Electricity Demand Growth and Forecasting in a Time of Change

NEW MEXICO PUBLIC REGULATION COMMISSION WORKSHOP ON LARGE LOAD GROWTH

PRESENTED BY

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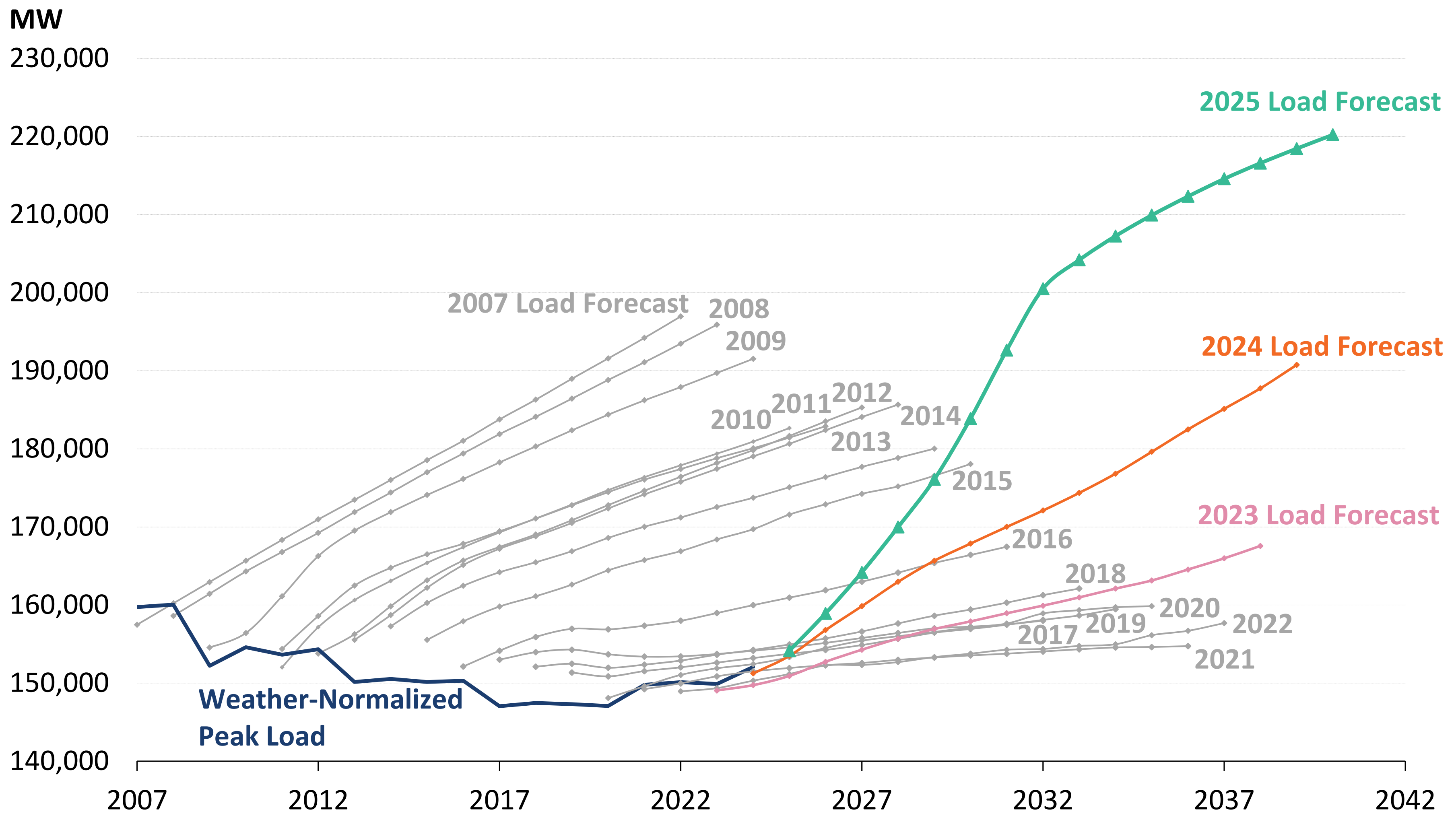
APRIL 16, 2025

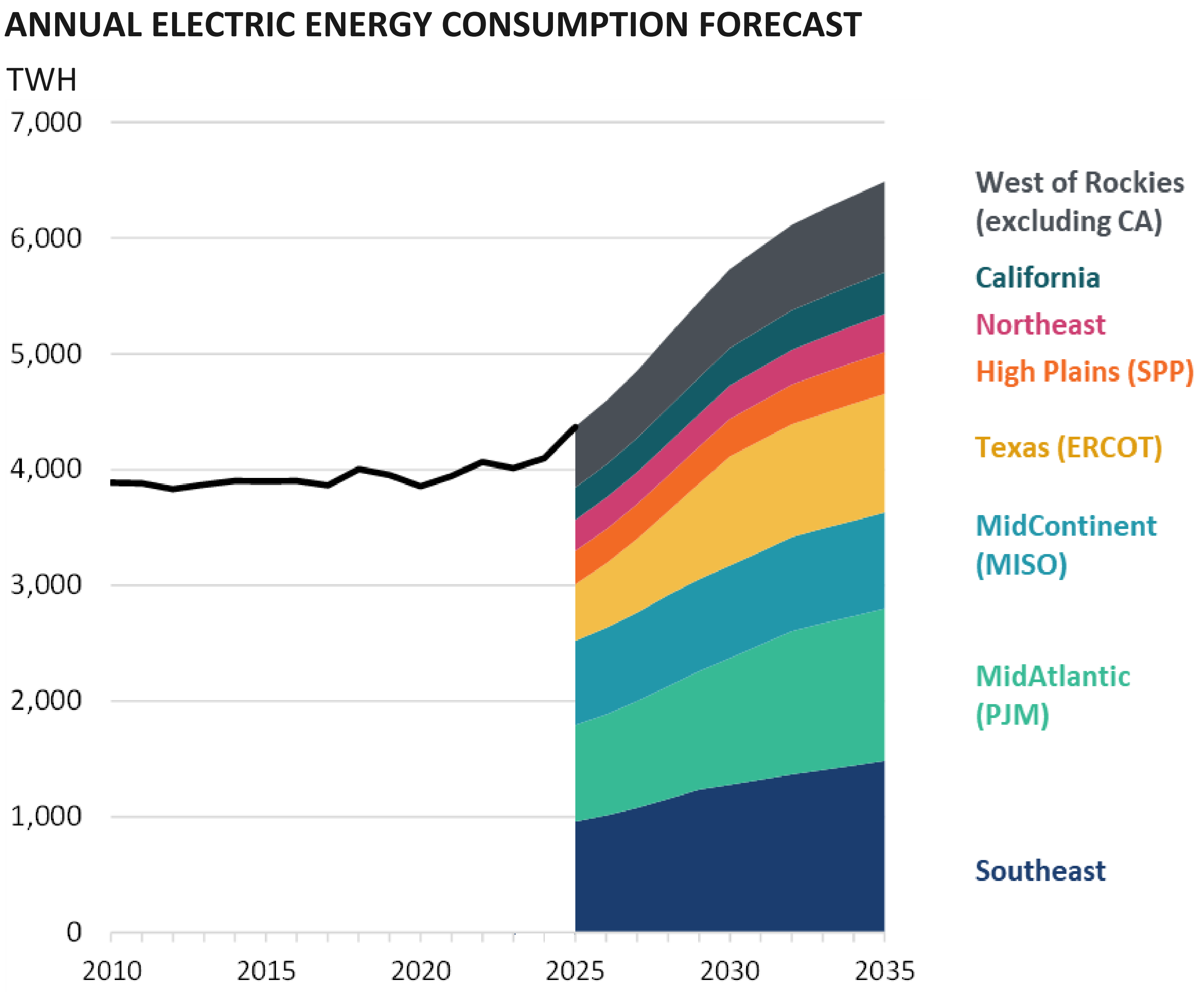
Brattle

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

PJM PEAK SUMMER LOAD FORECASTS



… And Across the United States



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

The New Drivers of Demand for Electricity

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

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

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

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:

- **Distributed generation (e.g. rooftop solar)**
- **Flexible loads/Virtual Power Plants**
- **Energy Efficiency**

How Electric Forecasts Are Changing

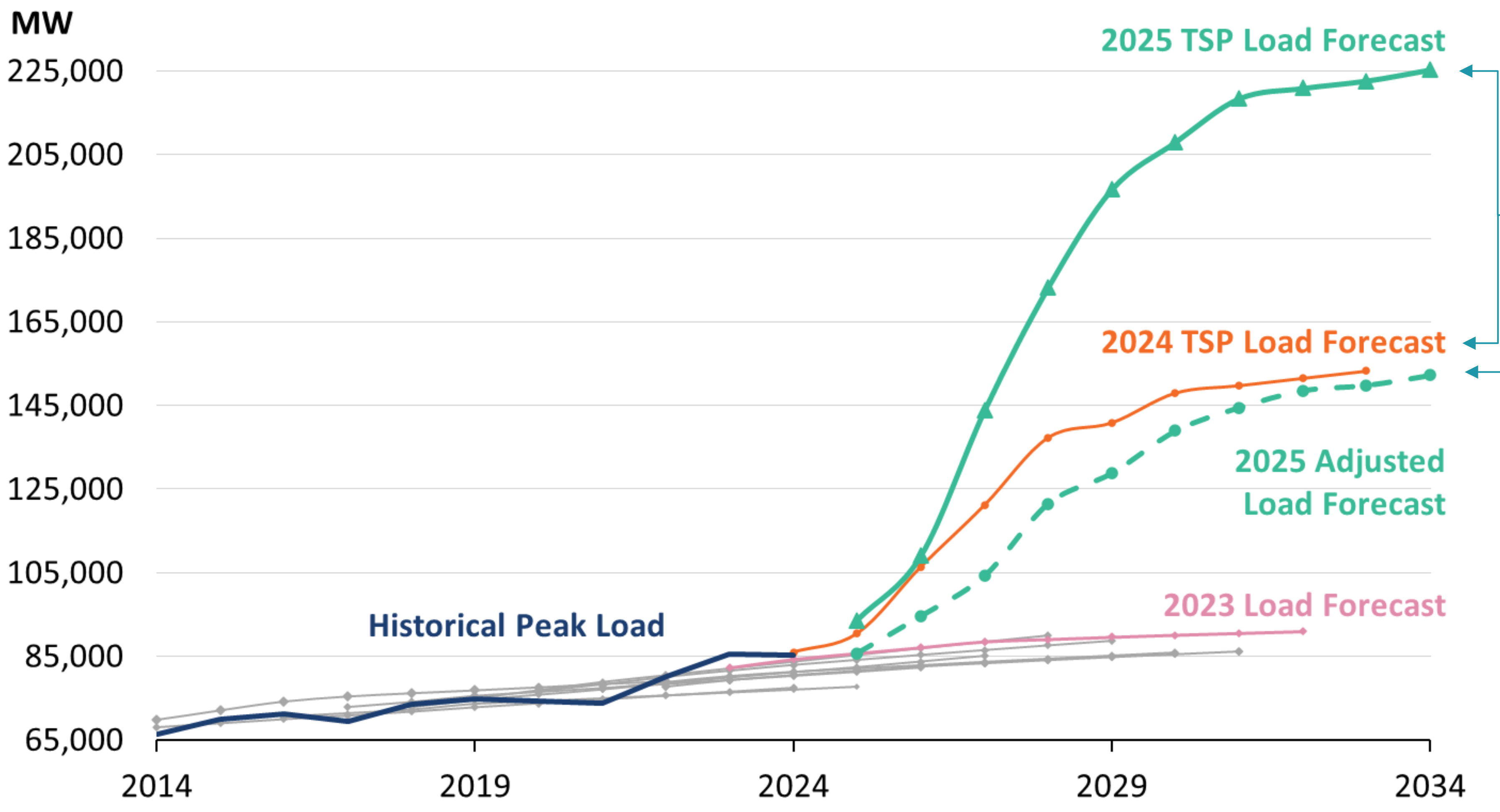
- Electricity forecasters from many different types of organizations (utilities, RTO/ISOs) are starting to adapt their forecasting methods
- These efforts vary widely in terms of improvement techniques and the level of maturity of the effort
- Several utilities and RTO/ISO have made changes to their 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 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)	✓	✓		✓	✓				

Managing Uncertainty: ERCOT Example

ERCOT PEAK SUMMER LOAD FORECASTS



2024/2025 forecasts reflect requirements from recent legislation (HB5066) to use a more generous method to account for new large loads.

2025 adjusted forecast discounts some of the load growth based on recent experience with the rate of realized load additions

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	• 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

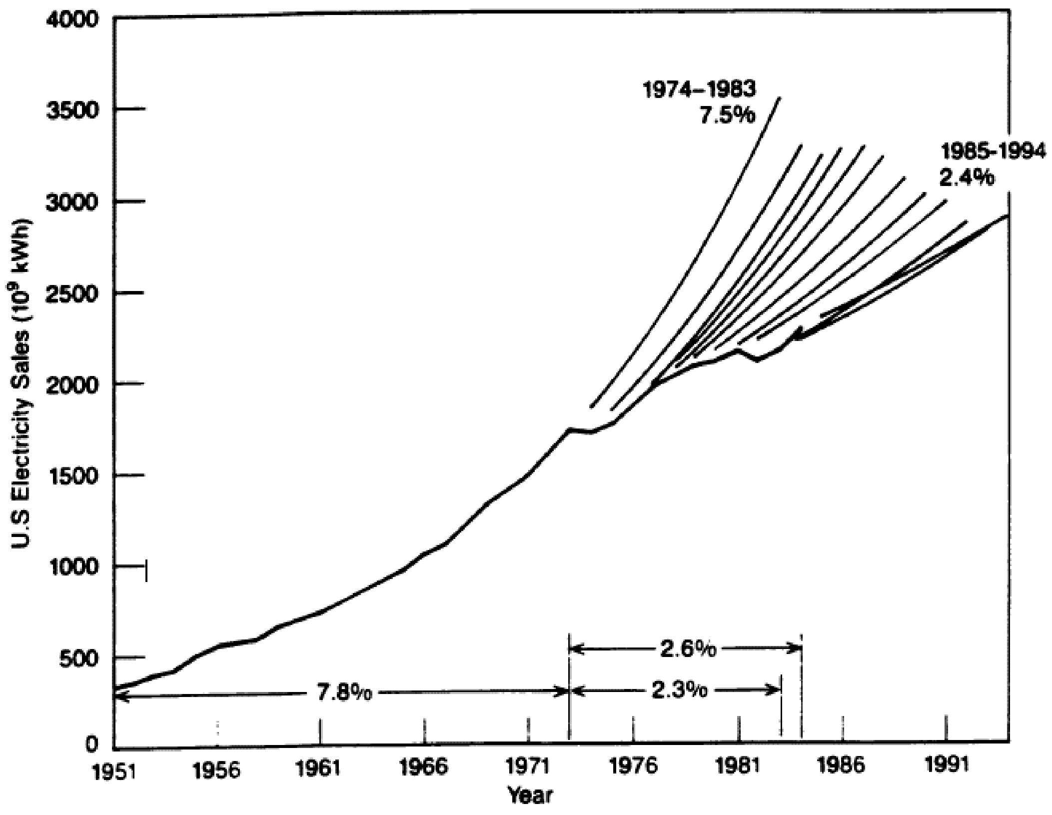
The Costs of Over- and Under-Forecasting

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



Key Takeaways

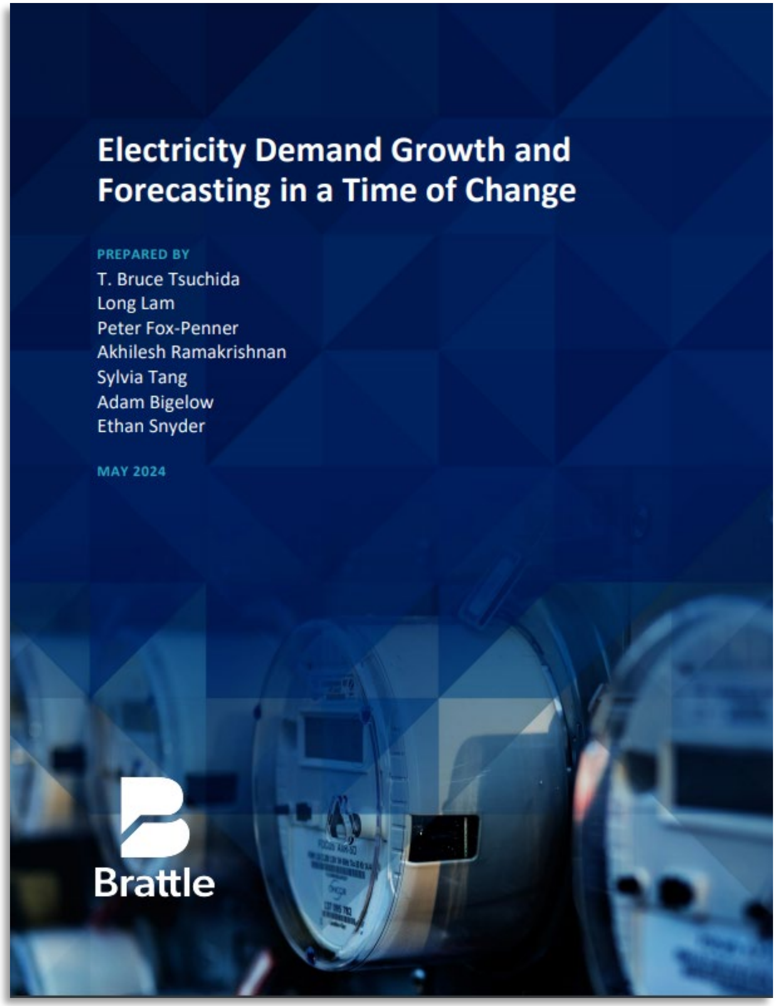
Electric forecasting entities of all types should be evolving their forecasts to incorporate major changes in electricity use in the coming decades

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

Utilities across the country have developed and adopted tools and processes to improve load forecasting and to mitigate risks associated with load growth

We need for proactive electric system planning, as infrastructure is already lagging and there is ample evidence of a significant upturn in the next few years

- 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

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Dr. Long Lam is an expert in the development and implementation of decarbonization strategies and in the design and analysis of clean energy policy.

His work for large companies and governments with net-zero commitments and for regulated utilities, market operators, and regulators focuses on several areas, including:

- Emissions reduction strategies and implementation program development for entities pursuing large-scale decarbonization
- Granular accounting of Scope 2 emissions and clean energy procurement, including defining future-ready contractual arrangements and policies
- The design and evaluation of smart rates, distributed energy resources, and load flexibility programs

Dr. Lam has led projects to develop greenhouse gas abatement cost curves and abatement measure prioritization, analyze programs to effectively integrate clean energy resources, and evaluate the economic benefits of grid modernization and transportation electrification programs.