DOE GHP impacts

Friday, January 26, 2024

The 2050 Benefits from Deploying Geothermal Heat Pumps

Eliminate the need for up to 43,600 miles of new interregional transmission infrastructure – equivalent to 44 SunZia transmission projects

Reduce up to 410 GW of nationwide generation capacity requirements – bolstering seasonal US grid resilience

Eliminate more than 7 gigatons of carbon – equivalent to all U.S. emissions produced in 2022

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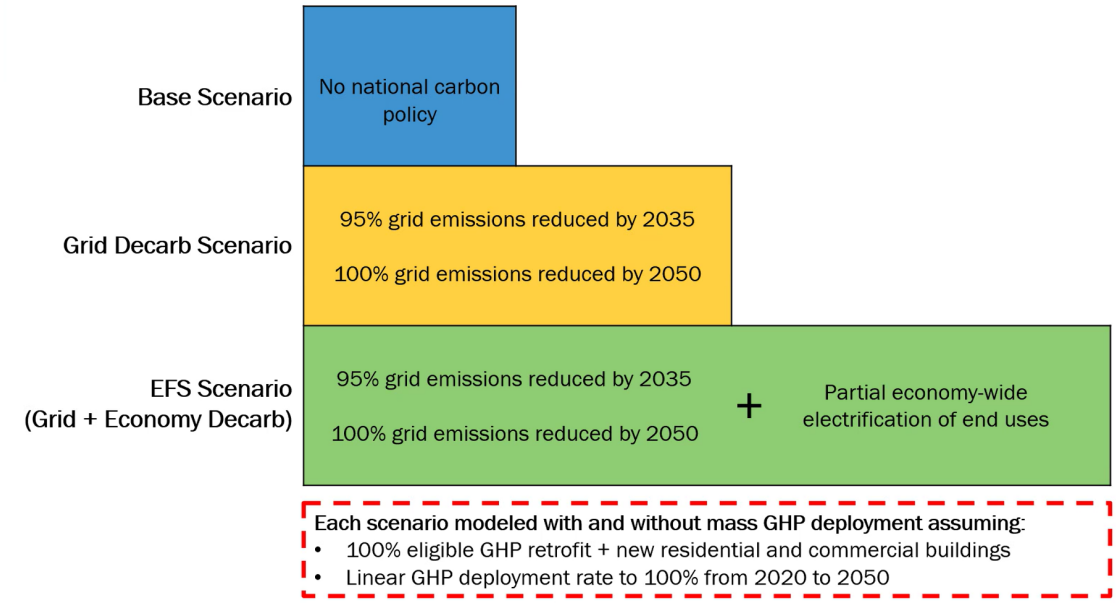
Modeled Scenarios Through 2050



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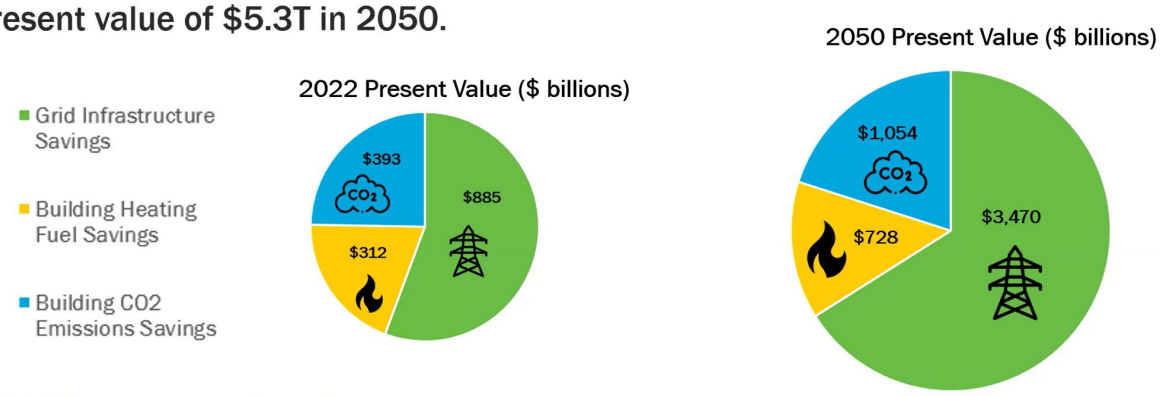
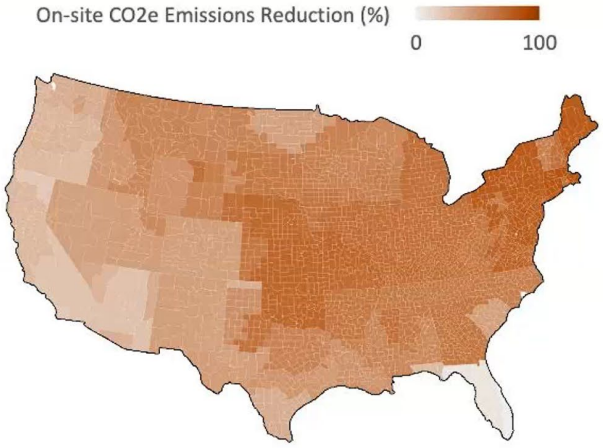
GHPs are a Grid Cost Reduction Technology

- GHPs are primarily an electric grid cost reduction tool and technology.
- GHPs create value for the grid by reducing the need for generating capacity, storage, and transmission expansion.
- Mass deployment of GHPs has a present value of $1.6T in 2022 and a present value of $5.3T in 2050.



GHPs Can Decarbonize Both the Grid and Building Heating

- All building heating electrification technologies will reduce or eliminate emissions from buildings, but this analysis indicates that <u>GHPs can *also* eliminate emissions from the grid</u>
- GHPs eliminate >7GT of carbon in the Base scenario and >4GT of carbon in the Grid Decarb scenario
- Applying building emissions reductions as a grid credit results in a Zero Carbon Grid by 2035



	Cumulative (MMT CO_2)	
	Base	Grid Decarb
Buildings	4,318	4,318
Grid	3,033	*minor*
Total	7,351	4,318

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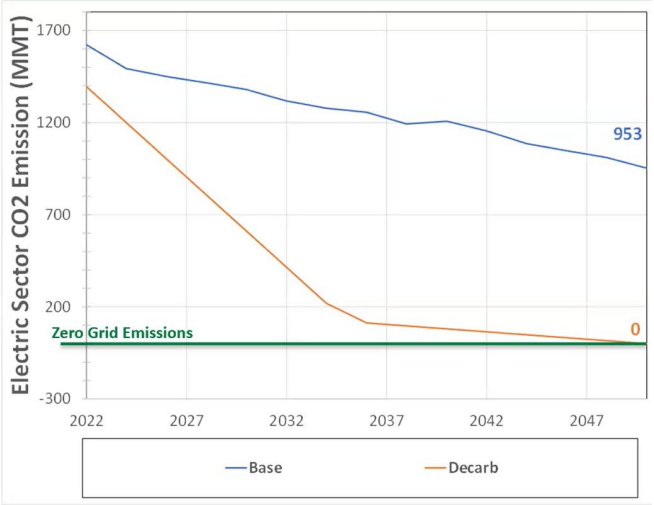

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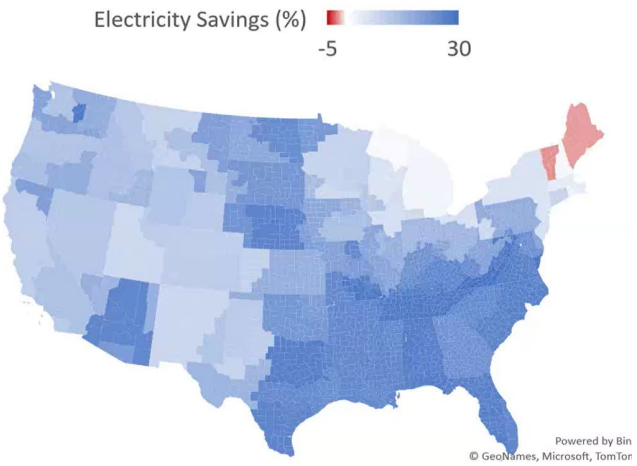
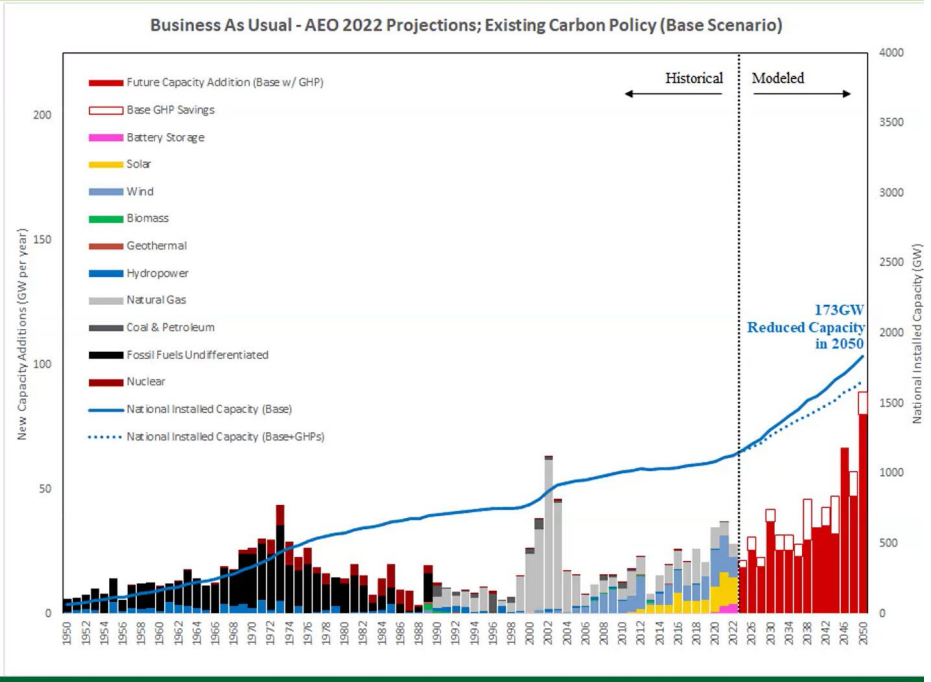
GHPs Reduce Annual Electricity Use, Even with Heating Electrification

- GHPs electrify heating in all climate zones and at high efficiency
- Electrification increases grid winter electrical demand; HOWEVER, in aggregate, increases are offset by summer cooling savings
- Net effect: GHPs, in combination with building envelope improvements, reduce annual electric consumption in all but 2 states
- By 2050, GHPs reduce required system costs by 13% for Grid Decarb and 11% for EFS



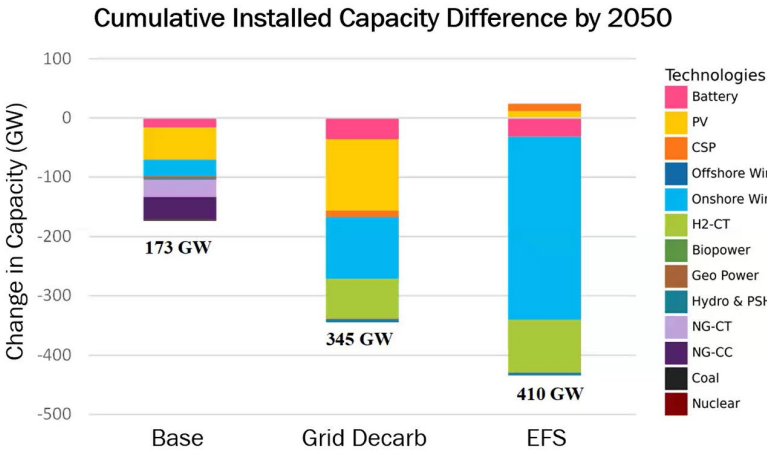
GHPs Reduce New Infrastructure Investments in All Categories

- GHPs reduce every cost category of constructing and operating the grid
- GHPs reduce the total new capacity required for stable grid operation in all three scenarios



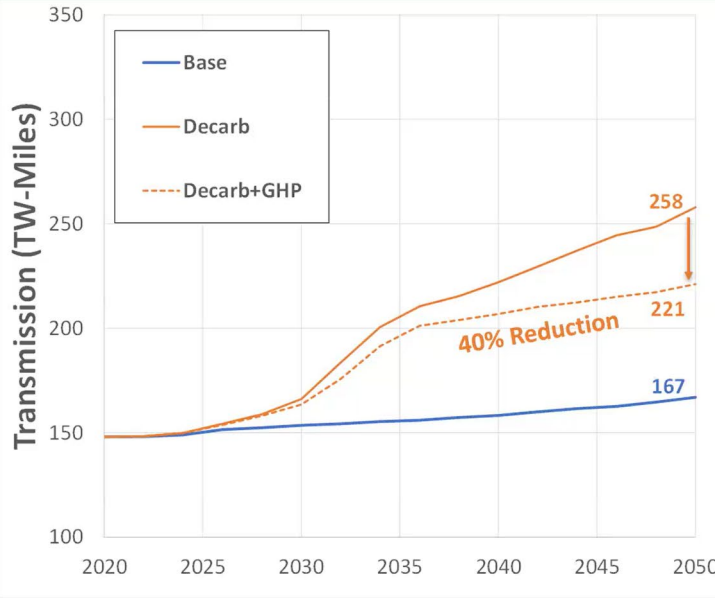
GHPs Reduce New Infrastructure Investments in All Categories

- Reduced capacity includes batteries, combustion turbines (both natural gas and hydrogen), solar PV, and wind
- GHPs Eliminate:
  - More than 65 GW of gas turbines for all scenarios, whether fired by natural gas (Base) or H2 (Decarb and EFS)
  - 28 GW, 104 GW, and >308 GW of wind capacity for the Base, Grid Decarb, and EFS scenarios respectively



GHPs Reduce New Infrastructure Investments in All Categories

- Mass deployment of GHPs smooth the pathway towards successful transmission build-out
- In Grid Decarb, it avoids roughly 24,500 miles of new interregional transmission construction – enough to cross CONUS eight times.
- In EFS, it avoids roughly 43,600 miles of new interregional transmission.



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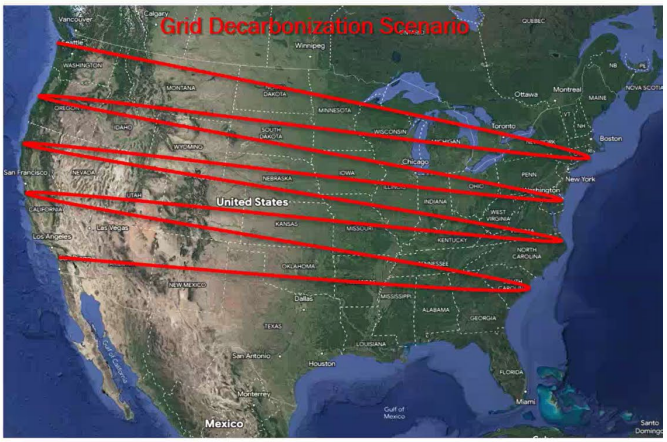

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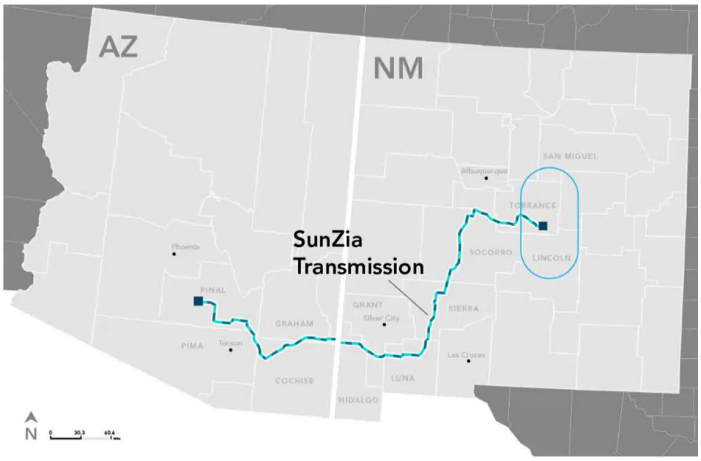

GHP System-Level Economic Benefits and Implications

- GHPs reduce the marginal system cost to decarbonize and electrify the grid
- GHPs reduce the average cost to the system to transition from the Base scenario to full grid decarbonization by about 30% in the years from 2035 to 2050