BRATTLE ECONOMIC ANALYSIS OF CLEAN ENERGY TAX CREDITS - PREPARED FOR CONSERVAMERICA

A Wide Array of Resources is Needed to Meet Growing U.S. Energy Demand

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Disclaimer, Approach, and Qualifiers

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APPROACH

Analyze the economic impacts of potential full removal of Clean Electricity Production Tax Credit (PTC) from §45Y and Investment Tax Credits (ITC) from §45E, affecting all new solar, wind, and storage coming online after 2025, all else equal.

Electricity demand is forecasted by compiling regional and utility forecasts from 2024.

Electricity supply and costs are modeled using a standard electric sector "capacity expansion" model.

- A Brattle proprietary best-in-class model, gridSIM
- Calibrated to today's fleet/prices/plans
- Simulates the future with least-cost investment and plant operation to meet currently-forecasted demand, given resource options and their costs with or without clean energy credits
- Accounts for transmission constraints, limited buildout by technology and geography accounting for land use, supply chain, and transmission interconnection pace
- Assumes states w/ clean energy mandates abide by them, but not EPA GHG rules under CAA §111

The broader effects on the economy (GDP, jobs) are modeled using a standard macroeconomic model.

- A Brattle proprietary model, BEYOND
- High-level representation of all sectors and regions: how they interact and change given electric sector impacts
- Uses standard inputs from open-source government data

QUALIFIERS

Focuses on most prevalent supply resources for meeting demand, understating the role increased energy efficiency and demand response can play; also does not quantify effects on less prevalent/ immediate recipients of credits, such as geothermal, mechanical storage, and new nuclear

Modeling optimistically assumes all new demand still enters even at higher electricity cost absent electricity credits, although the discussion addresses the possibility of not meeting all of that growth

Does not account for clean air benefits of clean energy credits

Does not account for technology development benefits furthered by development incentives for wind, solar, and storage that are less mature and still improving significantly in cost and performance

This is a "gross" economic analysis that does not account for economic benefits of alternative uses of tax dollars, deficit reduction, or taxpayer savings if clean energy credits were removed

Specific benefits are uncertain due to uncertainties in market and system conditions - such as demand growth, gas prices, resource costs, the pace of generation interconnection, and supply chain limits; results should be considered indicative

Executive Summary

Electric energy demand in the U.S. is expected to increase 50% over the next decade (and annual peaks by 30%), and a wide variety of resources is needed to support that and the associated economic growth; renewables and storage are ready now

A portfolio of all forms of energy resources can meet demand reliably and most cost effectively, but not all are available today

- Solar and wind are ready now at lowest cost
- Battery storage is ready now and provides capacity and quick-start capabilities
- Natural gas provides flexible backup, but with fewer MW currently in development and ~4-5 year development cycle
- Existing nuclear provides baseload; advanced nuclear will take more than a decade to commercialize widely
- Coal is less economic and declining

Source: Brattle's BEYOND model of the US economy, given outputs from gridSIM.
Notes: This analysis does not account for economic effects of alternative uses of tax dollars, deficit reduction, or taxpayer savings in the event that clean energy credits are removed. GDP and consumption values are expressed in $2024 dollars.

Elimination of clean energy credits would raise customer rates, reduce economic growth and eliminate jobs

- Average annual residential bill would increase
- GDP and jobs would decrease because of higher electricity rates and less construction, mostly in rural areas

Eliminating or altering clean energy credits would dramatically reduce investment in low-cost solar and wind generation, hurting economic growth

- Solar and wind investment through 2035 would be 50% lower, along with some decrease in storage
- Limited additional gas-fired generation is available until early 2030s, creating potential for a shortfall of supply to meet power need

Economic growth would be limited

American Demand for Power is Growing

Realizing economic growth will depend on how quickly new electric generation capacity can be added

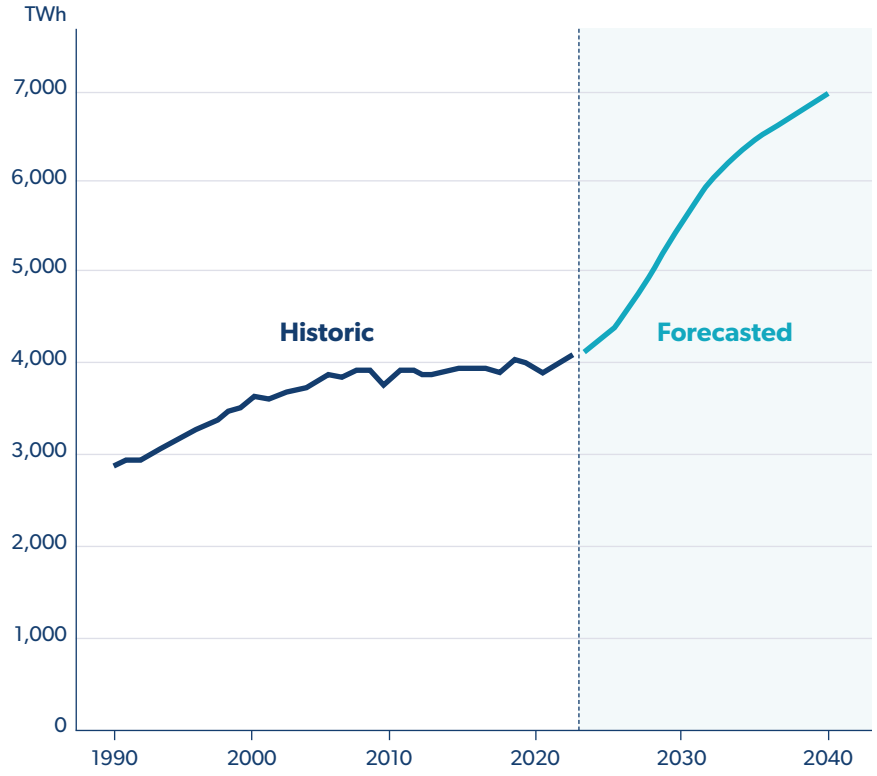
Electricity demand is surging to support an economic boom

- Data centers for AI
- Manufacturing reshoring
- Electrification of industry and other uses
- Growing oil and gas extraction

Serving this growth requires a lot more supply

- Peak demand growth rates exceed 5x that of the past decade
- By 2030, the U.S. will need to serve 20% higher annual peak or 150 GW
- By 2035, the peak will grow by 30%

By 2035, the U.S. will need 50% more annual electric energy production than today



Sources: a compilation of 2024 RTO and utility load forecasts for their own territories

All Supply Sources Are Needed to Meet Growing Demand Effectively

A wide array of resources is needed to provide enough power reliably and cost effectively

Nearly 2,000 GW of wind, solar, and storage projects in transmission interconnection queues

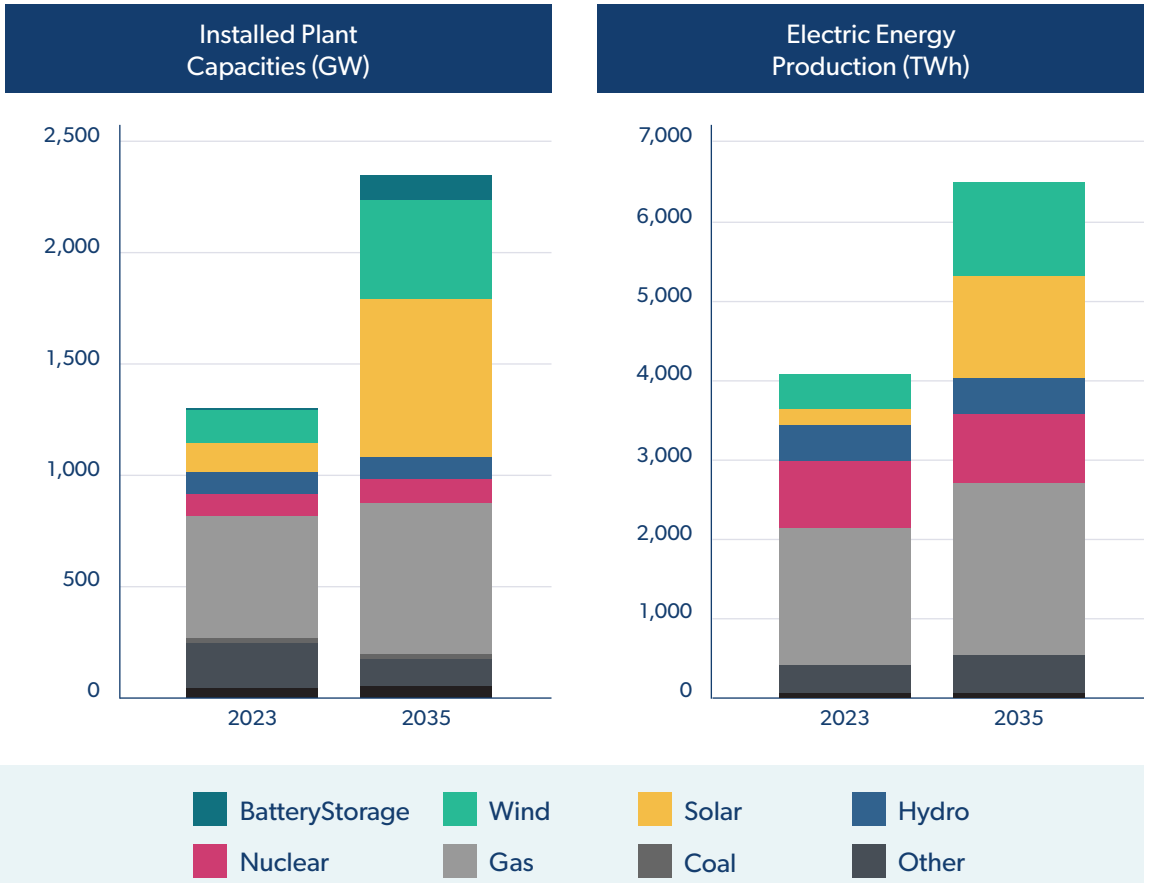
- Not all will be built, but a lot can be
- Even though these are intermittent or energy-limited, they produce a lot of low-cost energy and help meet demand growth

Much less gas fired generation is under development due to years of slow demand and limited turbine supply

- It will take years for the supply chain to develop and years for plants to be permitted, built and operational

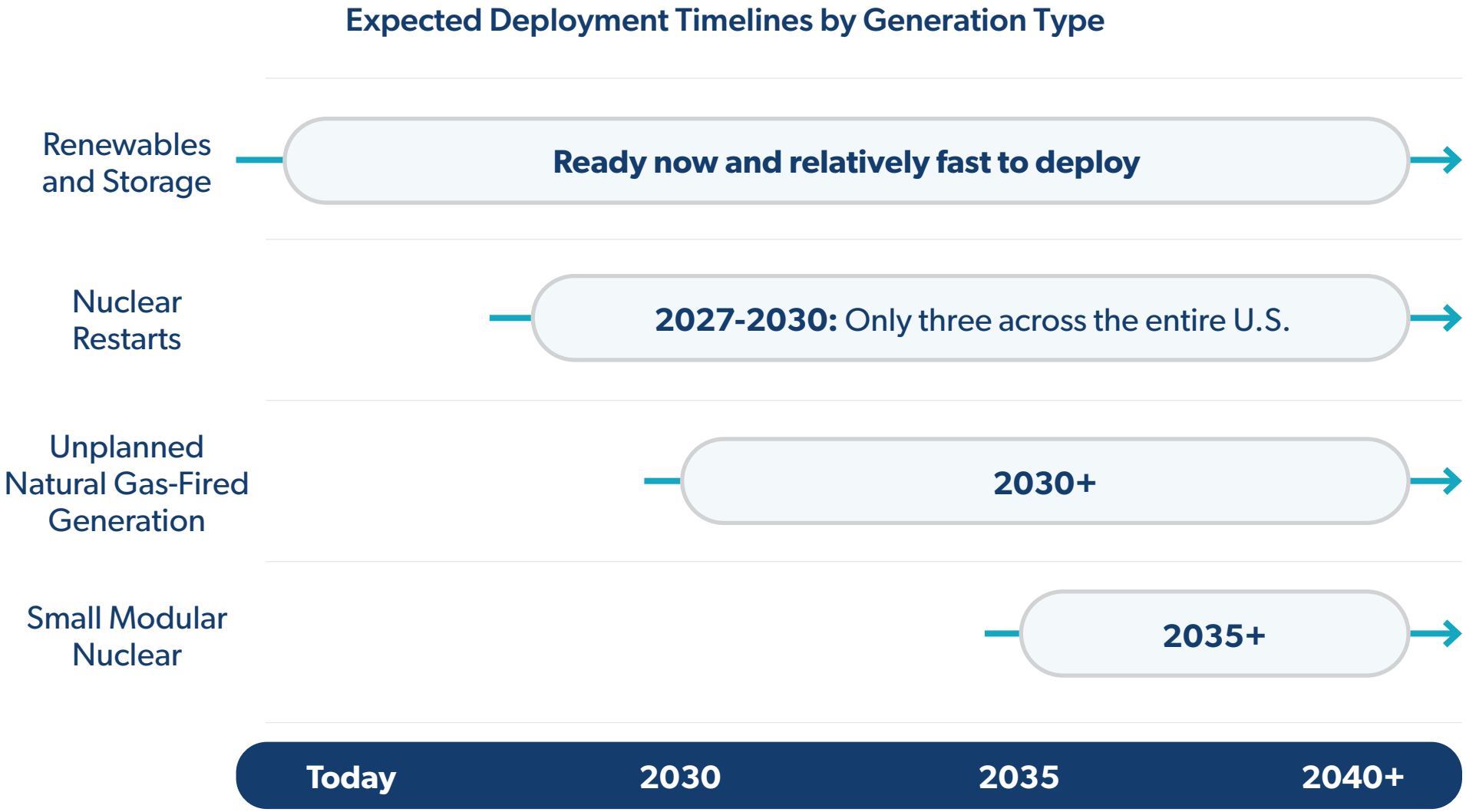
Current and Future Energy and Capacity

with current law and projected market conditions



Source: Brattle simulations of U.S. electricity investment and operations using gridSIM model, populated from EIA and other data sources

Solar, Wind and Storage Projects Are Already in Development and Can Meet Demand Now – Other Resources Are Available in Later Years

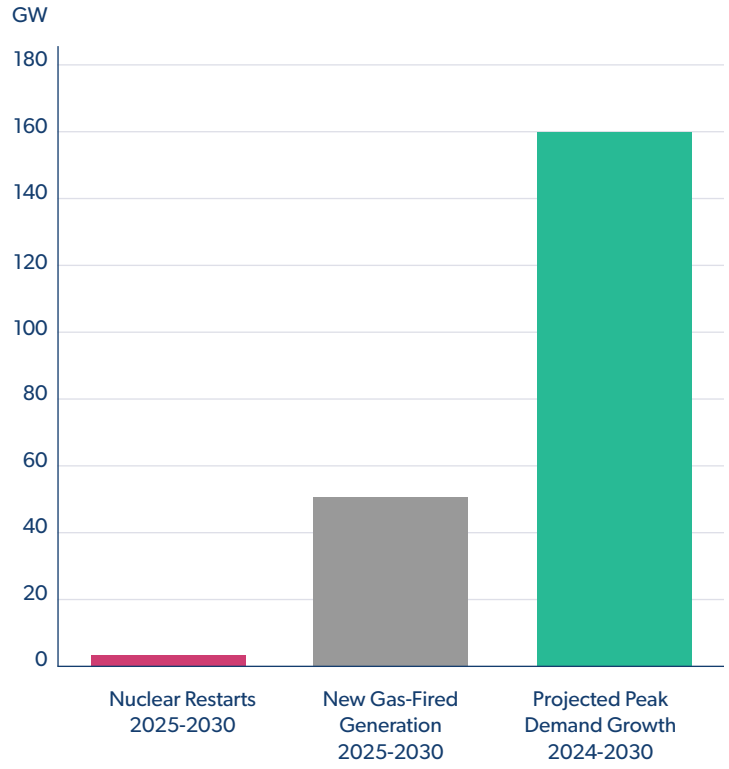


Note: all new supply has been facing multi-year interconnection studies and network upgrades. Wind, solar, and storage projects are ahead of many other resources in that process.

Because of a Number of Factors, Gas and Nuclear Alone Cannot Meet Projected Demand Growth in the Near Term

- Long lead time for gas turbines
- Prolonged development and construction timelines
- Increasing price of gas turbines
- Transmission queues and delays
- Very long lead time for new nuclear

New-Build Gas-Fired Generation and Nuclear Restarts Likely Insufficient to Meet Projected Peak Demand



Source and notes: Rough estimate of max gas-fired additions derived from statements from turbine manufacturers; does not include uprates to existing plants; Projected peak demand growth calculated from compilation of RTO and utility forecasts; does not account for the need to replace retirements.

Loss of Clean Energy Credits Would Dramatically Reduce Investment in American Energy Infrastructure

Solar and wind development would diminish markedly

- 50% less solar and wind would be built by 2035
- Reduces supply of low-cost energy and the main generation in development that is available now to meet growing power demand

New unplanned gas generation not built until roughly 2030+

Overall, capital investment would decrease, power prices would rise and consumers would be impacted

- $520 billion[1] less solar and wind investment through 2035 absent clean energy credits
- Power demand customers would still need generation, but without credits, they would pay higher prices
- As a result, the average American's electric bill would increase
- Risk of limiting growth of industry that demands much electricity

Estimated Impacts on New Investment in New Plants (GW)

	2026-30	2031-35	Total
Solar			
With Tax Credits	145	405	550
Without	121	121	242
Impact	-23	-284	**-308**
Wind			
With Tax Credits	181	73	254
Without	88	29	116
Impact	-93	-44	**-137**
Storage			
With Tax Credits	71	35	106
Without	83	17	100
Impact	12	-18	**-6**
Gas			
With Tax Credits	56	81	137
Without	56	124	180
Impact	0	43	**43**

1. Values are cumulative nominal undiscounted dollars.

Electricity Costs Would Increase for All American Consumers

By 2035 loss of tax credits would increase going-forward generation system costs by 14% and be passed on to all American consumers

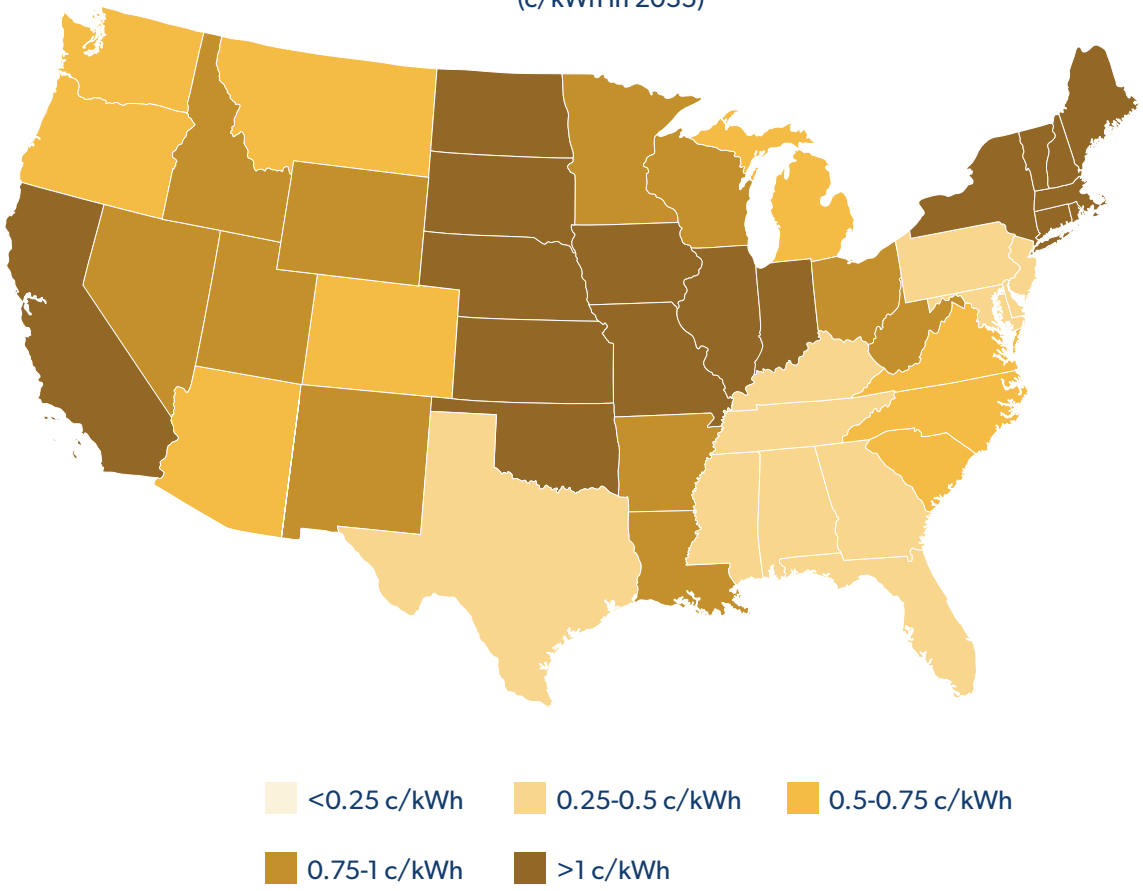
Residential electric bills would increase by an average of $83 per year, and as much as $152 per year in seven states[1].

Much like other energy costs, these rate impacts will place a heavier burden on lower and middle-income households

Year	Customer Costs (all classes)	Average Rates
2030	↑ **$26** Billion/Year	**+0.5** c/kWh
2035	↑ **$51** Billion/Year	**+0.8** c/kWh

Customer Electricity Cost Increases if Remove Clean Energy Credits

(c/kWh in 2035)



Source: Brattle's gridSIM simulations

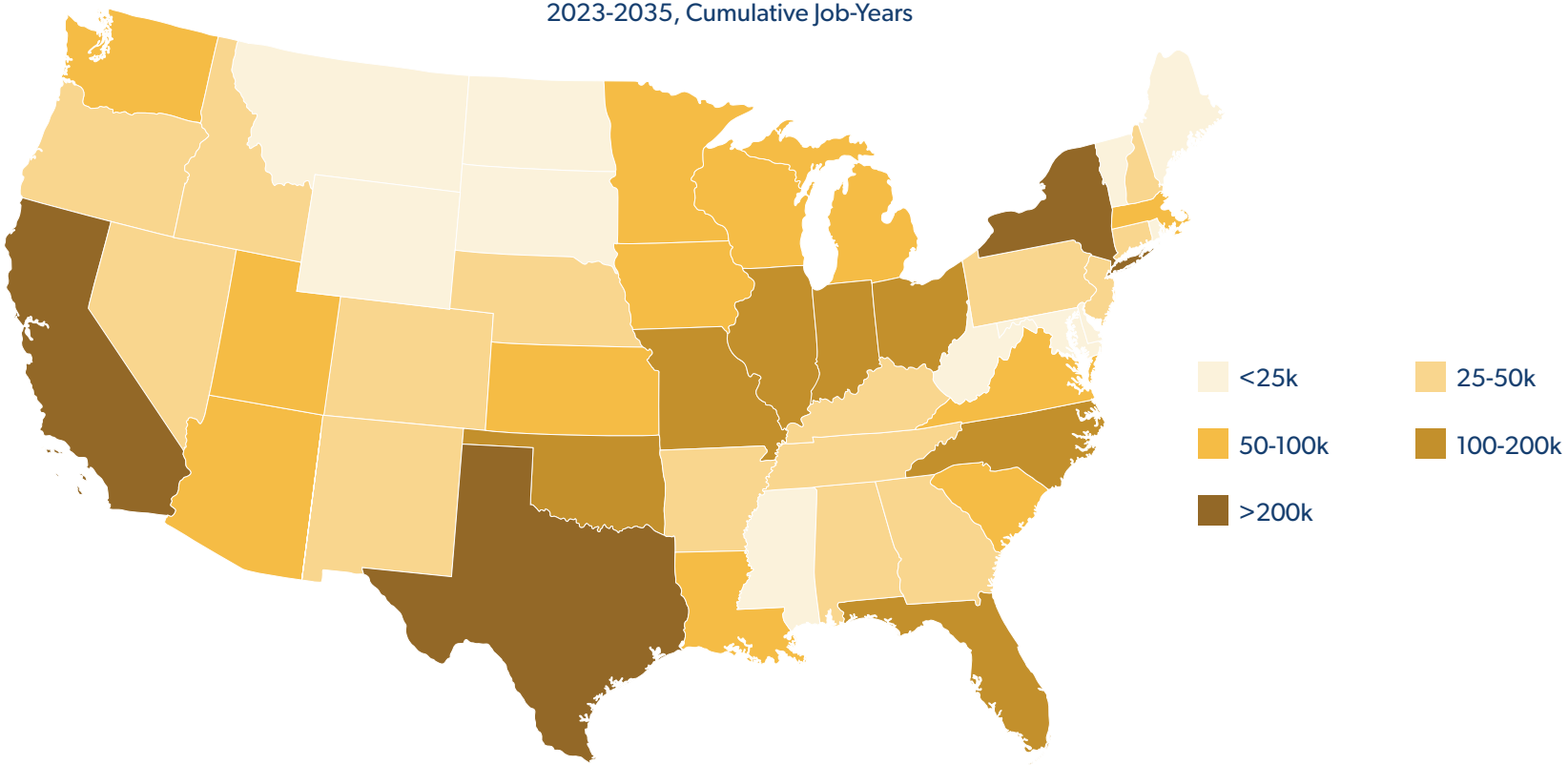
1. The seven states with the potential increase of up to $152 per year are North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Iowa, and Missouri due to their high wind capacity.

...And Eliminate Jobs Across the Country

3.8 million jobs-years lost cumulatively throughout the economy through 2035 as employers spend more on electricity, capital investment declines and higher electricity rates impact consumer spending in other sectors; or worse if tightened electricity supply limits growth of industry that depends on electricity supply expansion

Employment Impacts from Loss of Clean Energy Credits

2023-2035, Cumulative Job-Years



Source: Brattle's BEYOND model of the US economy, given outputs from gridSIM.
Notes: This analysis does not account for economic effects of alternative uses of tax dollars, deficit reduction, or taxpayer savings in the event that clean energy credits are removed.

...And Depress U.S. Economic Growth

Higher electric rates and the loss of solar/wind projects would affect the broader economy

Cumulatively from 2025 through 2035, under the optimistic assumption that all forecast demand growth will still be met, estimated economic impacts are:

Direct spending in the power sector: -$250 billion

- Almost 450 GW less renewables would be built, mostly in rural communities

GDP: -$510 billion

- Production would decrease due to less construction, higher electricity bills crowding out spending on other goods and wages, and less tax revenue
- Impacts would be felt throughout the economy

Household consumption: -$270 billion

- Higher household electricity bills, reduces spending on other goods
- Economic contraction (described above) results in lower household income

Source: Brattle's BEYOND model of the US economy, given outputs from gridSIM.
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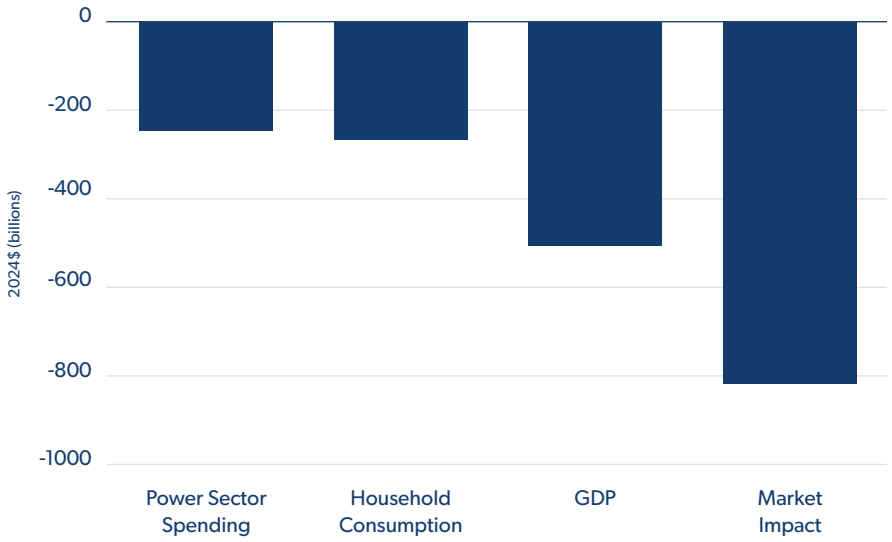
GDP and consumption values are expressed in $2024 dollars.

Economic Impacts of Removing Clean Energy Credits

2025-2035, Cumulative Billions in 2024 dollars



This metric differs from the others by describing the change in all goods and services transacted through all value chains including inputs and intermediates; it includes power sector spending and household consumption but relates to GDP more indirectly.

Total market impact: -$820 billion

- This is the change in all goods and services transacted throughout all value chains, including inputs and intermediates, not just final products

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