

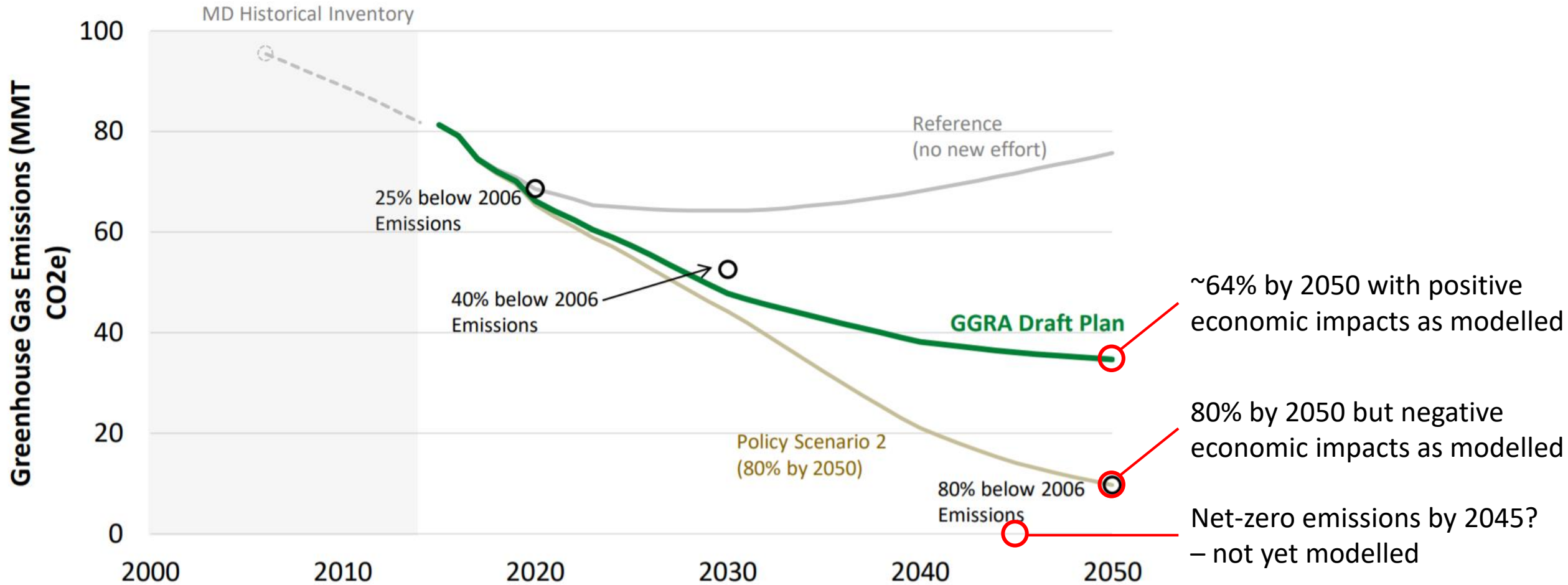
Decarbonizing Buildings

Addressing Residential, Commercial, and Industrial (RCI)
Direct Fuel Use in Maryland

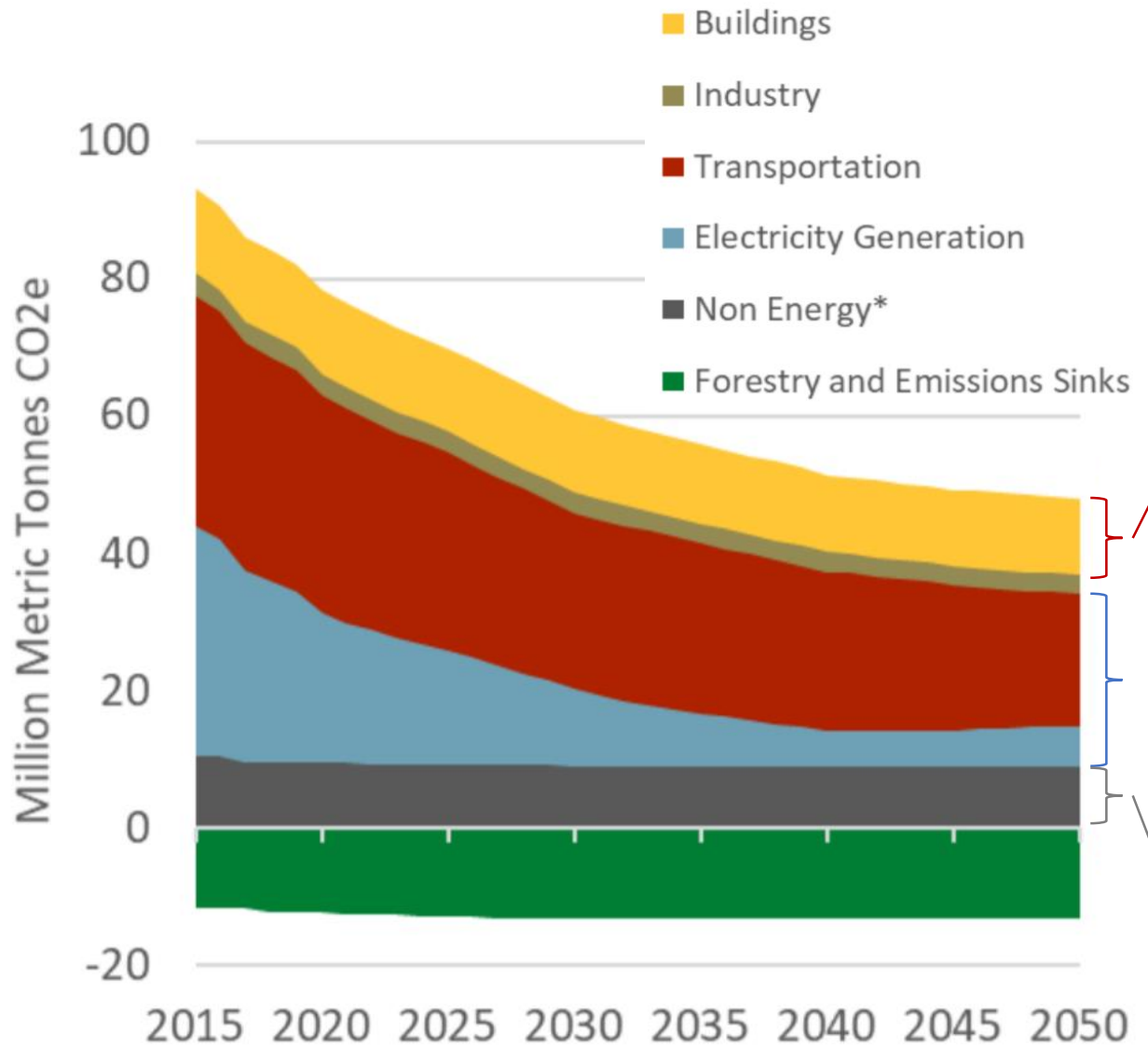
*These slides are informational only and meant to generate discussion on
the MCCC Mitigation Work Group (MWG)*

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Our Challenge: Find a Path to Net-Zero Emissions



Projected Emissions in the GGRA Draft Plan



The State should move swiftly to set its policy for achieving net-zero emissions from buildings.

Some fuel-burning equipment being installed today will still be operational beyond 2050. Lack of policy could create stranded assets.

Rightfully, the State is giving much attention to mitigating the two largest emissions sources: Transportation and Electricity Generation.

More attention might be needed here, too, but that's a topic for another day.

*Non Energy includes Agriculture, Waste Management, Industrial Process and Fossil Fuel Industry.

RCI Fuel Use in Maryland

Fuel Type	2017 Emissions (MMtCO ₂ e)
Natural Gas	9.74
Petroleum	2.91
Coal	1.17
Wood	0.06
<i>Total</i>	<i>13.87</i>

User	2017 Natural Gas Demand (tBtu)
Residential	79.4
Commercial	75.7
Industrial	16.5
<i>Total</i>	<i>171.6</i>

- Natural gas accounts for 70% of Maryland's RCI fuel use.
- 90% of Maryland's RCI natural gas use is for residential and commercial buildings.
- Natural gas represents the main challenge for decarbonizing buildings in Maryland.
- Maryland is fortunate (from a GHG perspective) to have low emissions from industry.

Washington Gas's Plan to Decarbonize DC's Natural Gas

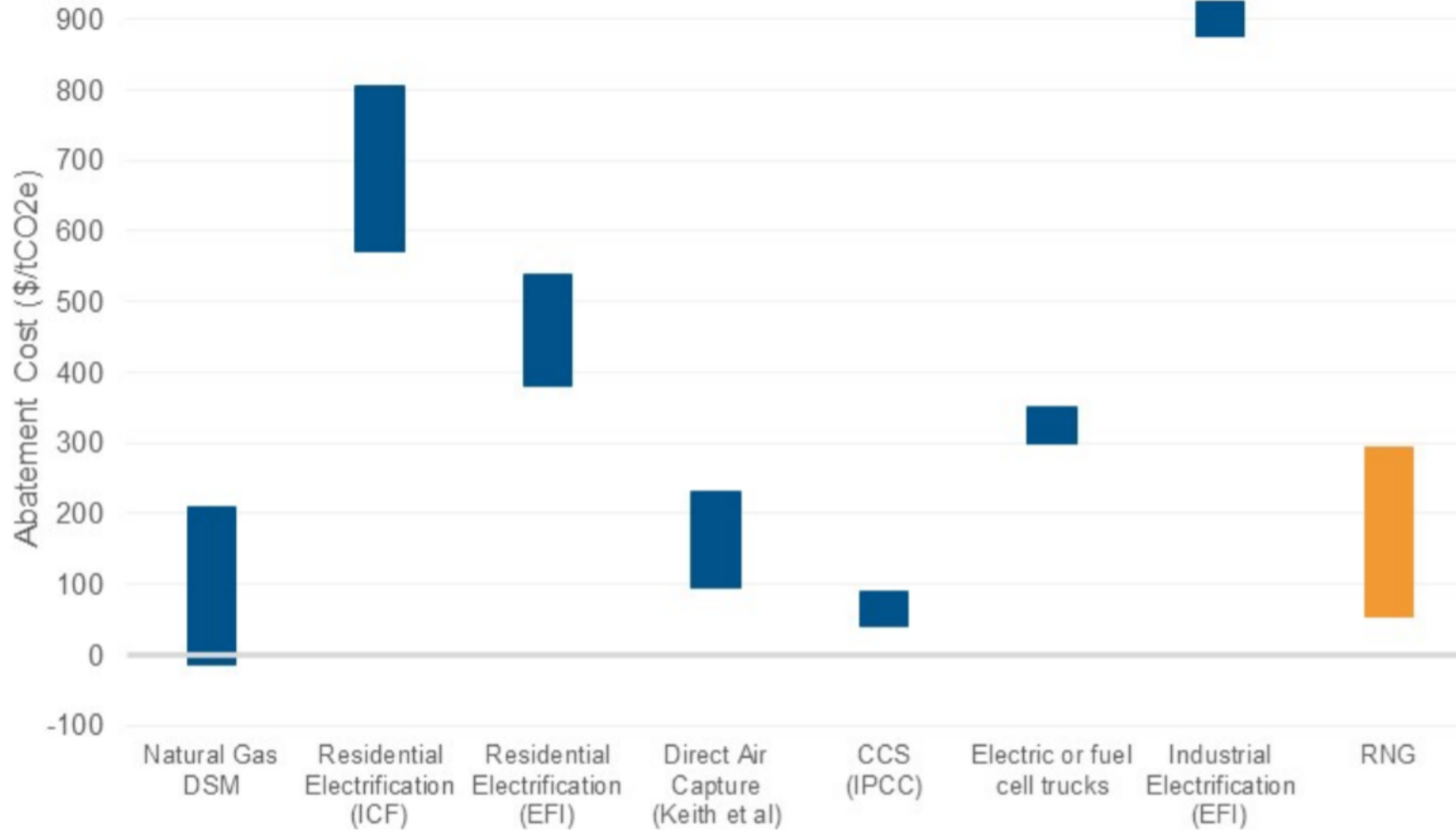


- Washington DC's Goal: Net-Zero Emissions by 2050
- Washington Gas/AltaGas just published its Climate Business Plan to achieve DC's goal for its sector:
 - **51% reduction** in emissions from **end-use efficiency** including hybrid heating (electric heat pumps that meet 80% of heating demand with gas furnace as backup)
 - **44% reduction** in emissions from **replacing natural gas with renewable natural gas (RNG)** and, to a lesser degree, power-to-gas and green hydrogen
 - **5% reduction** in emissions from **transmission and distribution efficiency** (reducing fugitive emissions)

Emissions reductions noted above are based on a 2017 baseline.

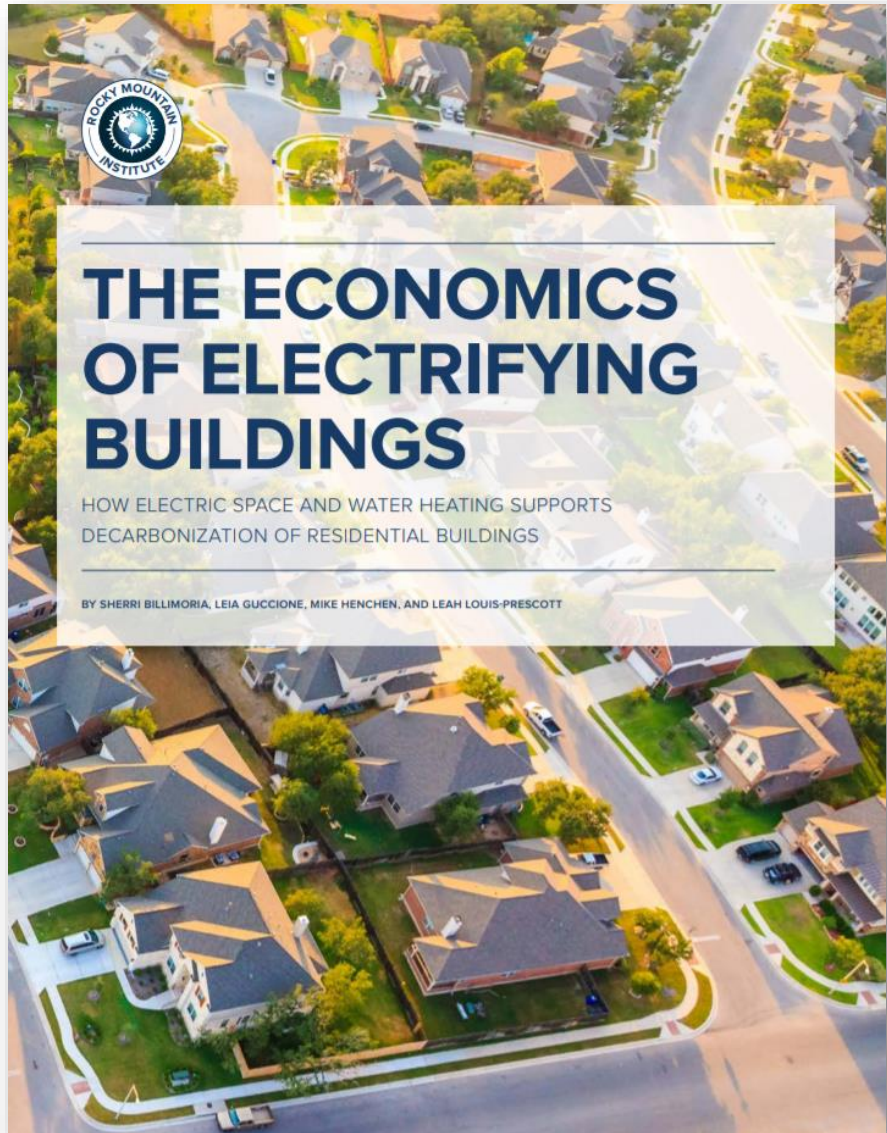
RNG is Reported to be a Low-Cost GHG Mitigation Measure

Full GHG Abatement Cost Ranges, Selected Measures, \$/tCO_{2e}



This data should not be misunderstood to mean that electrification is too expensive and that policy should focus on replacing natural gas with RNG.

Electrification Can be the Lowest-Cost Option for Homes

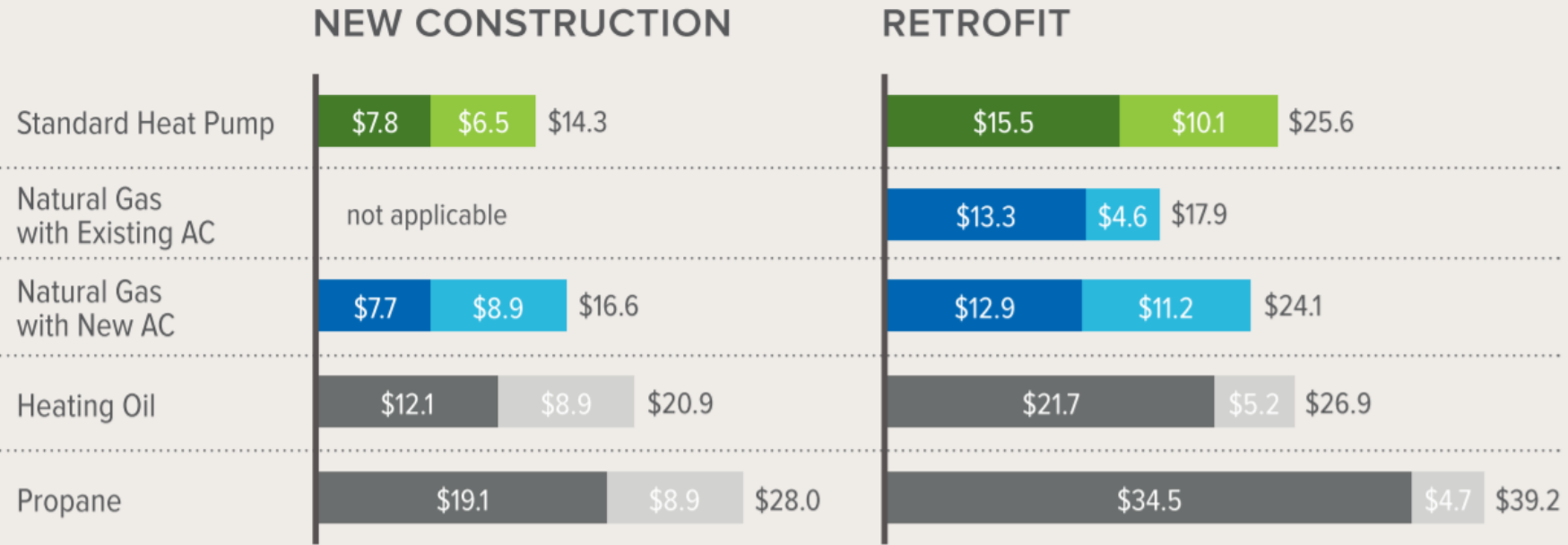


“We find electrification is cost-effective for customers switching away from propane or heating oil, for those gas customers who would otherwise need to replace both a furnace and air conditioner simultaneously, for customers who bundle rooftop solar with electrification, and for most new home construction, especially when considering the avoided cost of gas mains, services, and meters not needed in all-electric neighborhoods.”

Electrification Can be the Lowest-Cost Option for Homes

NET PRESENT COST OF WATER AND SPACE CONDITIONING, PROVIDENCE (THOUSAND \$)

Note: Study city is Providence, Rhode Island



- Heat Pump Energy Costs
- Heat Pump Fixed Costs
- Natural Gas Energy Costs
- Natural Gas Fixed Costs
- Heating Oil/Propane Energy Costs
- Heating Oil/Propane Fixed Costs

A standard heat pump costs less to install than a gas furnace and AC system for new construction or retrofit.

Lifecycle energy costs are comparable based on natural gas pricing, not RNG, which is 6 times as expensive.

RNG Supply Limitations

Region	Estimated Annual RNG Production by 2040 in ICF's "Achievable Scenario," tBtu/y
Greater DC Region	55
South Atlantic Region (MD to FL)	530
<i>MD's population-proportional share</i>	<i>50</i>
United States	4,500

Region	Percentage of Current RCI Natural Gas Use that could be replaced by RNG*
MD (based on Greater DC Region)	32%
MD (based on MD's population-proportional share of South Atlantic Region)	29%
South Atlantic Region	33%
United States	23%

* Assuming all RNG would be used for RCI, not electricity generation or transportation

Should RNG be Reserved for Industry?

Region	Estimated Annual RNG Production by 2040 in ICF's "Achievable Scenario," tBtu/y	Current Natural Gas Use for Industry Only, tBtu/y	Percentage of Current Industry Natural Gas Use that could be replaced by RNG ²
United States	4,500	10,560	43%
Maryland	50 ¹	16.5	300%

- Industry is hard to decarbonize and the most expensive sector to electrify with many high-heat processes.
- Nationally, only about half of industry's current gas use could be met using all of the nation's RNG sources by mid-century.
- In Maryland, 100% of industry's gas demand could be met using RNG, which could be the lowest-cost option for decarbonizing industry in the State.

1. Based on Maryland population-proportional share of South Atlantic Region's estimated annual RNG production

2. Assuming all RNG would be used for industry, not residential, commercial, electricity generation, or transportation

Key Questions:

1. New Construction: Should all new residential and commercial buildings be constructed with heat pumps instead of separate gas-heating and heat-pump-cooling systems?
2. Existing Buildings: How can contractors be incentivized to install heat pumps since contractors, not building owners, are typically who choose replacement systems?
3. Existing Buildings: How can the State reduce installation costs of heat pump systems, which would replace old heating and cooling systems at the same time?
4. Gas Supply: How can Maryland follow DC's lead in potentially requiring gas utilities to supply carbon neutral fuels by mid-century?
5. Industry: What is the economic impact on industry if its primary fuel supply for high-heat applications transitioned to RNG or other carbon neutral fuels by mid-century?
6. Should the MWG create a subgroup on this topic?