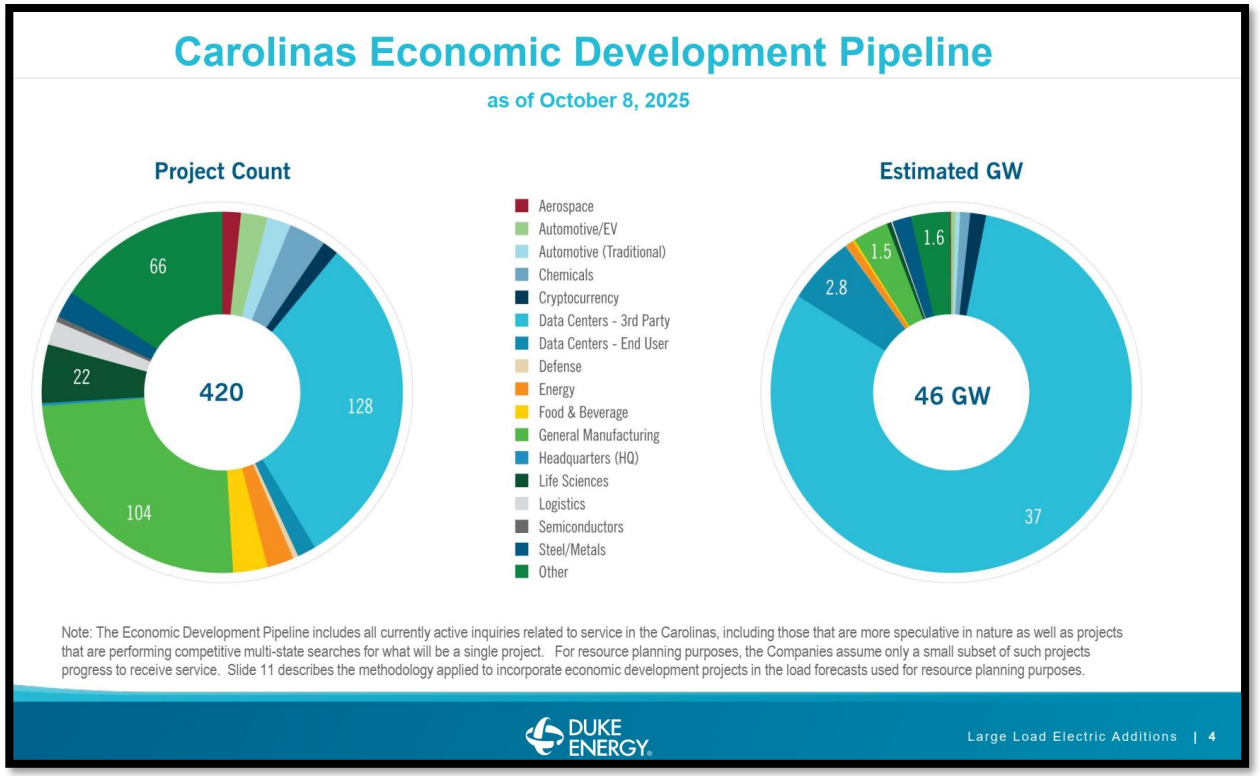

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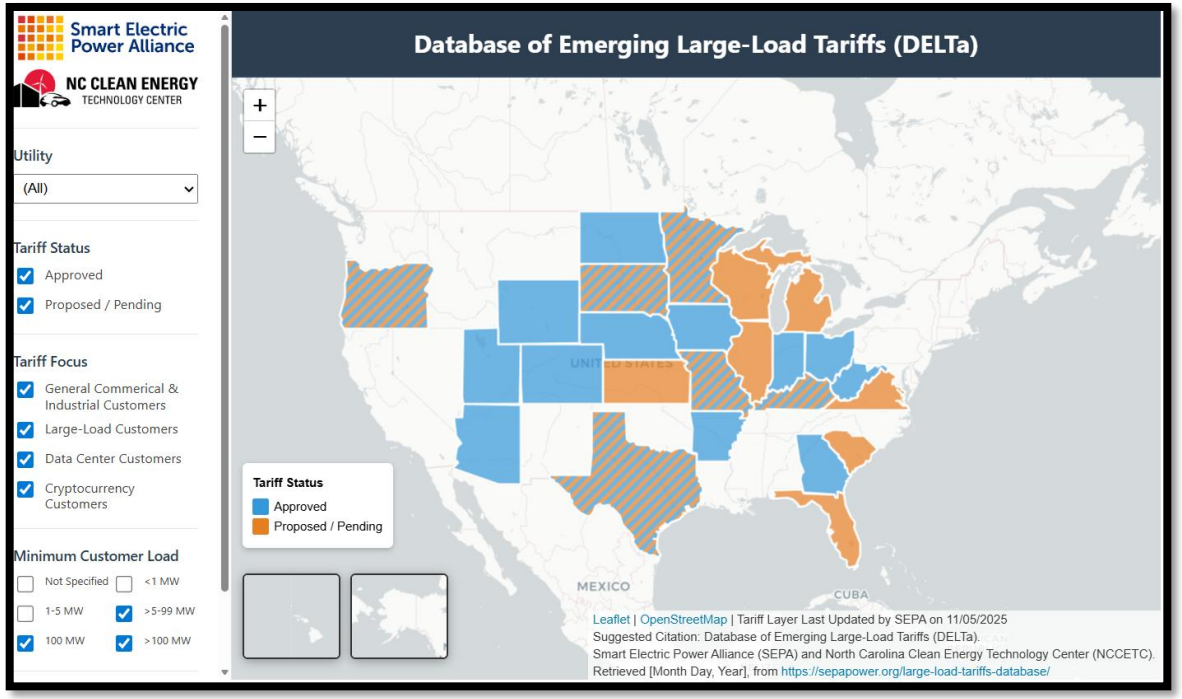

What Needs Improvement

Transparency and consistency

- Large loads are not described or assessed in a consistent manner in load forecasts.

Insufficient data

Particularly an issue for data centers – from multi-tenant to AI

- Early-process customer-supplied data are unreliable in certain respects
- Difficult for many utilities to obtain useful historical data, especially if they don't have a strong history with data centers

Alternative site data not shared

- Planners are only beginning to request information on this topic
- Practices for interpreting these data are probably not yet developed.

Load flexibility is not included

- No forecasts include load flexibility for future large loads
- Load flexibility planning practices may be complicated.

Lack of Consistent Definitions

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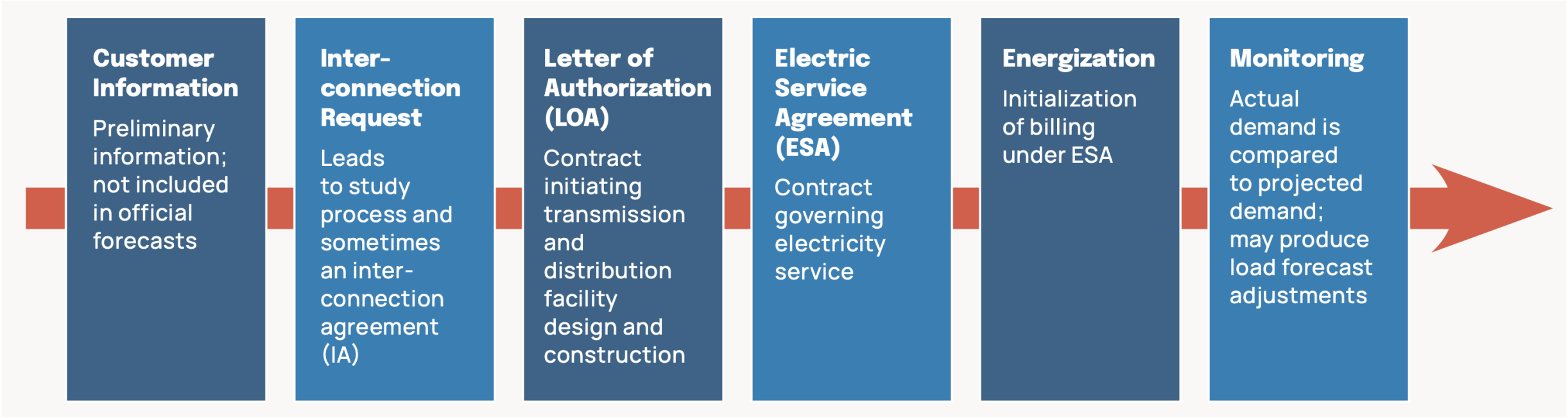
Large Load Characteristics and Forecast Metrics

Project Realization	Energization Date	Load Realization	Load Ramping	Load factor or load shape
The rate at which projects included in the load forecast are placed in service • Often presented as a percentage of project requests expected to come to fruition	The beginning of commercial operation by projects, including anticipated delays	The forecast peak load that the project is expected to require once it's fully scaled up • Often presented as a percentage of requested peak load	The monthly or annual forecast of demand during the startup period of commercial operation • Often presented as a percentage of requested peak load	• **Load factor:** Actual energy use as a proportion of facility capacity • **Load shape:** More detailed information on power needs, for example, an hourly schedule of energy use

Large Load Interconnection Milestones



Selected Recommendations

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Addressing Back-End Risk

- **How much load? When?** Front-end risks addressed through weighting factors, stochastic modeling, and scenario-based forecast.
- **Back-end risk:** Not currently addressed in load forecasts, either at project level or for systemic risks (correlated loads).
  - If data center forecasts turn out to be a development bubble, could lead to attrition of existing projects.
  - Demand falling below expectations could lead to stranded transmission and generation investments.
  - Recently-adopted tariffs provide some protection, but does not eliminate risks.
  - No studies of how well matched such attrition might be to other future load growth.

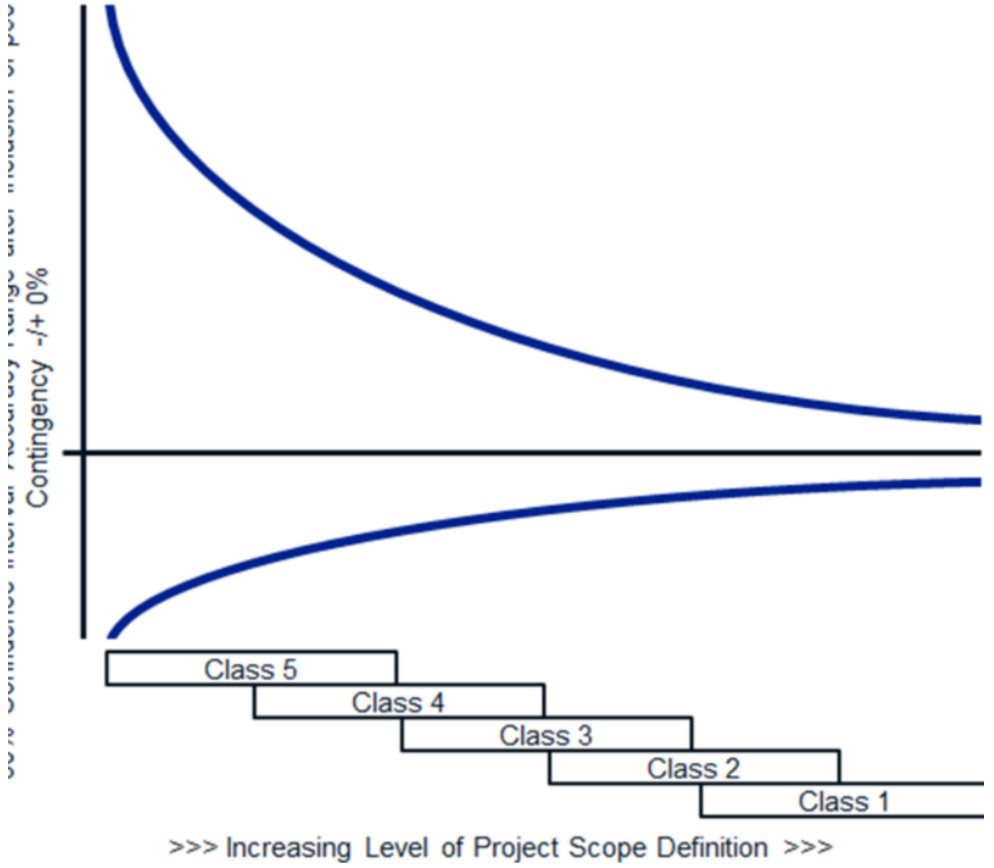
Sharing Large Load Data

- **Default option:** Wait several years until each utility gains experience
- **Commercial vendors:** Load and estimated energization date, probably no load ramping or load factor/shape data
- **Customer privacy is main barrier:** Legally complex to share data, EPRI has made some progress in obtaining data but cannot share widely
- **Steps to a database**
  - Collect data where possible – at least the first four load metrics
  - Simplest metrics first – project realization, load realization, and energization date
  - Define large load types – similar metrics and common characteristics
  - Add complexity – load ramping, load factor and load shapes; more types
- **Design large load forecast validation practices**

Maturity Assessment Framework

NERC Preliminary Draft Reliability Guideline

- Use project milestones to assess project maturity
- Potential model: AACE cost estimate classification system (at right)
- As projects mature towards higher classifications:
  - Weighting factors increase
  - Forecast accuracy range narrows




Thank you!
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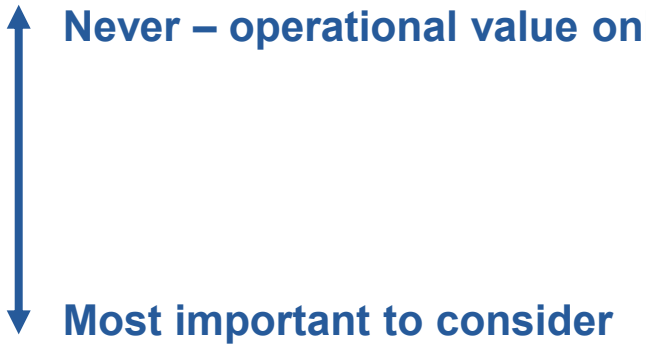
Load Forecasts for Regional Planning

	Post-Hoc Adjustment	Scenario Overlay	Regulatory Approach
	Aggregate member forecasts, then adjust	Aggregate member forecasts, then apply scenario overlays	Direct LSE forecasting practices for consistency (in progress)
CEC	-	✓	✓
ERCOT	✓	-	✓
NYISO	-	✓	-
PJM	✓	-	✓
SPP	✓	-	-

Forecast Standards for Load Flexibility

- **Where does load flexibility belong?** Long-term forecast OR supply-side resource?
- ERCOT: “forecasting flexible behavior is difficult.”
- **What types of load flexibility belong in long-term load forecasts?** Not all of them, and treatment varies for transmission, capacity, and energy planning.
  EPRI’s draft “tiers”:
  - Supports grid during disturbances
  - Self serves during transmission outages
  - Supports grid during peak stress
  - Provides fast or long flexible response
  - Acts like dispatchable capacity



- **How to measure load flexibility?** Components of load forecast metric:
  - Measurements of program use (when/how) and effectiveness
  - Forecast of enrollment (customers and capacity commitment)