



Advanced Water Heating Options for Decarbonization

Opportunities for Community Storage, Beneficial Electrification, and Renewable Gas

Tech Advantage

San Diego, CA

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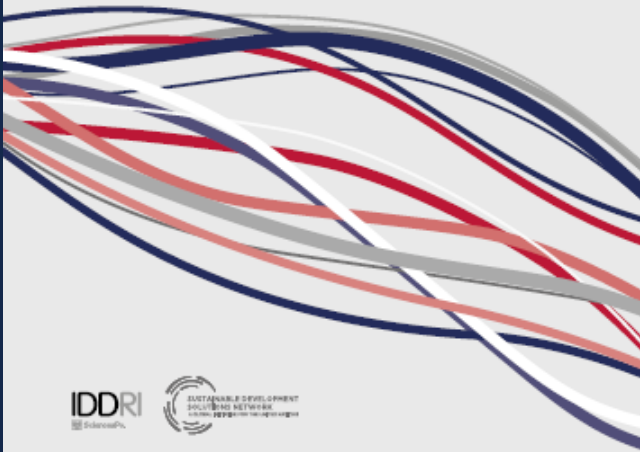
Consultant to Natural Resources Defense Council



Key Driver: Deep Decarbonization

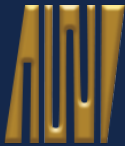
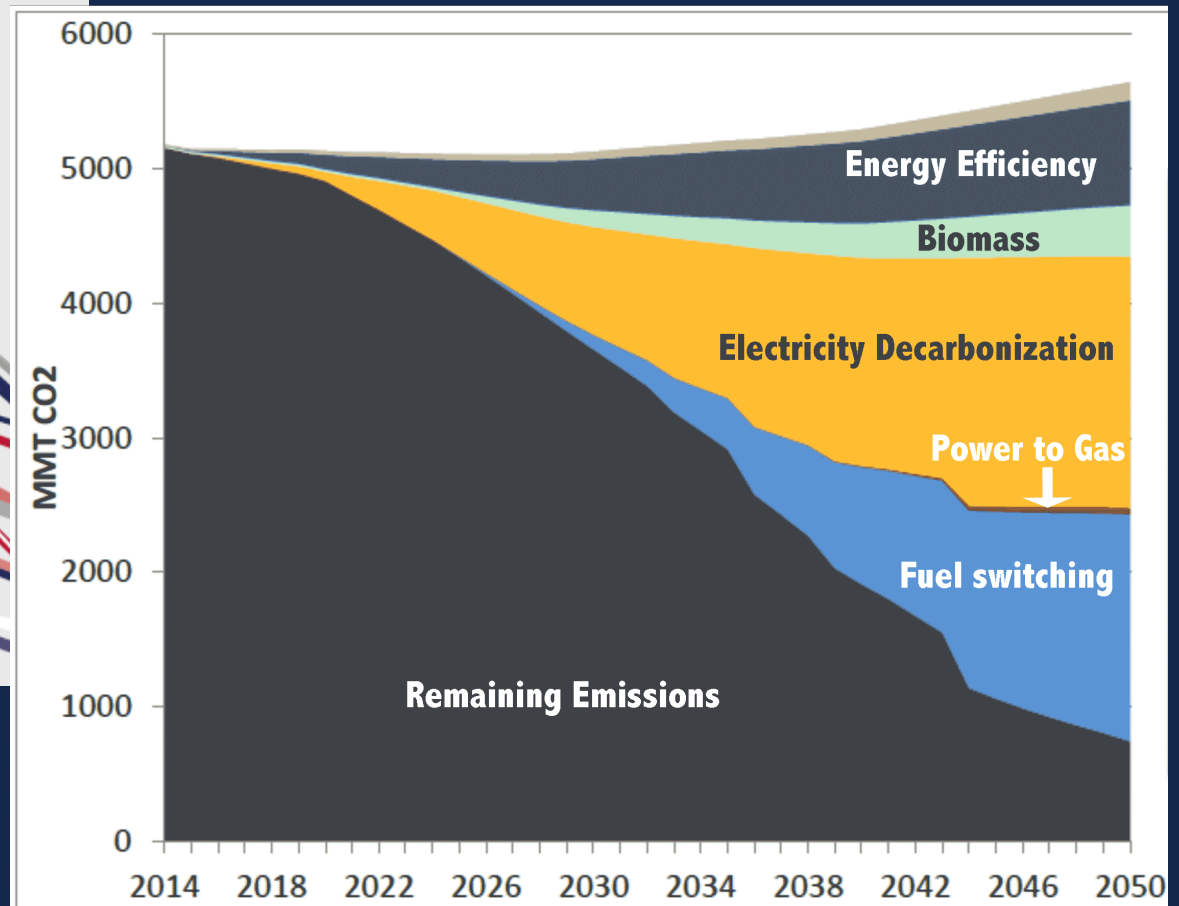
US 2050 Report

pathways to
deep decarbonization
in the United States

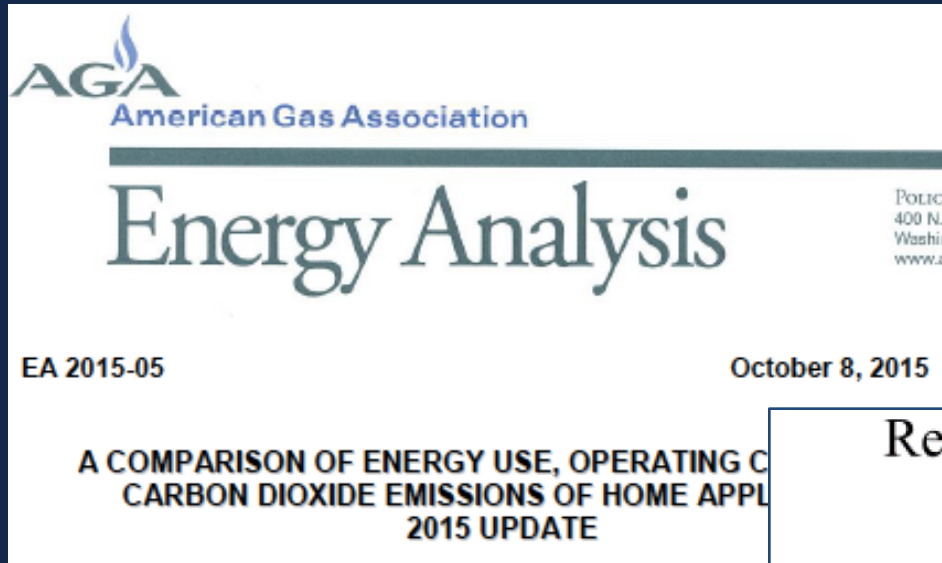


IDDRI
SUSTAINABLE DEVELOPMENT
GOALS REPORT
2023

- Technically & economically **feasible**
- Must look to **all options**



Gas: Historically the Cleaner, More Affordable Option for Water Heating



- **Gas beats traditional electric resistance** typically, where gas available

Residential Energy Efficiency Ratings Water Heaters

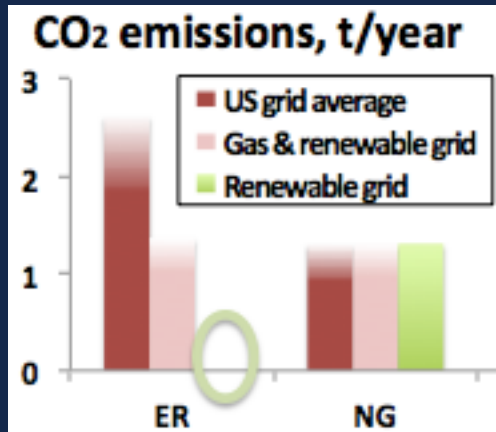
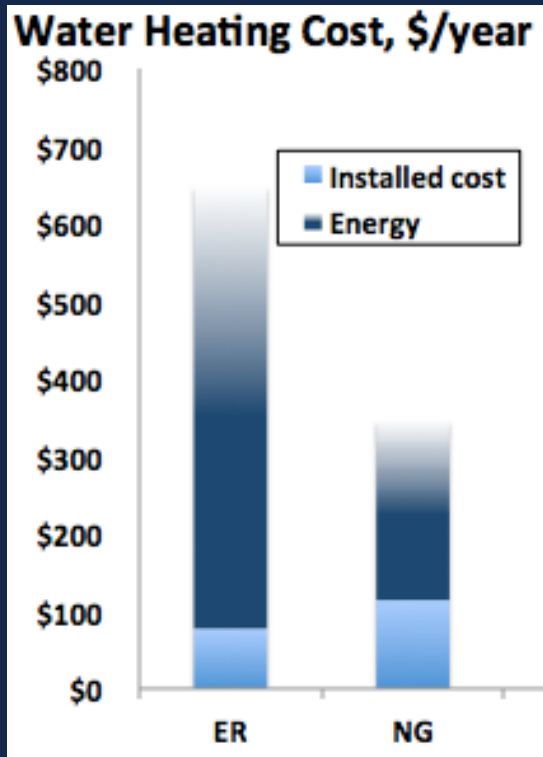
DOE site-specific energy ratings are misleading. While DOE rates an electric appliance with a more efficient energy rating than a similar gas appliance, in reality that electric appliance consumes more source energy, pollutes more, and costs the consumer more to operate.

Environmental Impact: 1.3 million tons of CO₂e
A 10% market shift in shipments/sales would reduce CO₂e emissions by 1.3 million metric tons per year.

	Electric Resistance	Natural Gas
DOE NAECA Efficiency Rating ¹ :	.95 EF	.86 EF
Full-Fuel-Cycle Energy Consumption (MMBtu/yr):	49.8	26.6
Energy Cost ² /yr :	\$589	\$244
CO ₂ e ³ Emissions (metric tons/unit/yr):	2.9	1.5
Average Installed Cost ⁴	\$662	\$967



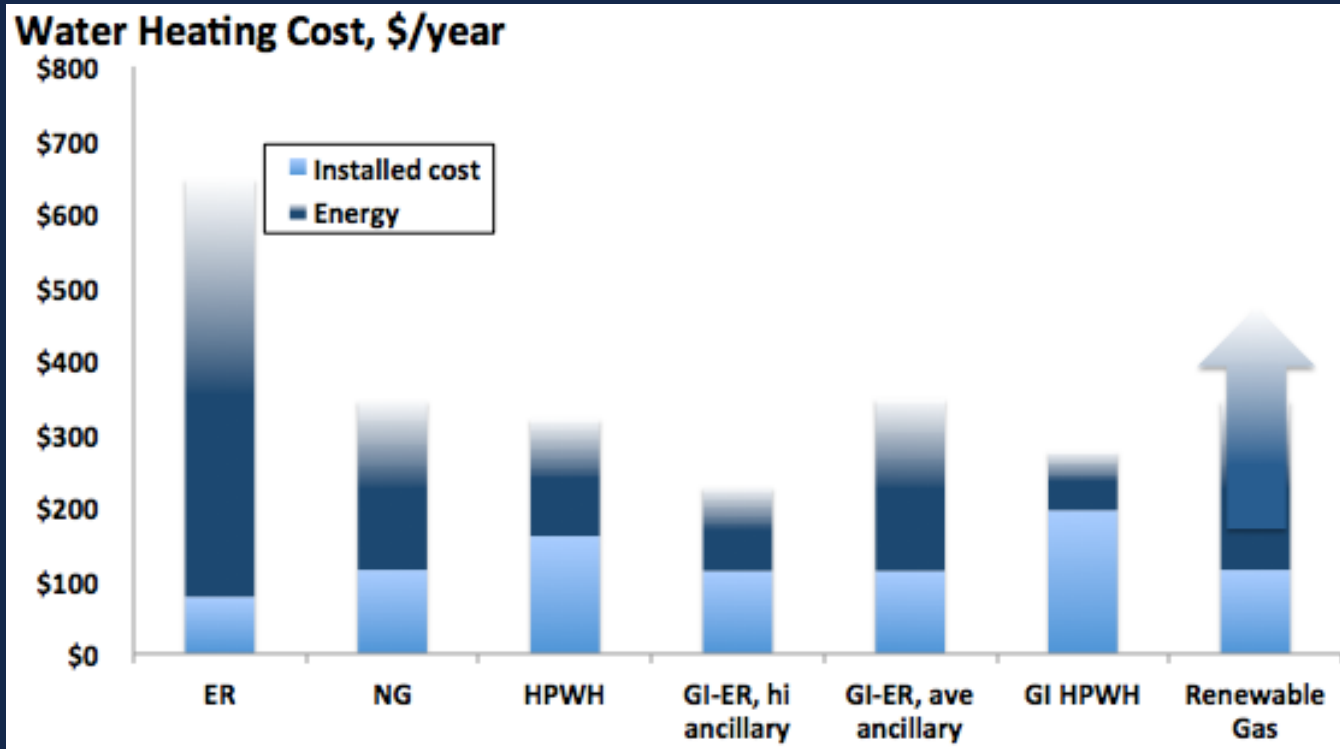
Water Heating Cost and Emissions



- **Natural Gas – traditionally a cleaner, cheaper option** than electric resistance where gas is available
- Many nuances, **assumptions and caveats**
- ...and major **new opportunities** emerging for cost and emissions reduction
 - **Heat pump water heaters**
 - **Grid interactive water heaters**
 - Renewable gas?



Cost and Emissions of Water Heating



Some Implications

- **Inertia favors gas** where available
- Deep **decarbonization favors electricity**
 - Assuming a clean grid
 - ...and that high volume, moderate cost renewable gas doesn't emerge
- **Strong opportunities** for very clean, economic water heating
- Big impact of **grid-interactive** / energy storage / ancillary services
- Many nuances, **assumptions and caveats**



Next Steps

- **Explore your options**
 - Assess specifics for your case
 - Don't gloss over the nuances, caveats & key assumptions
- **Collaborate**
 - Across the supply chain, and across the policy spectrum
 - **Join the Community Storage Initiative**
- **Engage**
 - Across the supply chain, and across the policy spectrum

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