

U.S. DEPARTMENT OF
ENERGY

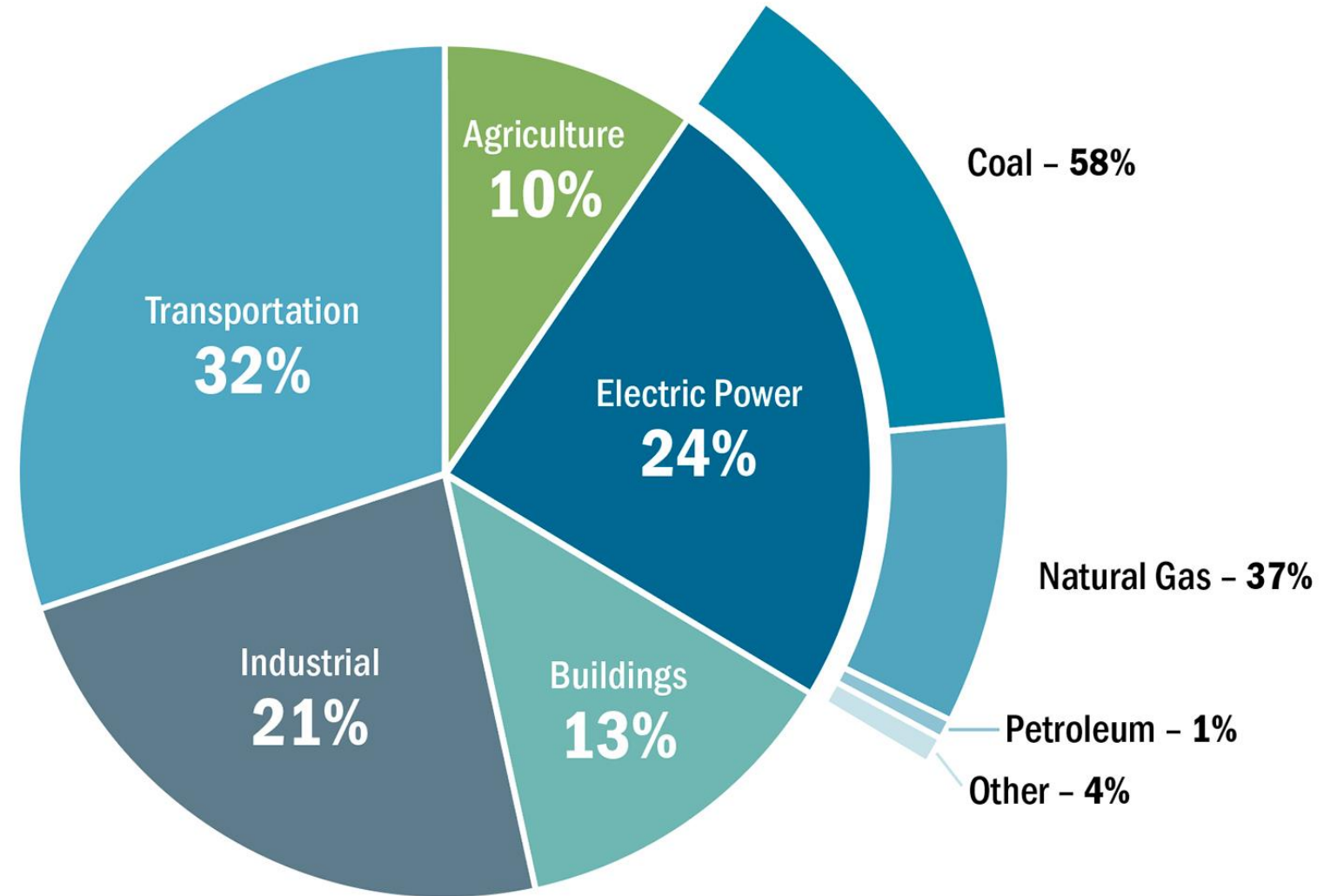
Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

WHY INNOVATION IN RENEWABLES (STILL) MATTERS

US DEPARTMENT OF ENERGY



Emissions from Electricity Supply

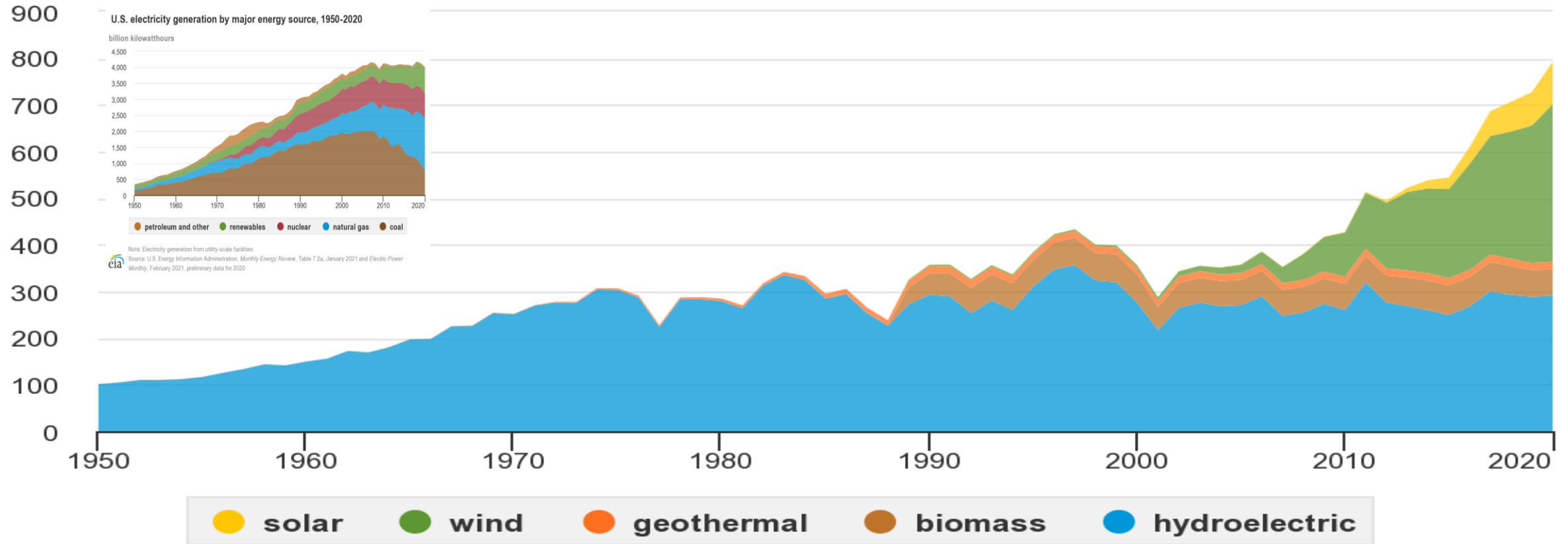


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RE in the Current Generation Mix

U.S. electricity generation from renewable energy sources, 1950-2020

billion kilowatthours



Note: Electricity generation from utility-scale facilities. Hydroelectric is conventional hydropower.

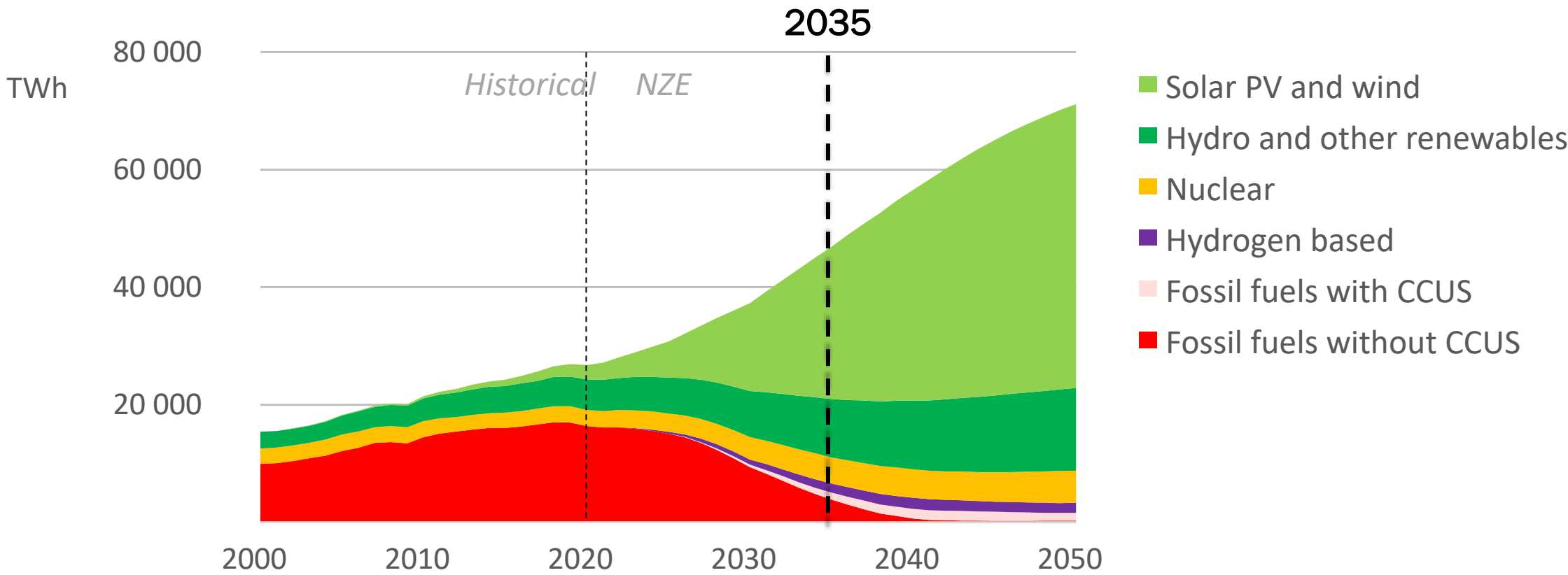
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 7.2a, January 2021 and *Electric Power Monthly*, February 2021, preliminary data for 2020

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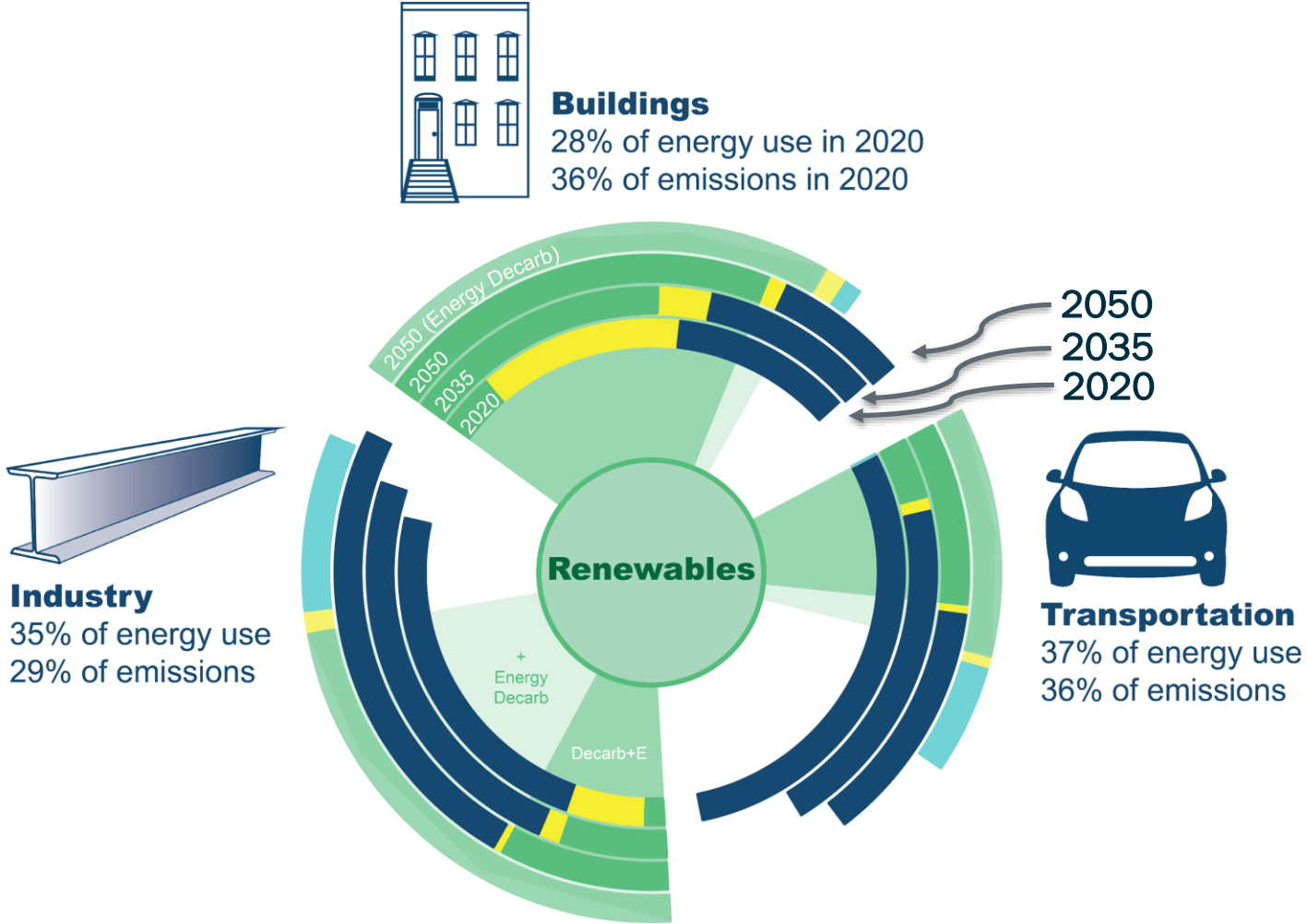
And must continue to expand 2035-2050 to reach net zero

Global electricity supply, IEA Net Zero Energy by 2050 scenario



In IEA net zero pathway, renewables make up nearly 90% of electricity generation in 2050,

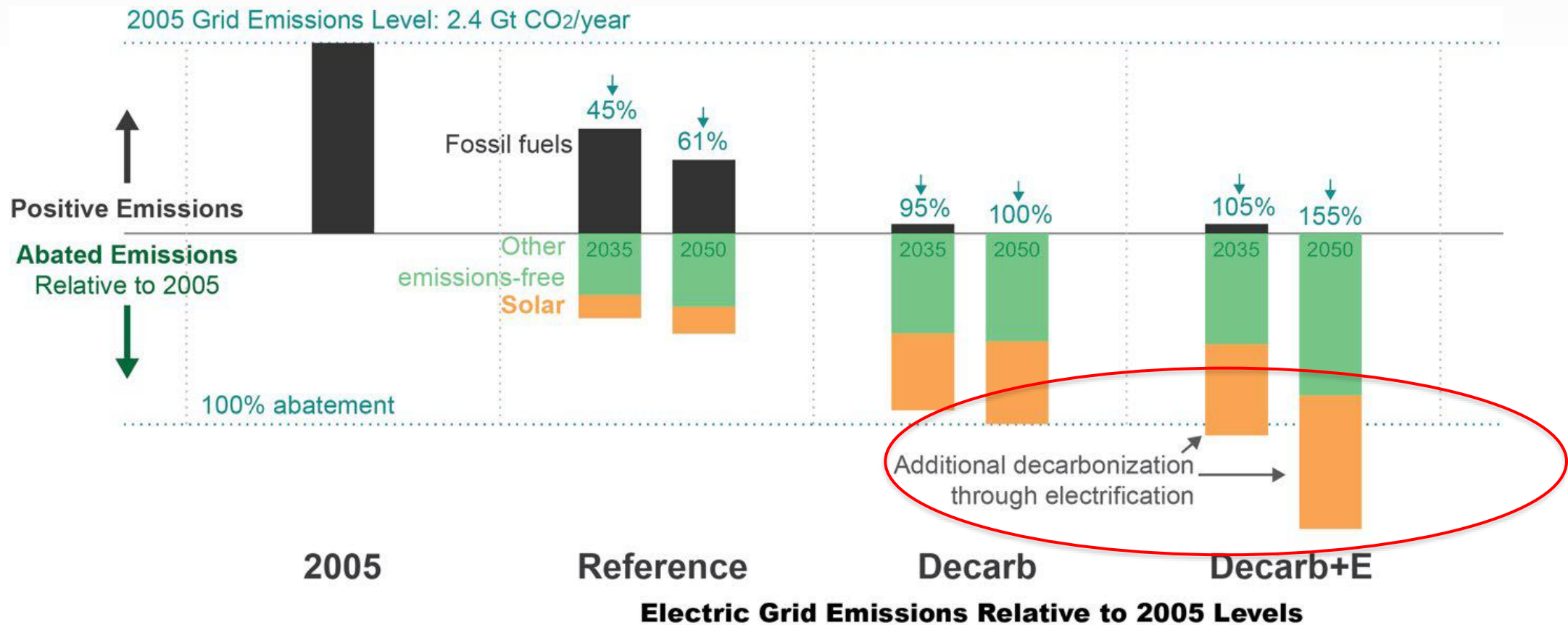
By 2050 Clean Electricity Will Need to Supply Most Energy Needs



Data from NREL Solar Futures Study, 2021

Electrification is critical to decarbonization goals

Aggressive electrification yields an additional reduction of 1.4 Gt Co2/yr by 2050 – the equivalent of over half of all power sector emissions in 2005 – and this is not yet net zero



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Renewable generation must expand dramatically by 2035

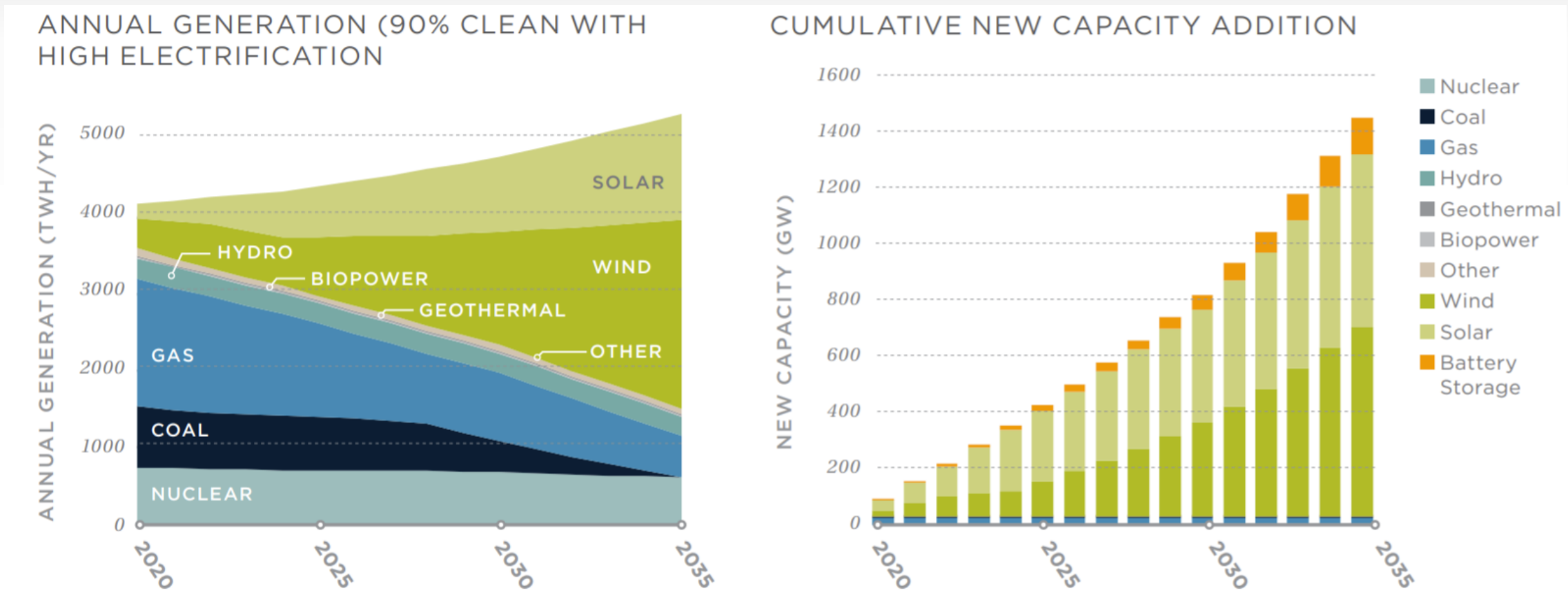


FIGURE 12.

Annual Generation and Cumulative New Capacity Addition (2020-2035), 90% Clean Case with High Electrification

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Overall Priorities in Renewable Power

RDD&D efforts in solar, wind, water, and geothermal power to help **reduce the costs** and accelerate the use and **integration of renewables** in a **reliable, secure, and resilient grid**.



Accelerate Deployment

Accelerate deployment of existing technologies by:

- Addressing market and regulatory barriers,
- Minimizing environmental and social impacts
- Ensuring projects provide equitable and local benefits



Sustain Cost Reductions

Drive continued cost reductions to:

- Ensure renewable energy is a least-cost generation option across the entire country by 2035
- Ensure growth continues to accelerate through 2050 to match newly electrified loads



Increase Resource Flexibility & Diversity

Maximize flexibility and reliability of generation & load through:

- New short and long-duration storage
- Enhance flexibility of variable generation and load
- Ensuring sufficient firm, flexible generation



(Joint with OE)

Support a Modernized Grid

Optimize grid infrastructure & mgmt. to an RE-led system, through:

- Expanded transmission
- Enhanced power system planning, operations, and resilience
- Advanced grid technologies
- Updated regulations and market design



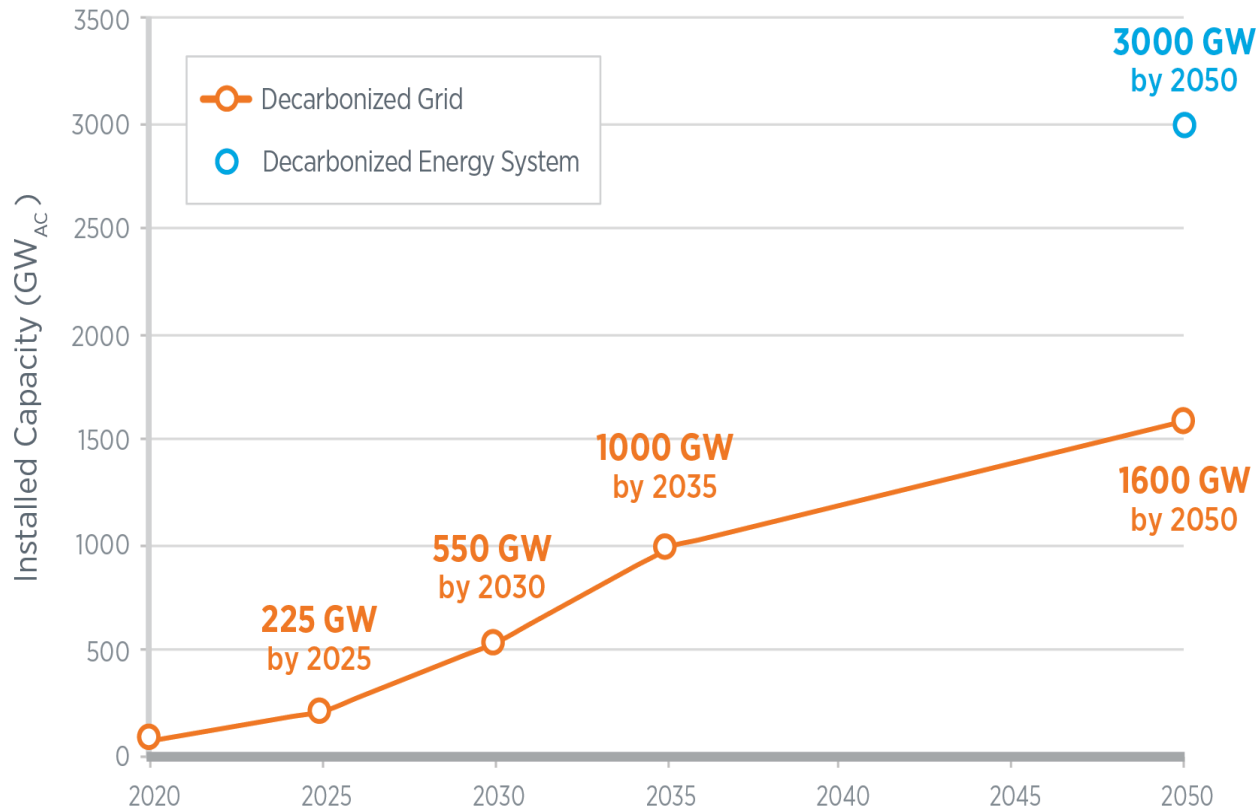
Support U.S. manufacturing and secure supply chains

Ensure renewable energy technologies benefit workers and communities by

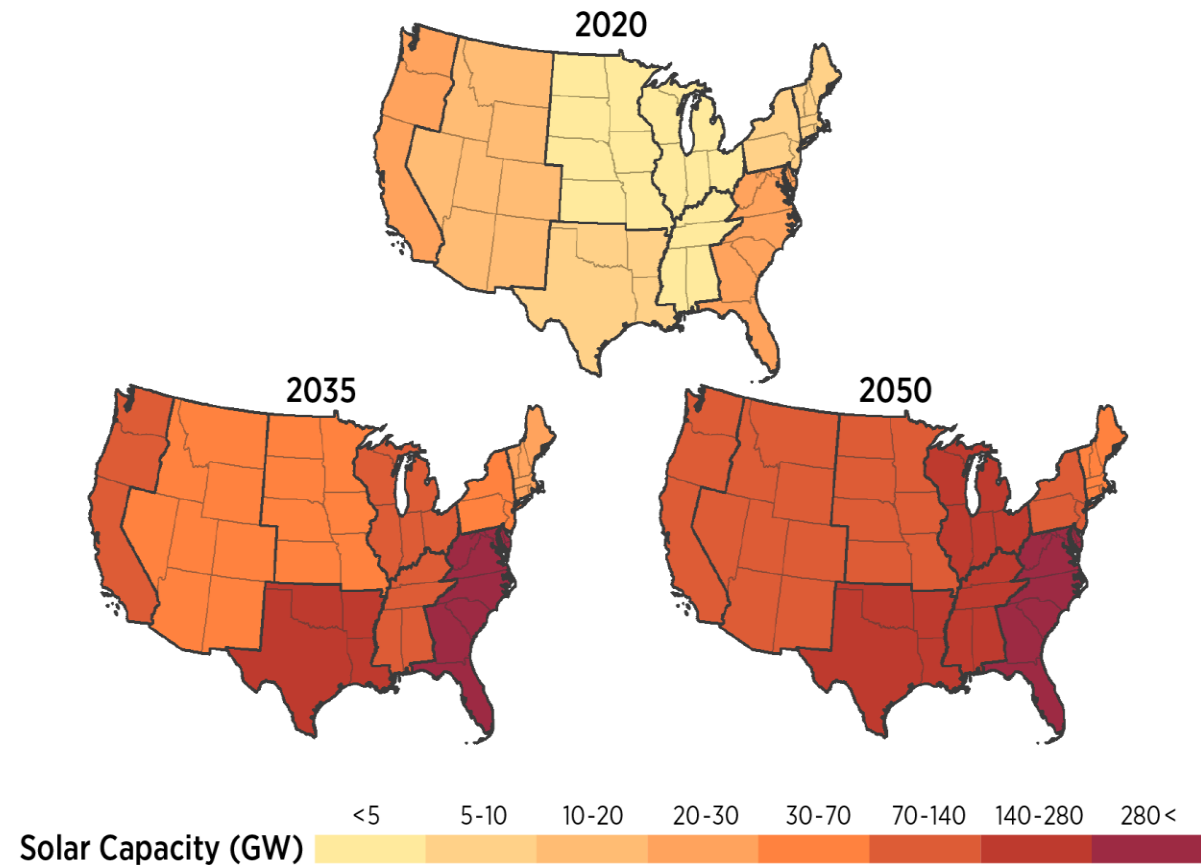
- Supporting clean energy workforce and new careers,
- Ensuring RE revenues and benefits are equitably distributed
- Minimizing life-cycle emissions
- Eliminating dependence on vulnerable or unsustainable materials

Solar Power: Deployment to Meet Net Zero

Solar Deployment 2020-2050

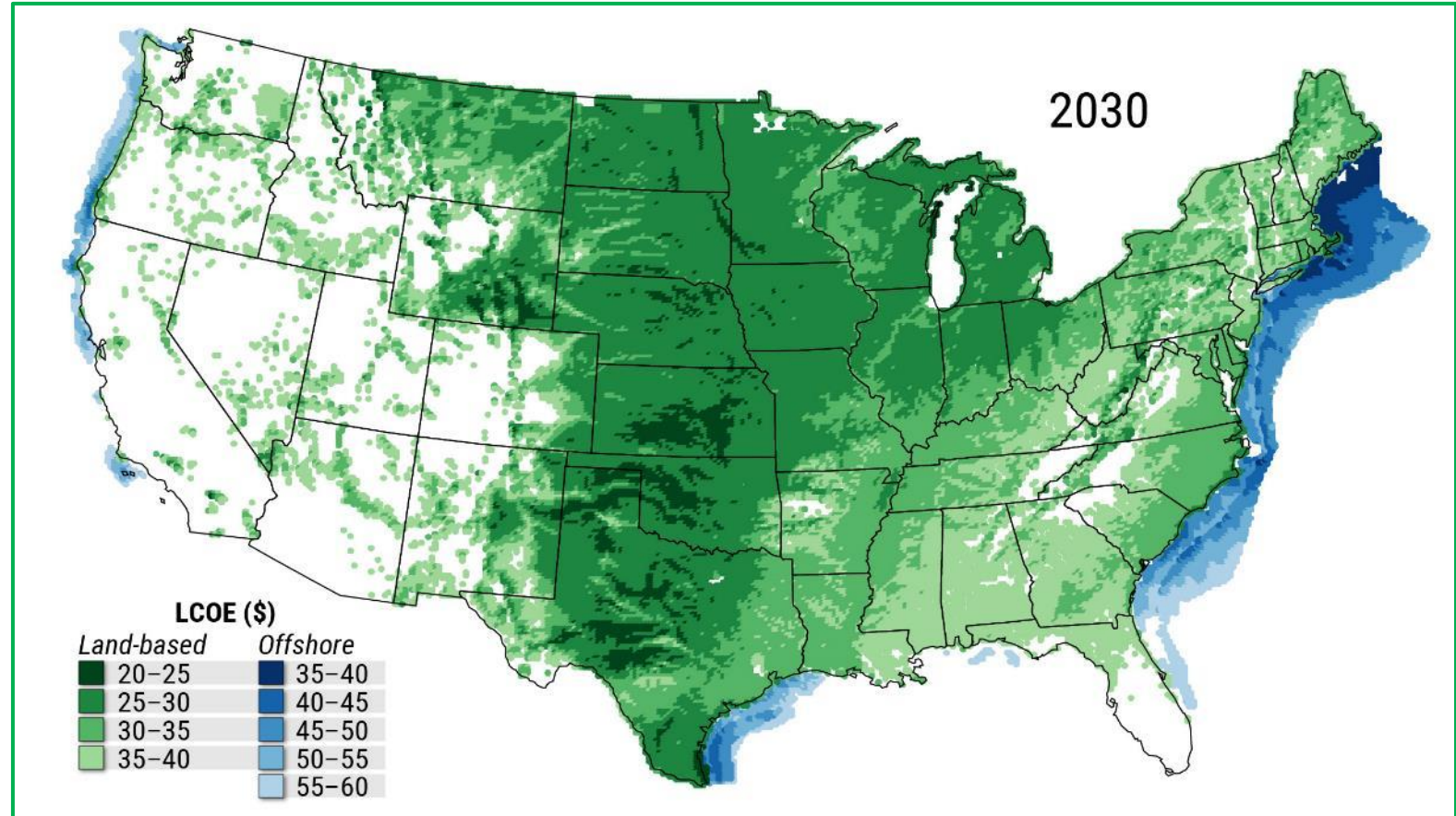
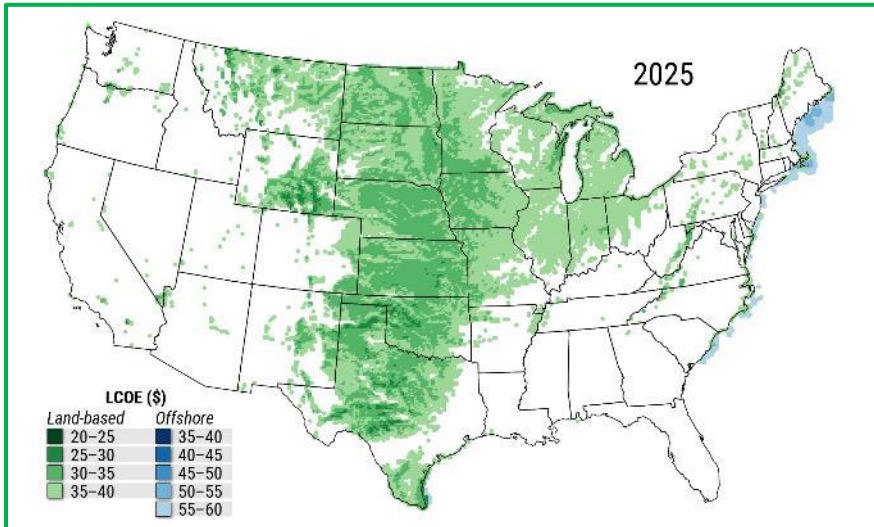
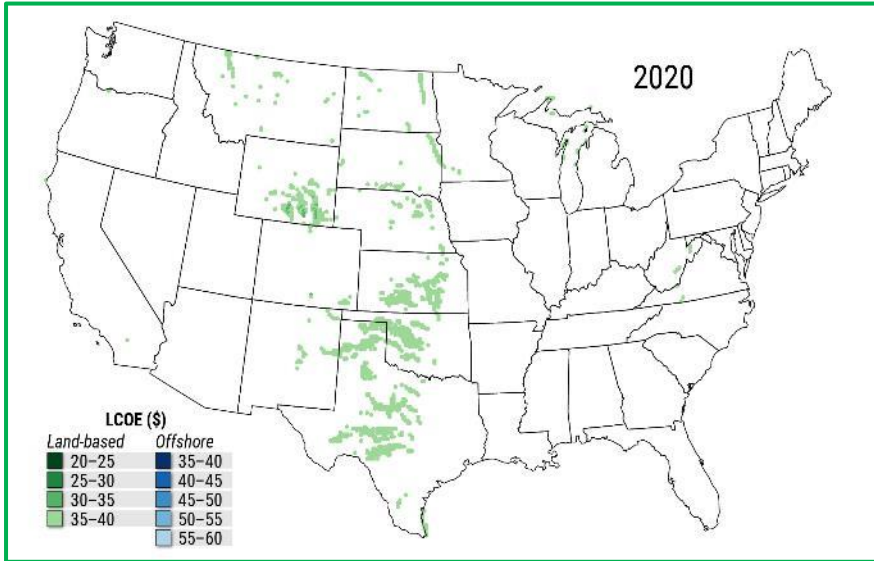


Solar Capacity by Census Division in 2020, 2035, and 2050

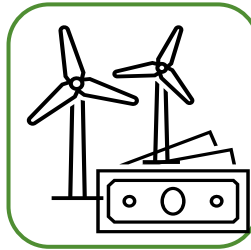
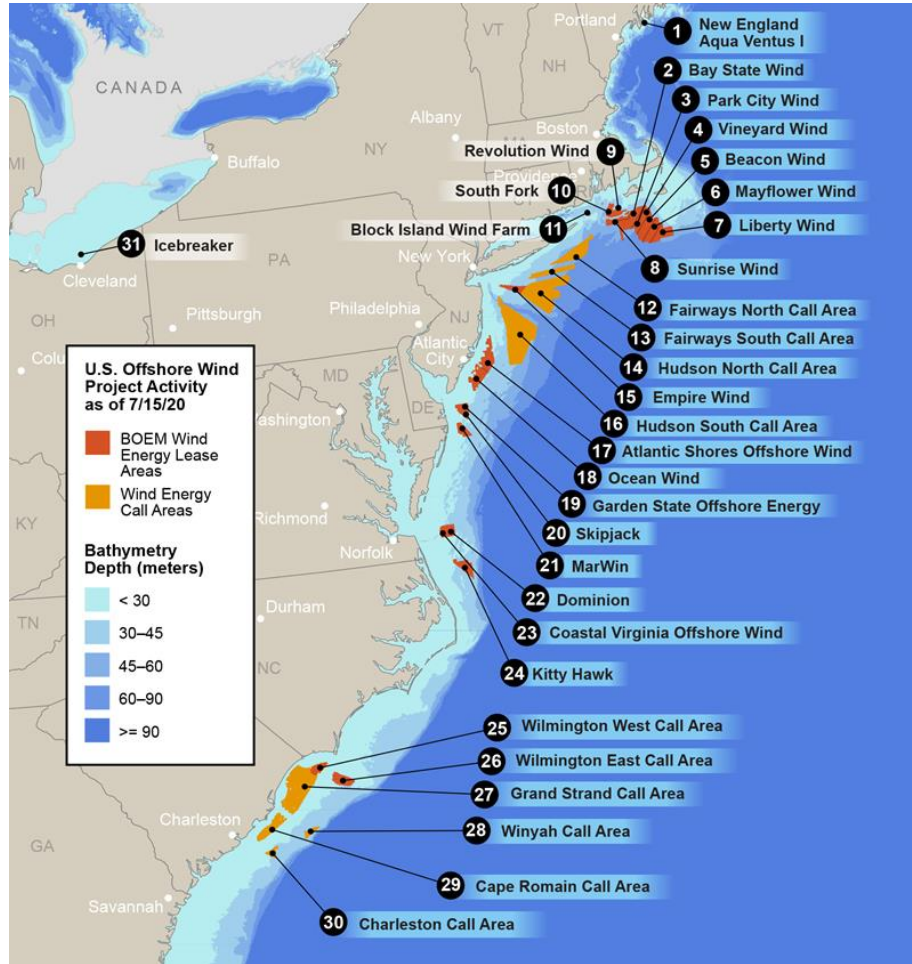


Impact of Further Wind Cost Reductions

The combination of cost-reduction, solutions to environmental siting barriers, and enhanced grid adequacy and access, enables wind energy to become the competitive option of choice on land and offshore.



Ambitious New 30 GW Offshore Wind Deployment Target by 2030



Atlantic offshore wind lease and call areas (DOI/BOEM)
Source: DOE Press Release/S-1 Joint Announcement – March 29, 2021

| Challenges | Opportunities |
|---|---|
| Cost of Energy | Policy incentives |
| | R&D to reduce cost |
| Siting and Permitting (with DOI, DOD, DHS) | Decreased permitting timeframes |
| | Increased leased areas |
| Grid Connections, Transmission Adequacy (with FERC) | Access to onshore and offshore transmission |
| | R&D to support grid reliability |
| Supply Chain (with Commerce) | <p>Financial and policy support to enable:</p> <ul style="list-style-type: none"> • U.S. turbine component manufacturing and materials • U.S. flagged installation vessels • Port expansion • Workforce development |



Emissions Reductions Potential from Geothermal



Electric Sector → up to 516 MMT of avoided CO₂e



Heating & Cooling Sector → up to 1,281 MMT of avoided CO₂e

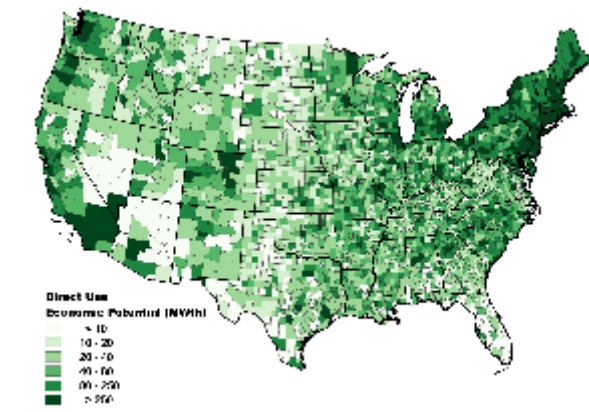
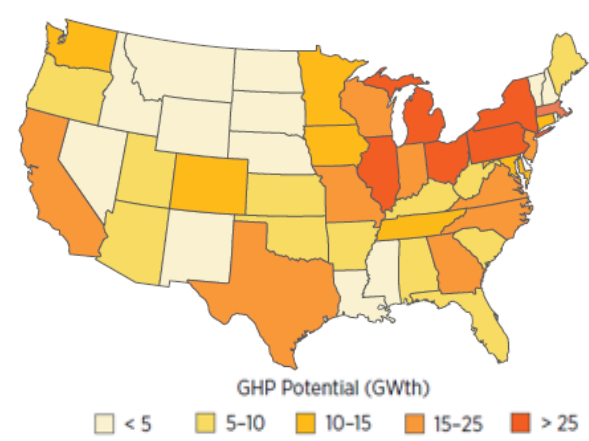
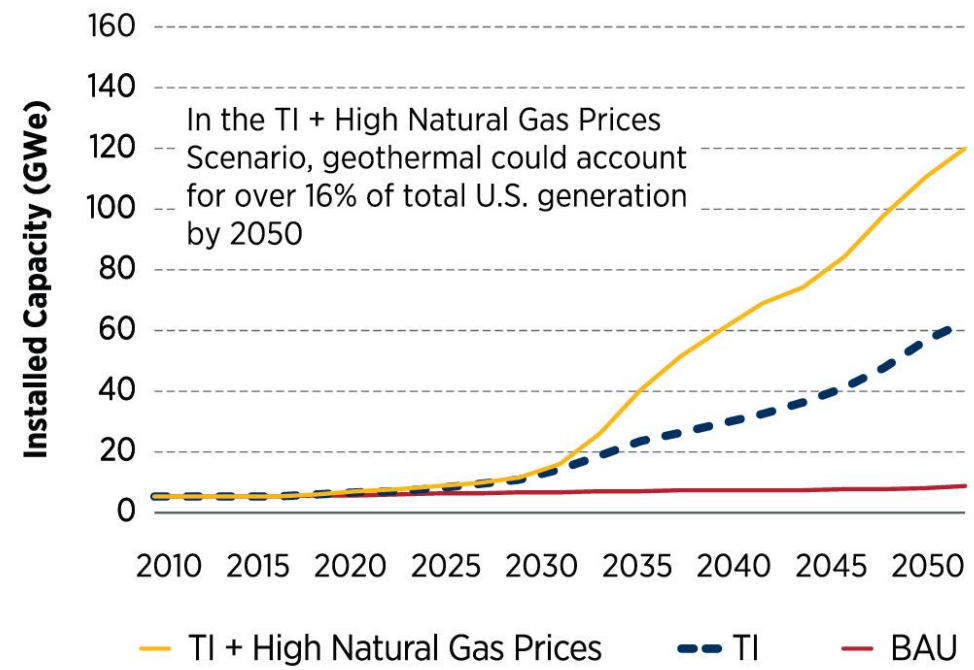
8% of ALL U.S. generation by 2050

23% of U.S. Heating and Cooling market by 2050

America could potentially achieve a 26-fold increase in geothermal generation, representing 60 GWe capacity.

Potential rise in geothermal heat pump installations from 2.5 million to **28 million**.

Potential increase in district heating installations from 23 to **17,500** installations nationwide.



Emissions Reductions = removal of 26 million cars per year