RESOURCES *for the* FUTURE

HEALTHY ENVIRONMENT.
THRIVING ECONOMY.

The US Inflation Reduction Act

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House of Sweden

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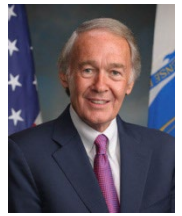
US Climate Policy Drama

2001 President Bush decision not to regulate power plant CO_2 emissions

2007 *Mass v. EPA* – Supreme Court affirms EPA authority to regulate under Clean Air Act

2009 Waxman-Markey economywide cap and trade passed House



2010 Endangerment and *Cause or Contribute* Findings

…….. Continuing state action in northeast (RGGI), California, elsewhere

2011 Clean Air Act: Mobile source standards and stationary sources

2015 Final Clean Power Plan regulation of power sector

2017 Supreme Court '*stays*' Clean Power Plan; three days later Judge Scalia dies

2019 Trump's Affordable Clean Energy Rule

2021 (January 5) the Georgia miracle gives Democrats a (slim!) trifecta

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Biden Era Federal Climate

Bipartisan Infrastructure Law ($1.2 trillion over ten years – not all climate)

- Electric vehicle EV charging
- Public transportation (trains, highways, buses) promoting clean transportation
- Access to high-speed internet; hydrogen hubs, CO_2 removal demonstration projects
- Electricity transmission boosts renewables; financial support for existing nuclear units

Justice 40 Initiative

- 40% of overall benefits to underserved communities
  - Example: Priority for build out of electric vehicle charging network
  - Example: Highway and bridge funds to repair “severed communities”

Clean Air Act Regulations

- Transportation vehicle fuel efficiency standards
- Electricity sector source-specific GHG performance standards (expected), air pollution

CHIPS Act

- $200 billion for domestic semiconductors

Biden Era Federal Climate (2)

2022 Inflation Reduction Act

The most important US environmental regulation since 1970

- Funding for climate and clean energy investments ~$205-$258 billion through 2032
  We think more, like Germany's experience with a Feed-in Tariff, because the IRA spending is not capped and likely extends past 2032.
- Prescription drug pricing reforms
- Corporate tax changes and increased enforcement (net revenue!)

Passed through "budget reconciliation process" meaning policy must be secondary to budget impact

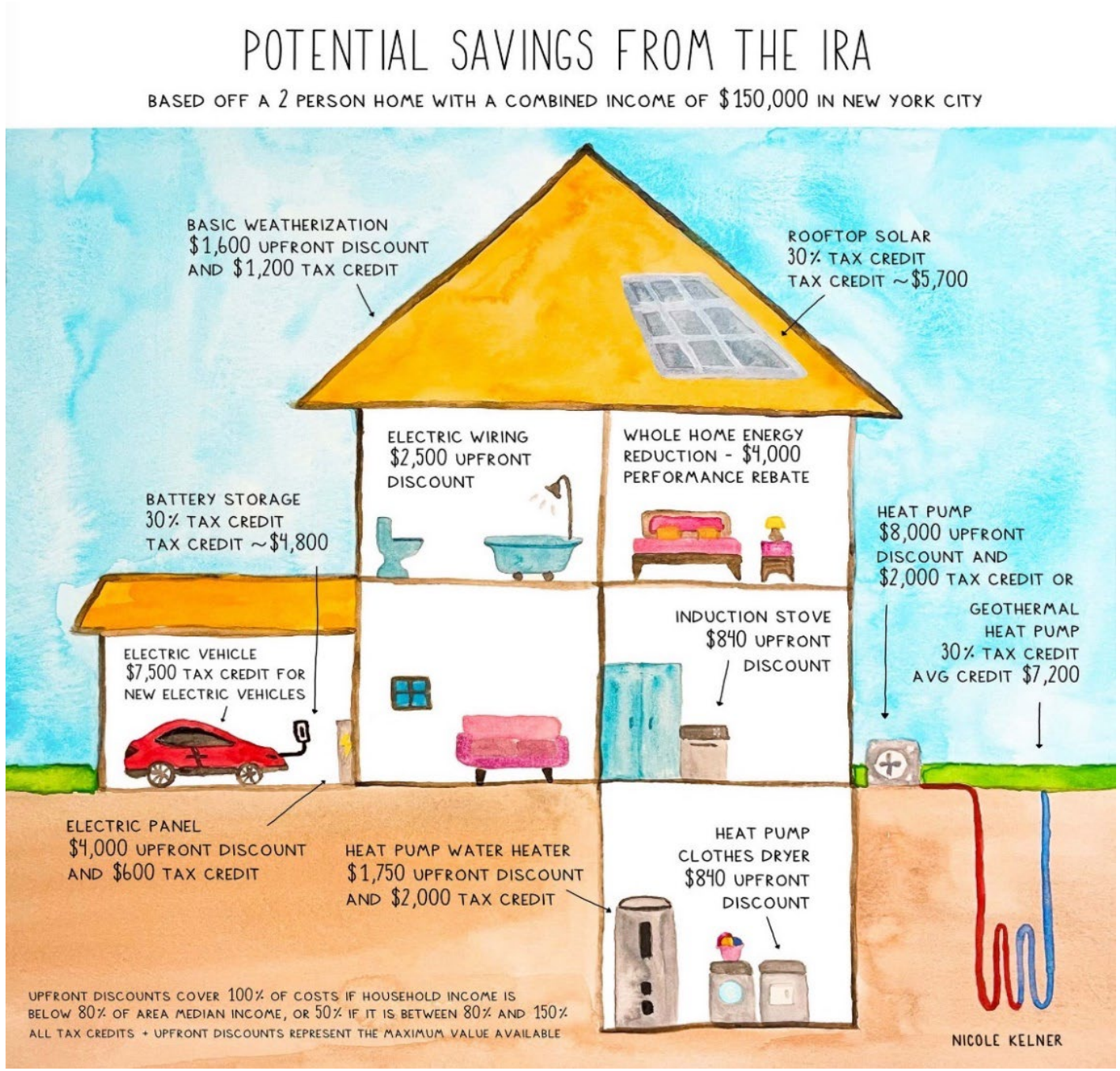
Institutes important cost shift from ratepayers to taxpayers

Climate-Related Features

1. Clean energy production/investment tax credits
   - Through 2032 or until sector emission < 25% of 2022 levels
   - Technology neutral
   - 2.5 cents/kWh (PTC) or 30% (ITC), inflation adjusted after 2025
   - 10% bonus for domestic content; 10% bonus in “energy communities”
2. Carbon capture tax credit for >75% capture (elec) or >50% (industry)
   - $85/ton in electricity sector, mapping to $85/MWh for coal, $40/MWh for gas
3. Hydrogen production/investment tax credits
   - “Clean” hydrogen <4 kg CO2e per kg
   - $3.60 per kg times cleanliness factor (20-100% range)
4. Electric vehicles / heavy vehicles tax credit
   - Up to $7,500 for low/moderate income with final assembly in No. America
   - 30% credit for new clean commercial EVs; $1 billion for heavy duty

Features (2)

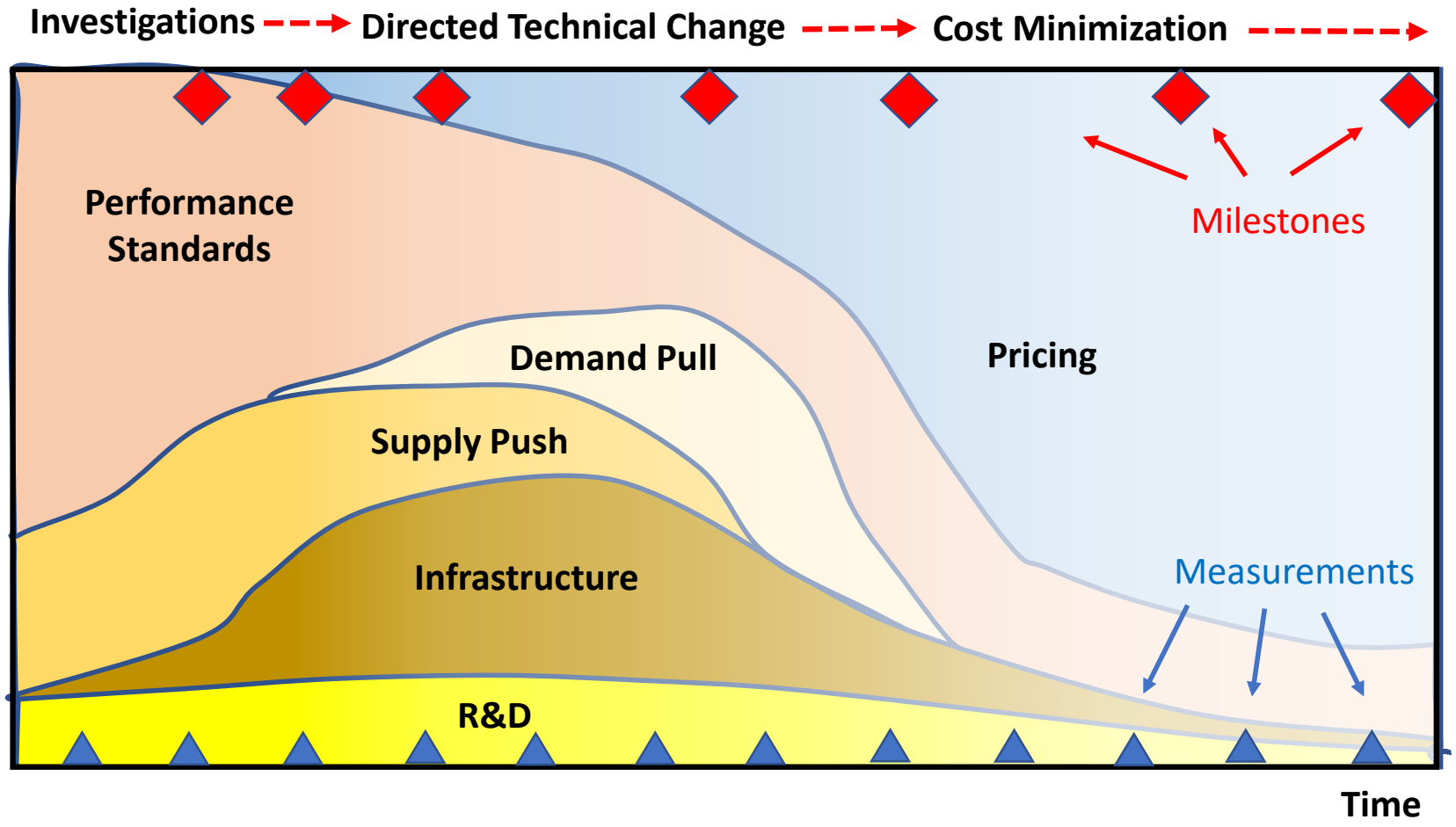
5. Advanced manufacturing tax credit
   - Retool to reduce emissions >20%
6. Zero-emissions, nuclear
7. Clean fuels
   - $1/gallon excise tax credit for biodiesel
   - $1.25/gallon for aviation fuels <50%; plus $0.01 gallon for each additional % point
8. Energy efficiency for nonbusiness buildings
9. Methane emissions fee
   - $1,500/ton for production leaks > 0.2% or 0.11/ton from transmission
10. Permitting reform; required offer of leasing on federal lands (Manchin)



Residential Credits

Rooftop solar
Basic weatherization
Electric wiring
Battery storage
Electric vehicle
Heat pump

The Inflation Reduction Act represents a shift in emphasis from *getting the prices right* to *getting expectations right* to drive investment.

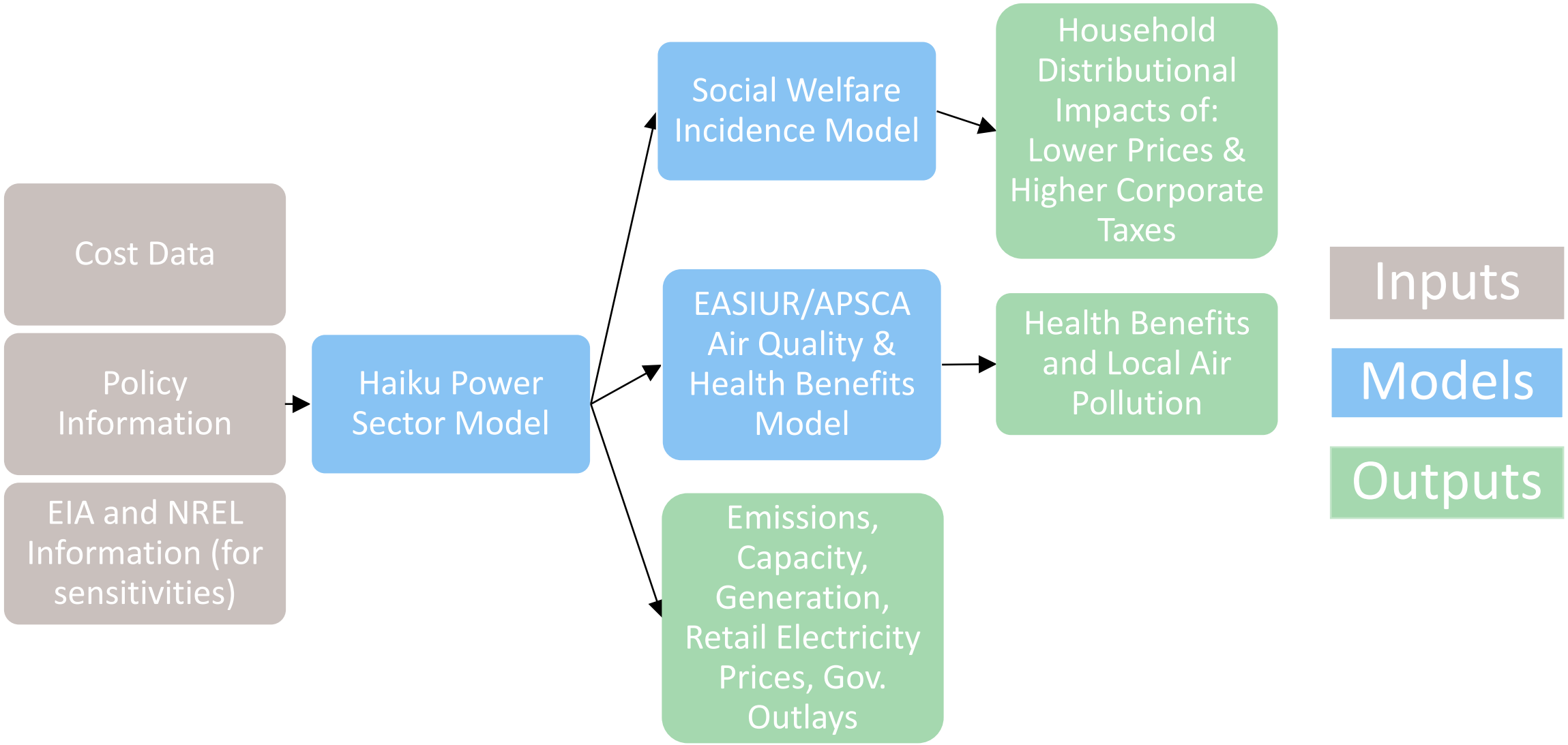


A Net-Zero Target Compels a Backward Induction Approach to Climate Policy, Dolphin et al. 2022

The IRA is expected to spark $1.2 trillion in total renewable investment through 2035
(Wood Mackenzie)

New federalism: Federal incentives for state policy enabling private investment

Multi-Model Analysis of Electricity Sector Provisions



RFF Analysis of Electricity Sector Provisions

- Haiku electricity market model
  - Perfect foresight with 23-year horizon and 24 time-blocks per year
  - Solves at state level with inter-state transmission
- Scenarios
  - Central case, low gas prices, high gas prices, high demand
  - Compare scenario relevant no-policy baseline with policy scenario

Projected Electricity Sector Emissions Reductions

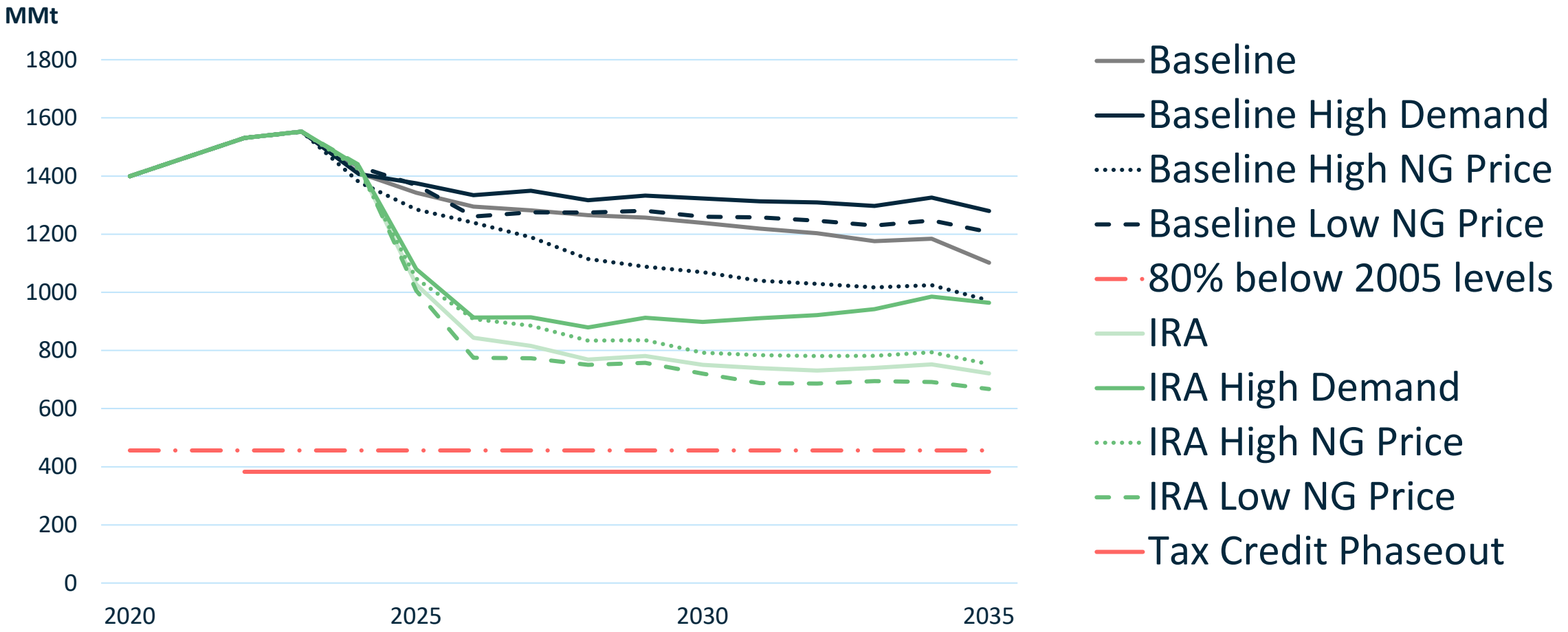
- 2030 electricity sector emissions are projected to drop to 61-68 percent below 2005 levels, compared to 51 percent below 2005 levels without the policy

  (Biden pledge corresponds to 80 percent reduction from electricity by 2030)

- Projected cumulative emissions reductions are ~5 billion metric tons below baseline by 2035 (central case)

- Effective average cost per ton of reductions of $50 per metric ton (central case)

Power Sector CO_2 Emissions

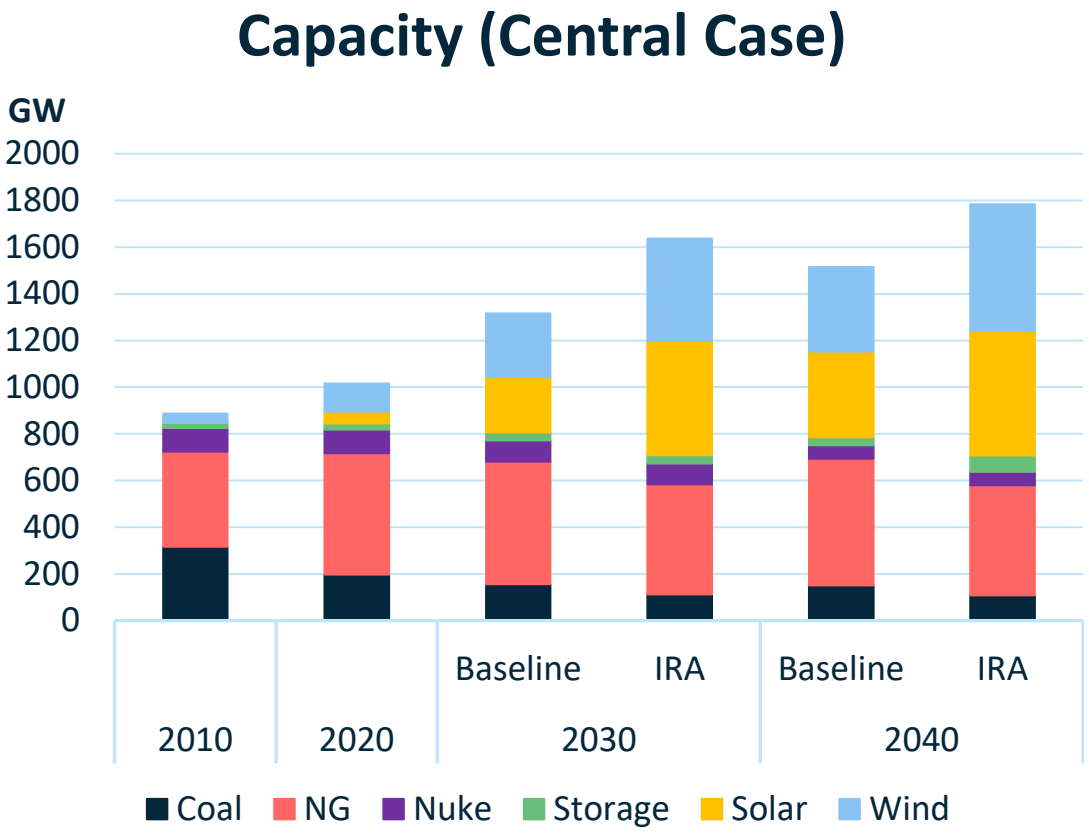


- Declines happen rapidly and reach plateau
- Power sector annual emissions are 700-900 million tons by 2030
- Tax credit phaseout likely won't happen with the IRA alone

Quick Takes on Other Sectors

- Emission reductions from **transportation provisions** (based on previous analysis) are projected to be modest; set the stage for enhanced action at federal and state level
- **Oil and gas leasing provisions** are projected to contribute ~20 MMt of additional emissions domestically in 2030
- Reductions from the **methane fee** are highly uncertain due to the structure of the provision

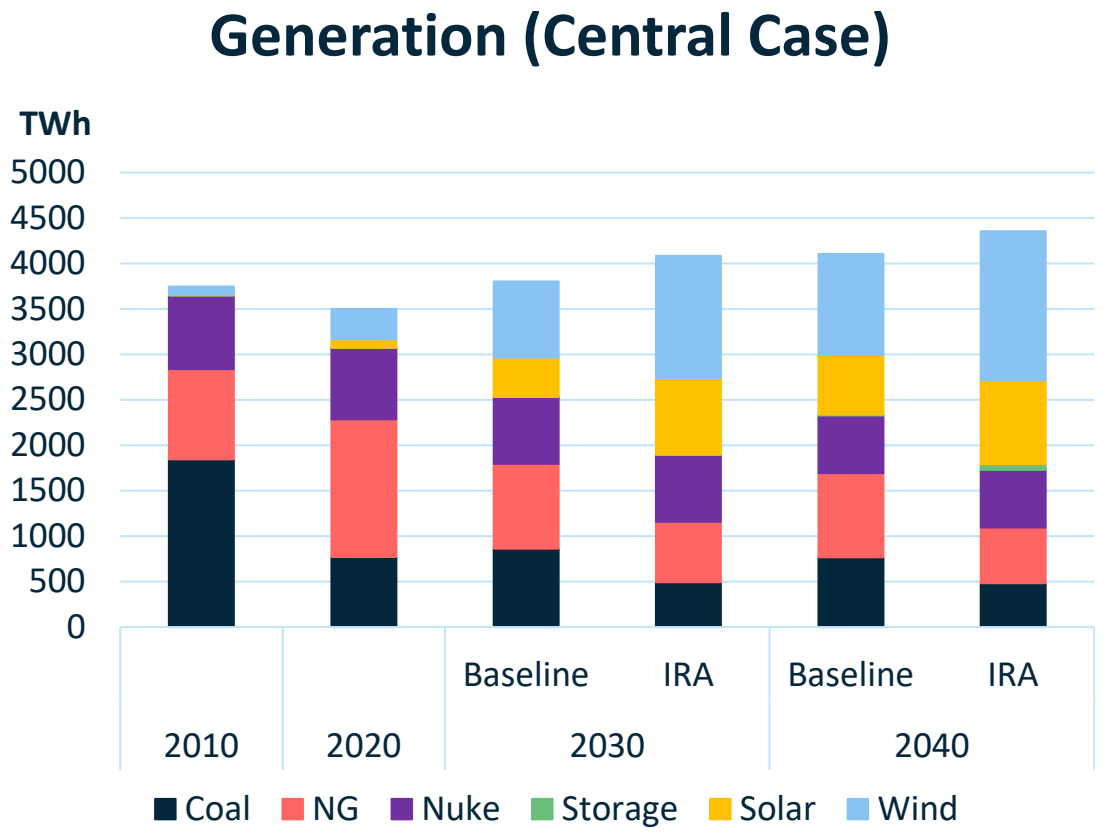
Four Decades of Power Sector Capacity and Generation



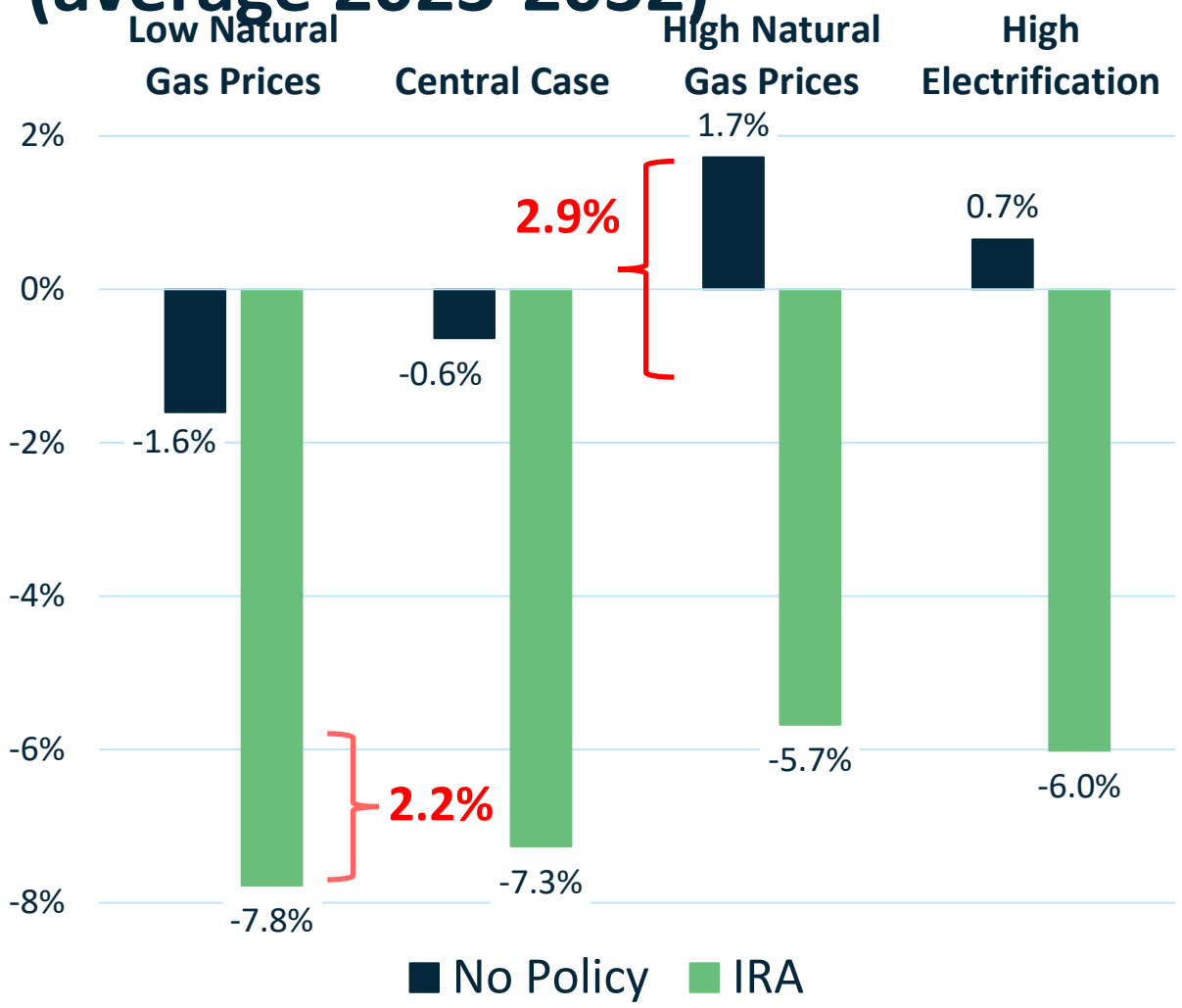
- More than 200 GW of wind and solar each by 2030
- Fossil capacity does not retire without “sticks”
- Storage capacity built in the long term due to reduced capital costs
  - More storage in high demand sensitivity
- Coal capacity falls less in sensitivities with high gas prices or high demand

Four Decades of Power Sector Capacity and Generation

- Major renewable use by 2030
  - Solar generates 380-410 TWh
  - Wind generates 410-640 TWh
- Fossil utilization falls, natural gas more so than coal
- Higher demand scenario sees more natural gas



Percent Change Relative to 2022 Levels of Retail Electricity Price (average 2023-2032)

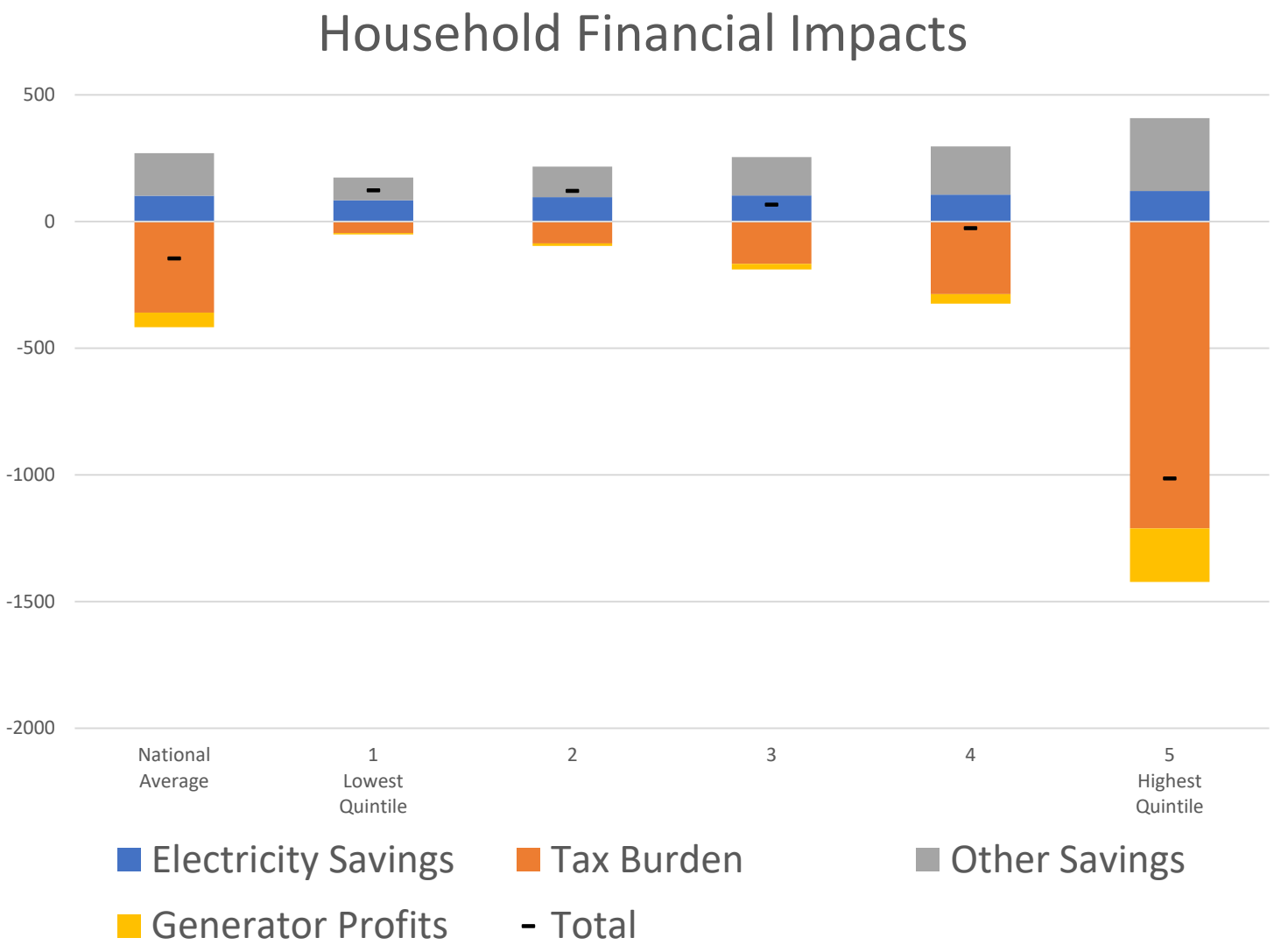


- Prices fall 5.7-7.8% over the next decade
- The cost shift from ratepayers to taxpayers is likely to be efficiency enhancing (Borenstein and Bushnell; Borenstein, Fowlie, Salee)
- Reducing electricity prices encourages additional electrification
- Volatility in electricity prices is reduced & decoupled from natural gas prices

Financial Impact on Households

- Electricity savings:
  - Proportional to electricity expenditure
- Savings on other goods and services:
  - Proportional to expenditures on other goods and services
- Generator profits:
  - Proportional to capital income
- Tax burden:
  - Proportional to corporate income tax burden, 75% on capital income (10% of which is foreign held) and 25% on labor income

Net household financial impacts are progressive



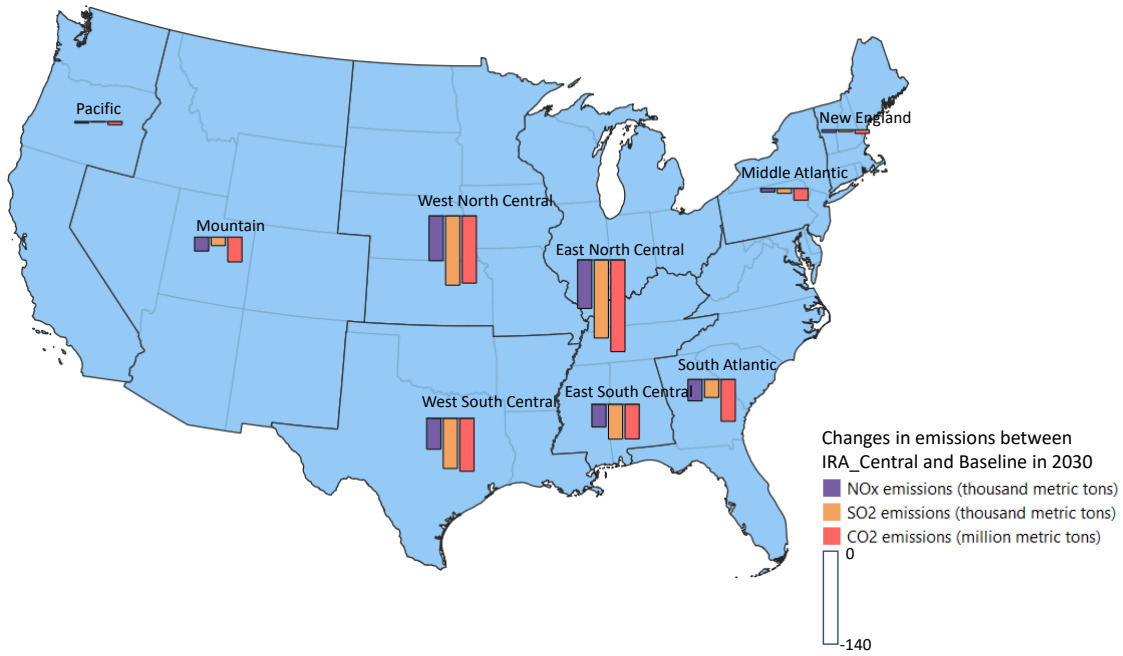
- Electricity costs are a greater share of low-income household budgets
- Indirect electricity price changes pass through changes in product prices
- Corporate income tax falls 75% on (higher income) owners of capital
- Excess burden of corporate income tax may be offset by efficiency gain from expanded electricity use
- 10% of equity is foreign held
- Changes in generator profits accrue to owners of capital

Health Impacts

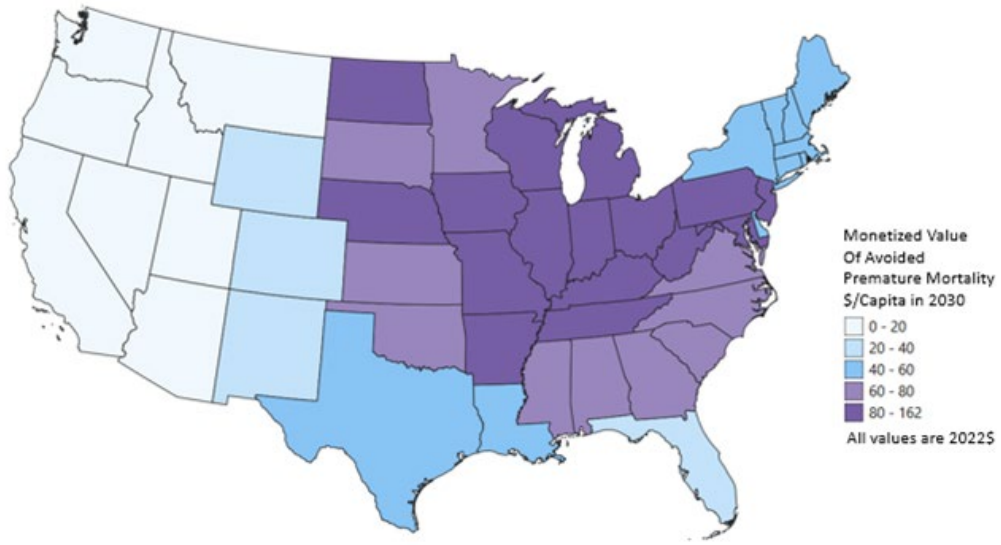
- Decreased coal and gas generation → lower SO_2 and NO_x
- Lower SO_2 and NO_x → reduced secondary fine particulate matter (PM2.5)
- Emissions are downscaled from the regional to the county level using NEI
- Avoided electricity-sector related PM2.5 mortality estimated using EASIUR, a reduced complexity air quality model (Heo et al. 2016)

Air quality benefits accrue in the Midwest and south where air pollution reductions from decreased coal use are greatest

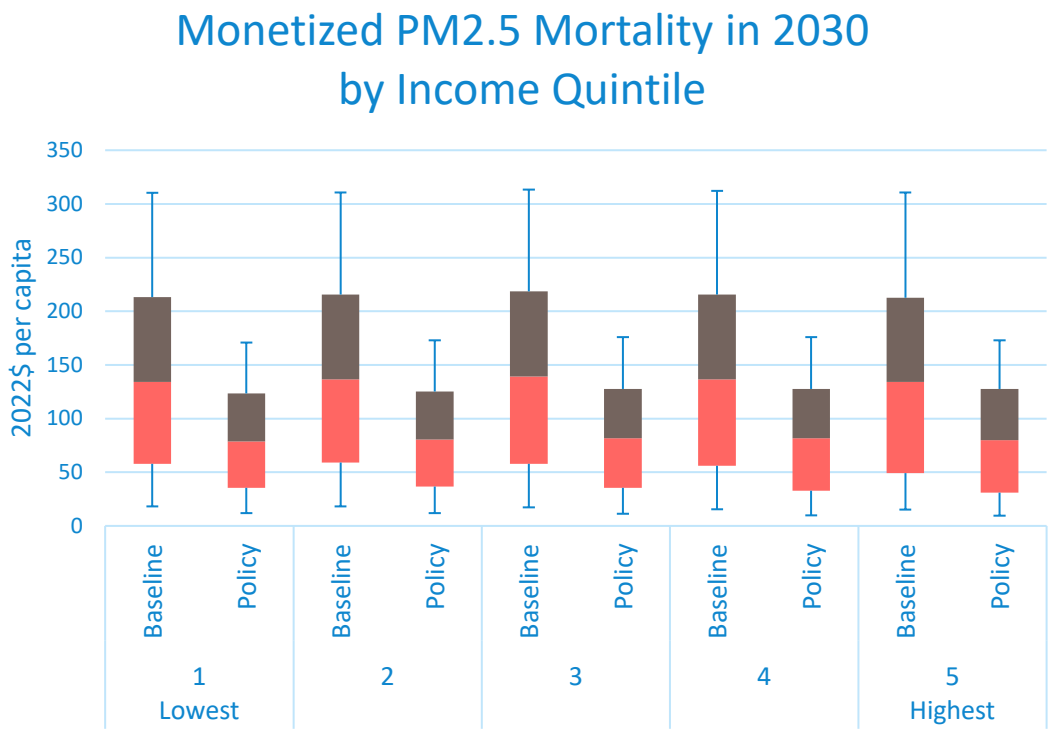
Regional Emissions Changes 2030

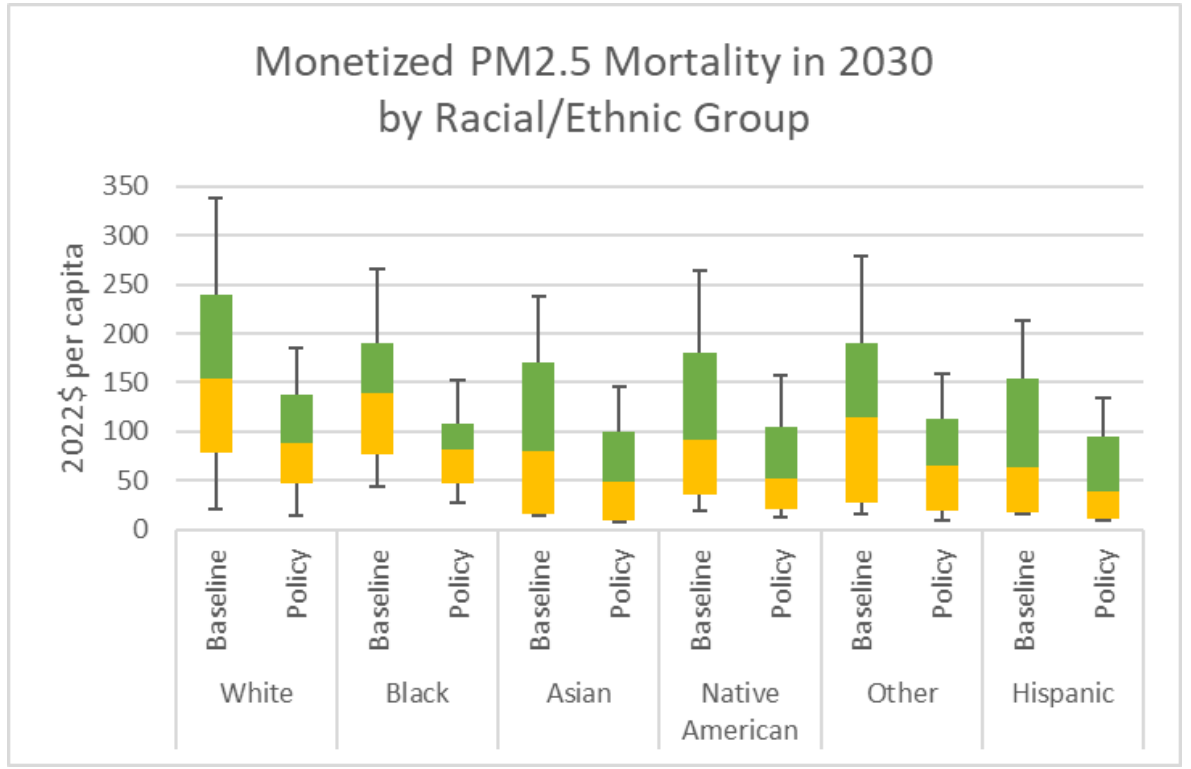


Monetized Avoided PM2.5 Mortality per Capita 2030



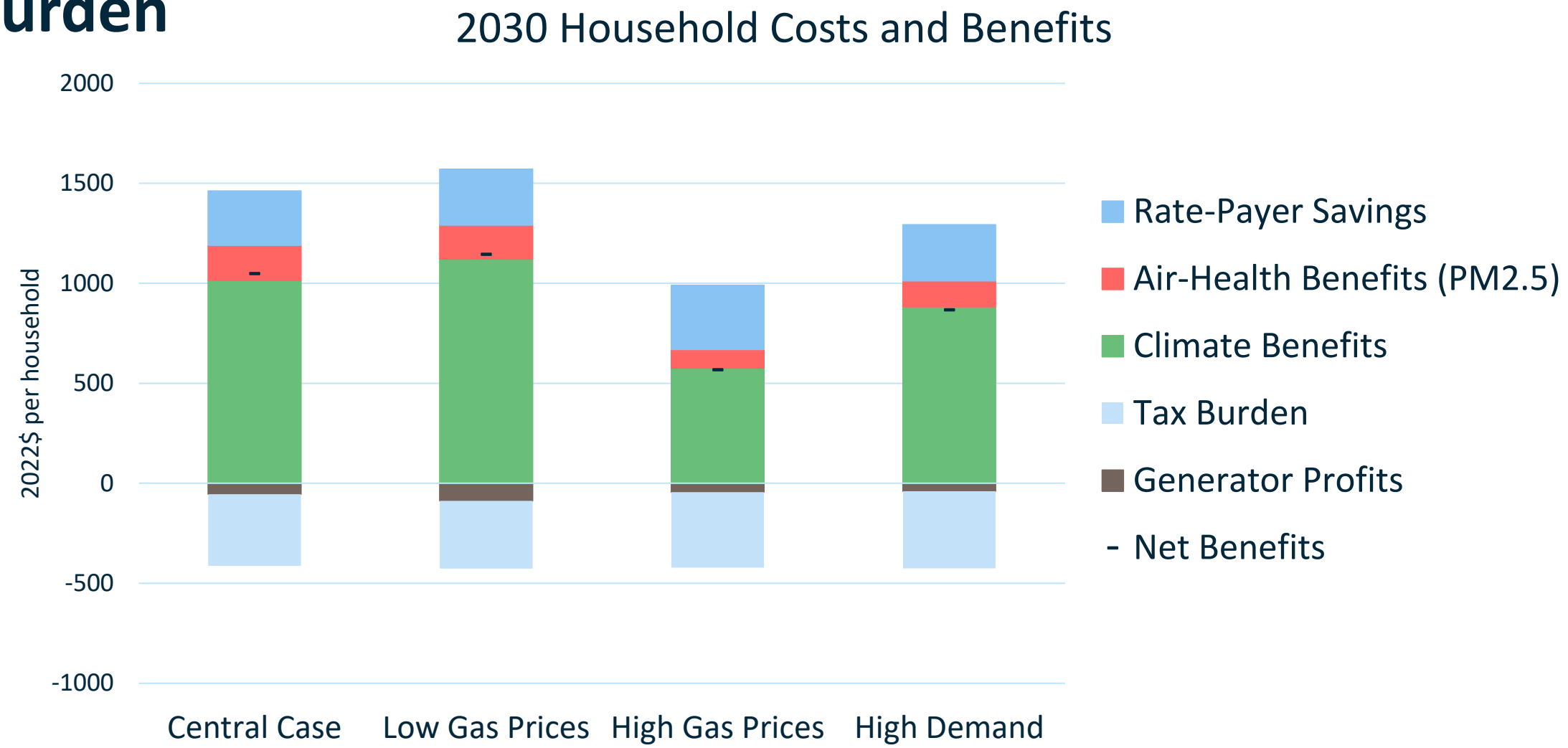
Electricity-related, health-related benefits are distributed broadly across income and racial/ethnic groups



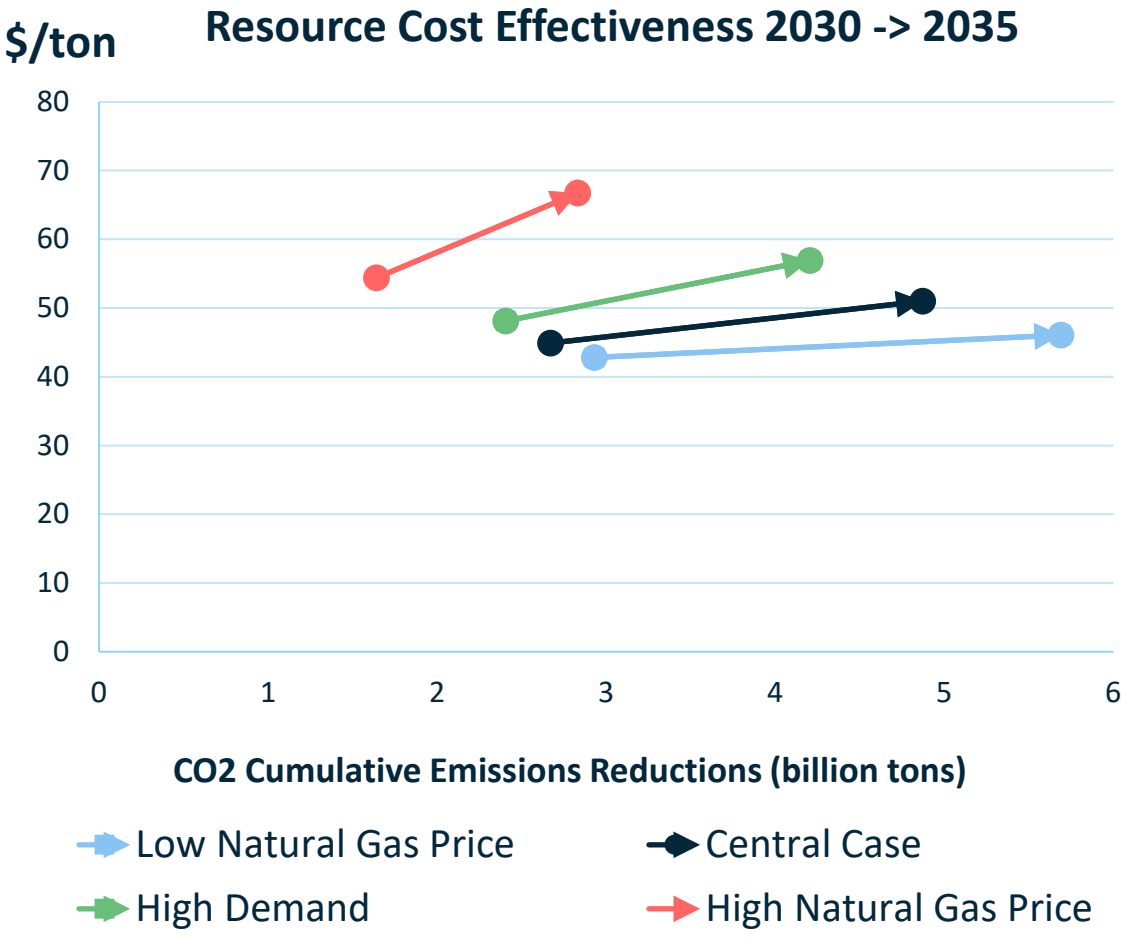


- Average electricity-related mortality falls by about 40% in 2030
- Differences among racial groups is due to regions of residence

Climate, health, and financial benefits exceed tax burden



Cost Effectiveness



- Cost effectiveness ranges from 43-54 $/ton in 2030
- Costs of reducing emissions increase to 46-66 $/ton in 2035
  - Decreasing cost effectiveness offers an opportunity for governments to return and add additional policies
- The clean energy incentives do not distinguish between coal and gas

Conclusion

- By 2030, the IRA leads to…
  - Annual CO2 emissions between 61-68% below 2005 levels
  - Costs of 43-54 $/ton for 1.6-2.9 billion tons of cumulative emissions reductions
  - Retail prices 5.7-7.8% below todays levels on average over the next decade that are also insulated from natural gas price volatility
  - A cost shift from rate payers to taxpayers that benefits lower income households
  - Substantial and widespread health benefits, especially in regions of the US with reduced coal generation

Beyond Clean Energy: The Financial Incidence and Health Effects of the IRA

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