Power Sector Impacts of the Inflation Reduction Act

Insights from EPRI's US-REGEN Model

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Energy Systems and Climate Analysis

EPRI-RFF Webcast on the Inflation Reduction Act
February 15, 2023

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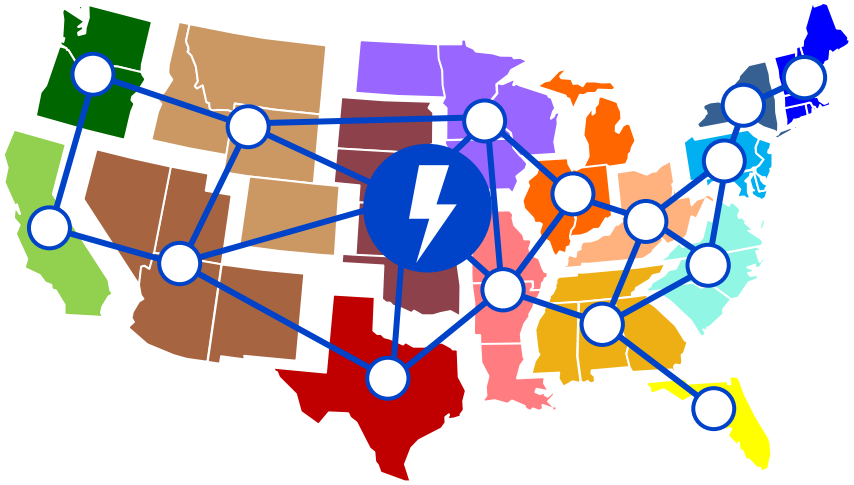
US-REGEN

Regional Economy, GHG, and Energy

EPRI

Electric Generation



Detailed representation of:

- Energy and capacity requirements
- Renewable integration, transmission, storage
- State-level policies and constraints

Integrated

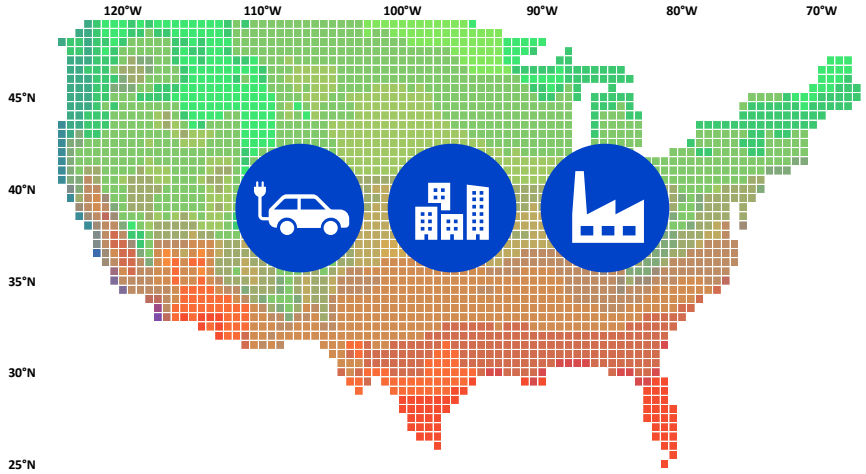
Hourly Load, Renewables, and Prices

Model Outputs:

Generation, capacity, and end-use mix

Power sector and economy emissions

Energy Use



Detailed representation of:

- Customer differences across end-use sectors
- End-use technology trade-offs
- Electrification and efficiency opportunities

Documentation, articles, and reports available at https://esca.epri.com

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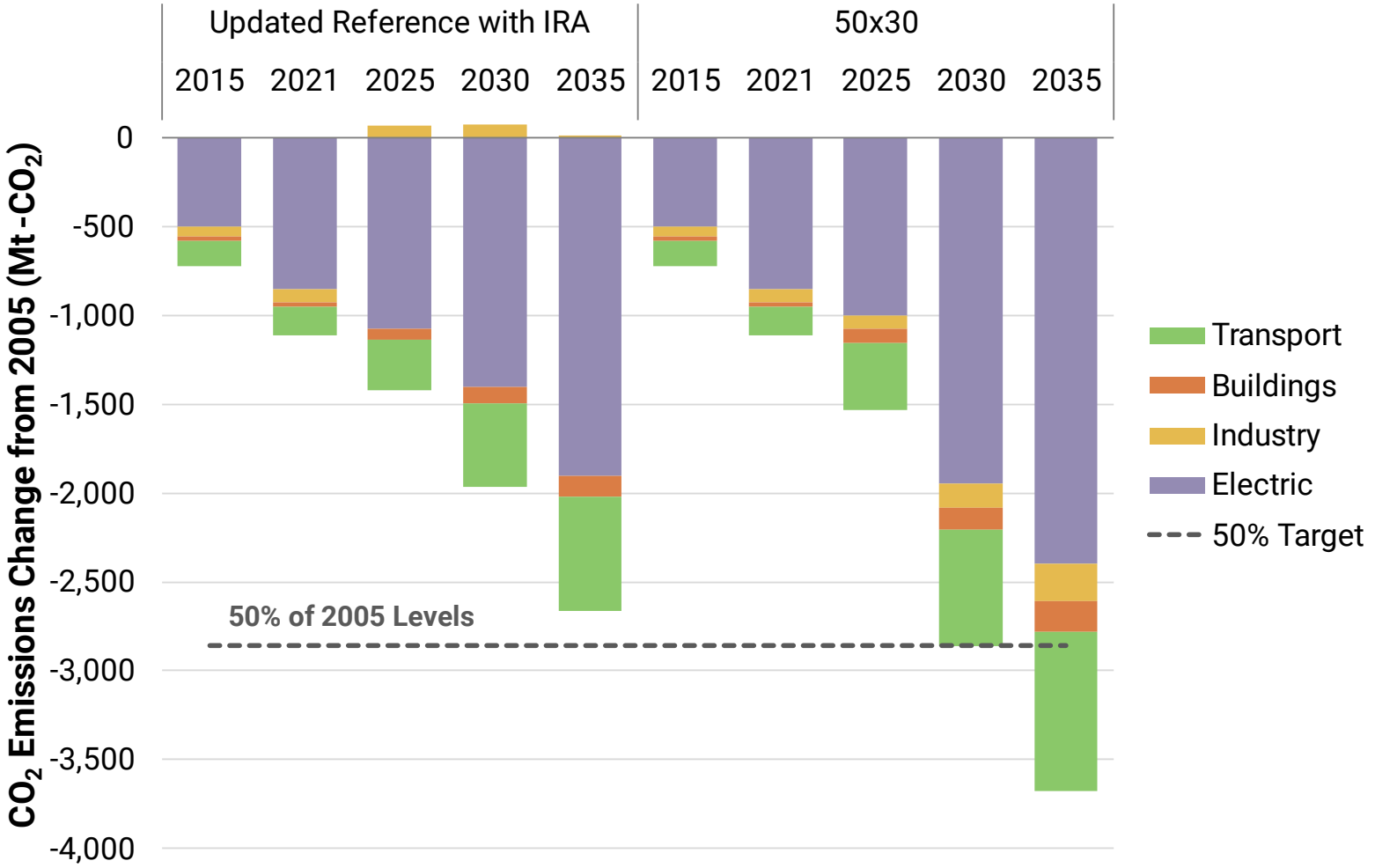
Model results presented today are being finalized for an EPRI report that will be released soon: "Impacts of Inflationary Drivers and Updated Policies on U.S. Decarbonization and Technology Transitions" (EPRI Report 3002026229)

IRA Lowers Emissions from Electric and Transport



- IRA, combined with existing policies and technology trends, lower power sector CO_2
  - 54-58% below 2005 in 2030
  - 75-79% in 2035 → Similar values to other modeling teams
- Most of 2030 reductions under IRA come from the power sector (70-74%)
- Power sector leads additional reductions for 50x30 targets, similar to projections from the Science article on these targets

IRA helps to lower 2030 emissions, but additional reductions are needed from all sectors to meet 2030 targets; electricity plays a key role in direct and indirect reductions through electrification

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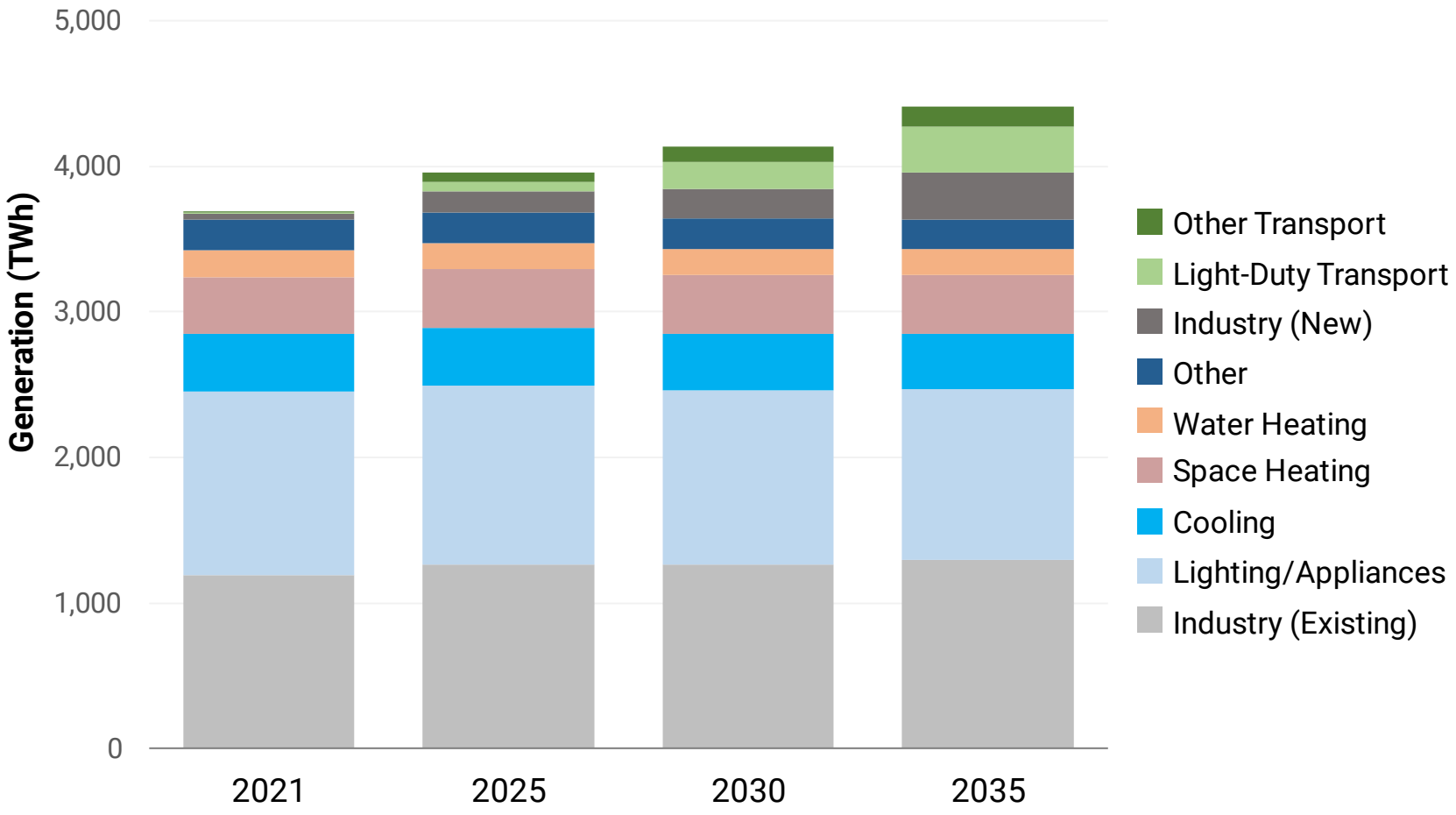
Electrification Drives Non-Electric Emissions Reductions



- Electrification in the reference, which is amplified with incentives and policies
- Load growth from current levels: 12% by 2030 and 20% by 2035
- These changes have important implications for load shapes and flexible demand

IRA increases end-use electrification, but levels vary based on assumptions

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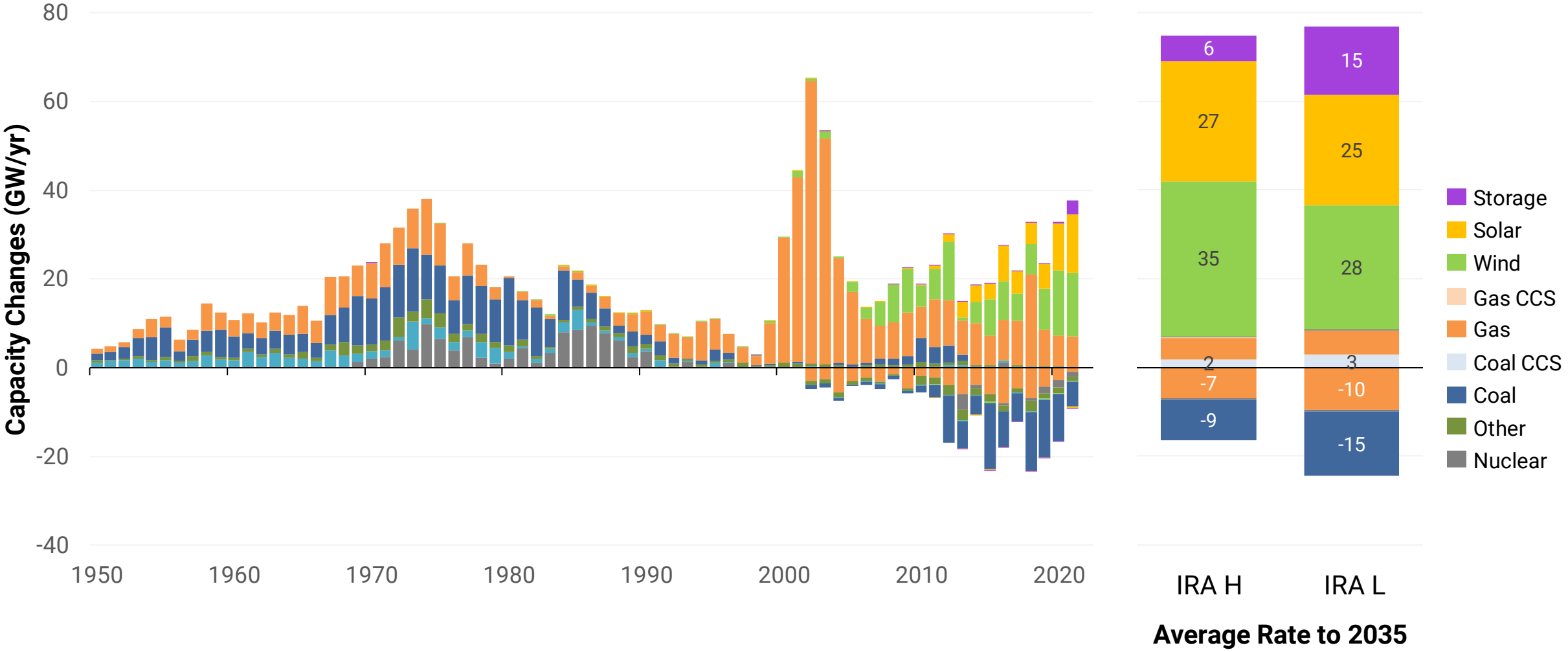
Rapid Buildout of the Grid in All Scenarios



Additions and retirements exceed historical annual maximum through 2035 with incentives

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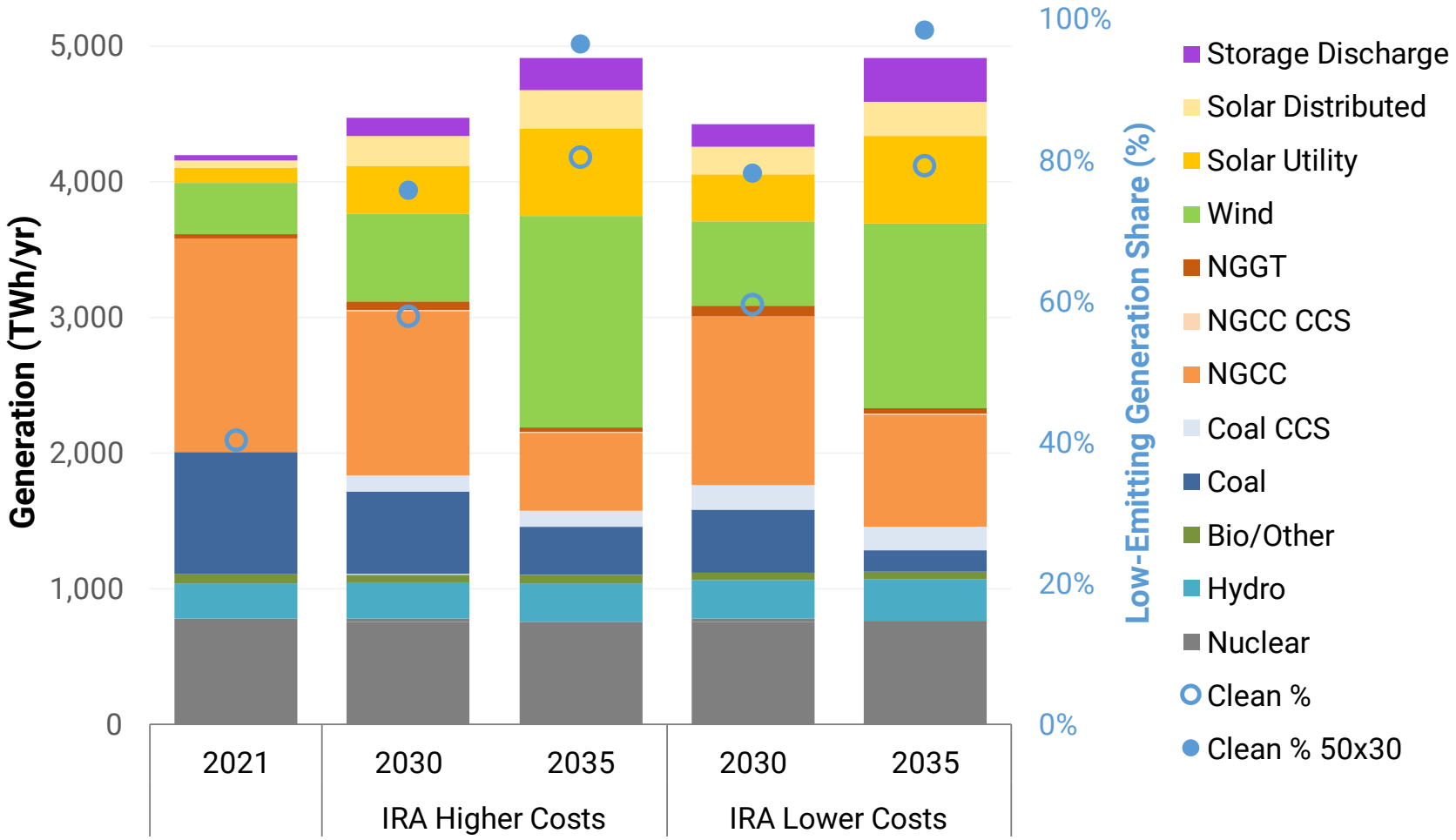
IRA and Supply Costs Impact Generation Shares



- Larger IRA transformations occur by 2035
  - Due to lower wind/solar costs, higher fuel costs, state policies
  - Low-emitting share: 79-81% in 2035 (58-60% in 2030)
- Coal and natural gas generation decline in all scenarios
  - Coal without CCS declines 60-83% by 2035 (from 2021 levels)
  - Gas declines 46-62% by 2035
- To reach 50x30 targets, share from low-CO_2 technologies is 76-78% by 2030

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Key Takeaways on IRA Analysis

IRA, along with other policies and market trends, shift "reference" scenarios **away from natural gas and coal generation and toward low-CO_2 resources**

- Coal declines faster than gas, and gas generation declines faster than gas capacity
- Capacity additions are more than two times current annual levels

IRA continues to drive emissions reductions beyond 2030

- Power sector CO_2 could fall 54-58% below 2005 by 2030 and 75-79% by 2035
- Low-emitting generation shares increase by a third between 2030 and 2035

Modeling IRA impacts is challenging

- Many subjective modeling decisions on impacts and uptake of incentives, given the law's complexity and pending guidance
- Range of possible outcomes based on different interpretations

EPRI white paper on IRA and 2030 targets will be published in the next few weeks!

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EPRI Publications on Reaching the 2030 U.S. Climate Target

Systems Modeling

Strategies and Actions for Achieving a 50% Reduction in U.S. Greenhouse Gas Emissions by 2030 (3002023165)

- Free EPRI report available published in Nov. 2021
- US-REGEN analysis of electric sector and economy-wide wide reductions
- Wide range of "what-if" scenarios

Actions for Reducing U.S. Emissions at Least 50% by 2030

- Published in *Science* in May 2022 (author link)
- Multi-model comparison with authors and models from EDF (EDF-NEMS), EPRI (US-REGEN), LBNL (ReEDS + PLEXOS + FACT), MIT (USREP-ReEDS), PNNL (GCAM-USA-AP), NRDC (EnergyPATHWAYS + RIO)

Issue Deep Dives

- **Enhancing Energy System Reliability and Resiliency in a Net-Zero Economy** (3002023437)
- **Leveraging Existing Infrastructure: Increasing the Capacity of Transmission Lines** (3002023004)
- **Technology Innovation: A Roadmap to Leverage Existing Nuclear Power Plants to Increase Zero-Carbon Energy Production** (3002022700)
- **Electric Utility Workforce Development and Decarbonization** (3002023229)
- **Maximizing Distributed Energy Resource Value Through Grid Modernization** (3002023235)
- **Supply Chain Risks and Needs to Support Electric Utility Sector Decarbonization** (3002023228)

Inflation Reduction Act (IRA) Modeled Provisions

Provisions shown next to applicable section

Electricity

- 13101: Production tax credit (PTC) extension
- 13102: Investment tax credit (ITC) extension
- 13103/13702: Solar in low-income communities
- 13015: Production tax credit for existing nuclear
- 13701/13702: New clean electricity PTC (45Y) and clean electricity ITC (48E)

Multi-Sector

- 13104: Extension of credits for captured CO_2 (45Q)
- 13204: Production credits for clean hydrogen (45V)

Transport

- 13401: Clean vehicle credit
- 13403: Commercial clean vehicle credit
- 13404: Alternative refueling property credit

Buildings

- 13302: Residential clean energy credit
- 13303: Energy efficient commercial building deduction
- 13304: Energy efficient home credit
- 50121: Home energy efficiency credit
- 50122: High efficiency home rebate program

Select Provisions *Not Modeled*

- 13201/13202: Extension of incentives for biofuels*
- 13203: Sustainable aviation credit*
- 13402: Credit for previously owned clean vehicles
- 13501: Extension of advanced energy project credit (48C)
- 45Q/45V limited outside of the power sector*
- 50161: Industrial facilities deployment program
- Agricultural conservation and forestry

*Provisions we will be able to represent in LCRI model

Omission of provisions from modeling has ambiguous effects on emissions outcomes

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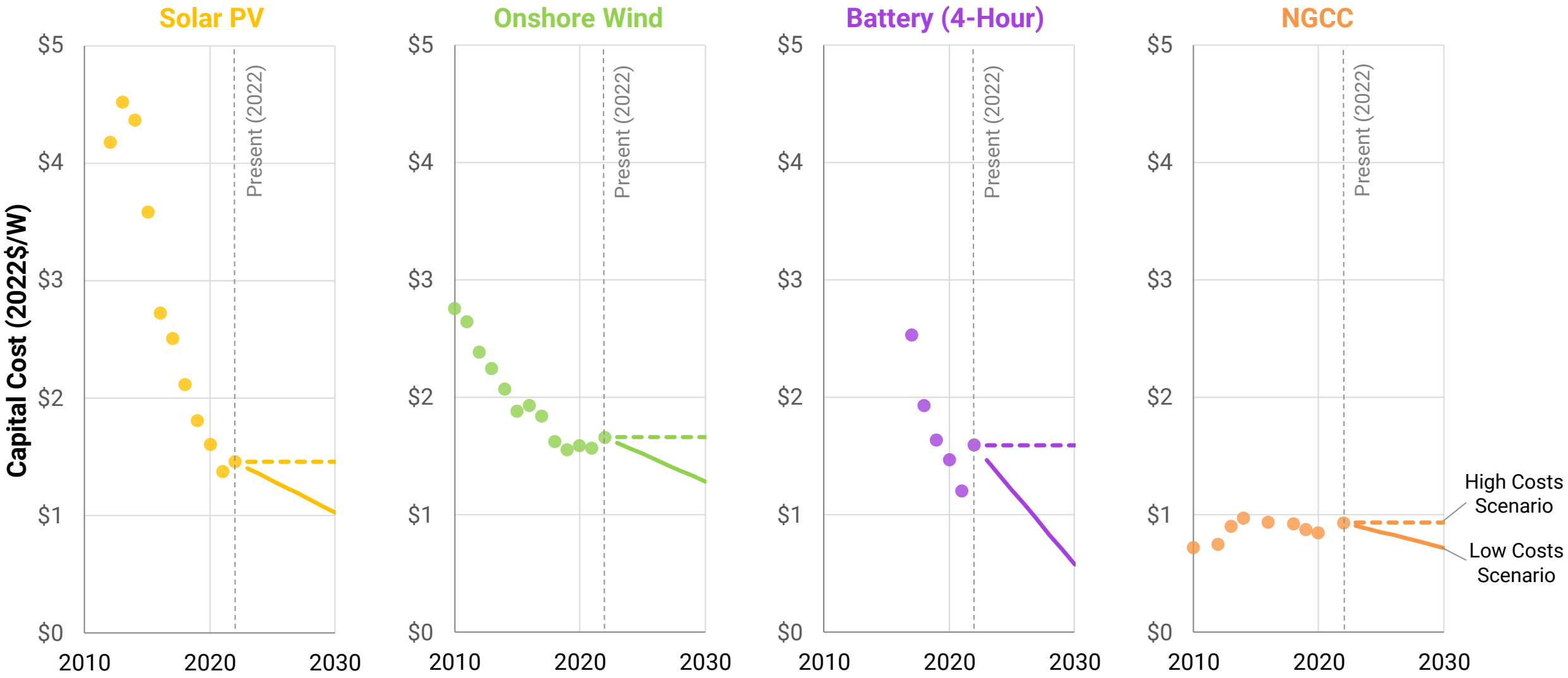
Cost Estimates for Generation/Storage Technologies



Sensitivities examine uncertainty about the persistence of near-term cost escalations

2022 estimates based on EPRI report 3002024231 (link)

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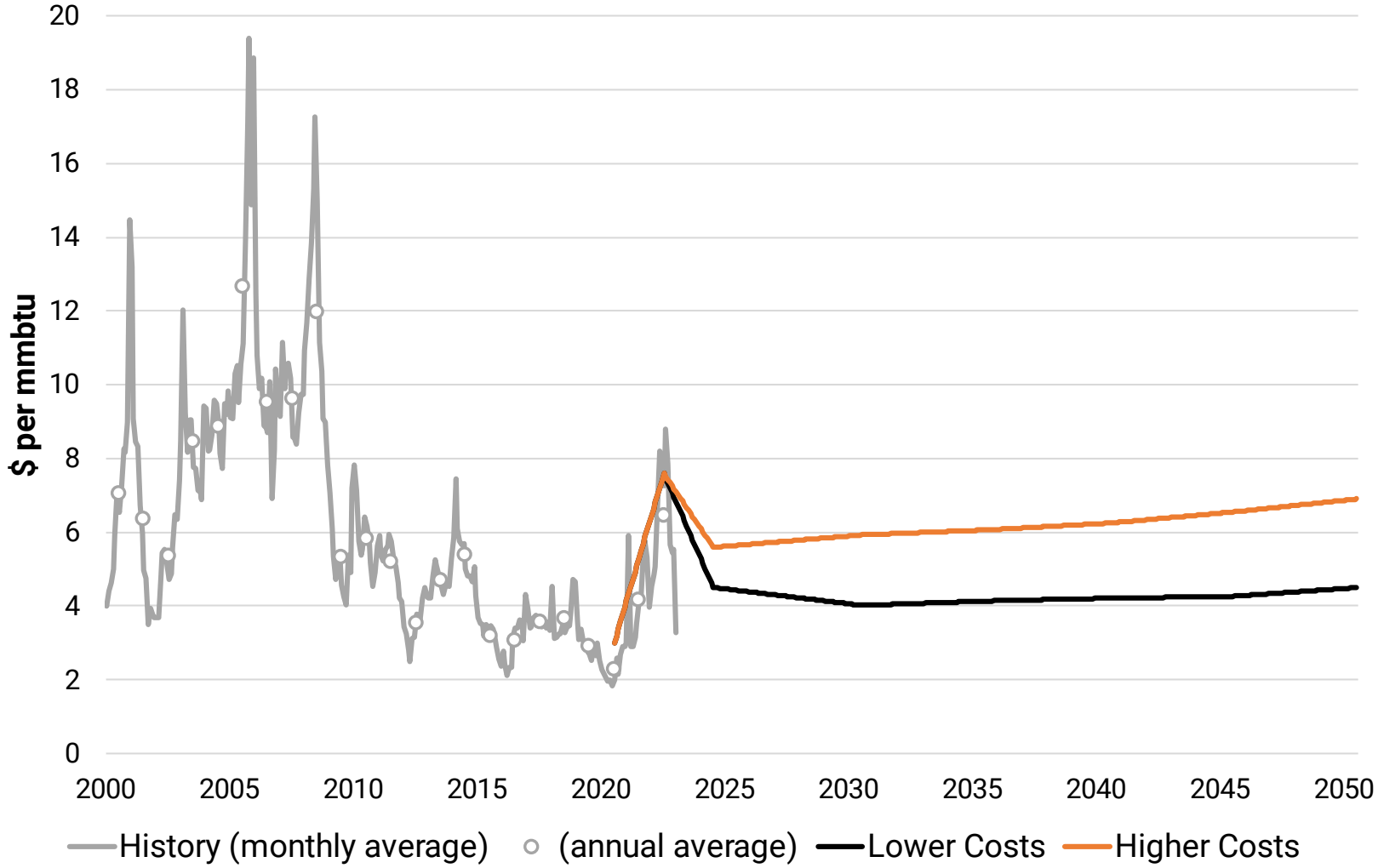
Natural Gas Price Scenarios



Prices in real 2022 U.S. dollar terms

Higher vs. Lower Costs (i.e., slow vs. fast recovery) scenarios span $2/MMBtu range by 2030

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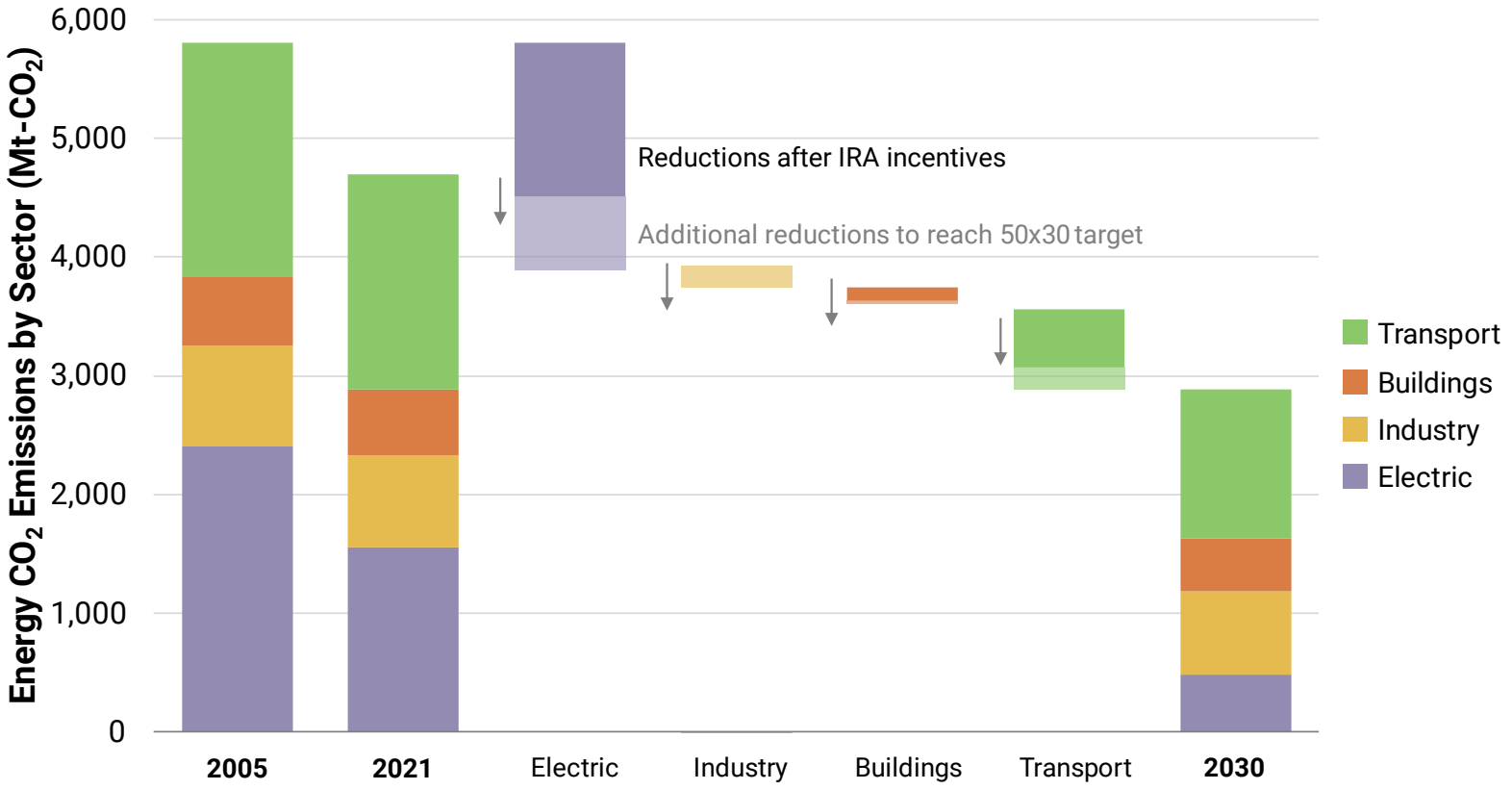
CO_2 Reductions from 2005 by Sector to Meet 2030 Target



Key Near-Term Actions

Energy CO_2 (modeled and shown to left)

- Lower coal, renewables/CCUS expansion, nuclear/gas retained
- Efficiency, switching to cleaner fuels (e.g., electrification, gas)
- Efficiency, residential/commercial electrification (e.g., heat pumps)
- Light-duty electrification, improved fuel economy

Other GHG emissions (outside model)

- HFC reduction (Kigali Amendment); lower CH_4 emissions from oil/gas

*50x30 scenario reaches 2030 U.S. target to reduce economy-wide emissions by at least 50% from 2005 levels

IRA helps to lower 2030 emissions, but additional reductions are required to meet 2030 targets from all sectors; electricity plays a key role in direct and indirect reductions through electrification

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Light-Duty Cars/Trucks Lead Demand Growth

- By 2030, electric vehicles are 46-50% of new sales—many times current levels (>6% so far in 2022)
- Faster sales growth in with IRA and 50x30
- Service demand and CO_2 changes lag new sales → Challenge for reaching 2030 goals

Vehicle electrification is extensive in all scenarios, but the pace is slow initially

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Caveats: Uses and Limitations of Economic Models

- Models are necessarily numerical abstractions of the complex economic and energy systems they represent. As such, they may contain:
  - Approximation errors
  - Incomplete system dynamics
  - Data quality issues

> "Essentially, all models are wrong, but some are useful."
>
> –George Edward Pelham Box

- When viewing model results, it is important to keep in mind:
  - Analyses are **not intended** to be viewed as predictions or forecasts
  - Insights come by running a variety of cases/sensitivities, comparing the results, and asking "what if" questions
  - Actual dispatch and other model outcomes are dependent on many additional factors, such as policy, uncertainty, and unmodeled factors

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