U.S. National Power Demand Study

CIBO 2025 May Policy and Technical Issues Conference

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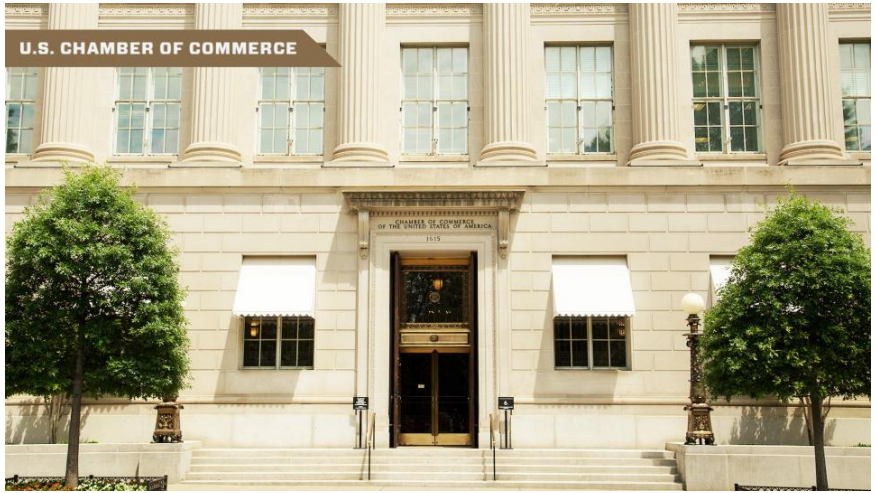
About Us…



U.S. Chamber of Commerce
Global Energy Institute

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U.S. National Power Demand Study

Performed by: **S&P Global**
Commodity Insights

Released: March 2025

Electricity Demand Returns to Growth

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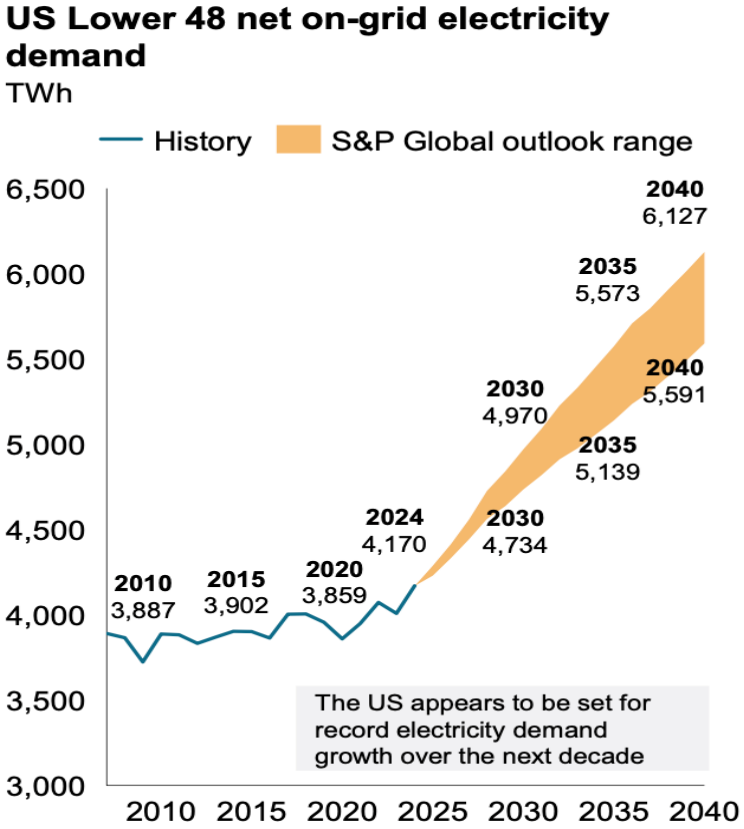
Growth is Back in a BIG Way



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Key Takeaways…

- Sustained Power growth through 2040:
  - Driven by manufacturing and data centers in the near-term; electrification heating and transportation in the long-term.
  - Economic and population growth underpin the outlook along the way.
- The next five years pose a major risk of supply and demand imbalance:
  - Datacenter buildout is expected to go through major development, while near-term supply response is constrained.
  - Load flexibility and co-location stand out as the few options to help meet rising demand in the short-term.
- Supply pathways: Renewables in bulk with natural gas-fired capacity and other firm resources like batteries being critical to provide capacity and balancing support.

Key Takeaways…Part 2

- By 2040, the US will require net additions of between 60 and 100 GW of gas, and over 900 GW of renewables and batteries. *Caveat!*
- All current generation technologies face differing challenges in deployment, and load profiles across the grid are diverse; a diversified portfolio of generation technologies will be needed to ensure planning reserve margins are met and grid reliability is maintained.
- There is also a role for clean firm technologies not currently deployed at scale (advanced nuclear and geothermal), especially if carbon emission mitigation is prioritized.

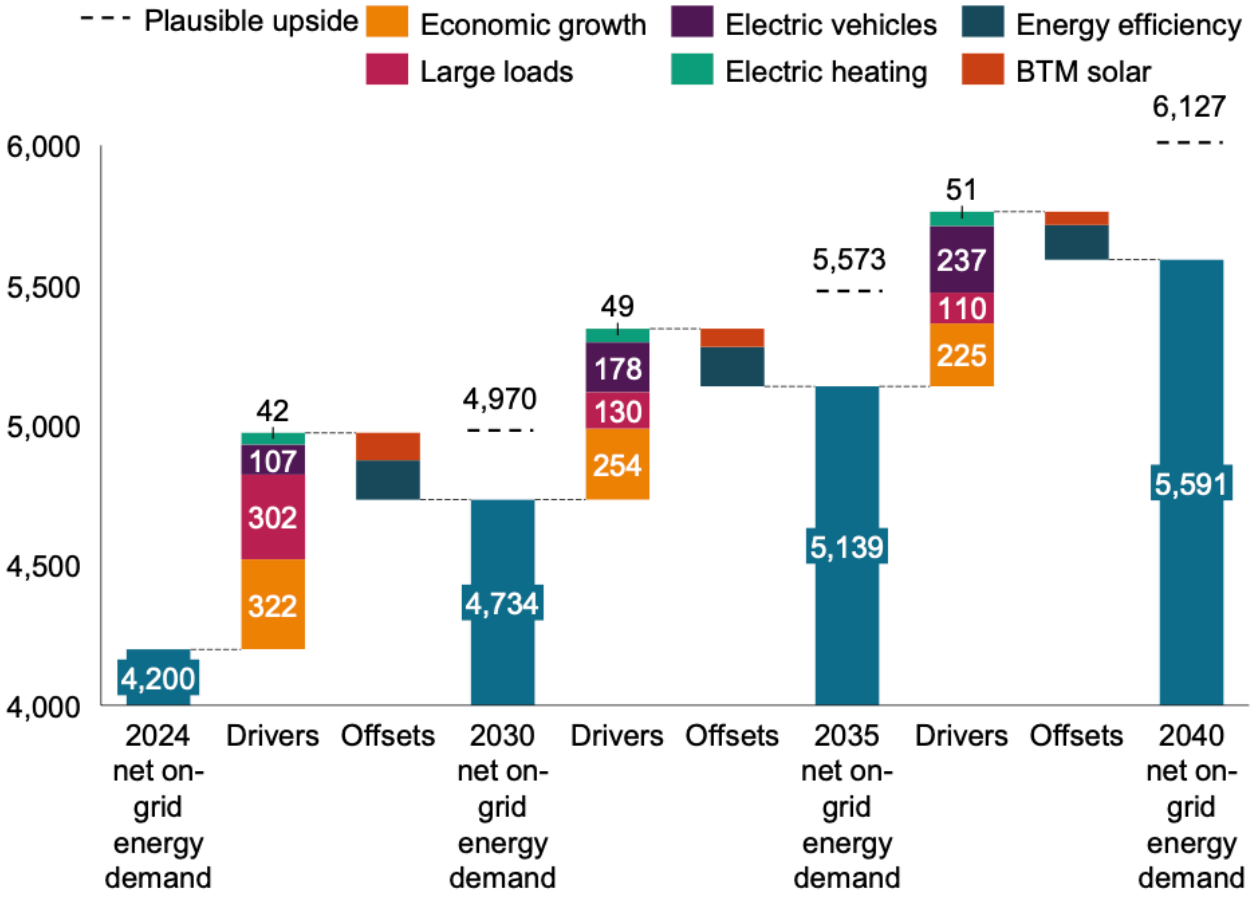
The Challenges to Success

- Significant challenges remain to quickly bring online large amounts of generation:
  - Supply response is constrained by outdated interconnection processes, local opposition, siting/permitting delays, ongoing challenges in developing economic transmission projects, supply chain constraints, and other limitations to deploying energy generation and delivery infrastructure.
  - Thoughtful policy reforms and a diversified supply response portfolio will be needed to reduce the demand/supply tension.
  - Successfully navigating these challenges will unlock economic growth and efficient, lower carbon emission trajectories for the sector. *Shortfalls = Missed Opportunities*

Zooming In…

Drivers and offsets of growth in US Lower 48 net on-grid electricity demand, 2024–40

TWh



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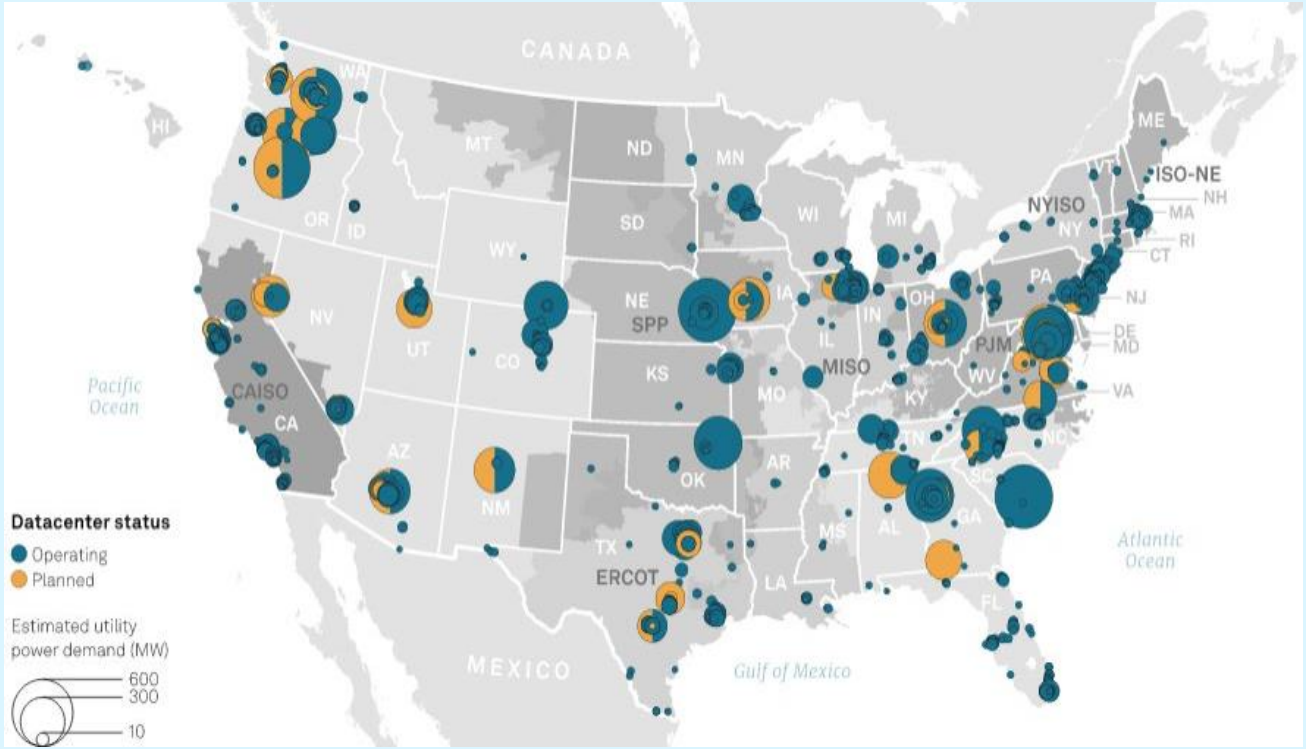
Diverse Drivers = Confidence in Forecast

- **The next decade demands more new electricity than any ten-year period in the nation's history**
  - Between 2024 and 2040, demand in the US is expected to grow by 35-50%
    - industrial loads like datacenters and manufacturing (near-term)
    - electrification of transport and heating (accelerate mid 2030s)
- Heterogeneous load profiles emerging from evolving demand drivers emphasizes the need for a diversified generation portfolio to sustain grid reliability and resilience.
- Early growth into 2030s mostly in Eastern Interconnection / Texas
- More dispersed thereafter toward 2040

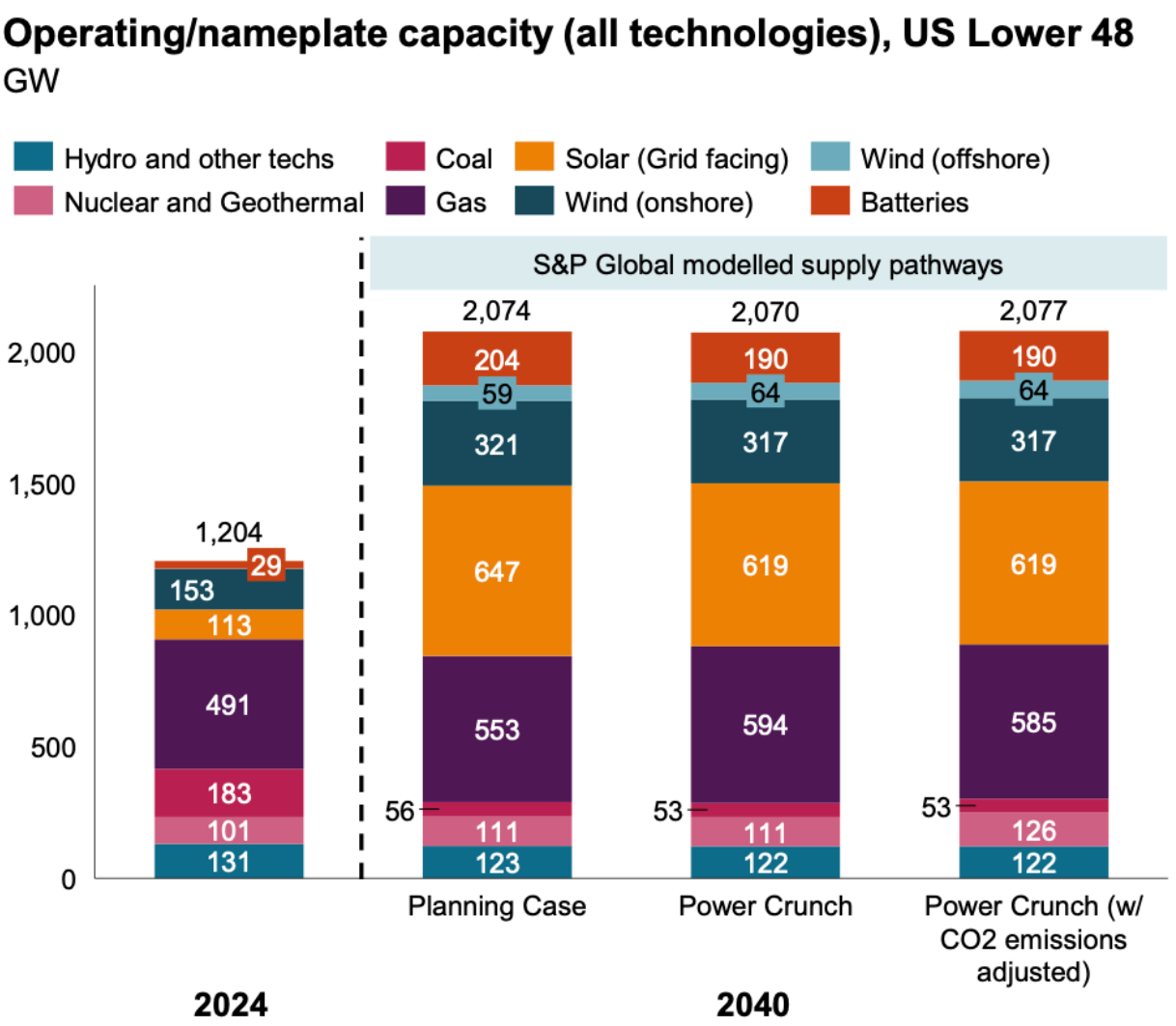
Data Build Leans East

Figure 5. Estimated data center growth by grid region



This figure illustrates the estimated growth in data center capacity across various regions, highlighting the need for corresponding infrastructure development to meet growing load demand. Source: S&P Global, POWER OF AI: Wild predictions of power demand from AI put industry on edge, October 2023, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/101623-power-of-ai-wild-predictions-of-power-demand-from-ai-put-industry-on-edge.

Buildout Coming…



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3 Supply Pathways → Nameplate Doubles

- 3 S&P Global cases:

  (1) Planning Case,

  (2) Faster demand growth and increased supply constraints, and

  (3) More clean firm capacity added.

- Adding above 900 GW to the supply mix through 2040, renewables and batteries lead on a *nameplate* basis due to availability, low-cost, consumer preference, and policy support.
  - BUT – ability of renewables and batteries to respond is constrained.
  - New firm capacity resources are required to meet peak demand growth.

Are Renewables the Bridge?

- Natural gas-fired generation capacity grows by 60 GW, providing needed capacity to balance intermittent gen.
  - Constraints shape buildout:
    - Supply Chain adjusting to increased demand
    - Gas delivery infrastructure bottlenecks
    - Pushes substantial gas buildout to 2030+
    - 40 GW+ of additional gas could be needed with further constraints on the renewables buildout and higher than expected load growth.
- Advanced nuclear and other clean firm technologies retain importance; but a stronger emphasis on emissions reductions increases the role of nuclear, though not ready at scale until 2030s.

Disparate Timeframes, Desperate Measures

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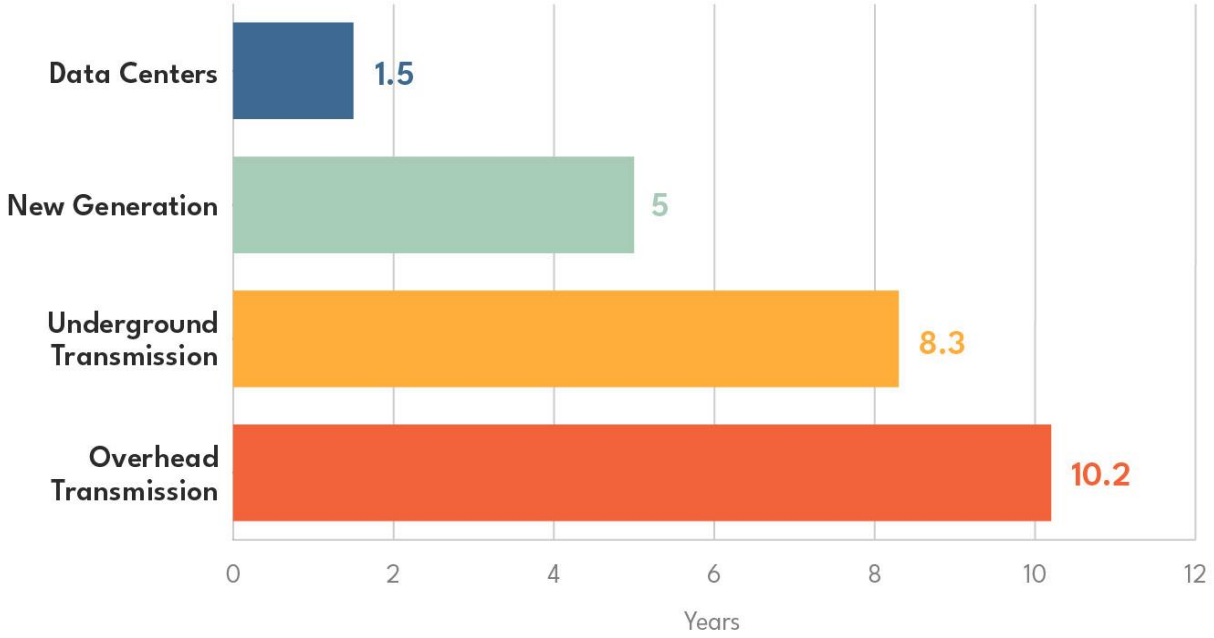
THIRD WAY

Average Lead Times to Build Key Load & Capacity Assets

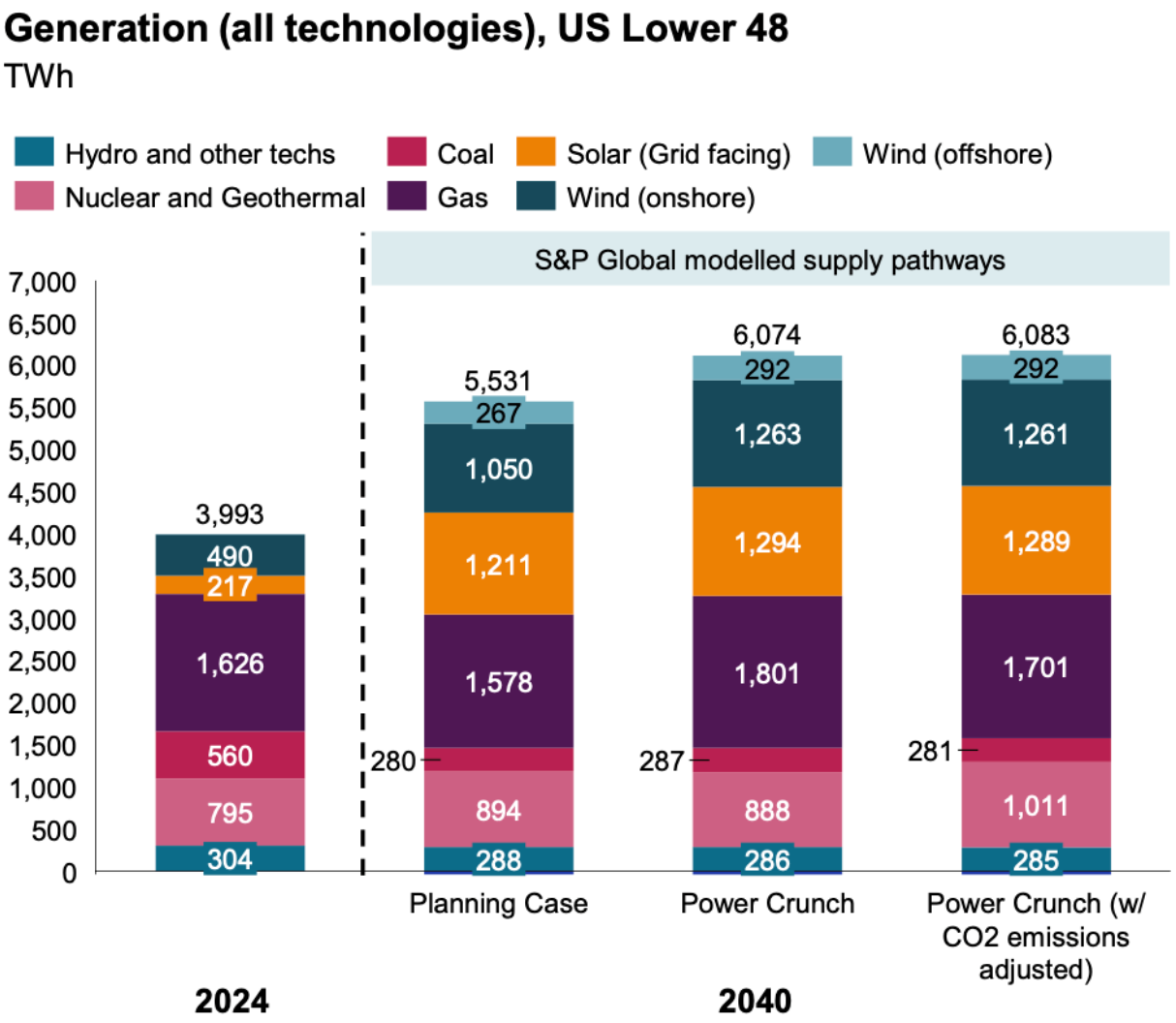


Source: IEA, Average lead times to build new electricity grid assets in Europe and the United States, 2010-2021, IEA, Paris https://www.iea.org/data-and-statistics/charts/average-lead-times-to-build-new-electricity-grid-assets-in-europe-and-the-united-states-2010-2021, IEA. Licence: CC BY 4.0.

Rand, Joseph, et al. "Queued Up: Characteristics of Power Plans Seeking Transmission Interconnection as of the End of 2022." Lawrence Berkeley National Laboratory, Apr. 2023.

Wilson, John, and Zimmerman, Zach. The Era of Flat Power Demand Is Over. Grid Strategies, Dec. 2023.

Appearances *Versus* Contributions…



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Gas and Renewables Do the Work

Renewables *combine* to reach almost half of total generation

- As the primary source of new energy supply, wind and solar combined become the majority of generation in the US.
- BUT – Natural gas dominates as the largest single source.

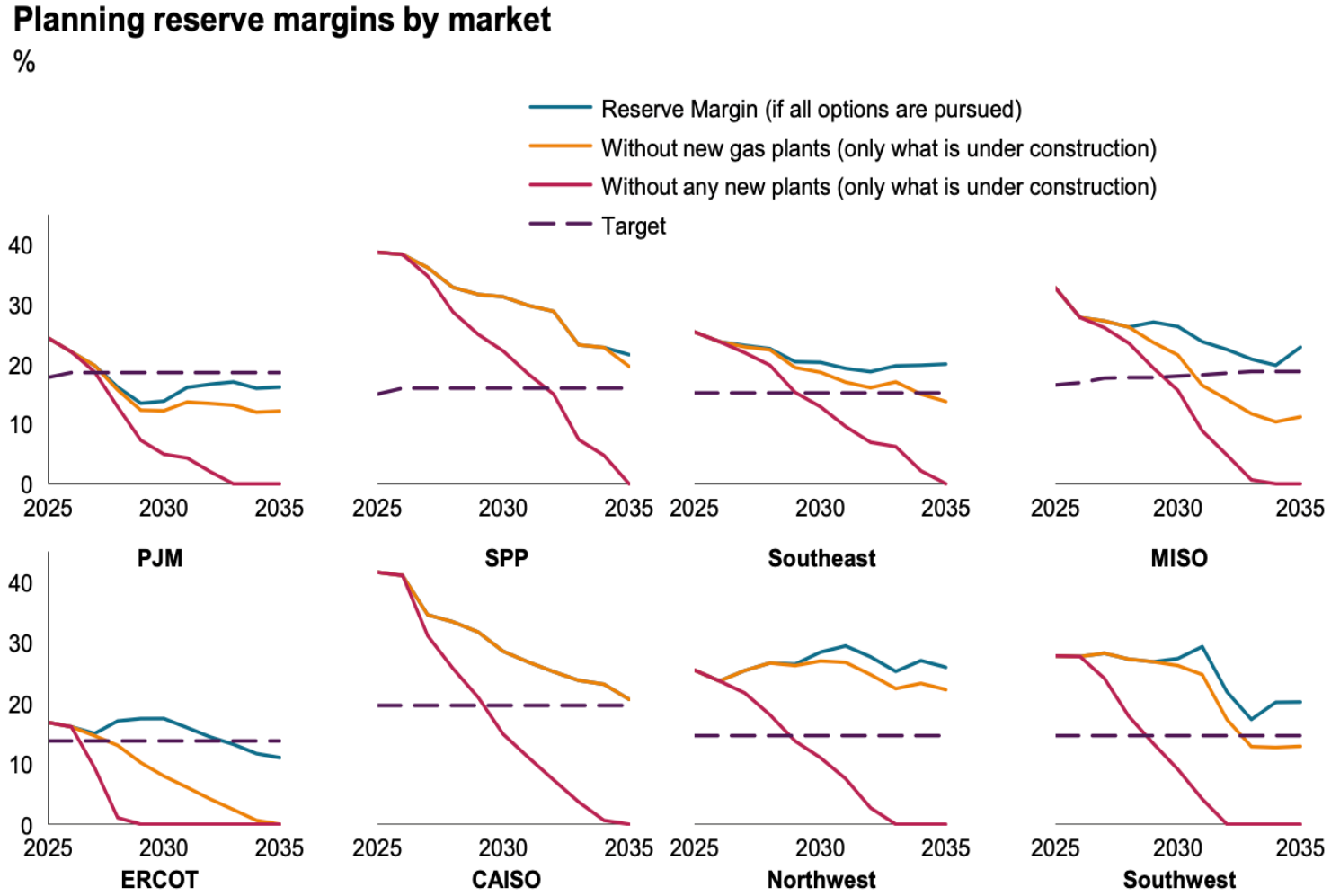
In Power Crunch, developers respond to siting and permitting challenges by accelerating plans to repower existing facilities.

Natural gas-fired generation *generally* remains near current levels

- As load grows and coal generation decreases, natural gas-fired generation holds mostly steady through 2040
- Gas upside of around 200 TWh in Power Crunch

  (higher load / constrained renewables)

Trending Down in a Major Way



1. The target reserve margin is typically calculated with a 0.1 Loss of Load Events (LOLE) per year criterion
Source: S&P Global Commodity Insights

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Challenges Limit the Supply Needed for Growth

With growth a given, how is demand met while maintaining reliability?

- Conflicting policy, economic, and reliability considerations
- Gas additions surging, but recovering from two-decade low in 2024
- Supply Chains need to quickly ramp up
- Coal retirements delays, but technical limits and regulations pressure exit
- Battery storage can expand quickly, but economics exposed to ongoing changes in capacity and ancillary markets
- Advanced nukes and geothermal are longer term, limiting their near-term utility.
- Nearly everywhere: siting, permitting, and interconnection add uncertainty

The Report's Policy Recommendations

Editorial Caveat: ***Some, but not all, available options…***

- Optimize Interconnection Study Process
- Prevent Speculative Behavior in the Queue
- Improve Interconnection Access and Flexibility
- Conduct Grid Upgrades – Streamline Permitting
- Explore Co-Location of Supply with Large Loads
- Enhance Energy Efficiency as a Grid Resource and Strengthen Demand-Side Management to Reduce Grid Strain

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