

# Carbon Footprint and Levelized Cost Comparison of Gas and Electric Water Heaters

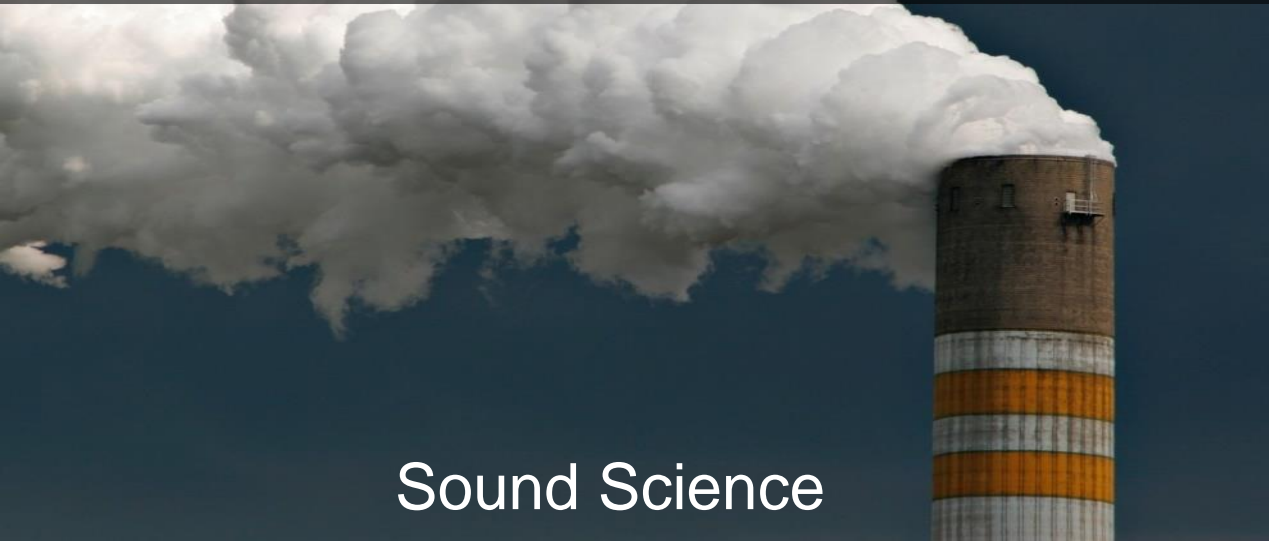
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# Environmental Defense Fund's approach



Sound Science



Corporate Partnerships



Market-Based Solutions

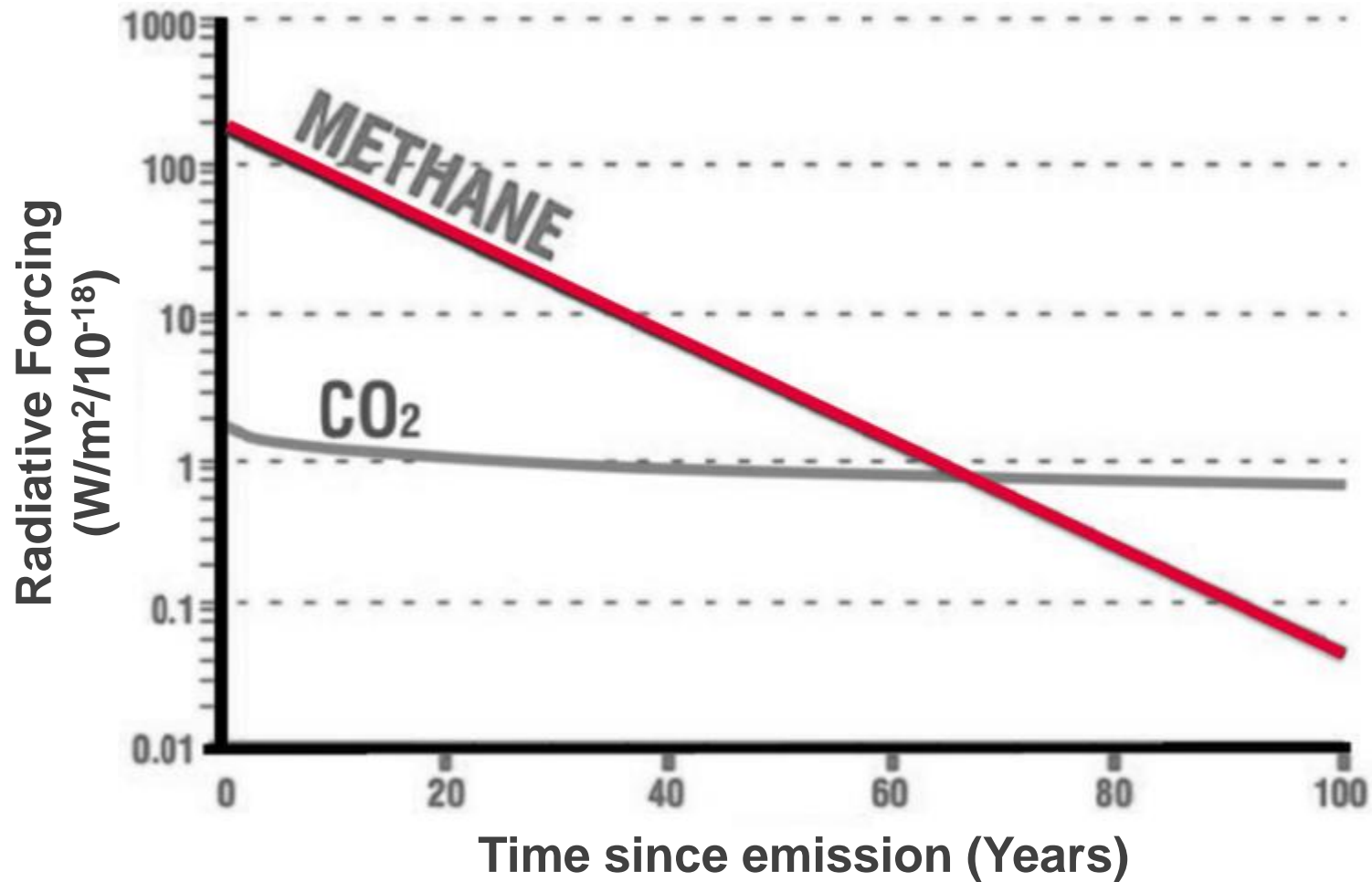


Non-Partisan Policy



**RESIDENTIAL WATER HEATER TECHNOLOGY**  
*Carbon Footprint Comparisons*

# Climate Impact from GHG Emissions



**EDF 2018 Methane Study:** Methane emissions from U.S. oil & gas supply chain: **2.3%**



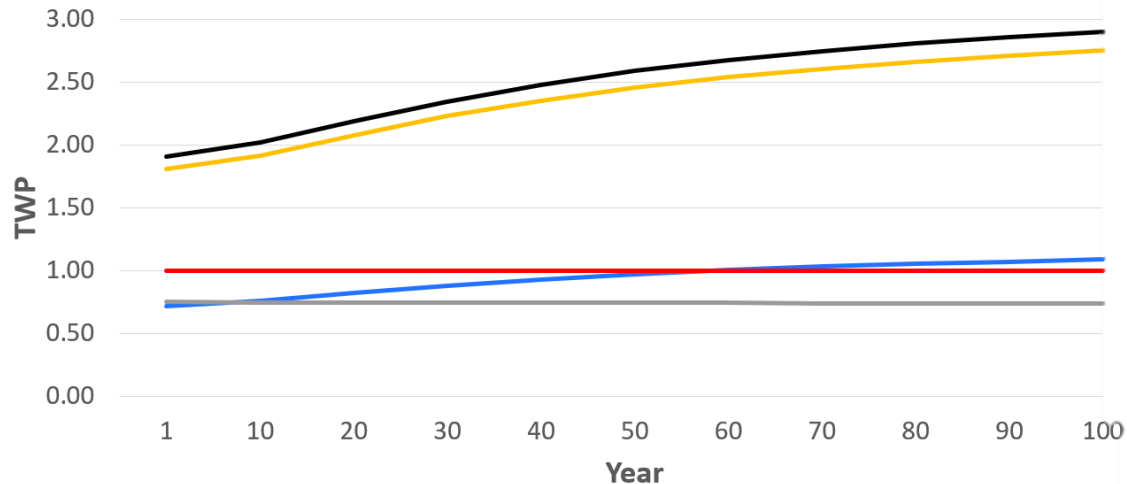
# Carbon Footprint Comparisons

## Scenarios Analyzed

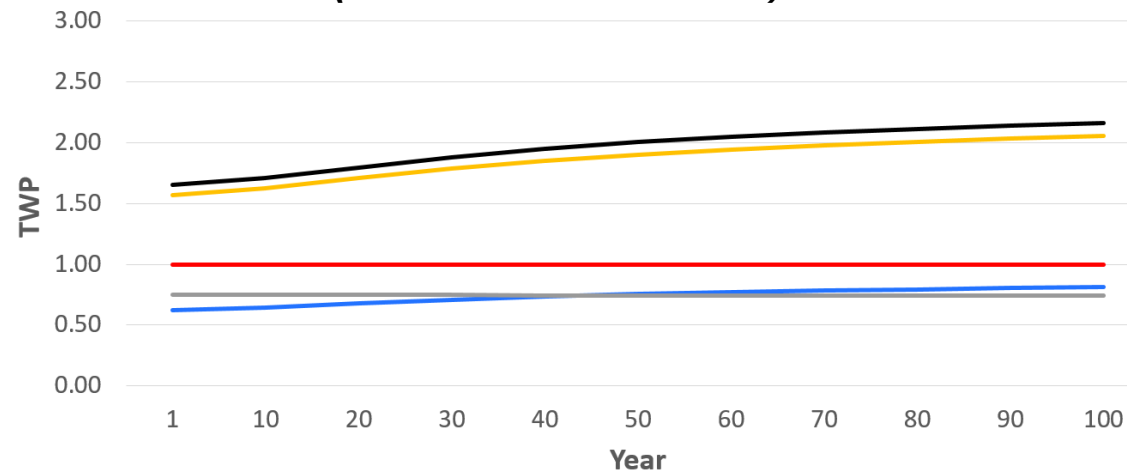
Scenario	Marginal Grid Mix
1	100% Coal w/ thermal efficiency of 33%
2	50% Coal w/ thermal efficiency of 33% 50% Gas w/ thermal efficiency of 50%
3	100% Gas w/ thermal efficiency of 50%
4	50% Gas w/ thermal efficiency of 50% 50% Zero carbon

# Technology Warming Potentials (Ref. Tech = Gas Tank WH)

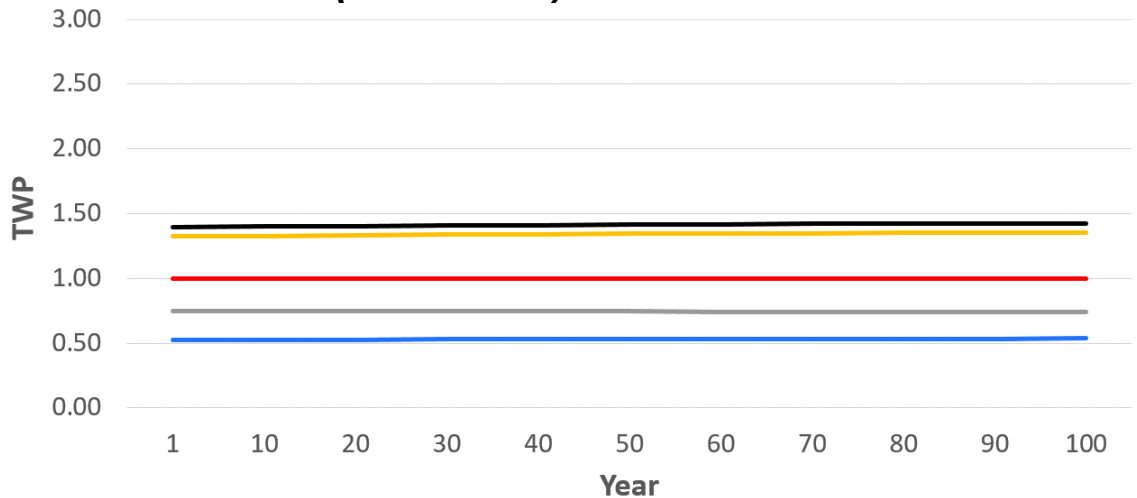
## Scenario 1 (100% Coal)



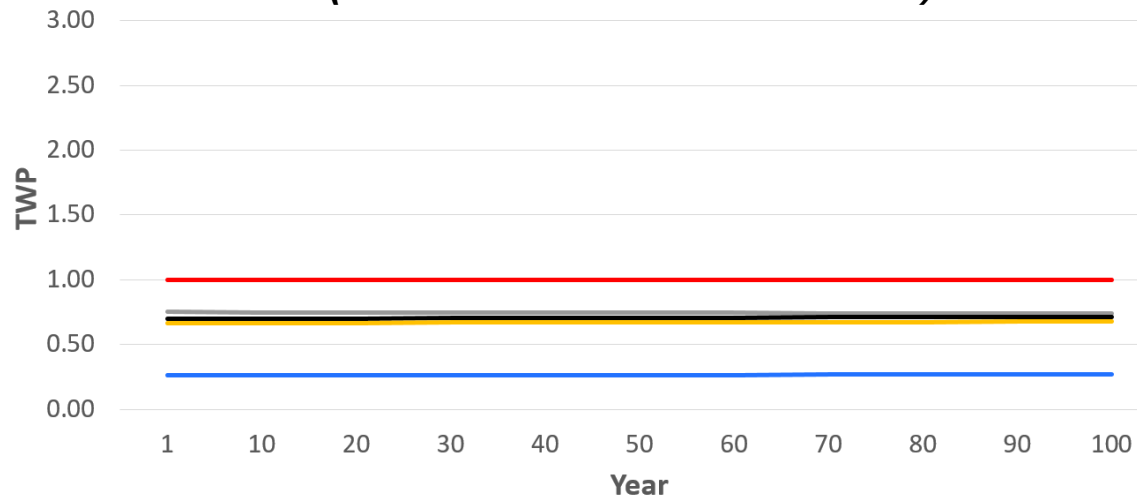
## Scenario 2 (50% Coal & 50% Gas)



## Scenario 3 (100% Gas)



## Scenario 4 (50% Gas & 50% Zero-carbon)



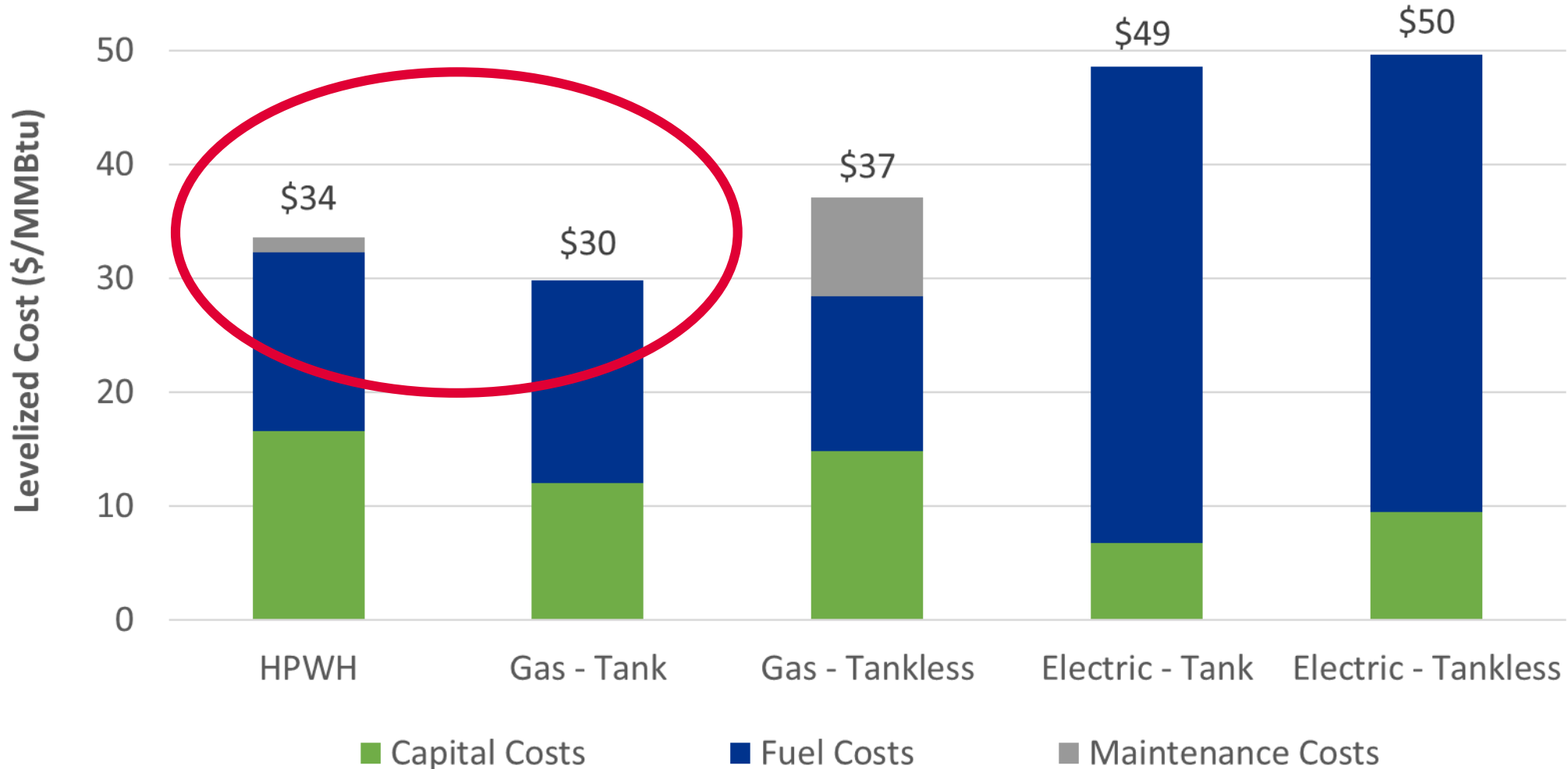
— HPWH - 2.5    
 — Gas tank WH - 0.64    
 — Gas tankless WH - 0.87    
 — ER tank WH - 0.94    
 — ER tankless WH - 0.99



**RESIDENTIAL WATER HEATER TECHNOLOGY**  
*Consumer Cost Comparisons*

# Consumer Cost Comparison

## Residential Levelized Water Heating Costs - United States

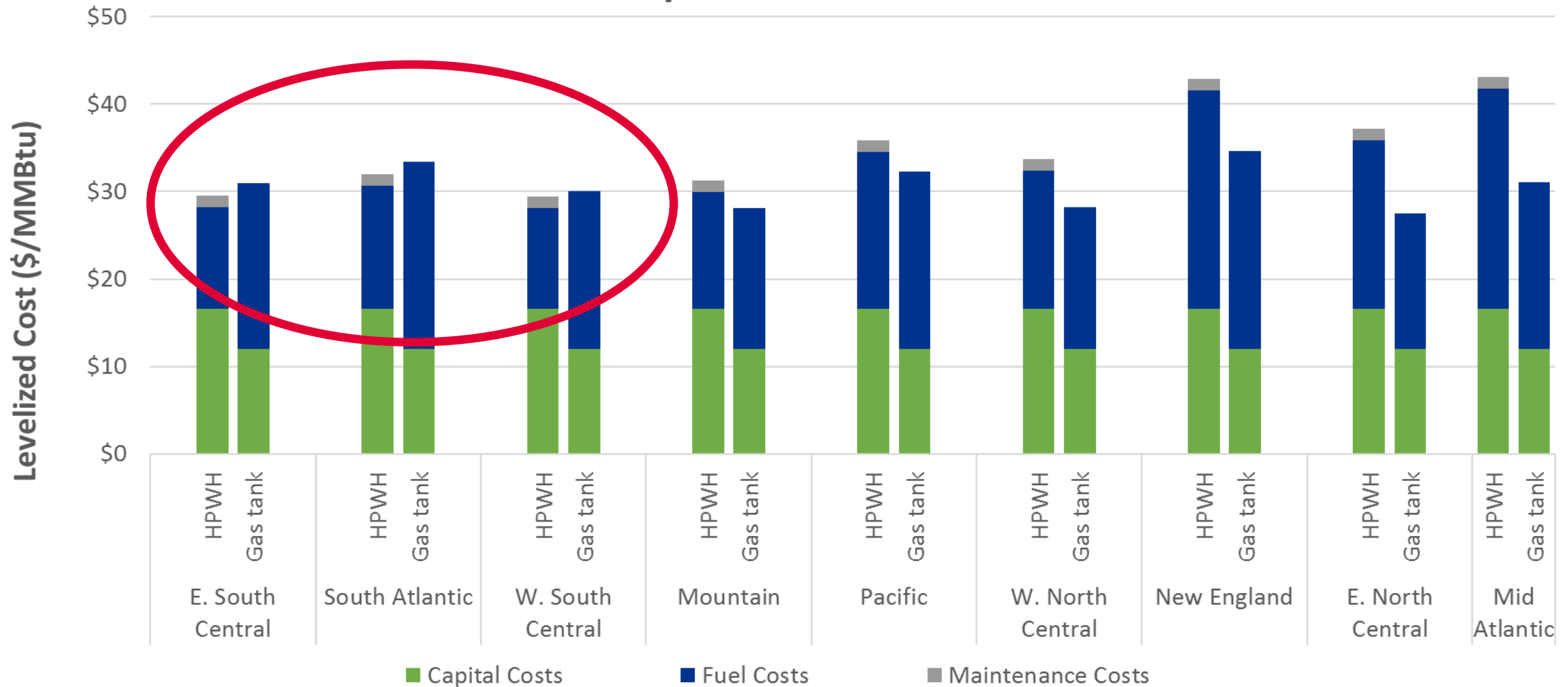


Discount Rate: 7%, Delivered Service Demand: 15 MMBtu/year



# Consumer Cost Comparison

## Levelized Cost Comparison by Region Heat Pump vs. Gas Tank Water Heater



Discount Rate: 7% & Delivered Service Demand: 15 MMBtu/year



**ELECTRIFICATION OF RESIDENTIAL WATER HEATING  
GHG Reduction Costs & Potential**

# GHG Reduction Cost and Potential

## Scenarios & Assumptions

Scenario	Marginal Grid Mix	Heat Pump Water Heater Technology Efficiencies
Base	Current Regional Marginal Grid Mix (EPA eGrid 2016 Non-BaseLoad)	2.25-2.75
Low	100% Natural Gas	2.75-3.25
Middle	50% Natural Gas 50% Zero carbon	3.00-3.50
High	100% Zero carbon	3.25-3.75

Other Assumptions: Discount rate: 7%

Methane emissions from natural gas supply chain: 2.3%



# GHG Reduction Cost and Potential\*

## Gas Tank WH to HPWH Conversions

Scenario	GHG Reduction Cost (\$/tCO <sub>2</sub> e)			GHG Reduction Potential (MMTCO <sub>2</sub> e)		
	Min	Avg.	Max	% Equipment Stock Converted		
				10%	50%	100%
Base	\$10	\$170	\$558	1.9	9.6	19.1
Low	-\$23	\$46	\$147	3.8	19.2	38.5
Middle	-\$26	\$21	\$77	5.6	27.7	55.5
High	-\$28	\$9	\$47	7.0	35.1	70.1

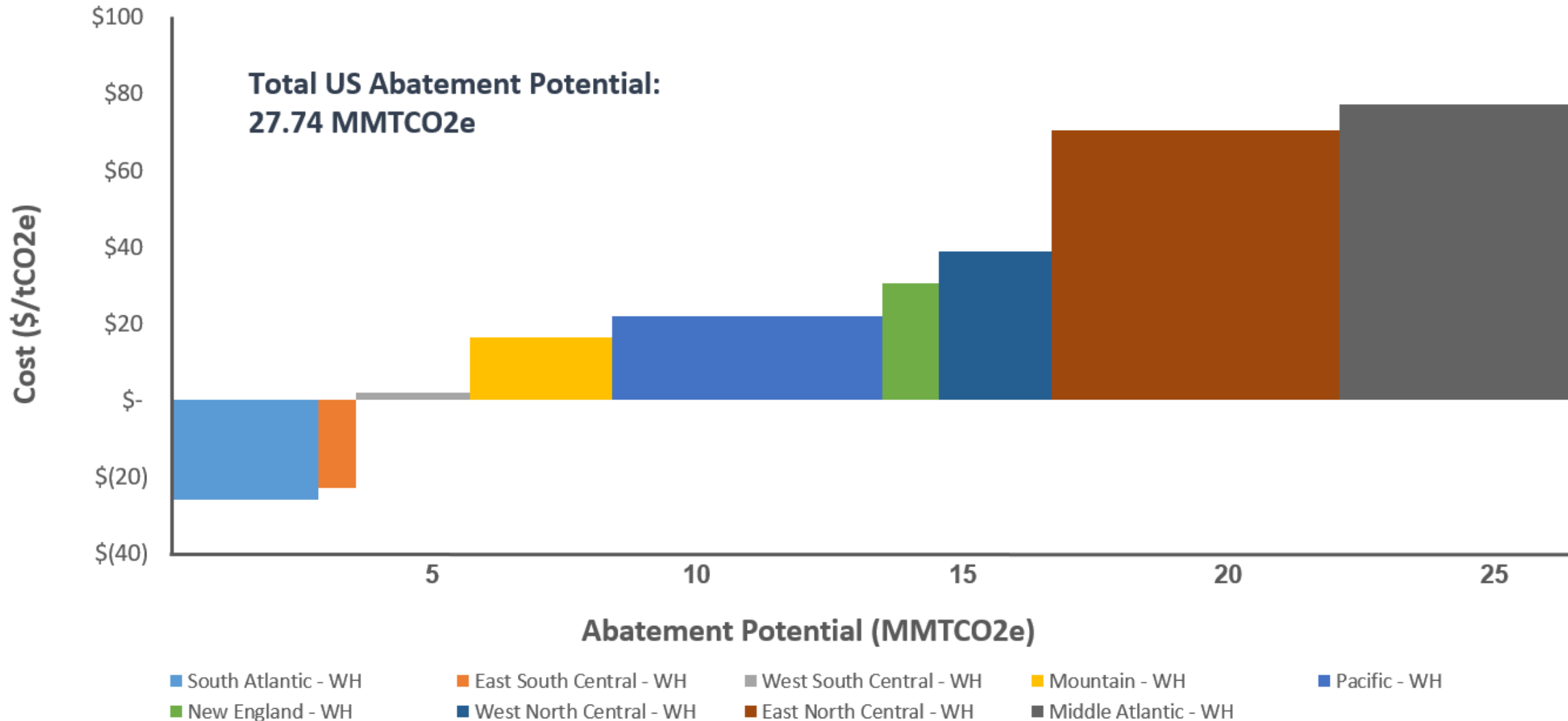
Grid getting cleaner & HPWH Tech Improving

% Converted

\*CO<sub>2</sub>e computed based on methane's warming potential over **100** years

# Marginal Abatement Cost Curve\*

Middle scenario w/ 50% equipment stock conversion



Total US Abatement Potential:  
27.74 MMTCO2e

Abatement Potential (MMTCO2e)

- South Atlantic - WH
- East South Central - WH
- West South Central - WH
- Mountain - WH
- Pacific - WH
- New England - WH
- West North Central - WH
- East North Central - WH
- Middle Atlantic - WH

\*CO2e computed based on methane's warming potential over **100** years





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**Thank you!**