Electricity Demand Growth and Forecasting in a Time of Change

CLEAN ENERGY STATES ALLIANCE

NATIONAL ENERGY SUMMIT FOR STATES

BREAKOUT SESSION *"LOAD GROWTH: WHAT STATES NEED TO KNOW"*

PRESENTED BY

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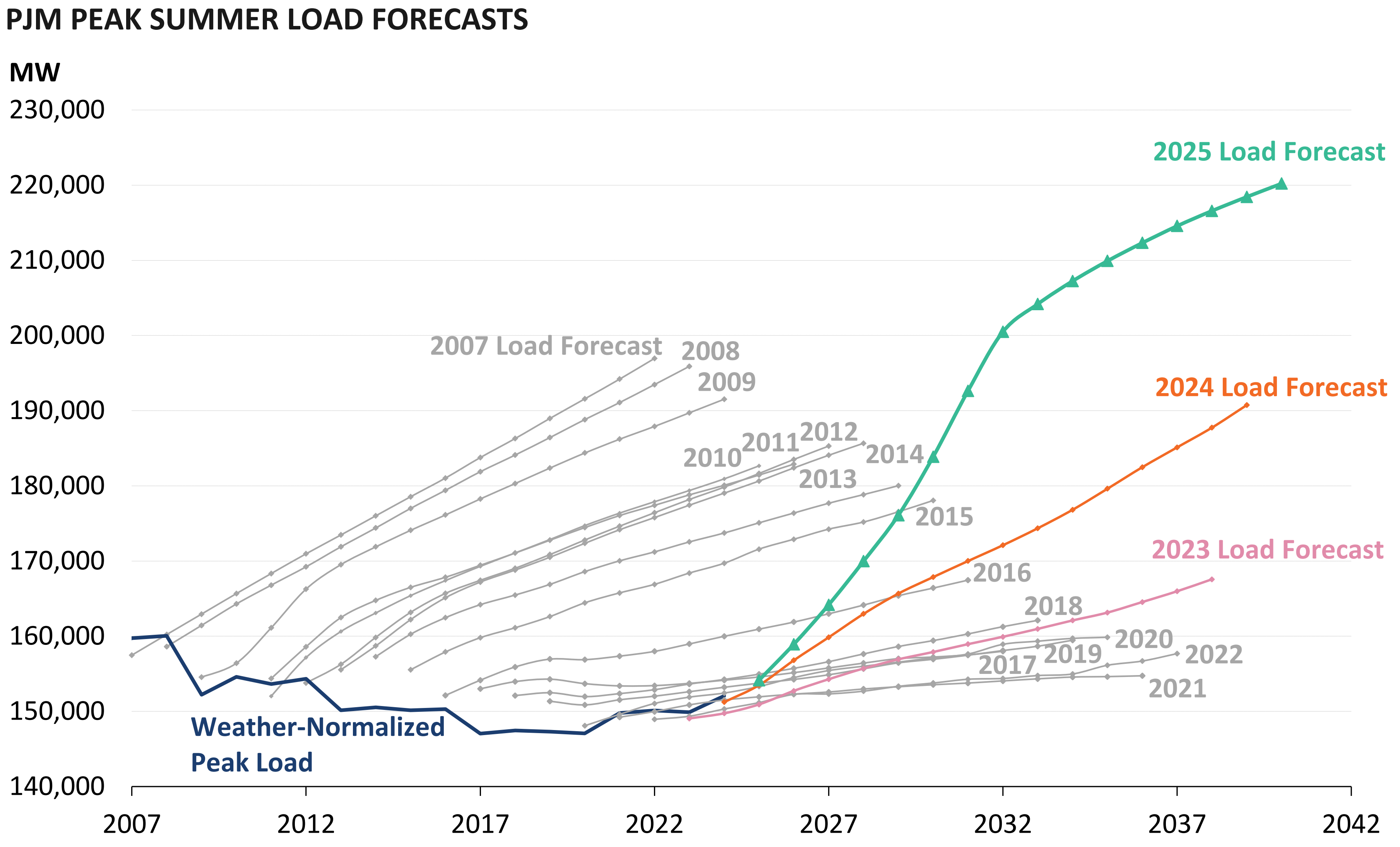
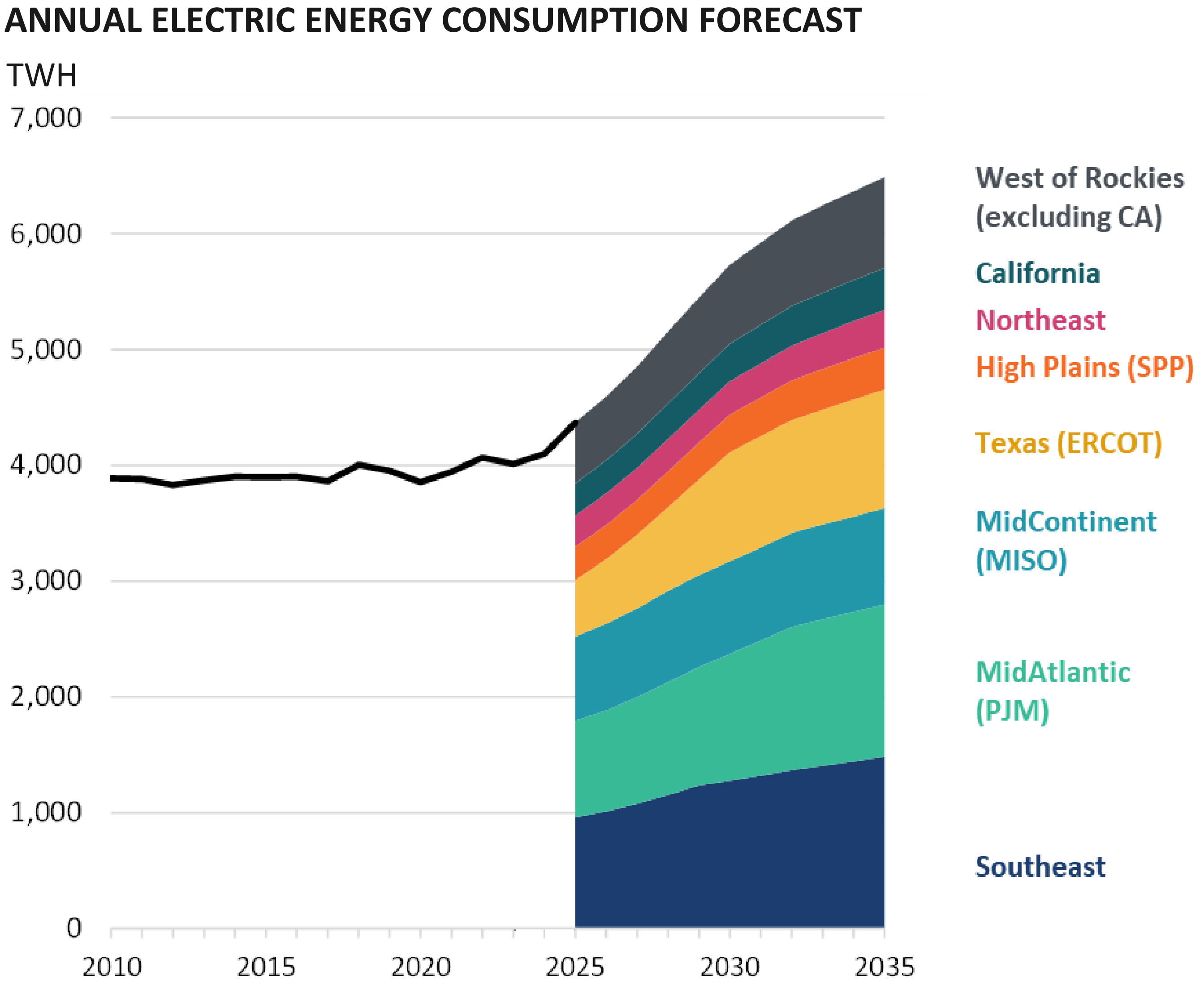
MAY 28, 2025

Brattle

Recent Forecasts Herald an Era of High Electricity Growth in PJM…



… And Across the United States



All slides sourced from the report will show a blue triangle at the upper right corner

Report from “A Year Ago”

Electric forecasting entities of all types should be evolving their forecasts to incorporate major changes in electricity use in the coming decades.

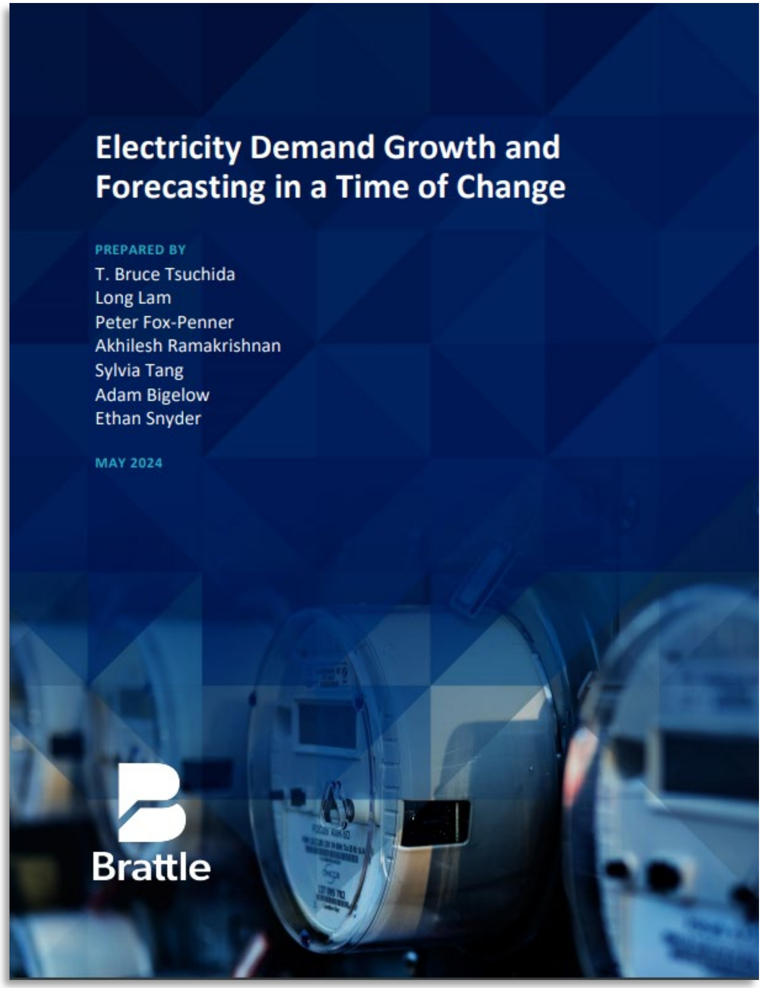
- Many forecasters have made substantial progress updating their forecasting methods, but overall there is still much progress urgently needed.

There is now a high potential cost of under-forecasting. We need proactive electric system planning, as infrastructure is already lagging and there is ample evidence of a significant upturn in the next few years.

- Recent industry conversation has also evolved to risks of over-forecasting, as evidence suggests data centers queue shopping/being double counted.

Explicit consideration and evaluation of expansion optionality in all generation and transmission plans to address the forecasting risks.

- Optimize usage of existing infrastructure (e.g., via the adoption of grid-enhancing technologies).
- Incorporate the full effects of demand-side resources (including flexibility) and non-wire alternatives.



Scan for link to the full report

The New Drivers of Electric Demand

DATA CENTERS

Data centers underpin the online economy technology sector and support the growth of artificial intelligence.

Current capacity: ~19 GW
Estimated electricity demand increase by 2030: +16 GW

ONSHORING & INDUSTRIAL ELECTRIFICATION

Electrification of the industrial sector is a major pathway to reduce emissions. New sources of electric demand are triggered by the onshoring of manufacturing activity, hydrogen production (e.g., electrolyzers), indoor agriculture, and carbon dioxide removal.

Current capacity: ~116 GW
Estimated electricity demand increase by 2030: +36 GW

CRYPTOCURRENCY MINING

Cryptocurrency mining is the process by which networks of computers generate and release new currencies and verify new transactions. Load from cryptocurrency mining is challenging to estimate because of its unique operational characteristics.

Current capacity: ~10–17 GW
Estimated electricity demand increase by 2030: +8–15 GW

BUILDING ELECTRIFICATION

Electrification is a major pathway to decarbonize buildings and can include space heating (e.g., heat pumps), water heating (e.g., heat pump water heaters), and cooking (e.g., electric/ induction cook stoves).

Current capacity: ~50 GW
Estimated electricity demand increase by 2030: +7 GW

TRANSPORTATION ELECTRIFICATION

A growing number of customers purchase electric passenger vehicles as a more climate-friendly alternative to gas vehicles; medium- and heavy-duty vehicles, motorcycles, and ferries can all operate on electricity.

Current capacity: ~7 GW (electric vehicles)
Estimated electricity demand increase by 2030: +8 GW

Partially offset by:

- **DG Solar**
- **Flexible Loads/VPPs**
- **Energy Efficiency**

The Two Types of New Load Drivers

	Type A	Type B
Description	• Large discrete and “lumpy” loads.	• Small and more distributed load; gradual growth.
Grid Impacts	• Impacts are highly regional/at specific locations, typically at Gen/Tx level. • Shorter planning horizon.	• Impacts are regional but more spread out at the distribution level. • Longer planning horizon.
Forecast Challenges	• Some loads can be speculative. • Less able to be forecasted in advance.	• Can be forecasted with greater foresight due to similar planning experience, but sharp load increase after a certain adoption level (assuming S-curve profile).
Potential Solutions	• Traditional Gen and Tx capacity expansion to ensure resource adequacy. • Use surplus Gen and Tx capacity. • Create capacity with load flexibility. • Leverage onsite generation. • Transparent interconnection processes.	• Execute system buildout under the assumption of steady expansion. • Leverage load flexibility tools to optimize distribution grid usage. • Offset with increased energy efficiency.
Examples	• Data centers, hydrogen electrolyzers, manufacturing plants.	• Electric vehicles, heat pumps.

How Electric Forecasts Are Changing

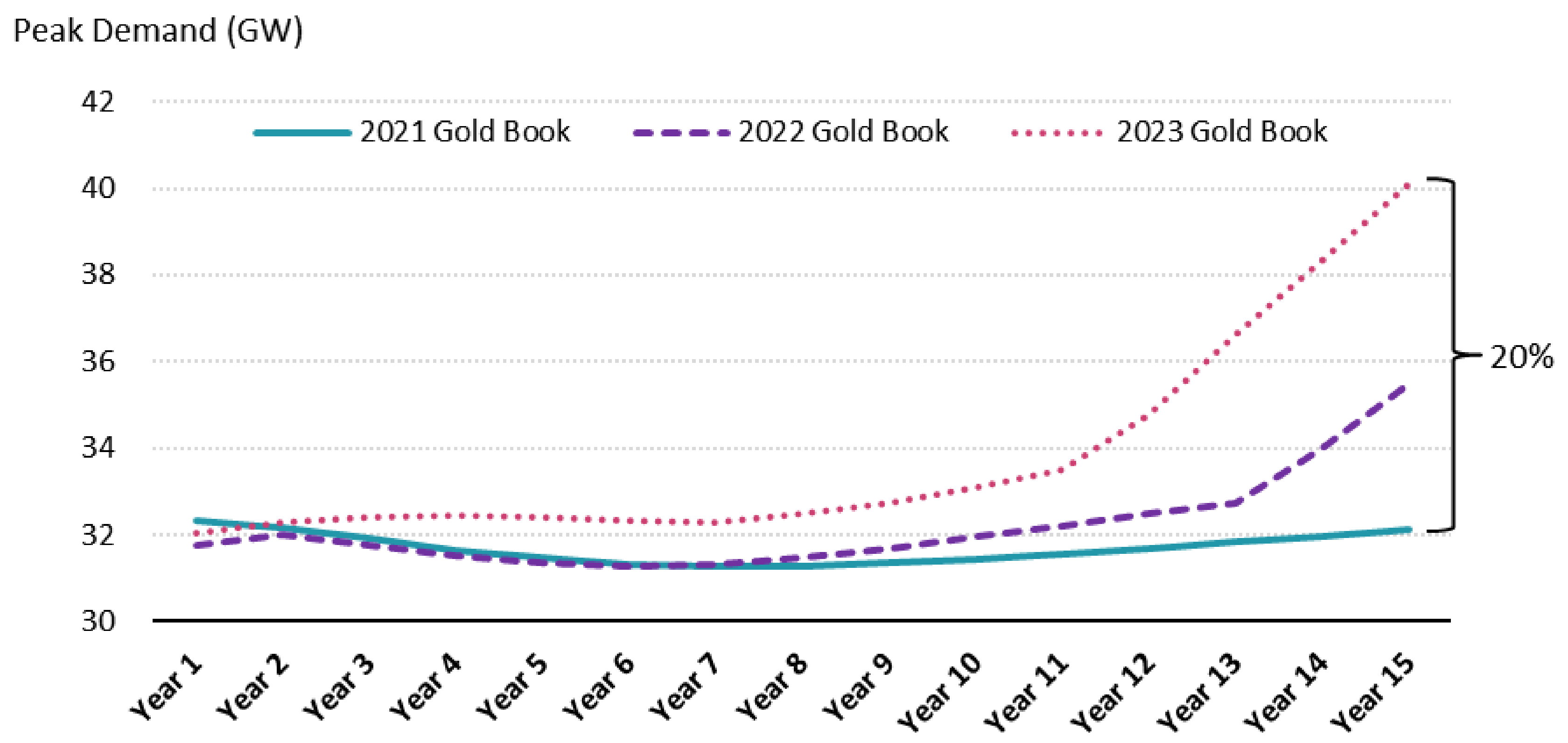
- Electricity forecasters from many different types of organizations (utilities, RTO/ISOs) are starting to adapt their forecasting methods.
- These efforts vary widely in terms of improvement techniques and the level of maturity of the effort.
- Several utilities and RTO/ISO have made changes to their forecast approaches to incorporate new demand drivers, resulting in sometimes substantial changes in their load forecasts over the course of a few vintages.
- Only a few entities include forecasts of these Type B drivers at the distribution level.

INCORPORATION OF SELECTED MAJOR DEMAND DRIVERS BY VARIOUS FORECASTING ENTITIES

		Demand-Side Resources			Type B Load		Type A Load			
		EE	DR	DG	EVs	Electric Heating	Data Center	Indoor Agriculture	Electrolyzer	Industrial Onshoring
AZ	Arizona Public Service (APS)	✓	✓	✓	✓		✓			✓
AZ	Salt River Project (SRP)	✓	✓	✓	✓	✓	✓			
CA	City of Palo Alto	✓	✓	✓	✓	✓				
CA	CleanPowerSF	✓	✓	✓	✓	✓				
CA	Los Angeles Department of Water and Power	✓	✓	✓	✓	✓				
CA	Pacific Gas & Electric (PG&E)	✓	✓	✓	✓	✓				
CA	Southern California Edison (SCE)	✓	✓	✓	✓	✓				
CA	San Diego Gas & Electric (SDG&E)	✓	✓	✓	✓	✓				
CA	Sacramento Municipal Utility District (SMUD)	✓	✓	✓	✓	✓	✓	✓*		
CO	Black Hills	✓	✓	✓			✓*			
CO	Colorado Springs Utilities (CSU)	✓	✓	✓	✓	✓				
CO	Public Service Company of Colorado (PSCO)	✓	✓		✓	✓				

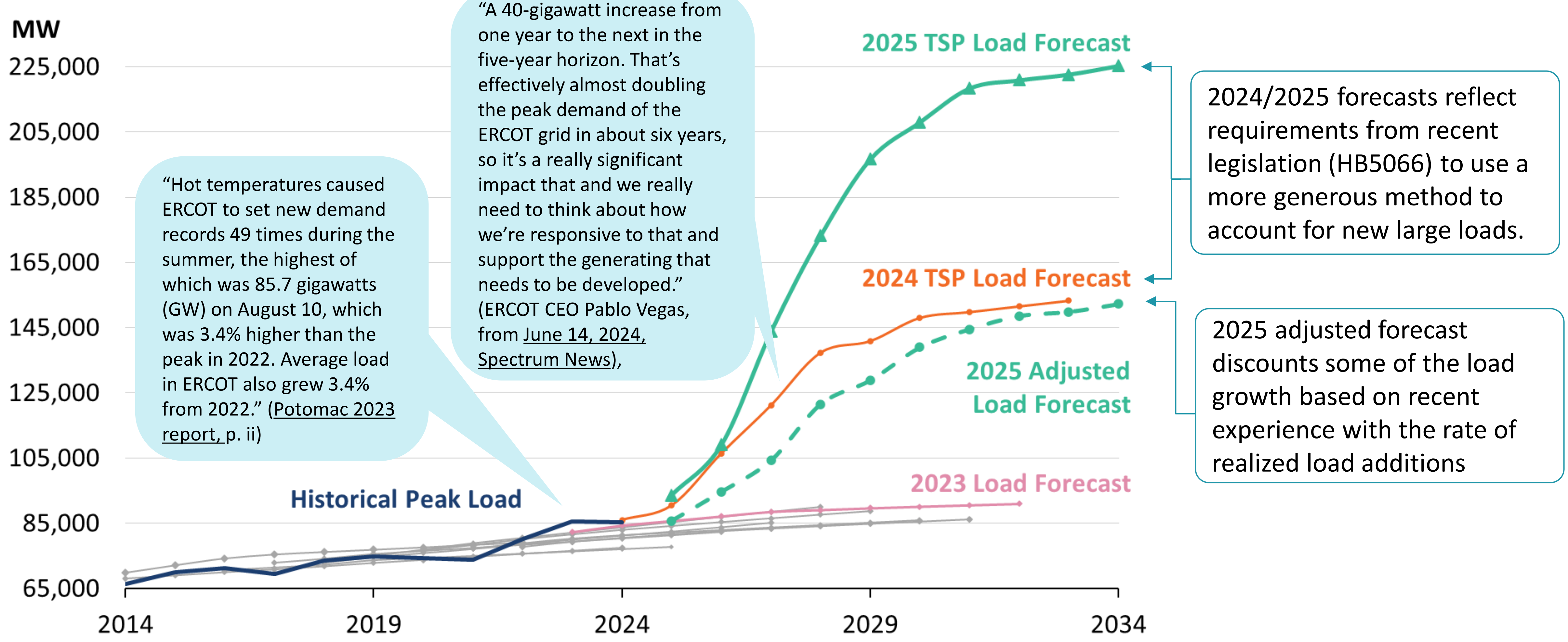
Change in Forecast - Assumptions

NEW YORK PEAK DEMAND FORECASTS



Change in Forecast - Policies

ERCOT PEAK SUMMER LOAD FORECASTS



Sources and Notes: Based on data collected from ERCOT Annual Long-Term Hourly Peak Demand and Energy Forecast reports. Available on ERCOT Load Forecast page under View Other Years. Historical Peak Load series sourced from ERCOT Yearly Peak Demand page. Figure does not include the ERCOT Mid-Year Update that incorporates Contracted and Officer Letter Load.

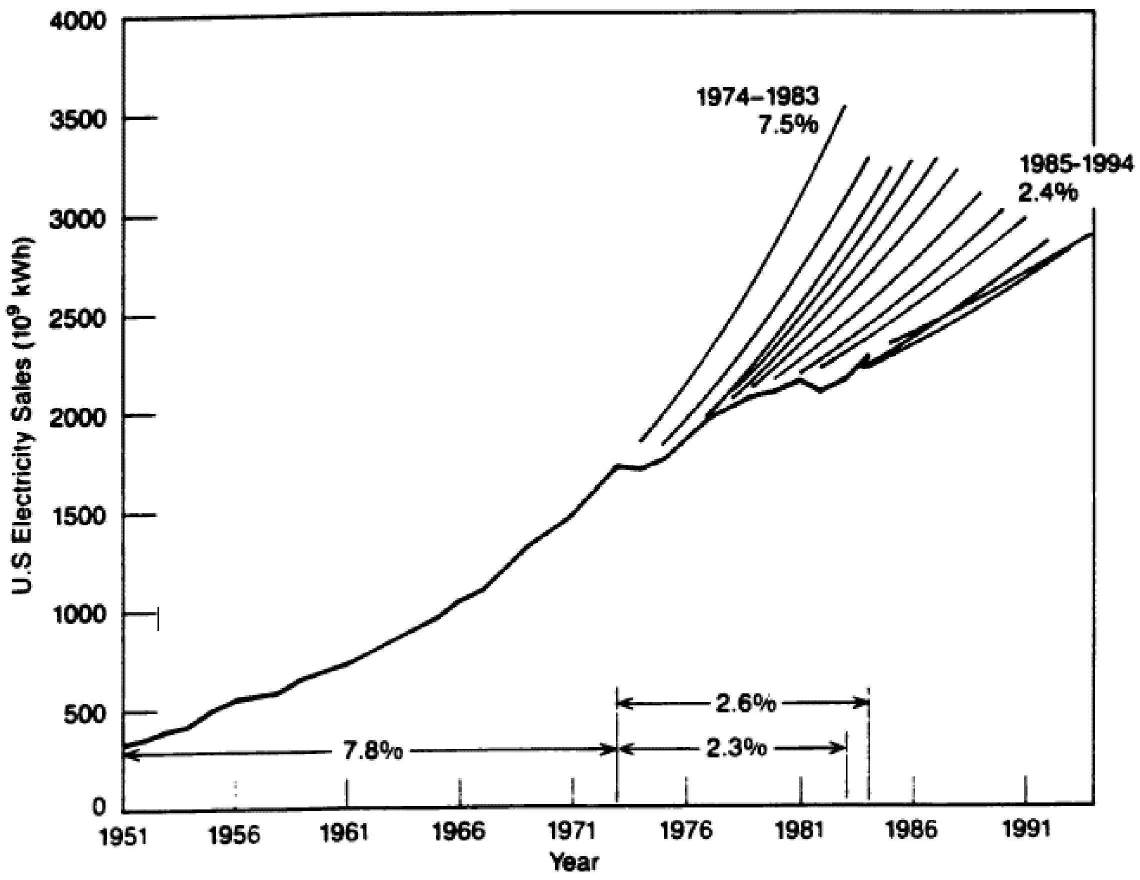
The Costs of Over- and Under-Forecasting

There are costs and risks to both over-forecasting (an issue historically) and under-forecasting.

Traditional practice: achieve forecasts that are believed to lie in the center of distribution of probable outcomes, identify the probable band of uncertainties and the signposts that will drive forecasts above or below the base case(s), and weigh probabilities of over-/under-forecasting with the associated costs.

Avoiding both is important, but current environment introduces additional costs for under-forecasting: long lead times to connect new generation projects, and long(er) time required to build transmission projects.

THE NERC FAN



Process Standardization Can Provide Greater Certainty

- Customers wishing to interconnect quickly may "queue shop", making forecasting new loads more challenging.
- A standardized and transparent intake process can reduce the uncertainty while helping to accelerate the interconnection process by filtering out the less serious customers.

A UTILITY'S INTAKE PROCESS FOR LARGE CUSTOMERS

1. Initial Evaluation	2. Project Details	3. Area Qualif. Study	4. Execute Agreements	5. RTO Request
• Utility explains process and evaluate request, including load ramp • 2-4 weeks	• Customer submits required documents and pays deposit • Utility provides pricing estimates and construction timeline • 2-3 months	• Request for Area Qualification study is sent to system operator • 90 days	• Parties negotiate and sign interconnection agreements, right-of-way agreements, and facilities extension agreements • 2-6 months	• Utility submits formal load request to RTO for evaluation

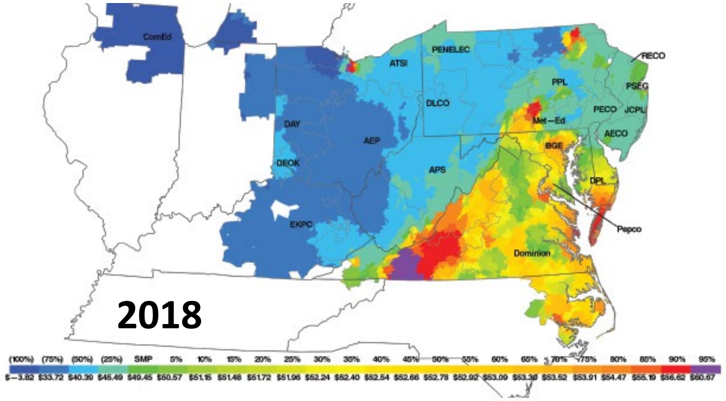
Source and note: Based on Evergy's proposed Path to Power process for connecting new large customers

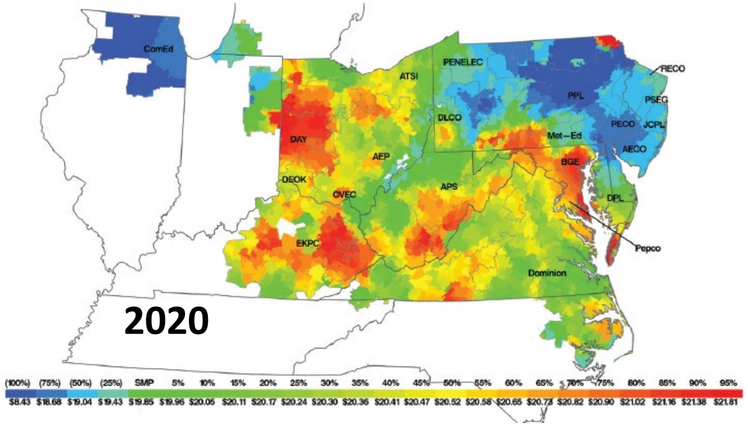
Tariff Designs Can Mitigate Risks from Load Growth

Collateral Requirement	• To protect against financial risks if a large customer suddenly scales back operations or exits the market, utilities are requiring large customers to post large collateral. • Customers with a good credit rating and/or sufficient liquidity may qualify for reduced collateral requirements.
Long-Term Contract	• Long contract terms (8-15 years) can provide greater revenue certainty.
Minimum Charge / Minimum Bill	• Minimum demand charge and minimum bills are used to ensure that large customers contribute to grid costs, even when their usage fluctuates.
Early Termination Fee	• Large customers can terminate service early in exchange for a fee. • Customers can also transfer their load responsibility to remaining customers.
Other	• Incremental cost- vs. average (embedded) cost-based cost allocation. • Minimum load factor. • Excess demand charge (if actual demand is lower than contracted demand). • Prepayments of necessary infrastructure investments. • Load auctions where utility and customers share in benefits.

Changes in Energy Prices…..

PJM real-time, load-weighted, average LMP for Q1 2018, Q1 2020, Q1 2022, and Q1 2024





Year over year changes do not follow a linear trend and can be difficult to predict.

Sources: https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2018/2018q1-som-pjm-sec3.pdf
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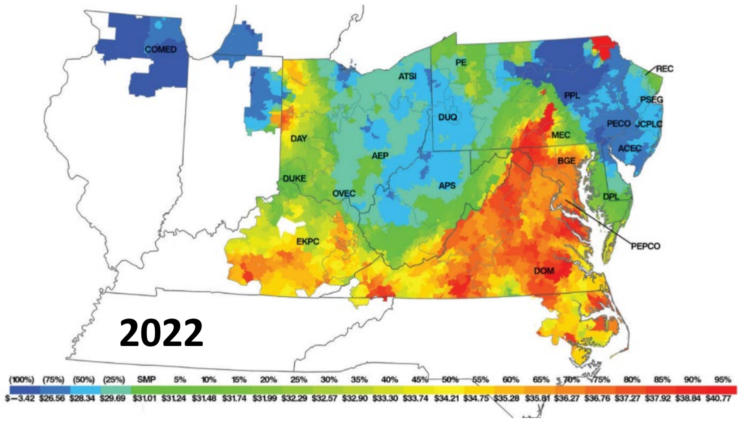

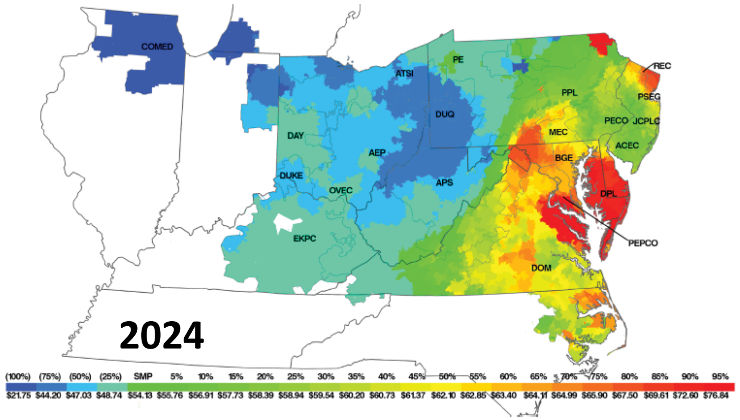

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Mr. T. Bruce Tsuchida is a Principal of The Brattle Group with over thirty years of experience in domestic and international power generation development, utility operation, and power market analysis. He specializes in bridging technology, economics, and regulatory policy, particularly in assessing the impact of new technologies and regulatory changes. This includes modeling of evolving wholesale and retail electricity markets, impact of renewables, storage, and other new technologies' on system operations, utility business, and various valuations (including the engineering and technical capabilities) of transmission, generation, and distribution assets, deliverability, and contracts.

Prior to joining Brattle, Mr. Tsuchida was a Principal at Charles River Associates, and previously a Project Manager at the Tokyo Electric Power Company where he oversaw international generation development projects and was the lead engineer for Southeast Asia generation units.

Mr. Tsuchida earned his M.S. in Technology and Policy, and M.S. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology in Cambridge, Massachusetts, and a B.S. in Mechanical Engineering from Waseda University in Tokyo, Japan.