# Electricity Demand Growth and Forecasting in a Time of Change

## CCIF 15TH ANNUAL KICKOFF FORUM

PRESENTED BY
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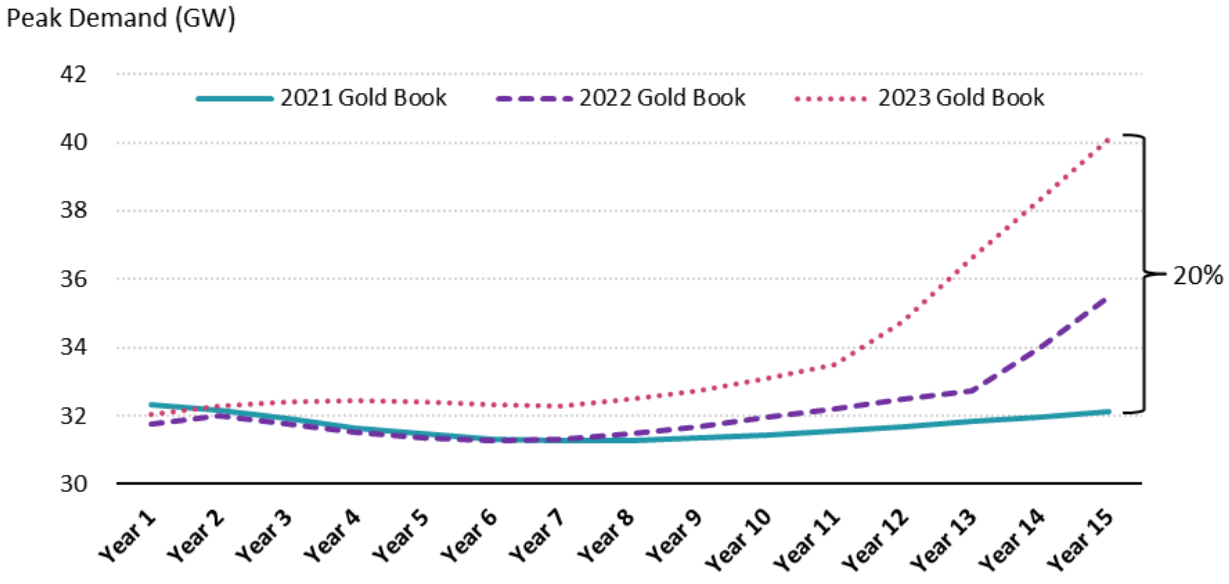
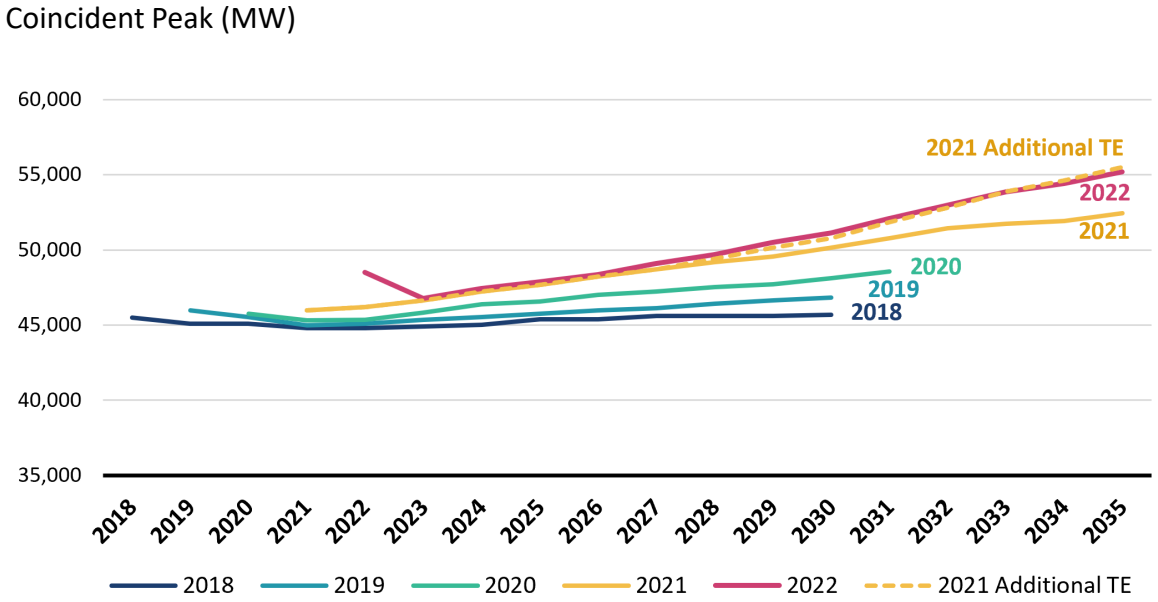
Brattle

# Recent Forecasts Herald an Era of High Electricity Growth

## NEW YORK PEAK DEMAND FORECASTS




## CALIFORNIA DEMAND FORECAST CHANGES OVER TIME



# 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.<br>• Shorter planning horizon. | • Impacts are regional but more spread out at the distribution level.<br>• Longer planning horizon. |
| **Forecast Challenges** | • Some loads can be speculative.<br>• 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.<br>• Use surplus Gen and Tx capacity.<br>• Create capacity with load flexibility.<br>• Leverage onsite generation.<br>• Transparent interconnection processes. | • Execute system buildout under the assumption of steady expansion.<br>• Leverage load flexibility tools to optimize distribution grid usage.<br>• Offset with increased energy efficiency. |
| **Examples** | • Data centers, hydrogen electrolyzers, manufacturing plants. | • Electric vehicles, heat pumps. |

# 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**

# How Electric Forecasts Are Changing

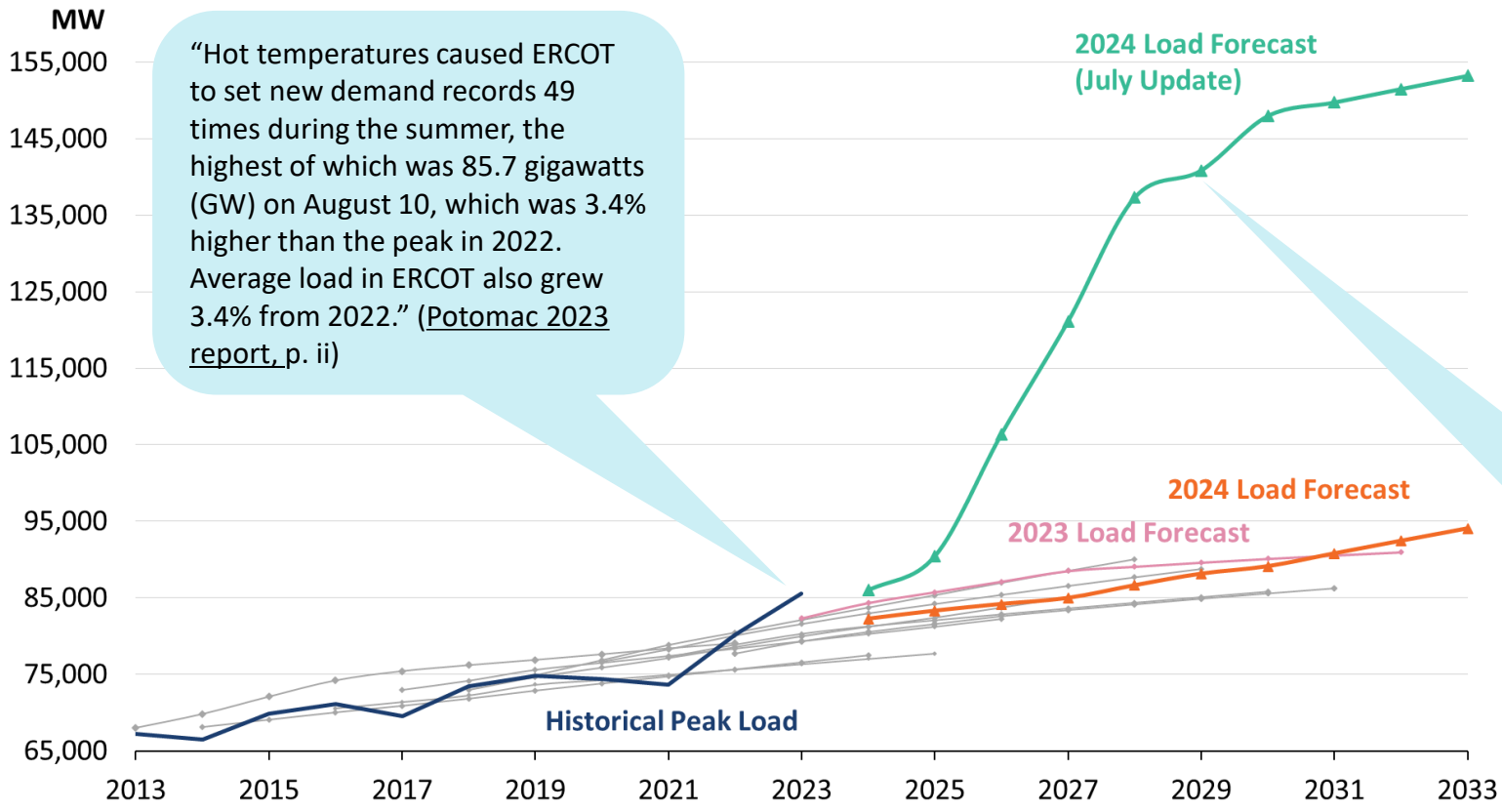
- Electricity forecasters from many different types of organizations (utilities, RTO/ISOs) are starting to adapt their forecasting methods.
- These efforts vary widely in terms of improvement techniques and the level of maturity of the effort.
- Several utilities and RTO/ISO have made changes to their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

# Load Forecast Uncertainty: ERCOT Example

**ERCOT Annual Peak Load Forecast Comparison (July 2024 Update)**




"Hot temperatures caused ERCOT to set new demand records 49 times during the summer, the highest of which was 85.7 gigawatts (GW) on August 10, which was 3.4% higher than the peak in 2022. Average load in ERCOT also grew 3.4% from 2022." (Potomac 2023 report, p. ii)

ERCOT updated their 2024 load forecast in July reflecting requirements from recent legislation (HB5066) to use a more generous method to account for the penetration of new large loads.

Load Growth Uncertainty

"A 40-gigawatt increase from one year to the next in the five-year horizon. That's effectively almost doubling the peak demand of the ERCOT grid in about six years, so it's a really significant impact that and we really need to think about how we're responsive to that and support the generating that needs to be developed." (ERCOT CEO Pablo Vegas, from June 14, 2024, Spectrum News),

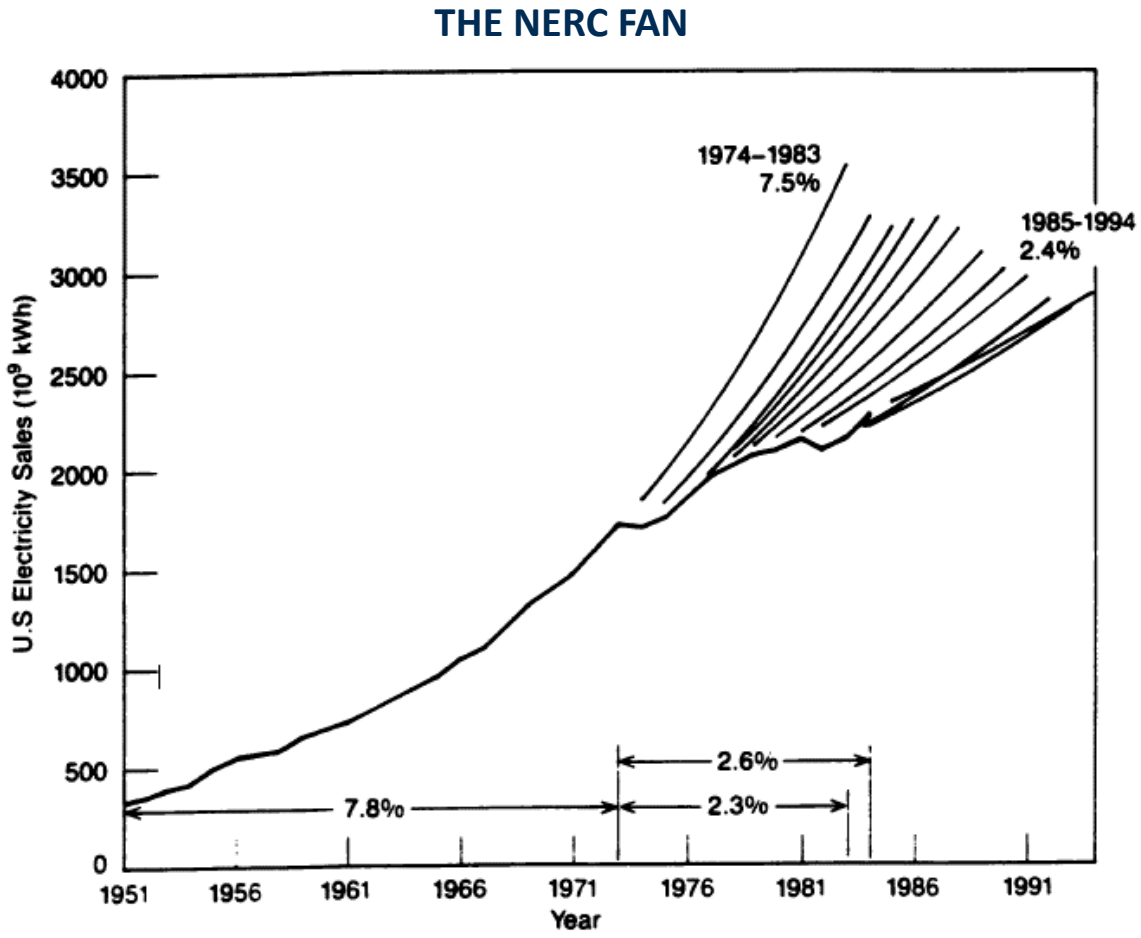
Sources and Notes: Based on data collected from ERCOT Annual Long-Term Hourly Peak Demand and Energy Forecast reports. Available on ERCOT Load Forecast page under View Other Years. Historical Peak Load series sourced from ERCOT Yearly Peak Demand page. Figure does not include the ERCOT Mid-Year Update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



# Key Takeaways

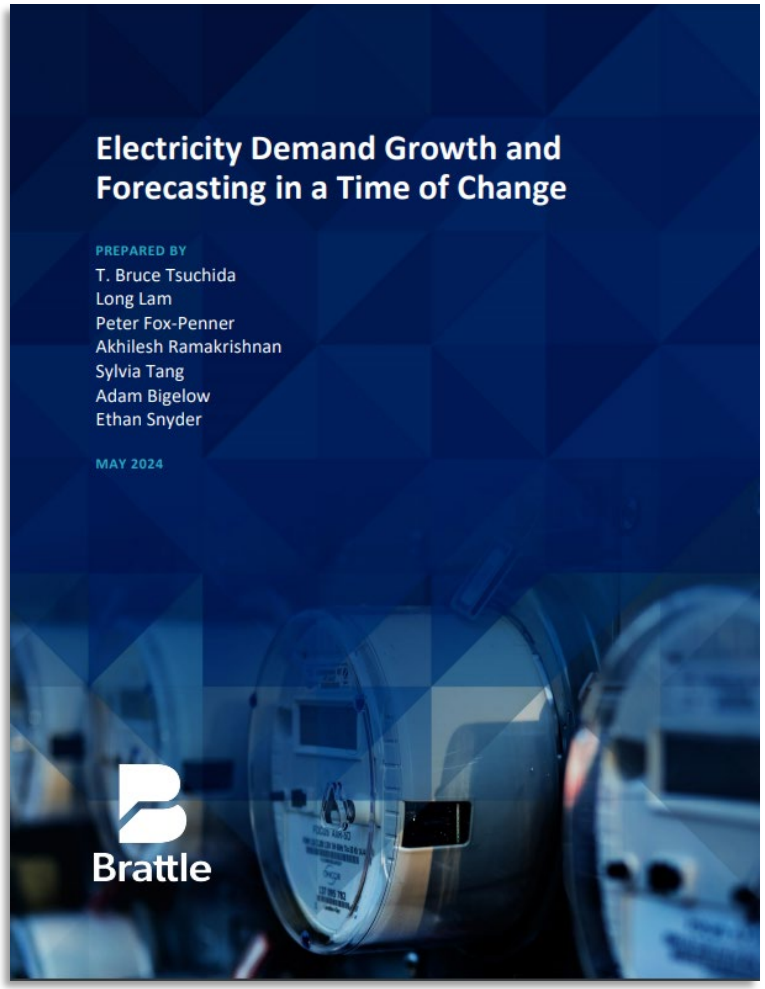
Electric forecasting entities of all types should be evolving their forecasts to incorporate major changes in electricity use in the coming decades.

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

There is now a high potential cost of under-forecasting. 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.

Explicit consideration and evaluation of expansion optionality in all generation and transmission plans.

- 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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