Challenges in Meeting Surging US Power Demand

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Energy Policy Research Foundation

www.eprinc.org

IEA's World Electricity Generation Outlooks to 2050

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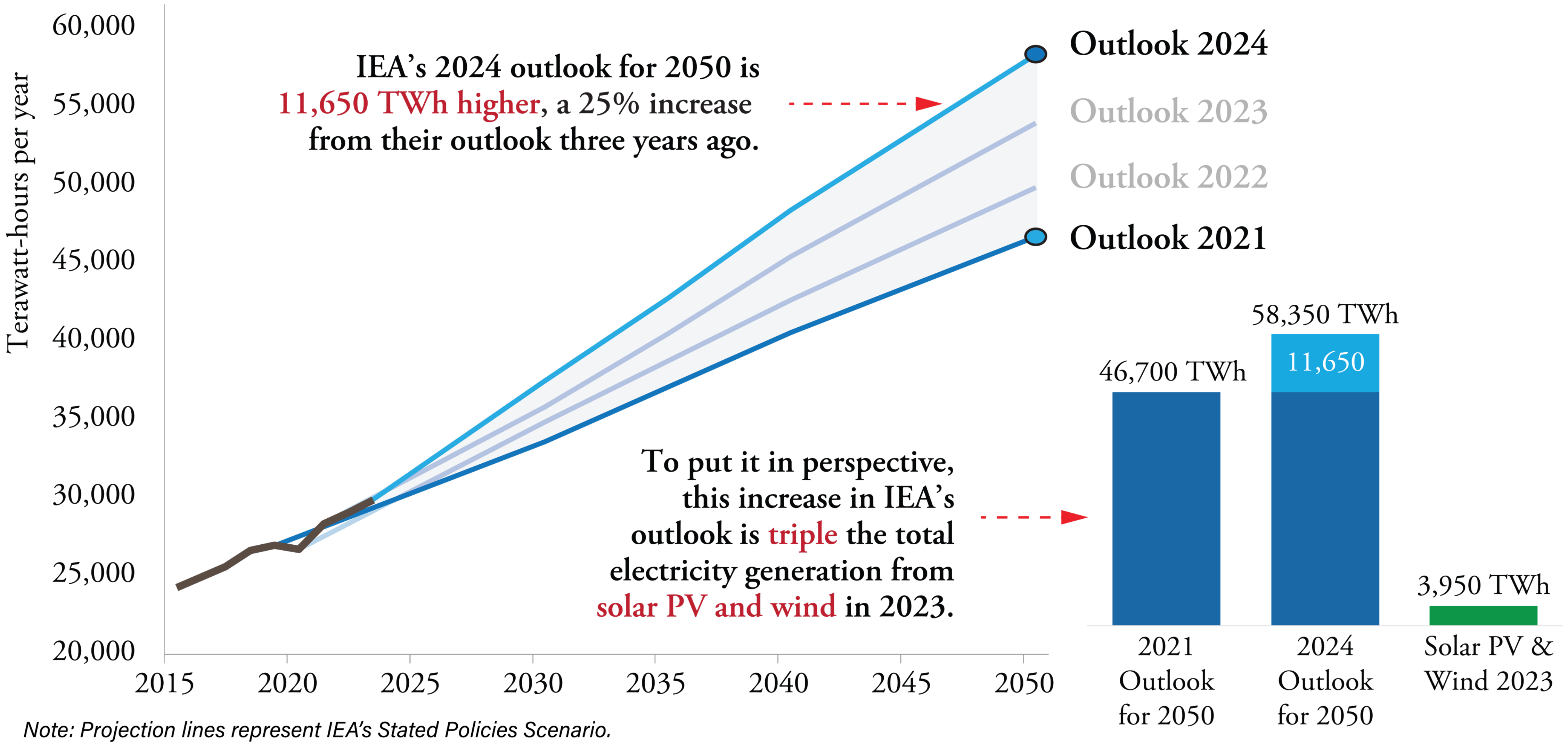

Note: Projection lines represent IEA's Stated Policies Scenario.
Source: Energy Policy Research based on IEA's World Energy Outlook data

Europe vs. U.S. States

Average Household Electricity Prices (cent/kWh) in Second Half of 2023

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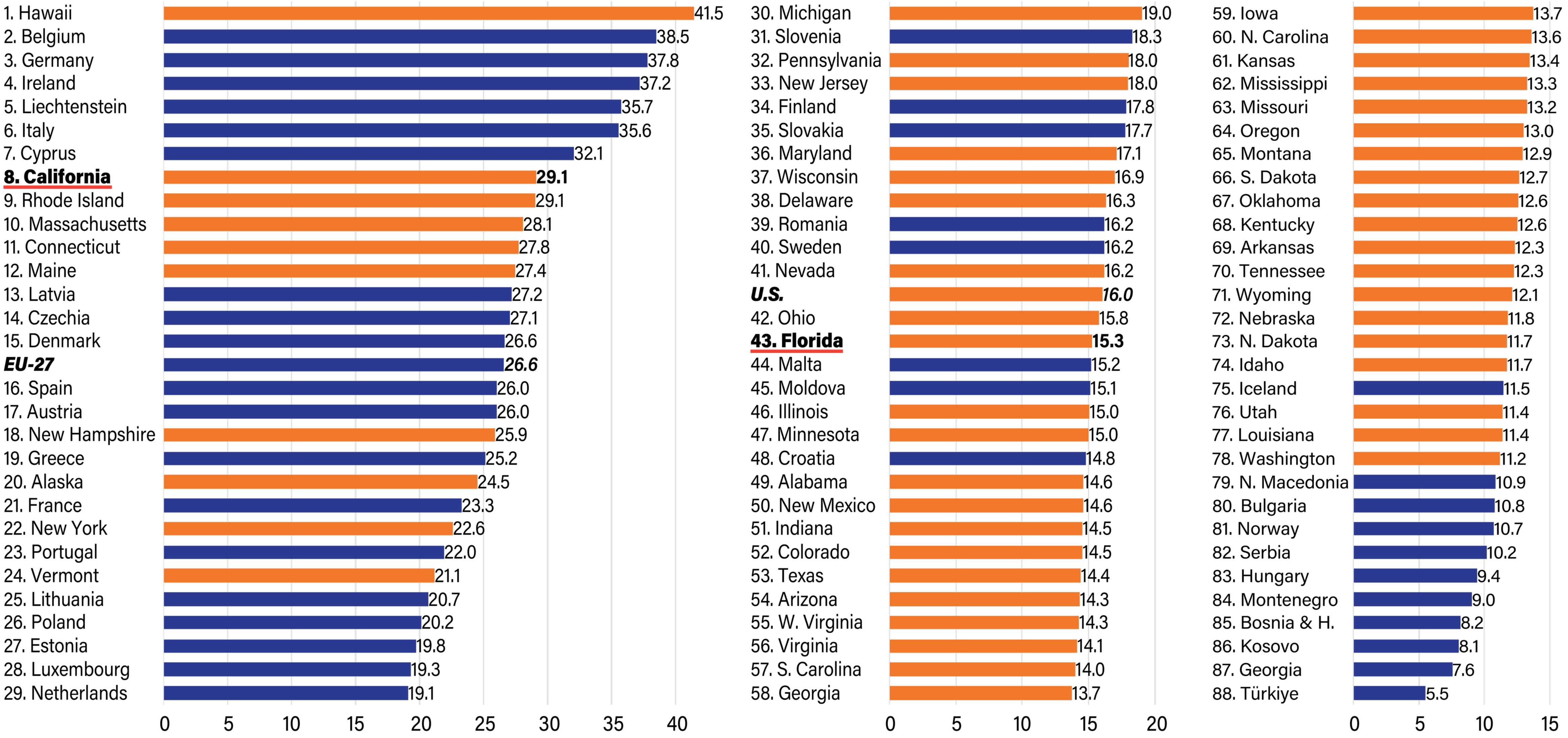

Note: The household electricity prices paid by ultimate customers exclude VAT and other recoverable taxes and levies. The EUR-USD exchange rate of 1.082 (average during the period) is applied.

Sources: EIA, Eurostat, ECB, Energy Policy Research

Rapid Deployment of Intermittent Power Can Increase Power Prices and Lower Resilience

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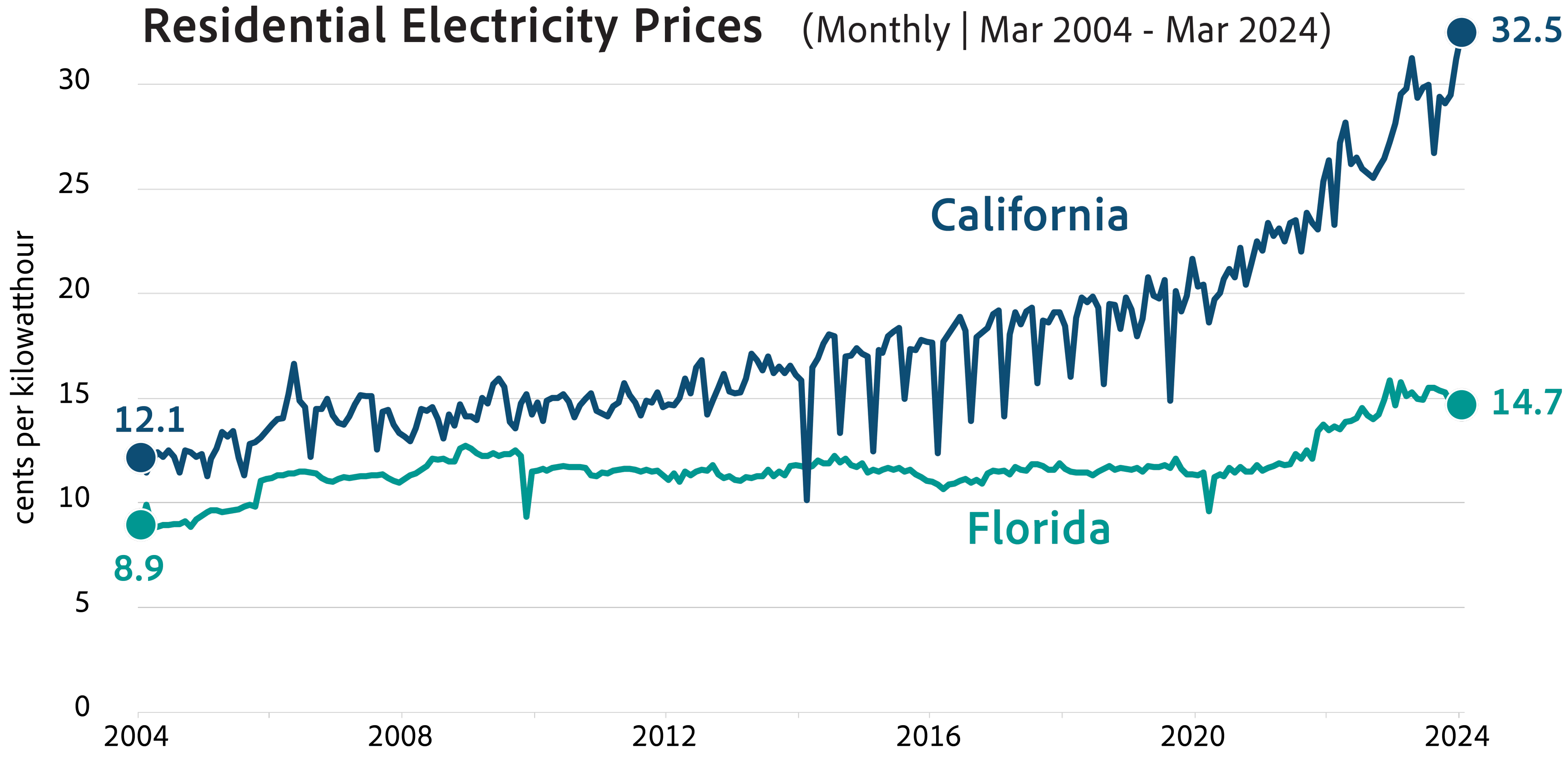
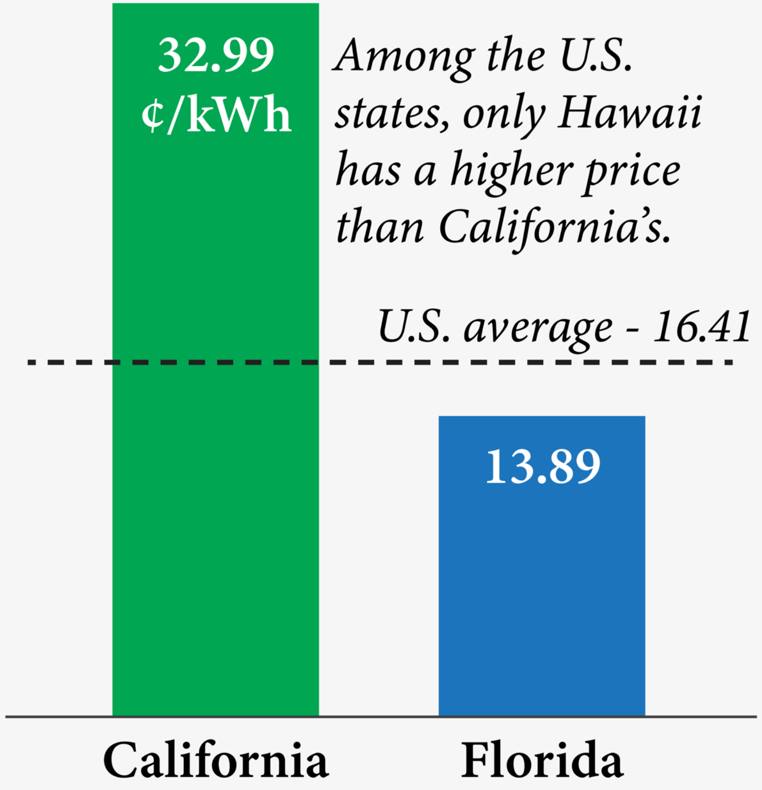


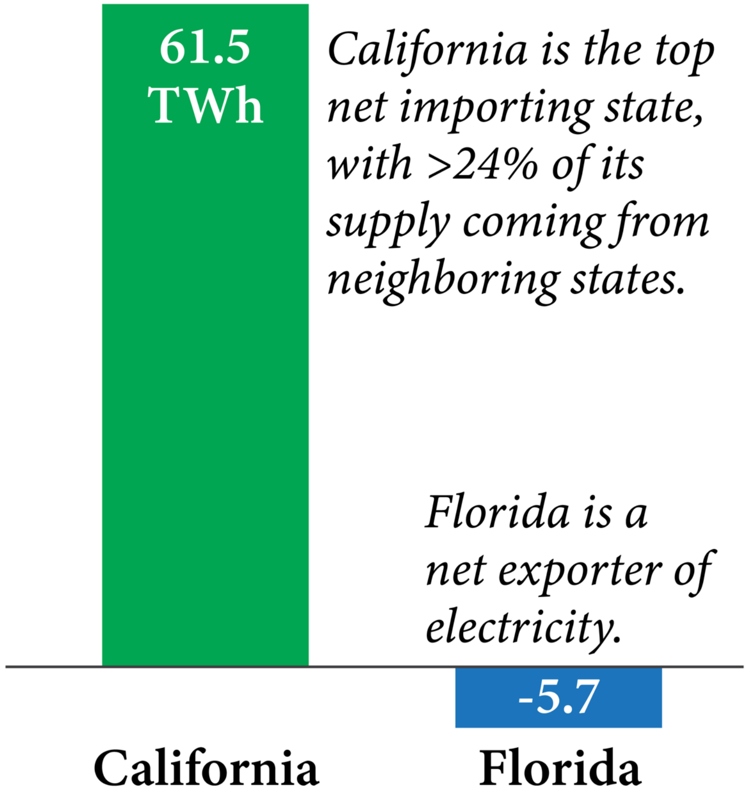
Residential electricity prices represent the average prices of electricity to ultimate residential customers
Data: EIA

A Tale of Two States: Electricity California v. Florida

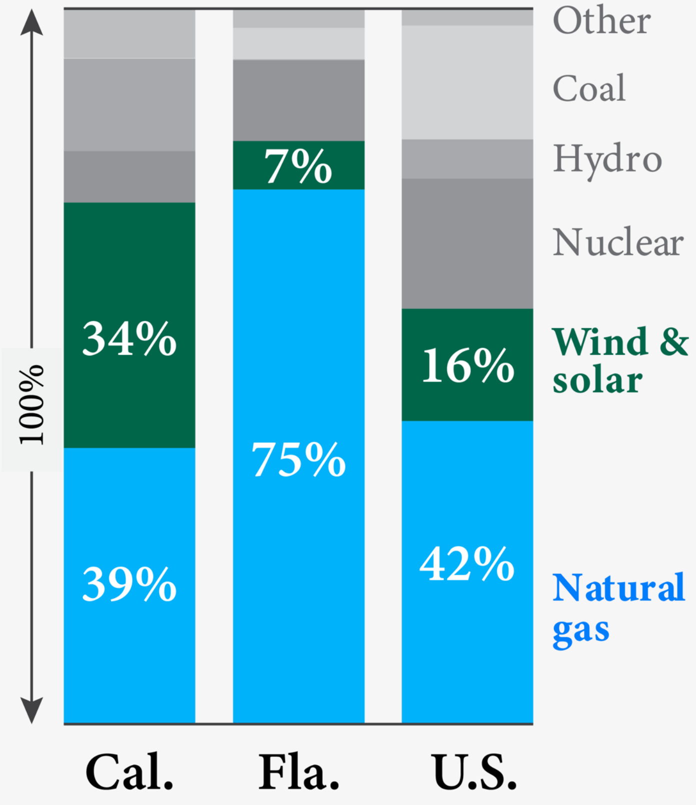
1 Residential electricity prices[1] (cents/kWh, June 2024)



2 Annual net electricity imports[2] (terawatt-hours, 2022)



3 Electricity mix (percent of net generation, 2022)



[1] Represents "Average Price of Electricity to Ultimate Consumers." [2] Net imports/exports are calculated by subtracting retail sales and direct use from net generation.
Sources: Energy Policy Research based on EIA data

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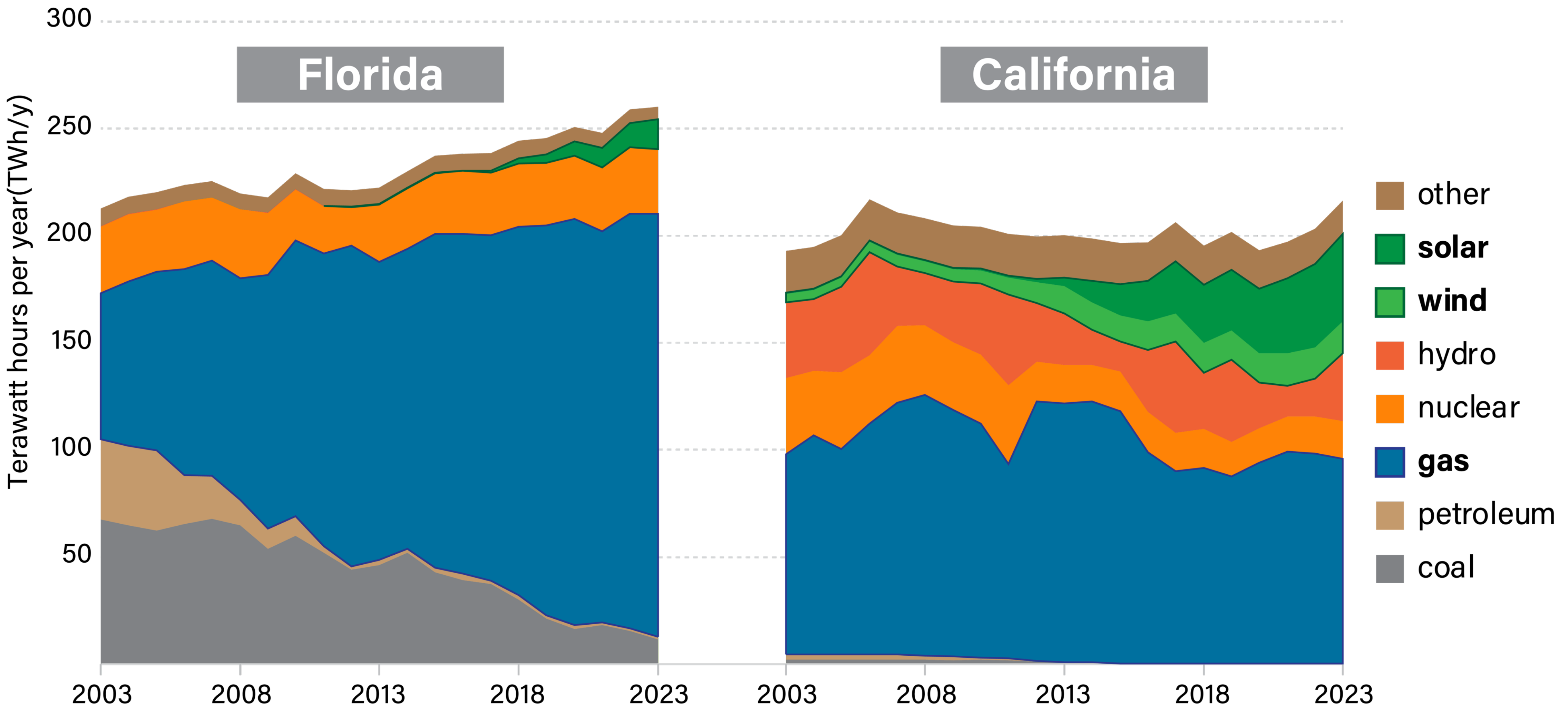
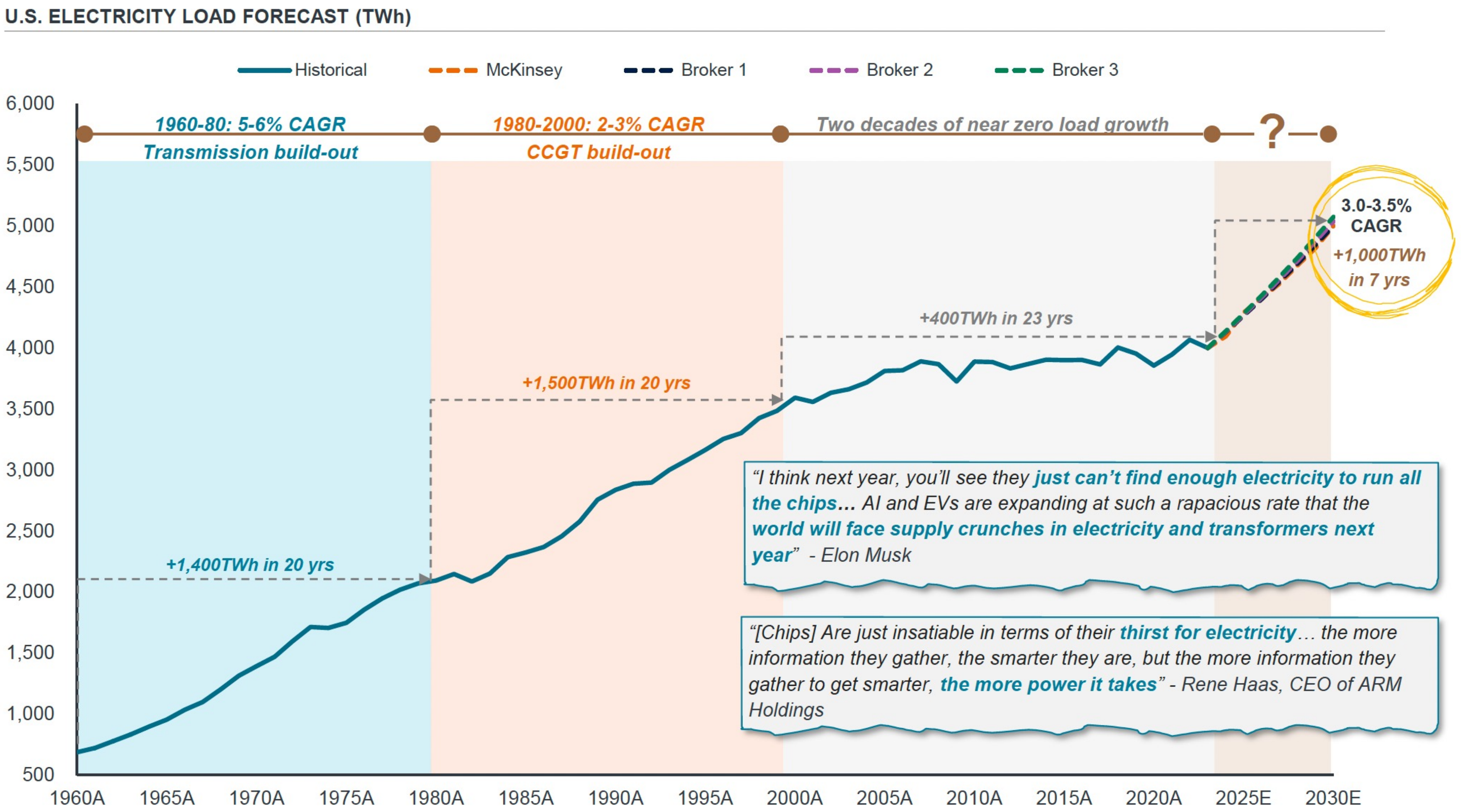
Annual net generation of electricity by fuel type (2003-2023)



Data: U.S. EIA, Energy Policy Research

US Electricity Load Growth Forecast: JPMorgan



Source: JPMorgan

Large Uncertainties Remain on Long-term Petroleum Demand

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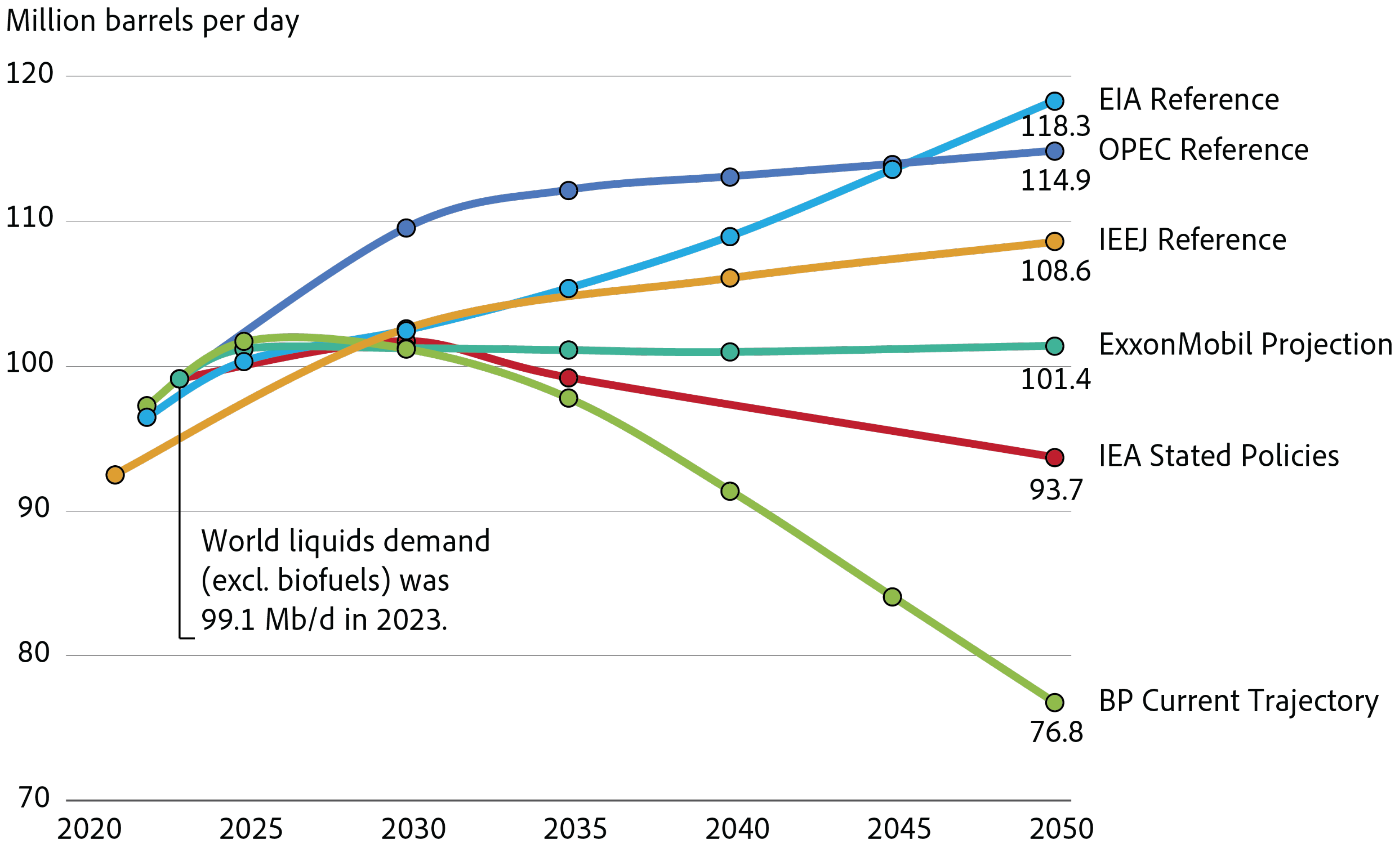
Oil Demand Outlooks by Select Modeling Groups



Note: Oil demand in this analysis represents liquids demand, excluding biofuels. ExxonMobil's projections were converted from Btus.
Source: Energy Policy Research based on each group's most recent outlook (2023-24)

Change in Commercial Sector Electricity Sale (2013-2023)

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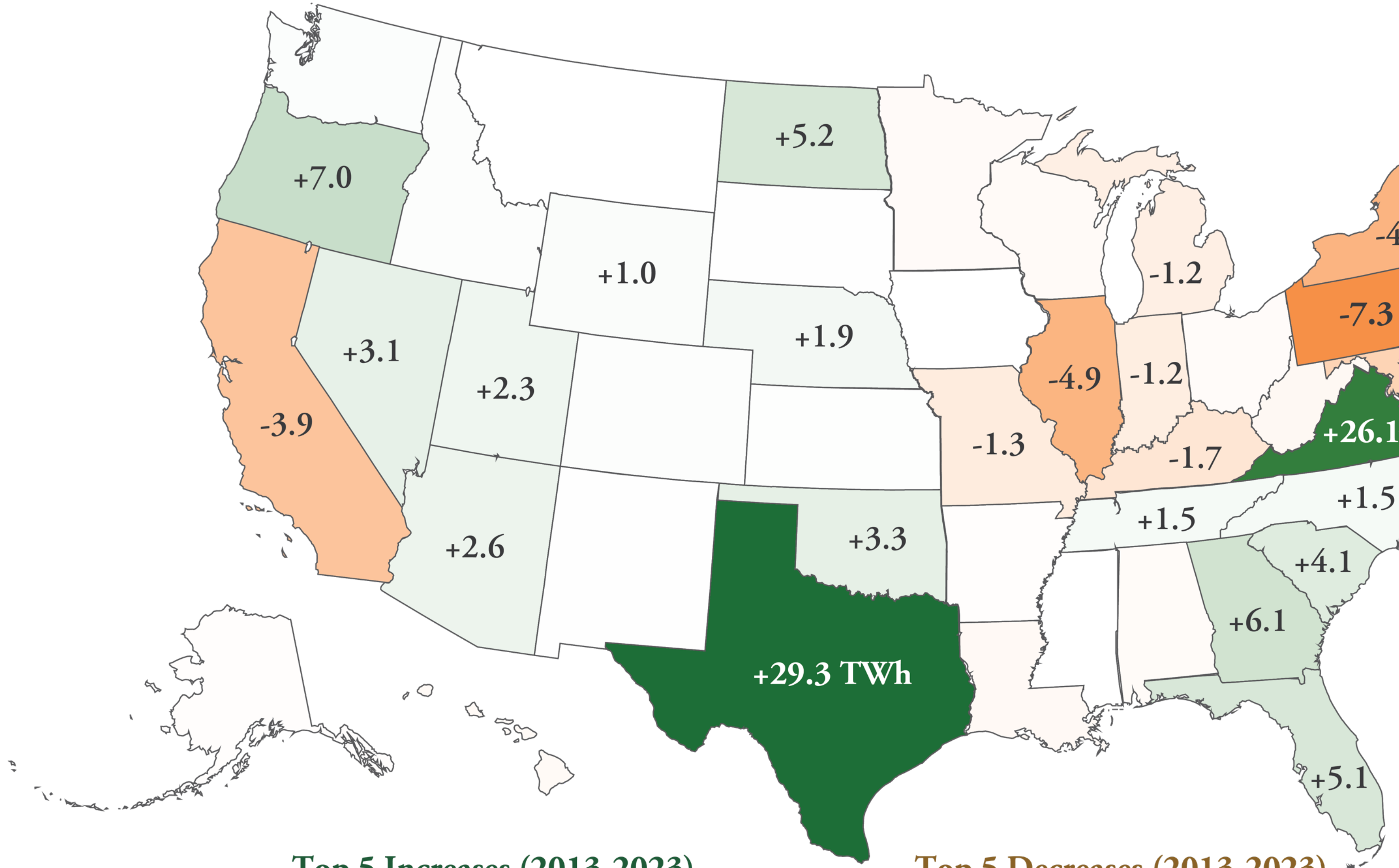
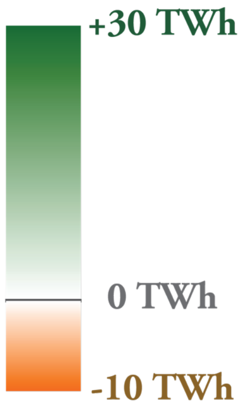




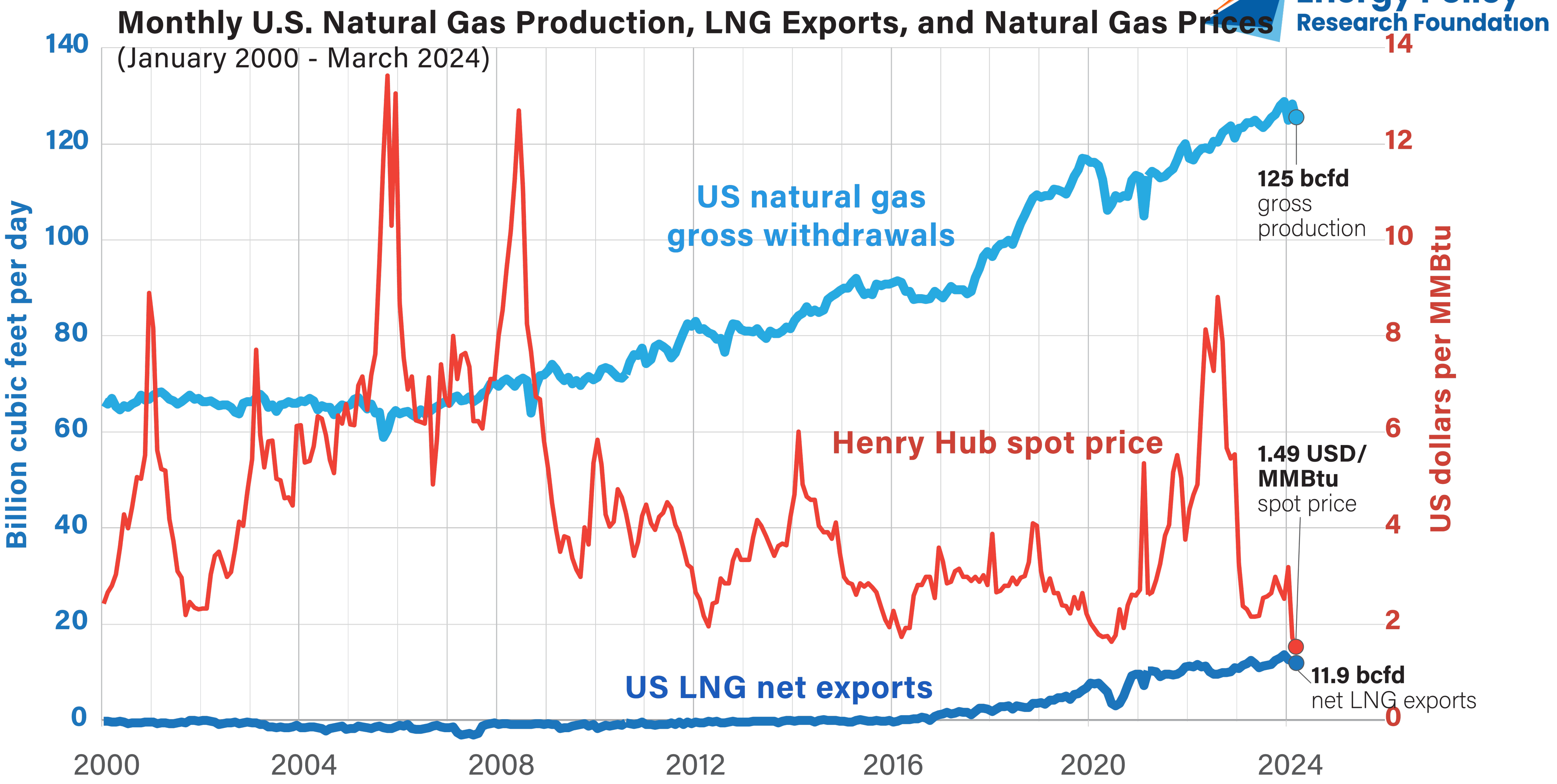
Top 5 Increases (2013-2023)

1.	Texas	+29.3 TWh
2.	Virginia	+26.1 TWh
3.	Oregon	+7.0 TWh
4.	Massachusetts	+6.6 TWh
5.	Georgia	+6.1 TWh

Top 5 Decreases (2013-2023)

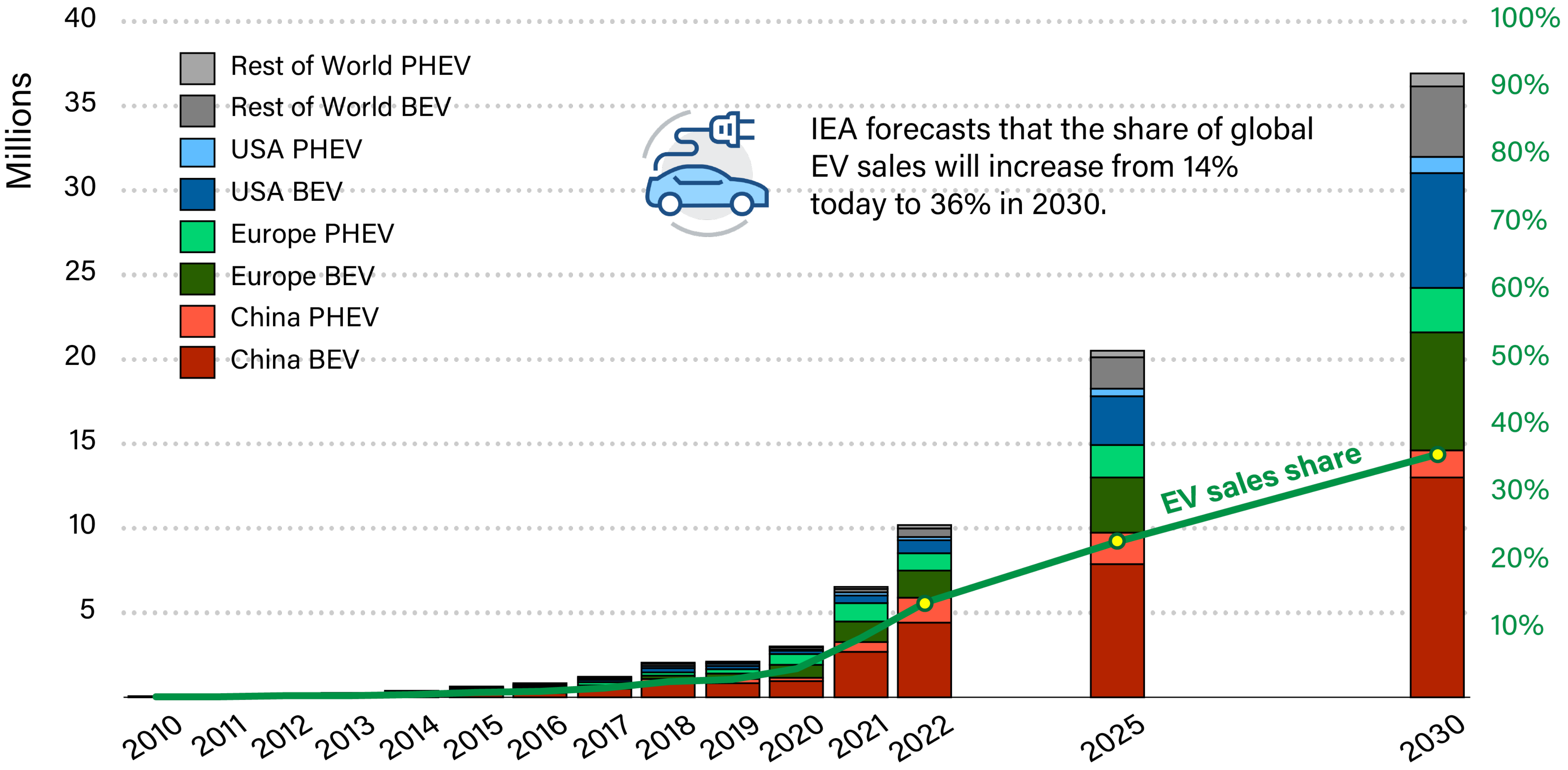
1.	Pennsylvania	-7.3 TWh
2.	New York	-4.9 TWh
3.	Illinois	-4.9 TWh
4.	California	-3.9 TWh
5.	Maryland	-2.9 TWh

Data: US EIA



Source: EIA, Energy Policy Research

IEA EV Outlook: Historical and Projected EV (Cars) Sales



Source: Energy Policy Research's analysis of IEA EV Outlook 2023

Data Centers, Internet, Crypto…

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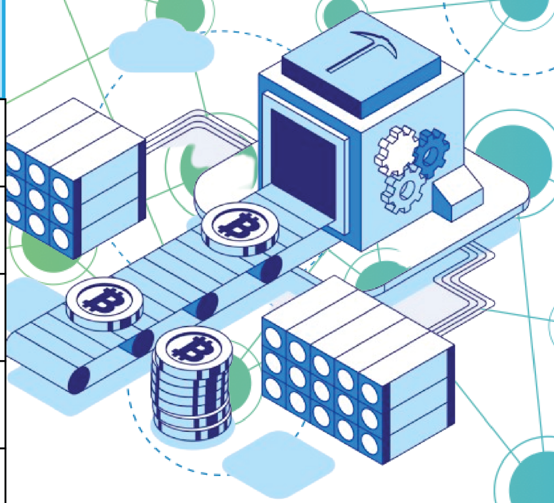
Top 10 electrcity consumers in 2022 (TWh)	
1. China	8,849
2. US	4,548
3. India	1,858
4. Russia	1,167
5. Japan	1,034
6. Brazil	677
7. Canada	660
8. S. Korea	620
9. Germany	577
10. France	468



Energy consumption in 2022 (TWh): IEA estimate	
Data centers	240-340
Data transmis-sion networks	260-360
Crypto mining	100-150
Total	**600-850**

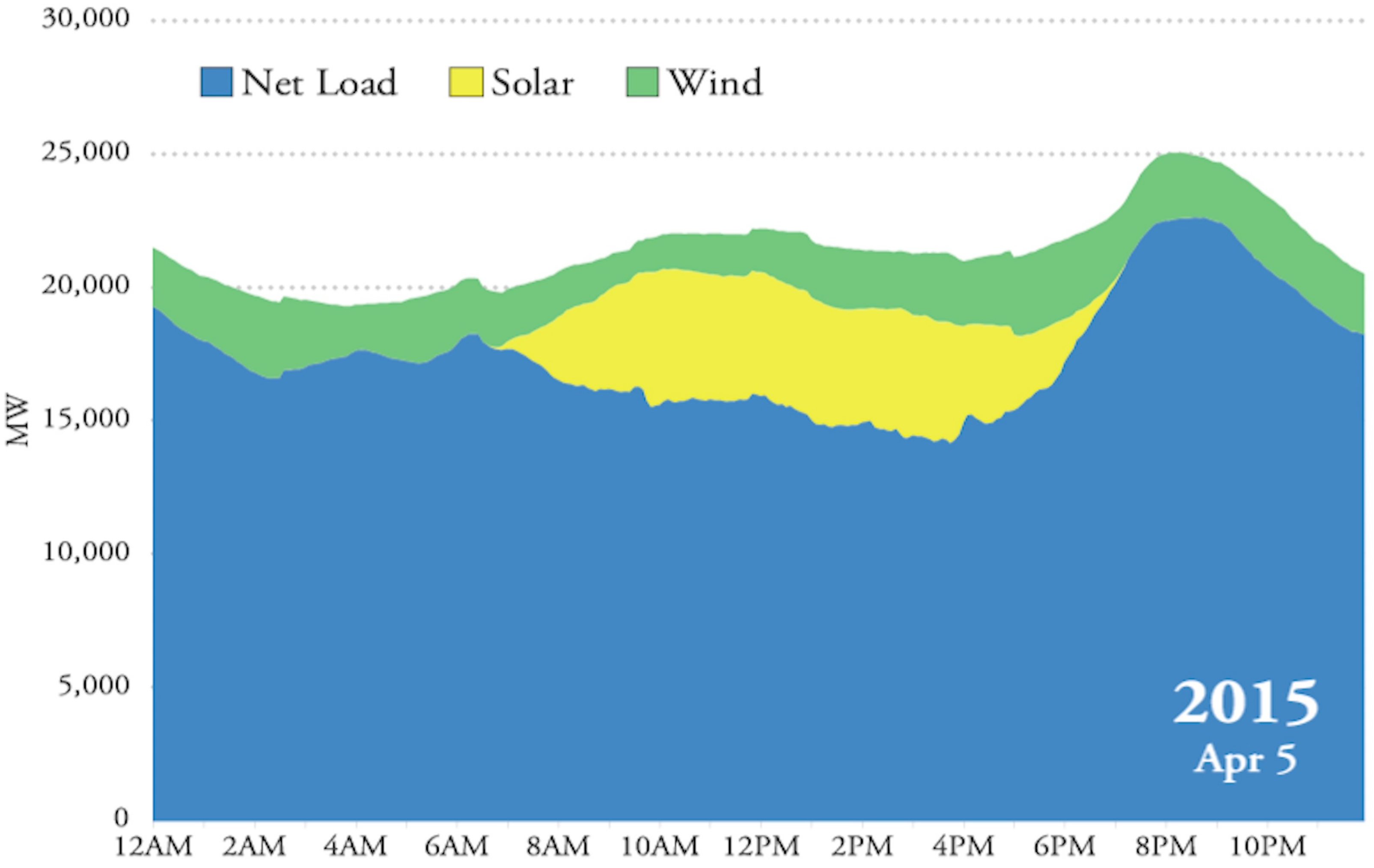
#6

The combined electricty demand of data centers, data transmission networks, and crypto mining, when compared with countries.

Data: IEA, BP

From Duck Curve to Canyon Curve

CAISO's lowest annual net load day (2015-2023)



Source: California ISO, Energy Policy Research Foundation

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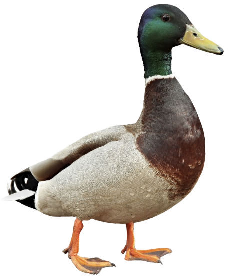
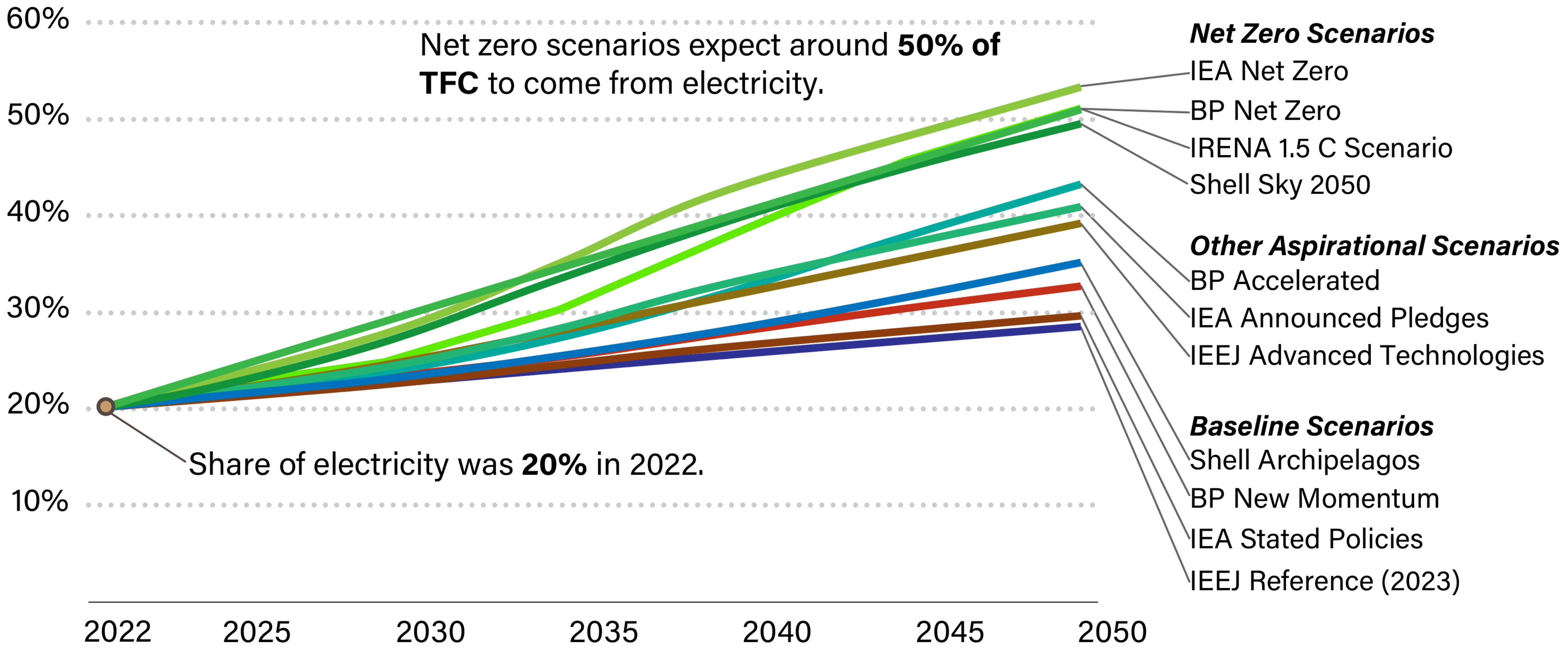
New challenges per CAISO:

- Short, steep ramps
- Oversupply risks
- Decreased frequency response



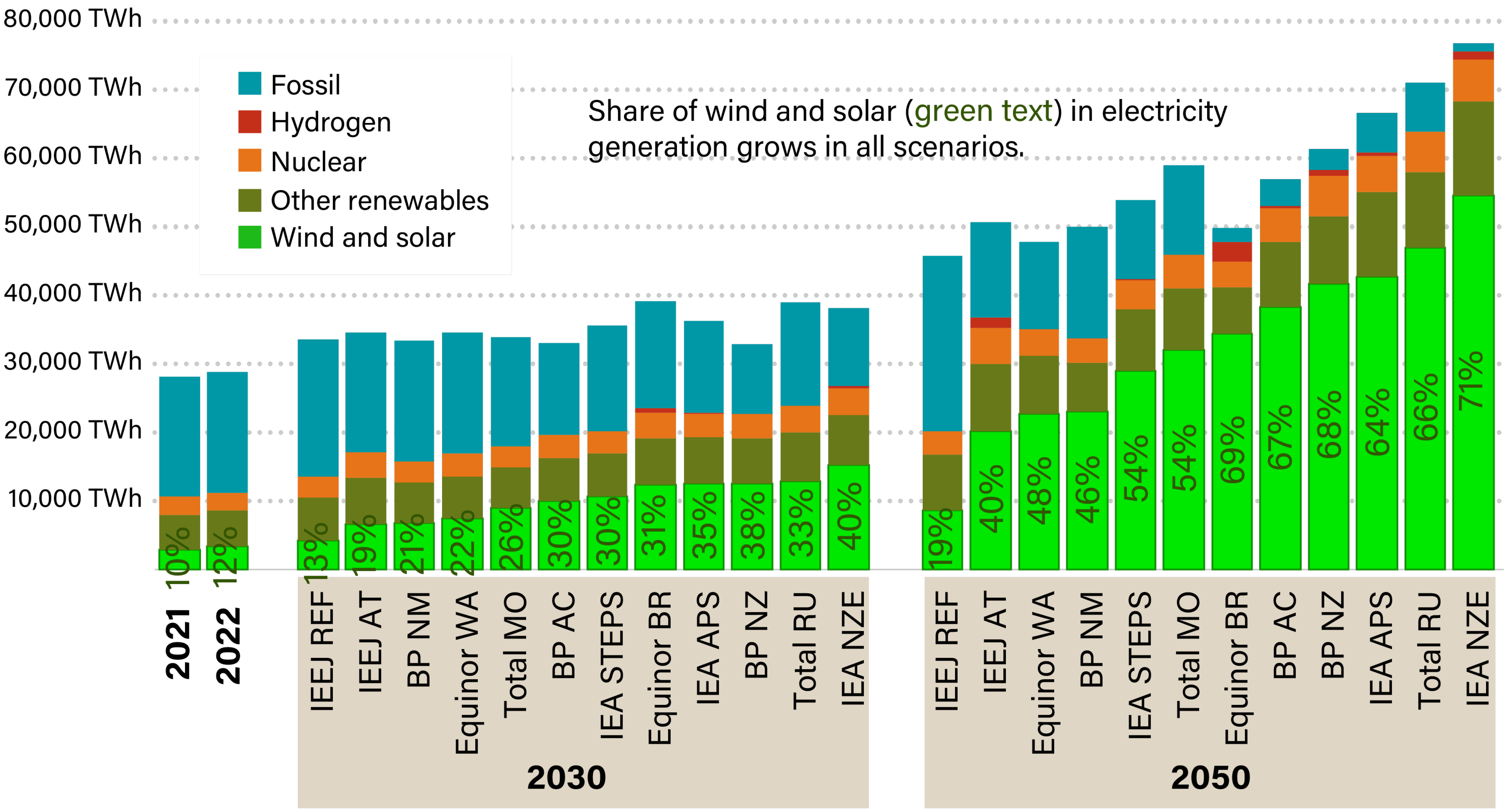
Share of Electricity in Total Final Consumption



Source: Energy Policy Research based on most recent outlooks (except IEEJ) as of Nov 2023

Global Electricity Generation by Source

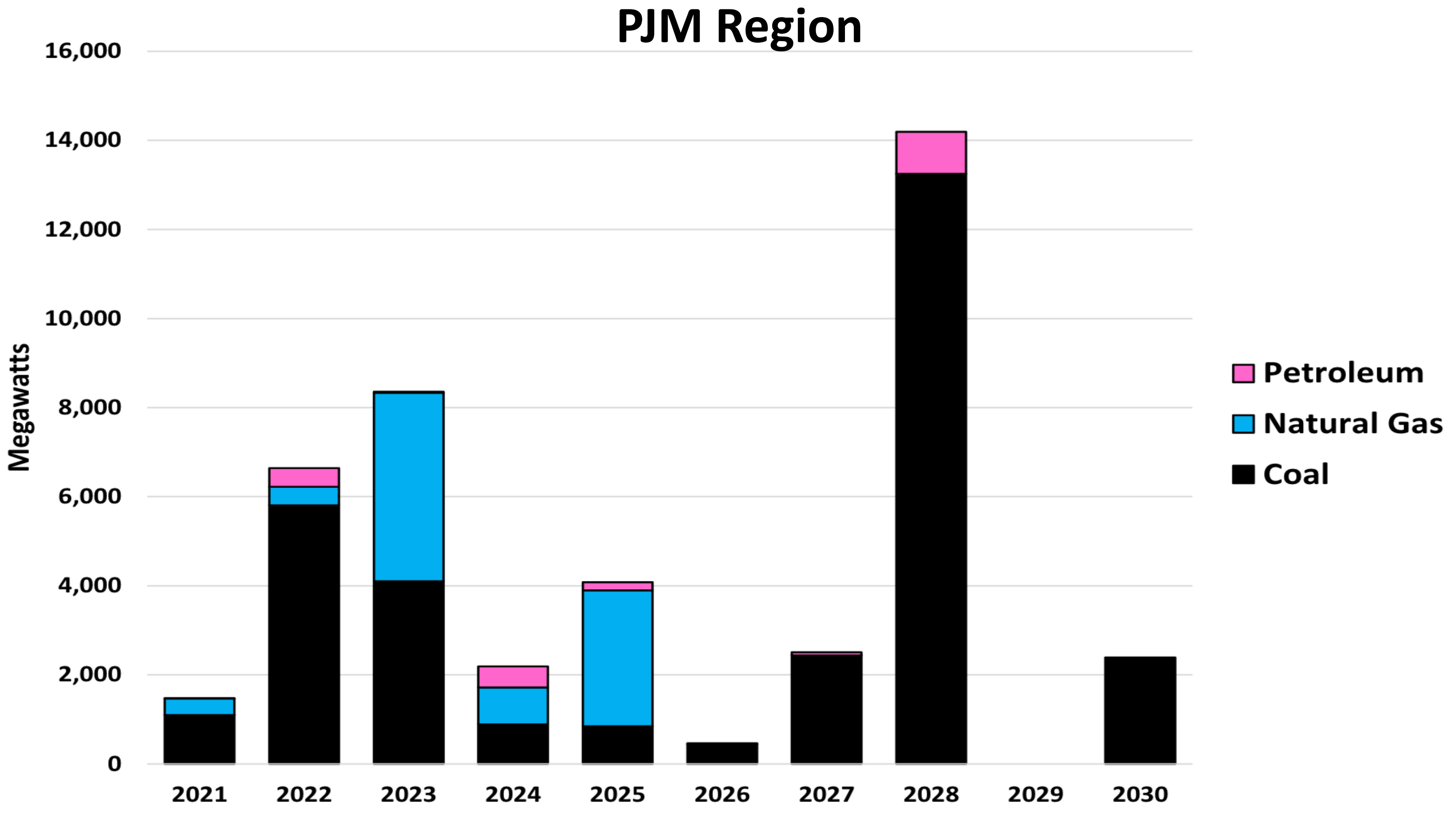
Energy Policy Research Foundation



Source: Energy Policy Research based on most recent outlooks (except IEEJ) as of Nov 2023

Figure 3

Retirements of Dispatchable Power Pose Serious Risks to Power Systems

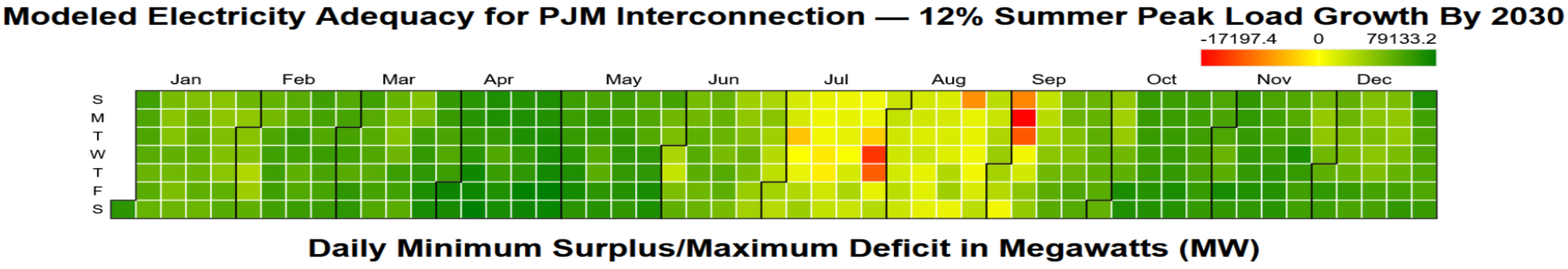


Source: Resilience Foundation, US EIA. See:
https://www.resilientsocieties.org/uploads/5/4/0/0/54008795/blackouts_predicted_presentation_for_nasuca_on_june_10_2024_as_shown.pdf

Figure 4

Requirements for AI, Data Centers, Advanced Manufacturing Will Require Substantial Additions of Reliable, Low-Cost Electric Power

PJM—12% Summer Peak Load Growth by 2030



For the modeled "High Entry" scenario in PJM Interconnection, expected generation capacity and imports minus demand (also subtracting necessary reserves) is estimated to be -17,197 megawatts, 10.2% below demand, at the critical hour of 5 PM EST on September 5.

For all of the 365-day Demand Profile, the estimate is 41 Loss of Load Hours (LOLH) over 10 days and 250,566 megawatt-hours of Expected Unserved Energy (EUE).

Source: Resilience Foundation, US EIA. See: https://www.resilientsocieties.org/uploads/5/4/0/0/54008795/blackouts_predicted_presentation_for_nasuca_on_june_10_2024_as_shown.pdf