

Impact of Data Centers on the Grid

PANEL DISCUSSION AT THE ARTIFICIAL INTELLIGENCE-RELATED
DATA CENTER ELECTRICITY USE AND EMISSIONS WORKSHOP

NATIONAL ACADEMIES OF SCIENCES ENGINEERING AND MEDICINE

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The New Drivers of Electric Demand and Peak Forecasts



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



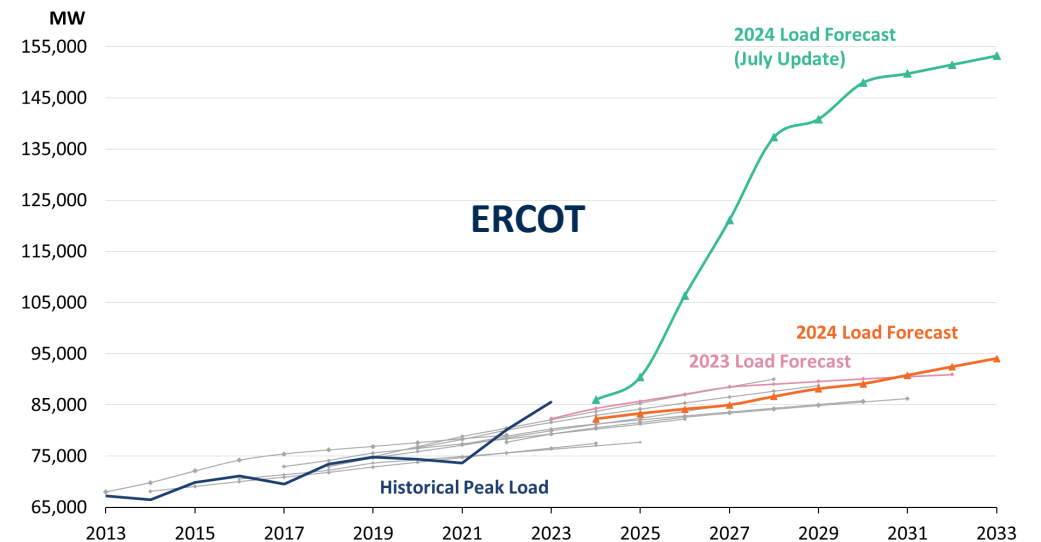
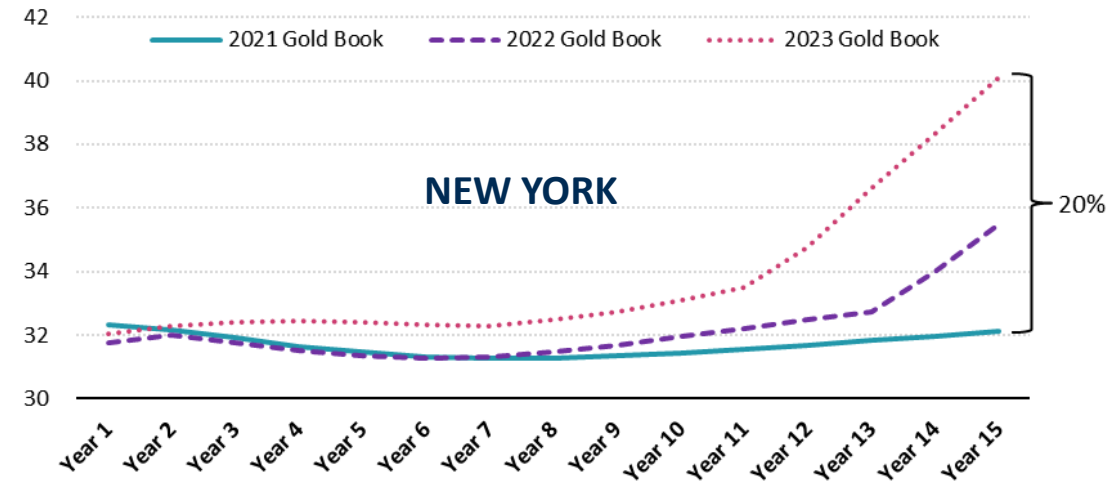
TRANSPORTATION ELECTRIFICATION

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

Peak Demand (GW)



Key Takeaways and Unanswered Questions

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.

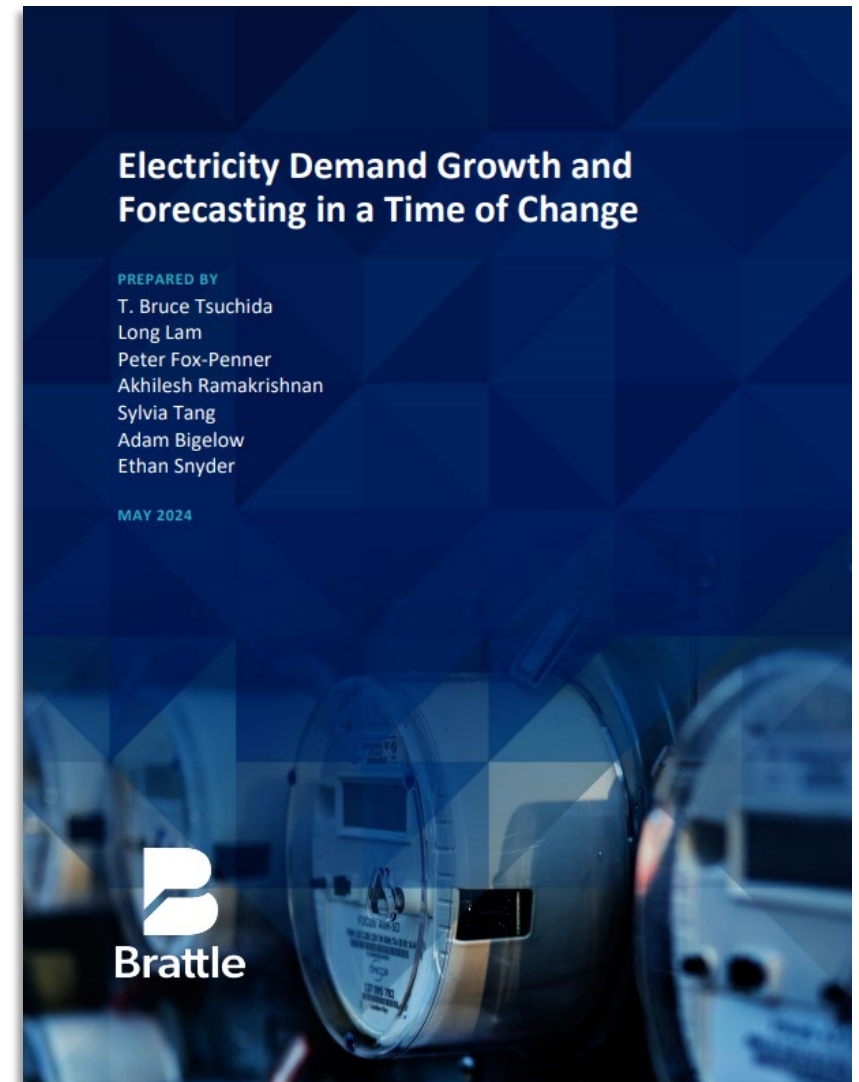
There is now a high potential cost of under-forecasting. We need for proactive electric system planning, as infrastructure is already lagging and there is ample evidence of a significant upturn in the next few years.

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

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

Unanswered Questions:

- ***How should utilities serve these new large loads?***
- ***How should utilities charge these new large loads?***



<https://www.brattle.com/wp-content/uploads/2024/05/Electricity-Demand-Growth-and-Forecasting-in-a-Time-of-Change-1.pdf>