Building for Efficiency: Home Appliance Cost and Emissions Comparison

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Key Findings from the Study

1. **New Homes Prefer High-Efficiency Gas**: Over 75% of new homes with natural gas use a 90%+ efficient furnace. In colder climates, customers prefer gas 5-to-1 over electric heat pumps.

2. **Competitive Cost Savings**: A gas home costs $1,132 less per year than an all-electric home. High-efficiency gas appliances save $492 annually vs. an electric cold-climate heat pump.

3. **Greenhouse Gas Reductions**: Condensing gas furnaces reduce lifetime emissions by 17% compared to the typical all-electric household. Matched to a cold climate heat pump, natural gas can equal or exceed emissions reductions while cutting lifetime costs by thousands.

4. **Better Energy Performance for Homes:** Natural gas heat pumps, hybrid gas-electric systems, and renewable natural gas can reduce costs and emissions more cost-effectively than many electric home configurations.

New Homes Prefer High-Efficiency Gas

An Introduction to the Residential Natural Gas Marketplace

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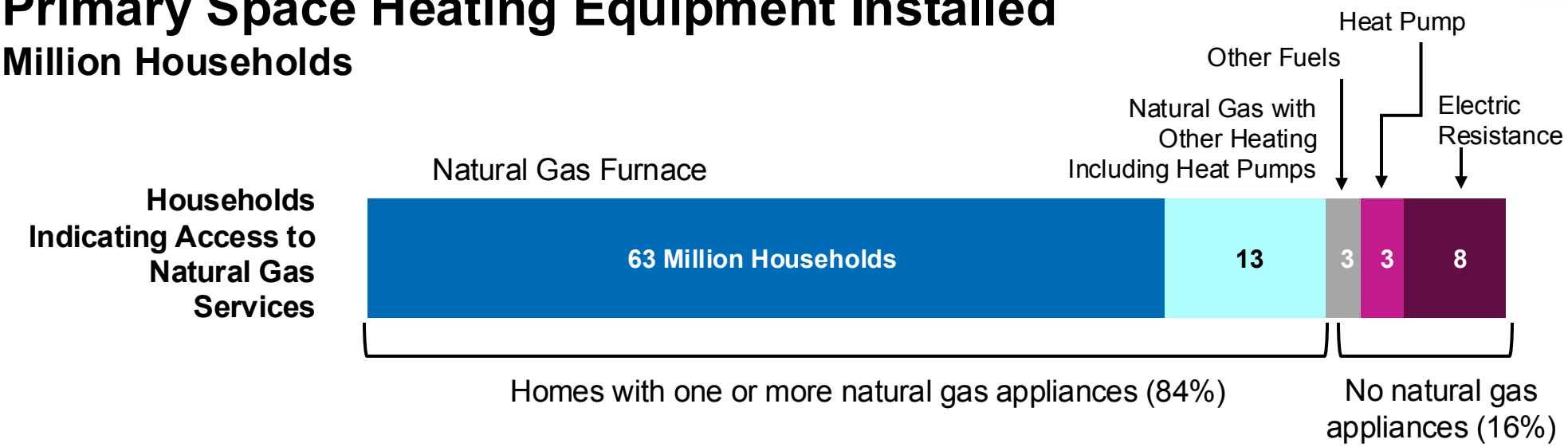
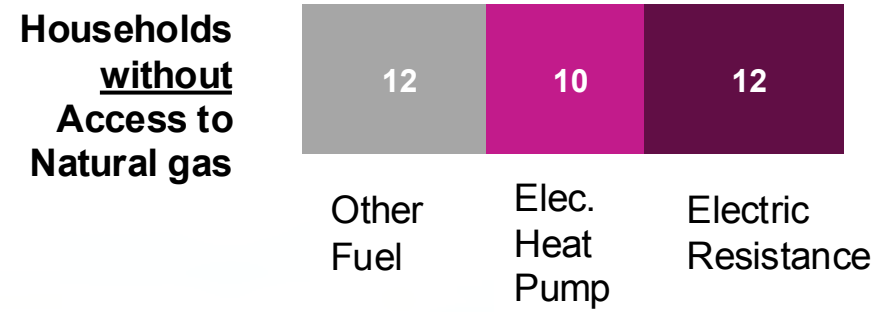
Most consumers use natural gas for space heating when gas service is available. Electric heat pumps are typically installed in homes without access to natural gas.

Primary Space Heating Equipment Installed

Million Households





60% of all electric heat pumps installed are in homes without natural gas service.

Energy Information Administration: Residential Energy Consumption Survey 2020

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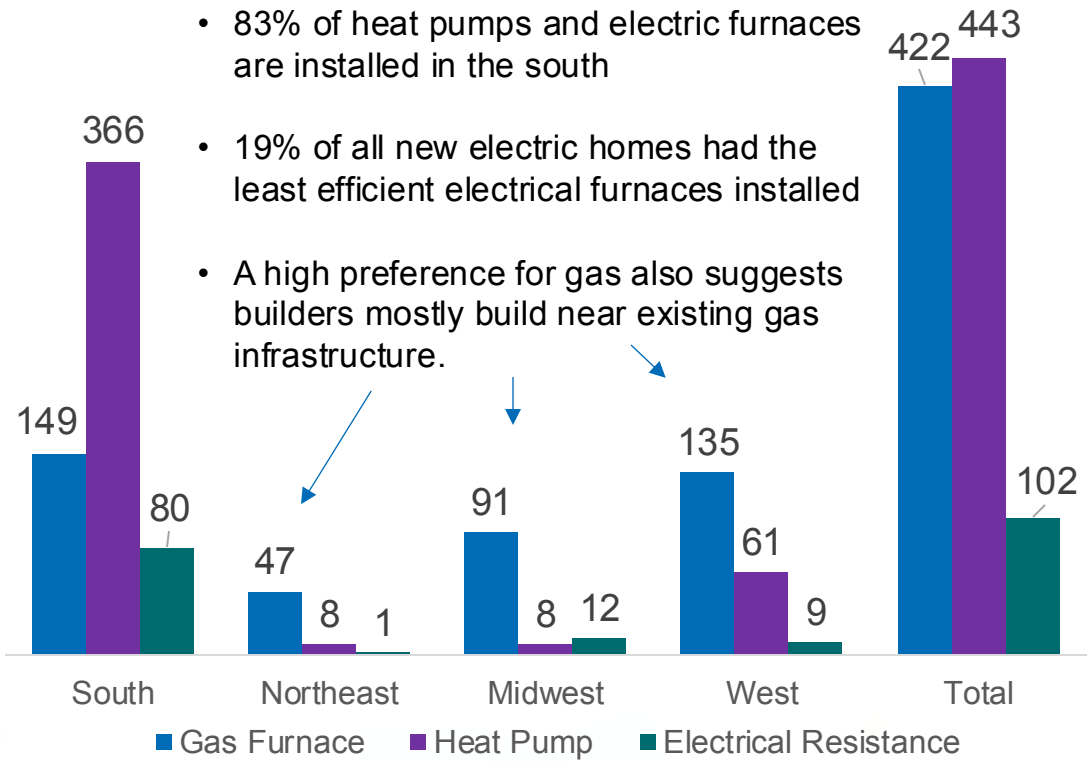
In 2023, 44% of all new single-family homes installed natural gas. Outside of the Southern US, there is generally a high market penetration for natural gas, with 5 to 1 new homes installing natural gas.

New Single-Family Home Market by Region

Thousands of Homes Built in 2023

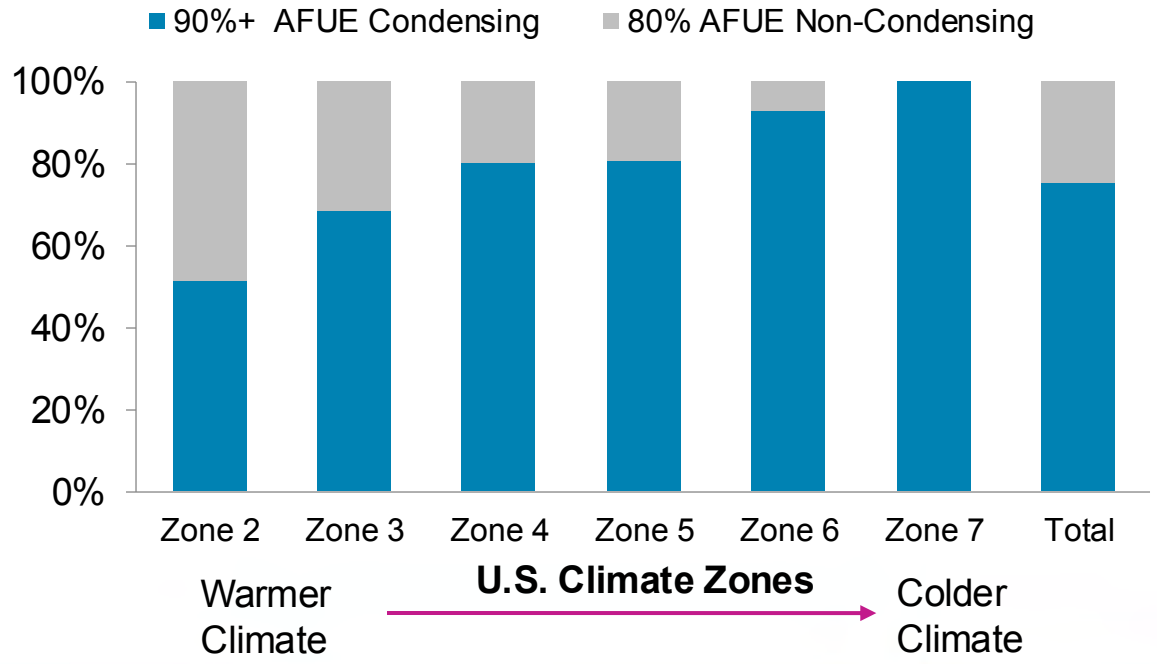
- 83% of heat pumps and electric furnaces are installed in the south
- 19% of all new electric homes had the least efficient electrical furnaces installed
- A high preference for gas also suggests builders mostly build near existing gas infrastructure.



Natural Gas Furnaces

Installed base by efficiency/product class

75% average condensing installation rate for new homes and businesses.
90% or more in the coldest climates.



Left: U.S. Census Bureau, Characteristics of Residential New Construction
Right: U.S. Department of Energy, Rulemaking on Energy Conservation Standards for Non-Weatherized Gas Furnaces

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Competitive Cost Savings

Modeling Energy Performance in a New Single-Family Home

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How This Study Modeled Energy Performance

- This AGA study evaluates energy costs and emissions for typical new single-family homes for different appliances and fuels using a full-fuel-cycle methodology to examine energy use and greenhouse gas emissions.

New Construction Household Performance Examined	
Monthly Energy Costs	Greenhouse Gas Emissions

Appliances	Energy Sources
Space Heating	Electricity
Water Heating	Natural Gas
Cooking	Renewable Natural Gas
Clothes Drying	

Household Energy and Appliance Scenarios

	Baseline	Advanced	Emerging
	All-Electric Home	**Advanced All-Electric**	**Natural Gas Hybrid**
Space Heating	8.8 HSPF2 Heat Pump	11 HSPF2 Cold Climate Heat Pump	95% AFUE Furnace w/
Water Heating	99% COP Tanked Water Heater	220% COP Tanked Water Heater	8.8 HSPF2 Heat Pump
Stove / Dryer	Electric Stove and Dryer	Induction Stove and Electric Dryer	95% COP Tankless Water Heater
Space Cooling	16 SEER Heat Pump	19 SEER Heat Pump	Gas Stove and Dryer
			16 SEER Heat Pump
	Natural Gas Home	**Advanced Natural Gas**	**Natural Gas Heat Pump**
	80% AFUE Furnace	95% AFUE Furnace	140% COP Gas Heat Pump
	64% COP Tanked Water Heater	95% COP Tankless Water Heater	95% COP Tankless Water Heater
	Gas Stove and Dryer	Gas Stove and Dryer	Gas Stove and Dryer
	16 SEER Air Conditioner	19 SEER Air Conditioner	19 SEER Air Conditioner

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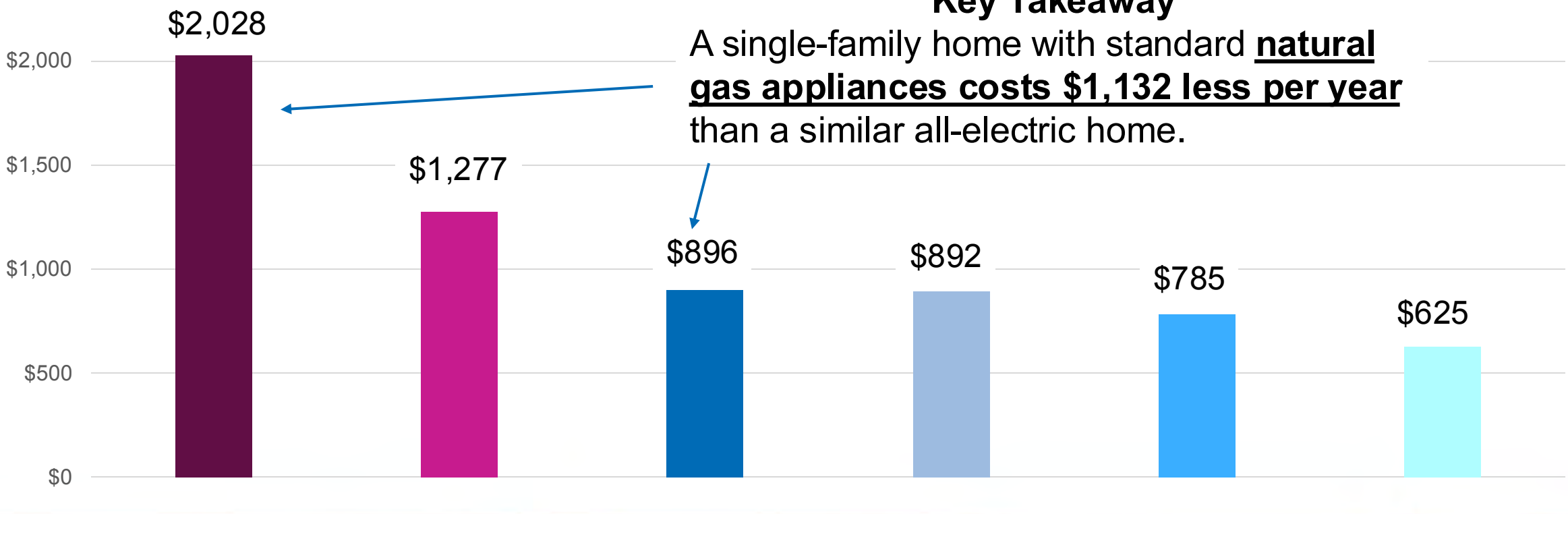
Natural gas households typically have the lowest energy costs compared with similar electric configurations.

Cost Comparison of Gas and Equivalent Electric Appliances

Annual Energy Costs of Heating and Cooking Appliances, Dollars



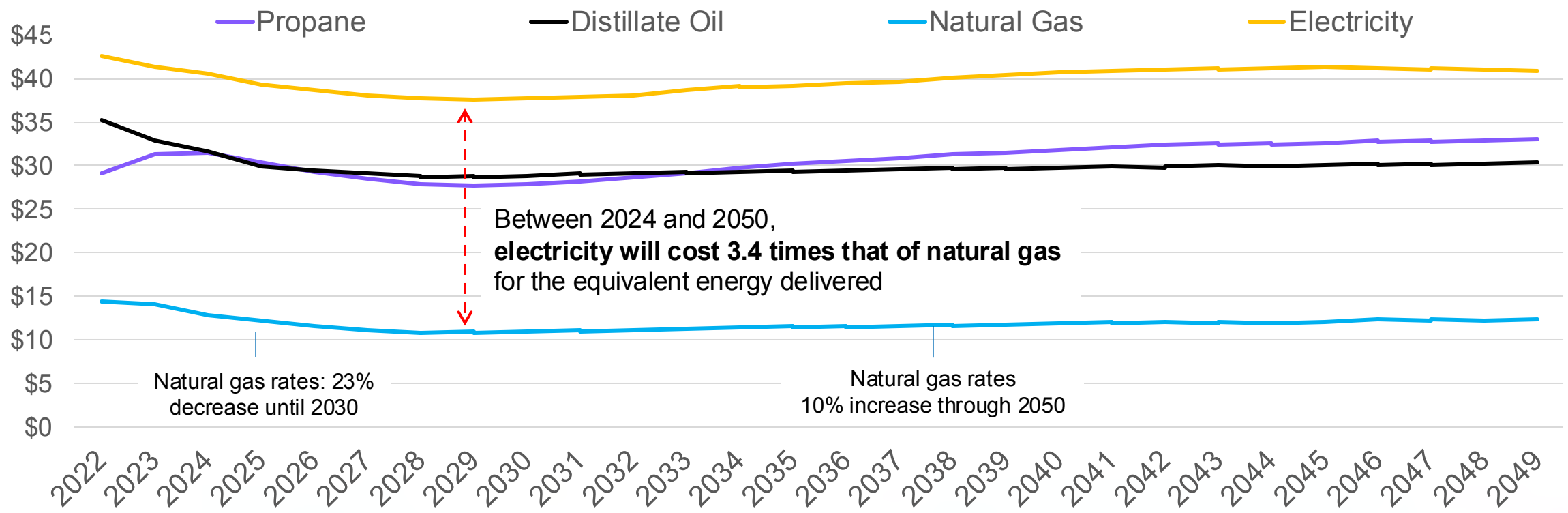
Key Takeaway

A single-family home with standard **natural gas appliances costs $1,132 less per year** than a similar all-electric home.

Natural gas retains a long-term price advantage in U.S. government energy outlook.

Residential Retail Energy Prices

Dollars (2022$) per MMBtu



U.S. Energy Information Administration, Annual Energy Outlook 2023

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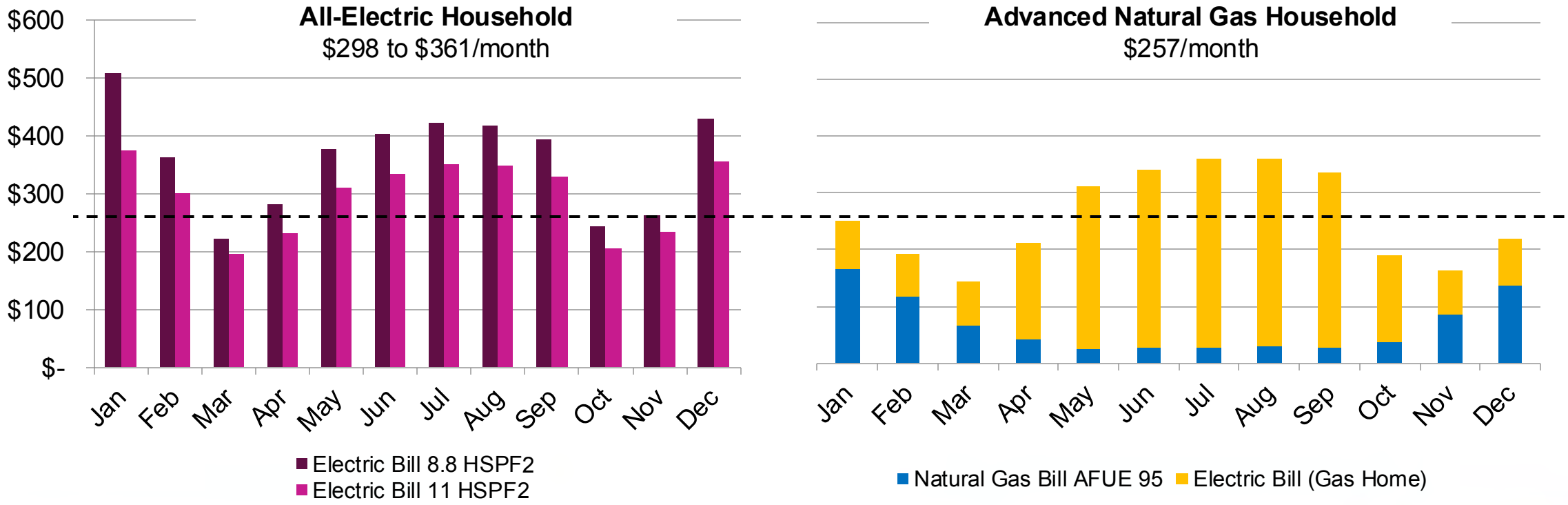
Less Volatility Each Month & Lower Winter Bills Overall

Monthly Energy Costs for All End Uses

Dollars per Month



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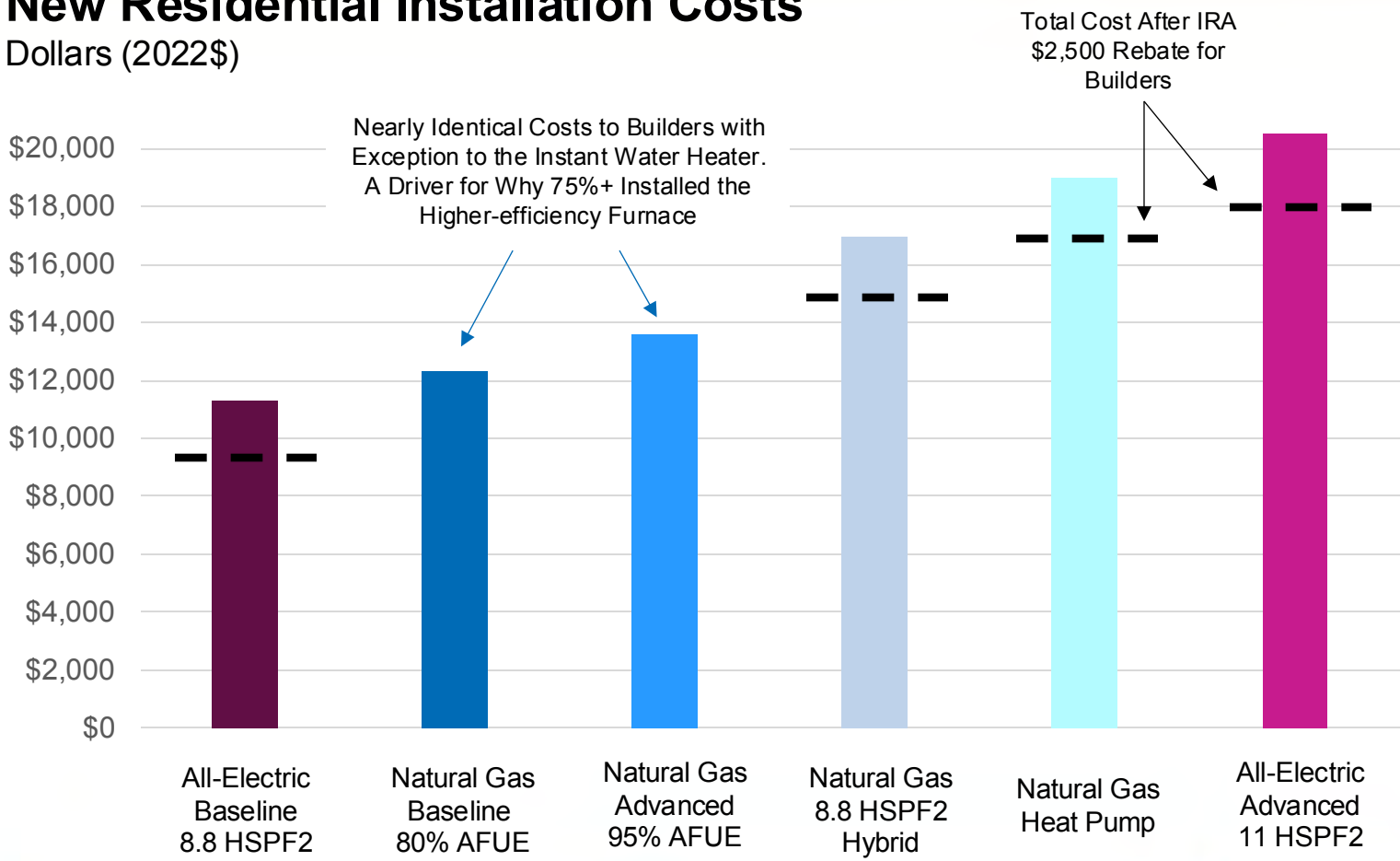
Upfront Costs and Impact on Builders

- **Costs to builders to install non-condensing and condensing gas furnaces are nearly the same**, helping explain why most new households install higher-efficiency condensing equipment.
- **Less efficient all-electric options can cost less to build but result in higher operating costs.** Based on builder and homeowner preferences, this mainly happens in warmer US climates.
- Gas heat pumps (even in smaller homes) and hybrid systems can be a more cost-efficient alternative than all-electric configurations.

New Residential Installation Costs

Dollars (2022$)



Row houses, mixed-use, and multi-family buildings can affect installation costs, particularly with condensing equipment.

Source: Home Innovation Research Labs - Cost and Other Implications of Electrification Policies on Residential Construction 2021

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Greenhouse Gas Reductions

Modeled Renewable Natural Gas Combined with Electricity Can Reduce GHG Emissions in Homes

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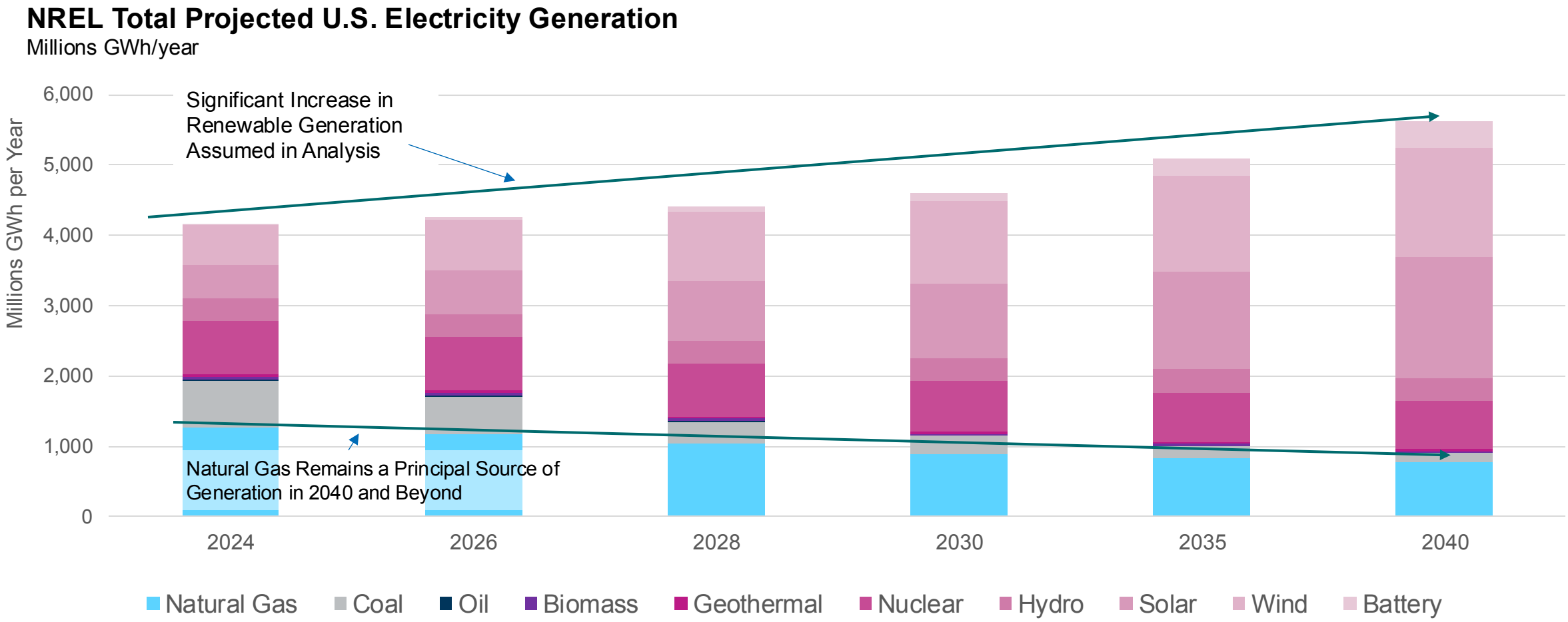
AGA Used the National Renewable Energy Laboratory Cambium Database to Model Long Term Electric Emissions



NREL's model outputs projections on hourly average and marginal emissions rates. Hourly long-term marginal emissions rates are critical for evaluating policies that can impact changes to current trends. Not unlike any other projected forecast, estimates on emissions beyond a short time can be very uncertain. Within this analysis, the use of the data out to 2040 projects meaningful emissions reductions from the electric power sector but net zero from electricity is not met nationwide by 2050 based on NREL's analysis

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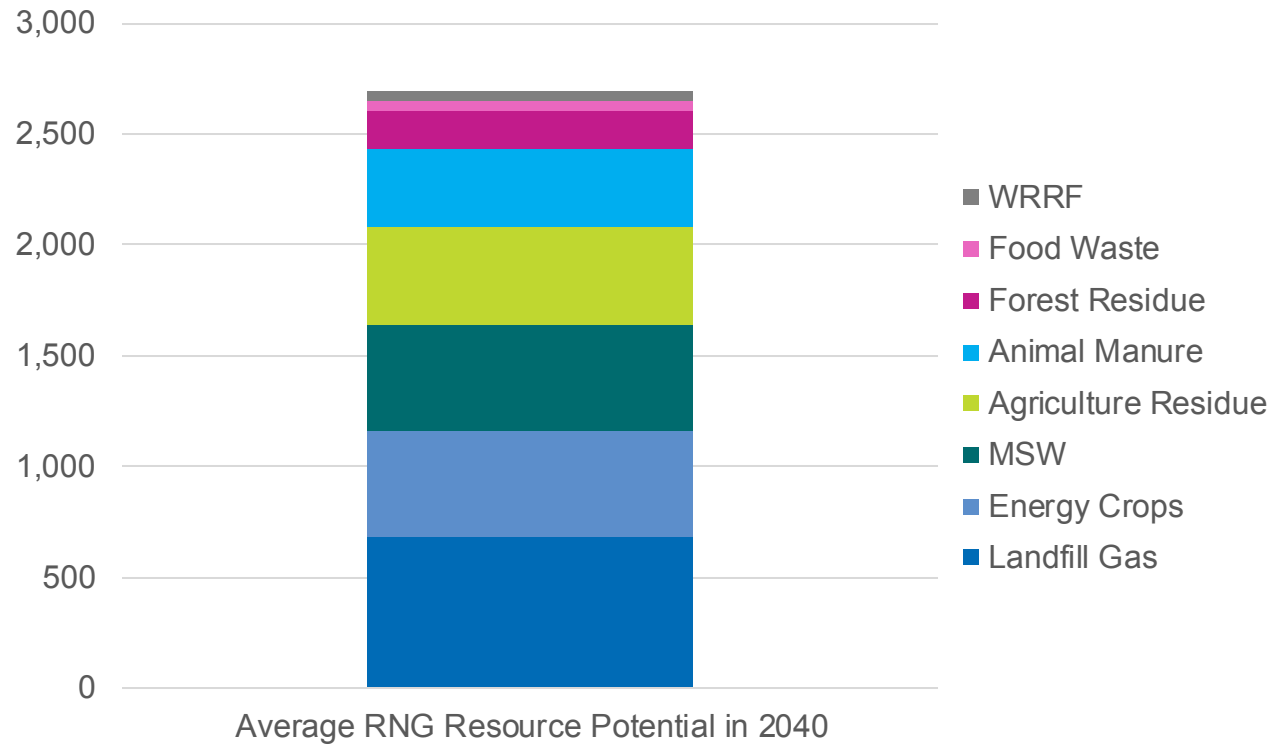
There is Significant Potential for Renewable Natural Gas to Reduce Residential Emissions

- By 2040, the **production of RNG is modeled to grow to the equivalent of one-third of total residential and commercial natural gas** demand, with an average annualized mix of 20% over the next 15 years.
- The annual gas bill of an all-condensing home was $784, and the **incremental cost of 20% RNG was $92 or $458 for 100%.**
- The **projected average cost of renewable natural gas (RNG) for residential homes is $21.24 per MMBtu**, about 50% higher than the average residential price of natural gas in 2023.
- Using **1 unit of RNG offsets 96% of the emissions** from conventional natural gas, which has an average carbon footprint of 63 kg CO2e per MMBtu.

Estimated Average Annual RNG Production in 2040

Based on AGF *Renewable Sources of Natural Gas* 2019 Study

tBtu/year



Source:
American Gas Foundation: Renewable Sources of Natural Gas (2019)

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Better Energy Performance for Homes

The Value of Natural Gas and Emissions Reduction

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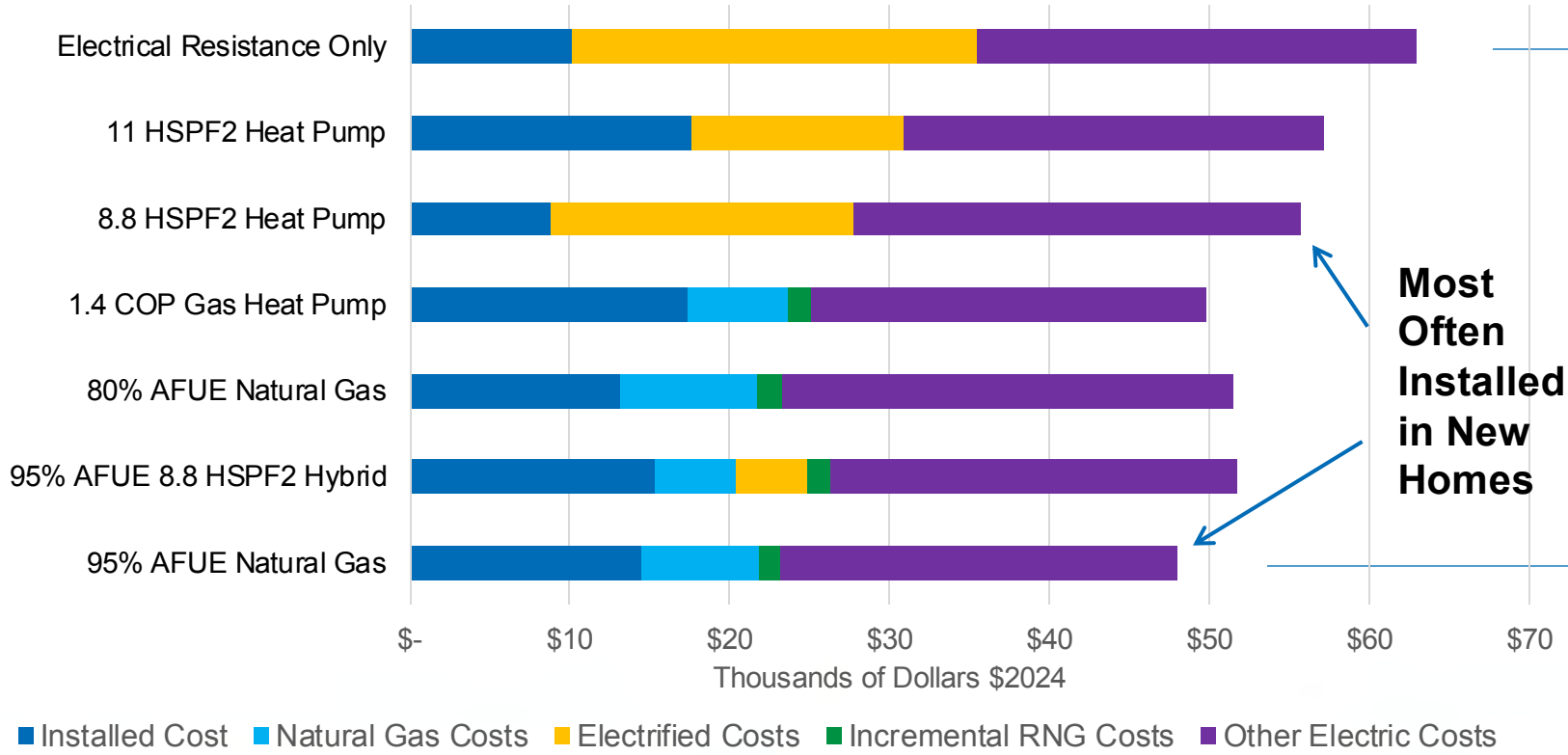
Natural gas is the most affordable option while contributing to lower carbon emissions.

15-Year Lifecycle Costs, All Appliances

Thousand Dollars (2024$)



Most Often Installed in New Homes

15-Year Life Cycle GHG Emissions	
Gas or Electrified Equipment	**Total Home Impact**
80.7	151.8
44.9	114.1
59.2	131.7
32.8	98.1
53.5	126.5
37.5	108.7
44.7	109.9

Metric Tons CO2e
100 Year GWP

Natural gas and electricity costs based on EIA Annual Energy Outlook 2023. Renewable Natural gas "RNG" costs are fixed at current estimates made by ICF. All operating costs subject to a 3% discount rate. Electric power emissions based on NREL Cambium database.

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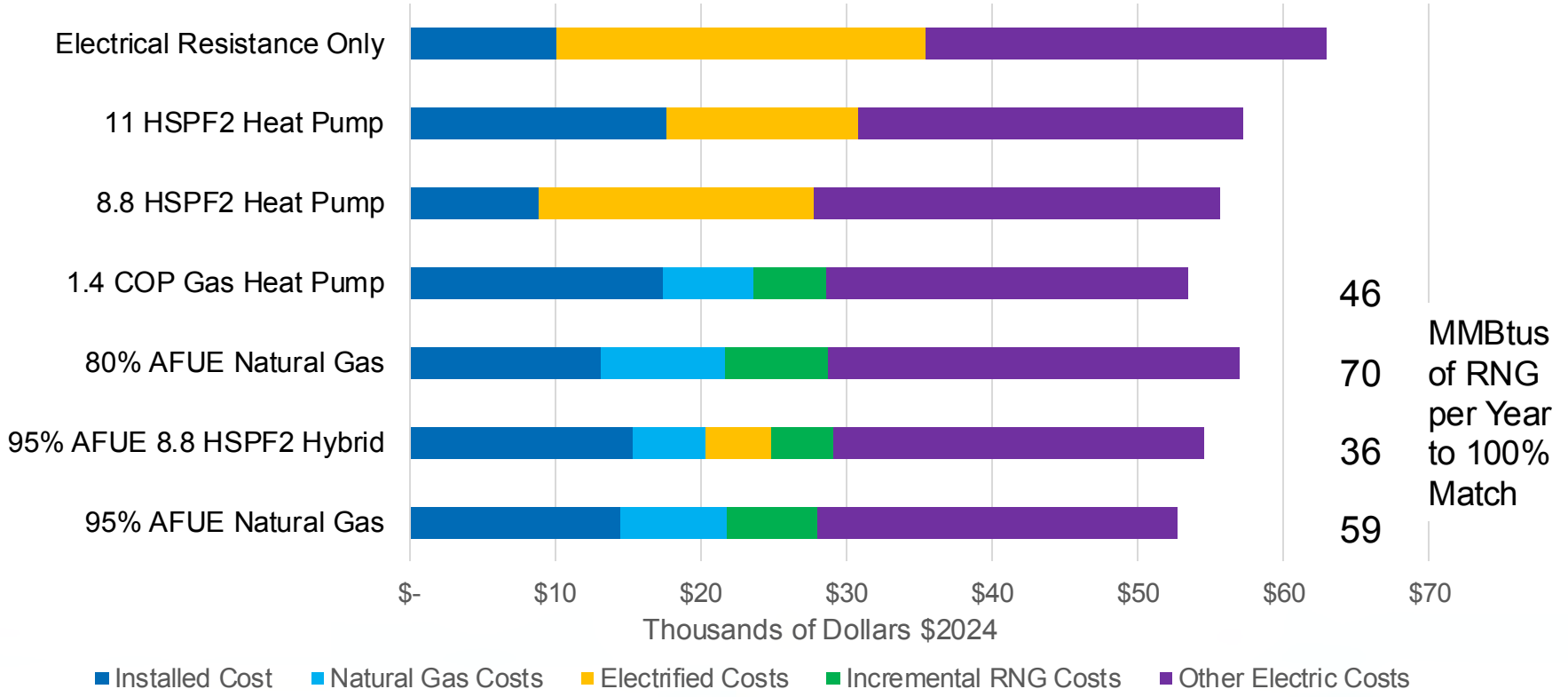
Households Maximizing RNG Can Cost-Effectively **Neutralize** Greenhouse Gas Emissions From Natural Gas Appliances

15-Year Lifecycle Costs, All Appliances

Thousand Dollars (2024$)



15-Year Life Cycle GHG Emissions	
Gas or Electrified Equipment	**Total Home Impact**
80.7	151.8
44.9	114.1
59.2	131.7
1.9	67.1
2.9	75.9
17.1	88.3
2.4	67.7

Metric Tons CO2e
100 Year GWP

Natural gas and electricity costs based on EIA Annual Energy Outlook 2023. Renewable Natural gas "RNG" costs are fixed at current estimates reported by American Gas Foundation 2019. All operating costs subject to a 3% discount rate. Normalizing for weather, the average US household consumed 67 MMBtu in 2023 (compared to the modeled baseline of 70 MMBtu). Electric power emissions based on NREL Cambium database.

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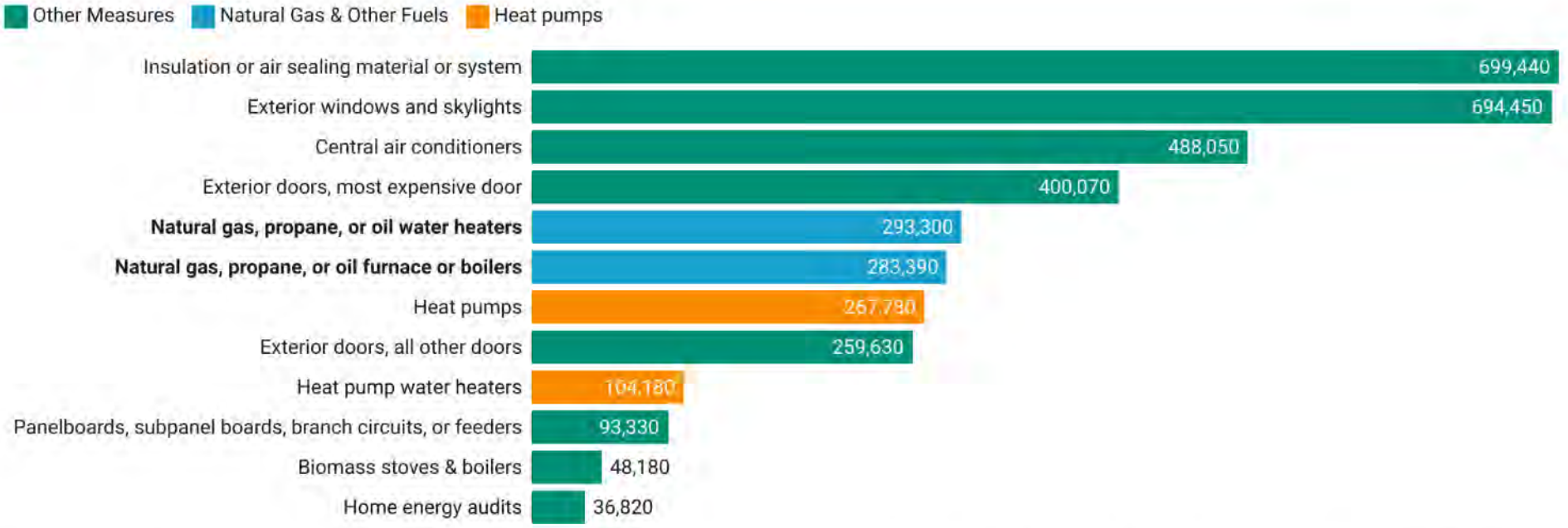
Incentives for Energy Efficiency Have Impacts on Affordability

Homes are using natural gas tax credits among many efficiency measures available. Consumers are taking advantage of credits that make the most sense for them.

Energy Efficiency Home Improvement Credits Issued



People are taking advantage of credits that make the most sense for them. People want natural gas equipment. It's often more affordable, familiar, and comfortable. The home improvement tax credits help ensure they are making a more efficient choice. The heat pump categories include a small number of natural gas heat pumps.

Chart: American Gas Association • Source: Internal Revenue Service, Return and Account Services (RAAS), August 2024 • Created with Datawrapper

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