2024 New England Avoided Energy Supply Cost Study

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AESC 2024 Study Overview

- **Objective**: estimate avoidable costs of the energy system in New England for calculating program benefits, including electric energy, electric capacity, fossil fuels, T&D, reliability, and other costs
- **Application**: 2025-2027 Plan
- **Stakeholders**: PAs, State Agencies, and NGOs representing EE for all six New England states
  - Regional study performed every three years
  - 70+ individuals representing 20+ organizations in the Study Group
  - Biweekly coordination calls in July 2023 thru January 2024
- **Lead Vendor**: Synapse Energy Economics
  - Selected by Regional RFP in Summer 2023
- **Status**: Results expected to be finalized on January 31st
  - Each state decides how to apply the results, according to legislative and regulatory requirements.

Benefits of Avoiding Energy Costs

- Avoided costs are used to estimate the economic value of the programs.
- Results are not a forecast of energy prices. Results are a forecast of energy prices absent future program EE, electrification, and active demand.
- EE program activities reduce total system energy demand, thereby reducing future energy costs.
  - Electrification and active demand activities have other impacts, e.g., increasing or shifting demand
- The future avoided energy costs are used to quantify benefits for cost-effectiveness analysis.

Calculating Benefits from AESC

Impacts × Avoided Costs = Benefits

Electric Energy (kWh)	Electric Energy Generation Electric Energy DRIPE Non-Embedded GHG Impacts
Electric Capacity (kW)	Electric Capacity Generation Electric Capacity DRIPE Electric Transmission
Natural Gas (MMBTU)	Natural Gas Natural Gas DRIPE Natural Gas GHG Impacts
Fuel Oil (MMBTU)	Fuel Oil Fuel Oil DRIPE Fuel Oil GHG Impacts
Propane (MMBTU)	Propane Propane GHG Impacts

Benefits are calculated for each year of a measure's life, and present-valued using a discount rate, to determine lifetime benefits.

Other avoided costs not calculated within AESC are water benefits, distribution benefits, and non-energy impacts (NEIs), like health and safety benefits.

Summary of Avoided Cost Categories

- Electricity Wholesale Market Prices
  - Energy (kWh) driven by natural gas and RPS compliance
  - Capacity (kW) estimated through new Capacity Market analysis
- Fuel Prices for Heating & Generation
  - Natural Gas, Oil, Propane, Wood, Gasoline, Diesel
- Demand Reduction Induced Price Effects (DRIPE)
  - EE reduces energy/capacity demand, thereby reducing prices
- Greenhouse Gas Emissions
  - Social Value of Greenhouse Gas Emission Reductions, also referred to as the Social Cost of Carbon (SCC)
  - New England regional Marginal Abatement Cost (MAC)
- Transmission and Distribution (T&D) and Grid Reliability

The Social Cost of Carbon is Important

- SCC is the value of mitigating future damages from climate change by reducing current emissions.
- Source: EPA's *Report on the Social Cost of Greenhouse Gases* (2023).
- Models: GHGs > Climate > Damage > Discounting
- Social Discount Rates
  - Currently using 2% from prior AESC and DPU Order
  - AESC produced two SCC results using 1.5% & 2%
- Results vary from $249/MTCO2e to $415/MTCO2e

Draft Results

Results Overview

Comparisons to AESC-2021 using 15-year levelized costs:

- Slightly higher electric avoided costs overall compared to AESC 2021
- Increased value of electric capacity and energy (+9%)
- Increased value of Renewable Portfolio Standard (+79%)
  - RPS playing larger role in setting marginal electric costs.
- Increased Social Cost of Carbon (+72% or +187%)
  - Based on modeling advancements published by EPA
- Shift of DRIPE from electric capacity to energy (+/-50%)
  - Improved modeling techniques shifted dynamic.
- Reduced value of deferring regional transmission (-28%)
  - Methodology changed to reflect forward-looking planning
- Reduced value of natural gas (-15%)
  - Despite high short-term prices, price forecasts decreased.
- Increased value of fuel oil and other fuels (+13%)

Electric Energy & Capacity

Table 2. Illustrative avoided costs for hypothetical energy efficiency measure installed in Massachusetts, AESC 2024 Counterfactual #1 versus AESC 2021 Counterfactual #1

		AESC 2021	AESC 2024	Differ-ence	% Differ-ence	Notes
Energy	*2024 $/MWh*	$46	$50	$4	9%	*4*
RPS compliance	*2024 $/MWh*	$12	$22	$10	79%	*4, 5*
Electric energy and cross-DRIPE	*2024 $/MWh*	$13	$19	$6	42%	*6*
GHG non-embedded	*2024 $/MWh*	$51	$154	$103	202%	*4,7,8*
Energy subtotal	***2024 $/MWh***	**$123**	**$245**	**$123**	**100%**	
Capacity	*2024 $/kW-year*	$48	$52	$4	9%	*9*
Capacity DRIPE	*2024 $/kW-year*	$19	$9	-$10	-53%	*9,10*
Regional transmission & distribution (PTF)	*2024 $/kW-year*	$95	$69	-$26	-28%	*11*
Value of reliability	*2024 $/kW-year*	$1	$0	$0	-18%	*9*
Capacity subtotal	***2024 $/kW-year***	**$162**	**$130**	**-$32**	**-20%**	-
Capacity subtotal	***2024 $/MWh***	**$33**	**$26**	**-$7**	**-20%**	*12*
Total	***2024 $/MWh***	**$156**	**$272**	**$116**	**75%**	-

Source: AESC 2024 Draft Report (results may change in final report). Note: The AESC 2024 GHG values assume 1.5% discount rate

Natural Gas & Other Fuels

Table 5. Avoided cost of gas for all retail customers by end-use assuming no avoidable margin

	Units	Southern New England	Northern New England
AESC 2021 (2021-2035)	2024$/MMBtu	$7.32	$7.22
AESC 2024 (2024–2038)	2024$/MMBtu	$6.25	$6.32
Percent change	%	-15%	-12%

MA Uses

Table 6. Avoided costs of retail fuels (15-year levelized, 2024$ per MMBtu)

	Residential						Commercial		Transportation	
	No. 2 Distill-ate	Pro-pane	Kero-sene	Bio-Fuel (B20)	Cord Wood	Wood Pellets	No. 2 Distillate	No. 6 Resid-ual	Motor Gasoline	Motor Diesel
AESC 2021 (2021-2035)	$27.14	$43.79	$33.41	$24.42	$23.52	$25.36	$25.11	$17.77	$24.92	$25.70
AESC 2024 (2024-2038)	$30.60	$58.11	$38.47	$29.07	$29.37	$30.73	$28.59	$21.58	$27.16	$28.76
Percent change	12.8%	32.7%	15.2%	19.0%	24.9%	21.2%	13.8%	21.5%	9.0%	11.9%

Source: AESC-2024 Draft Report (results may change in final report)

Social Cost of Carbon

Table 11. Comparison of GHG costs under different approaches (2024 $ per short ton) in Counterfactual #1

	AESC 2021	AESC 2024	Difference	% Difference
Social cost of greenhouse gases (SC-GHG or "damage cost") at 1.5% and 2% discount rates	$144 (2% only)	$249 to 415	$104 to 270	72 to 187%
New England-based marginal abatement cost, derived from the electric sector	$141	$173	$32	23%
New England-based marginal abatement cost, derived from multiple sectors	$557	$581	$24	4%

Notes: All values shown are levelized over 15 years. All AESC 2024 values except the SCC are levelized using a 1.74 percent discount rate (SCC uses a 2.0 percent discount rate). All AESC 2021 values are levelized using a 0.81 percent discount rate, then converted into 2024 dollars. Values shown above remove energy prices, but not embedded costs. Values shown above do not include transmission and distribution losses.

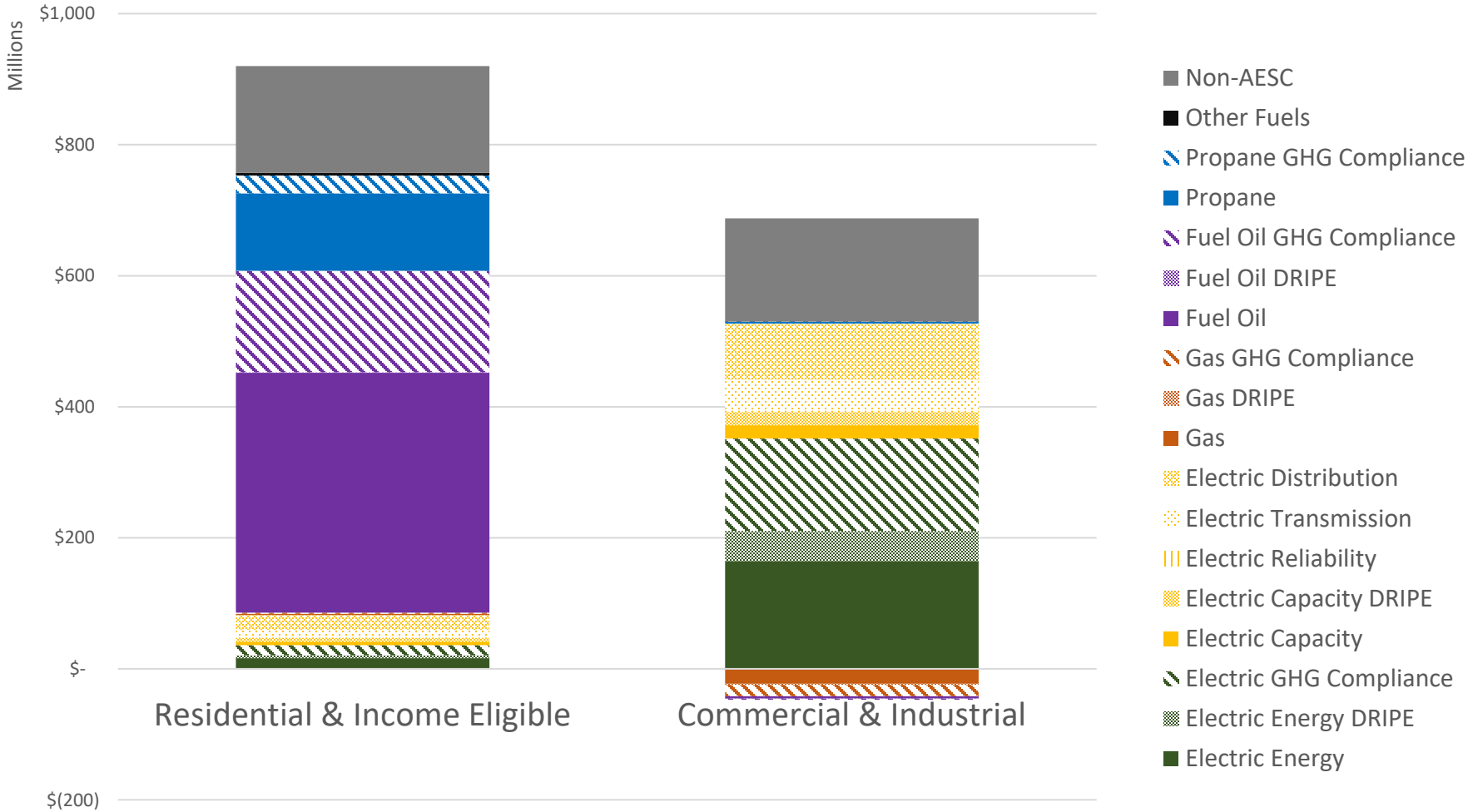
Source: AESC-2024 Draft Report (results may change in final report)

Why we recommend SCC with 1.5% discount rate

- PAs and EEAC Consultants recommend using the 1.5% discount rate for social cost of carbon
- As PAs stated in 2022-2024 Three Year Plan filing, we, along with EEAC Consultants and other stakeholders believe that 2% social discount rate does not appropriately value the urgency and intergenerational effects of climate change
- We believe a lower discount rate is more consistent with Massachusetts' goals to reduce GHG emissions now and through 2050, and for all generations

Benefits by AESC Cost Category

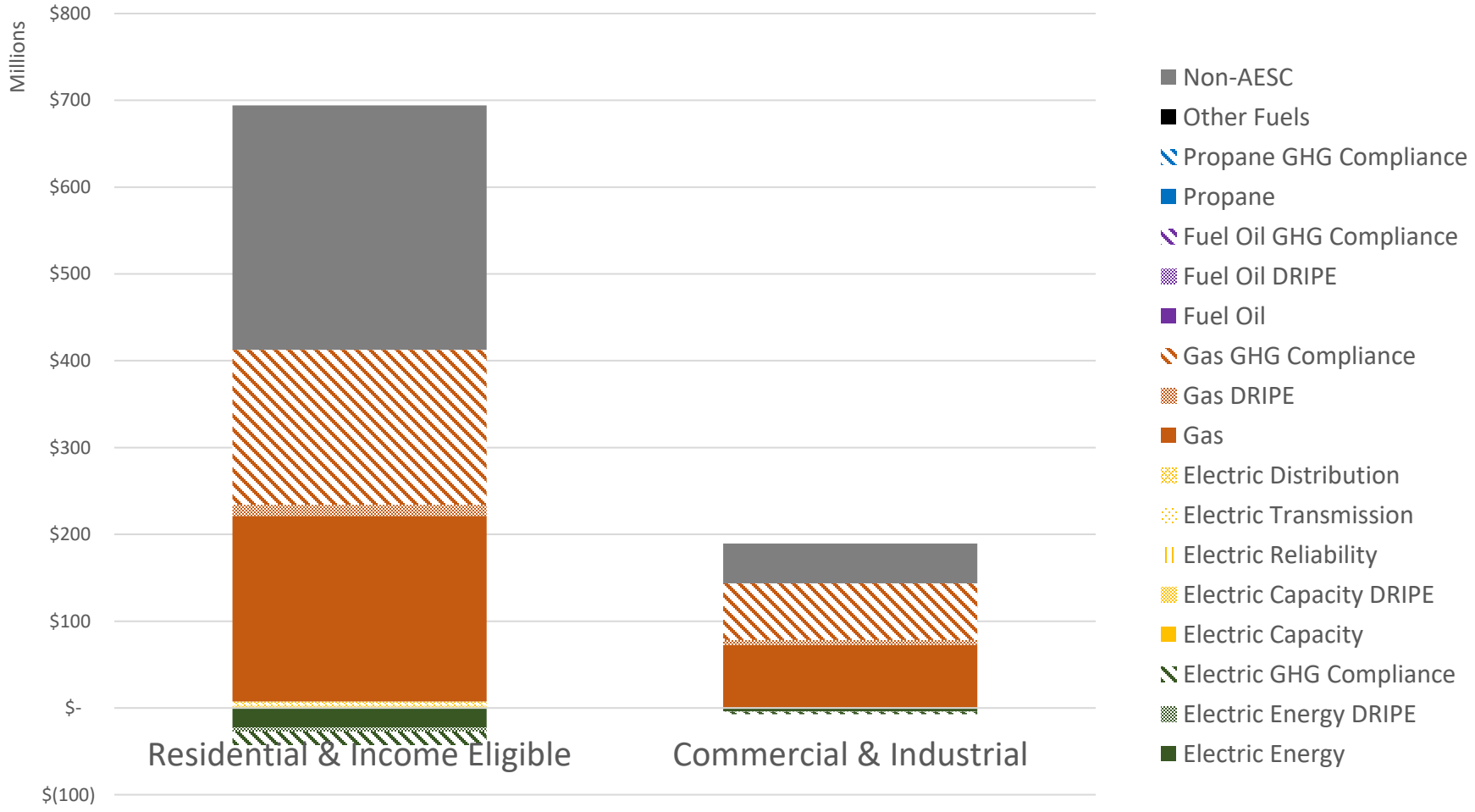
(2022 Actual Statewide Electric Portfolio Example)



Propane | **Fuel Oil** | **Gas** | **Electric Capacity** | **Electric Energy**

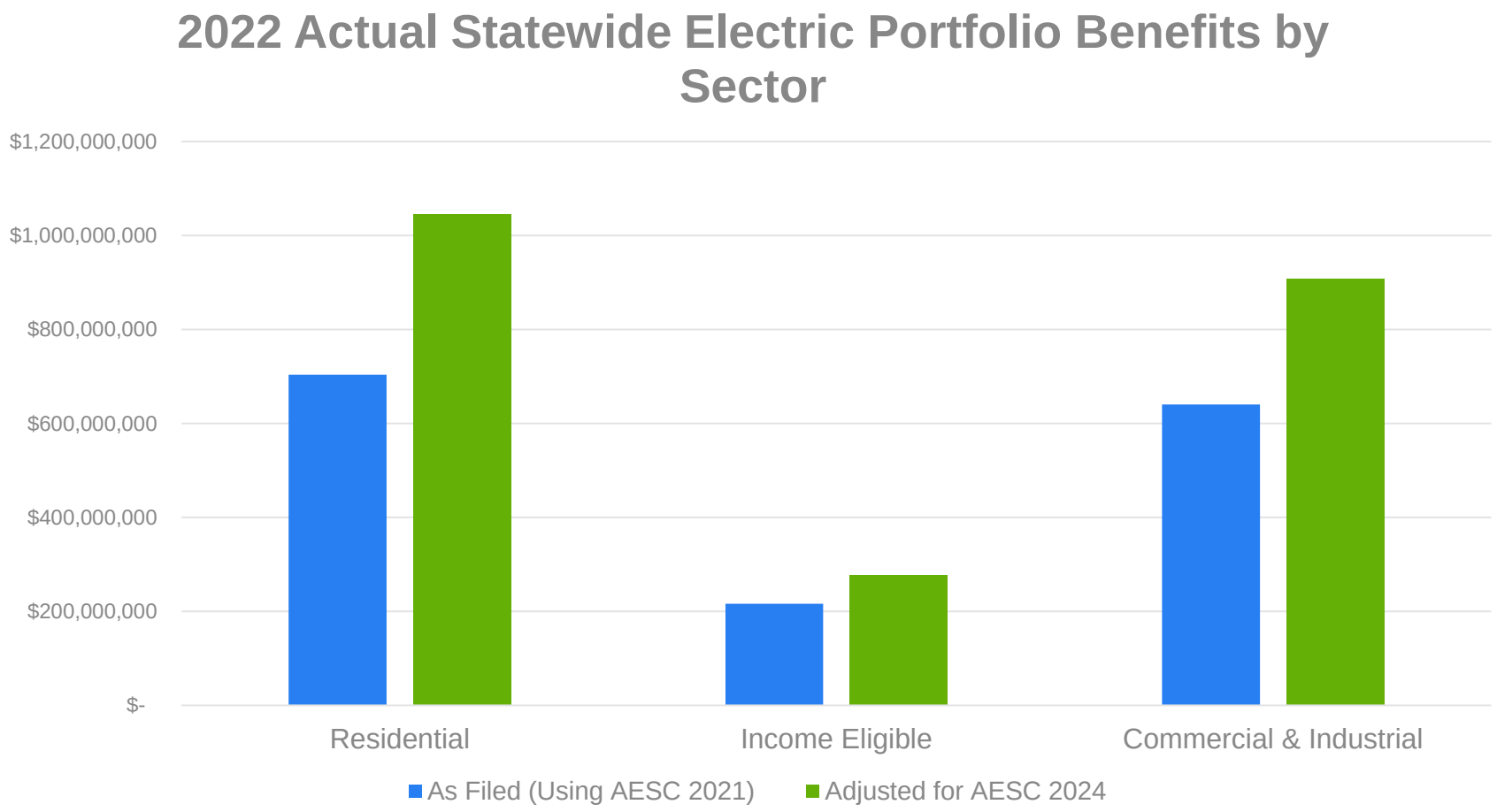
Benefits by AESC Cost Category

(2022 Actual Statewide Gas Portfolio Example)



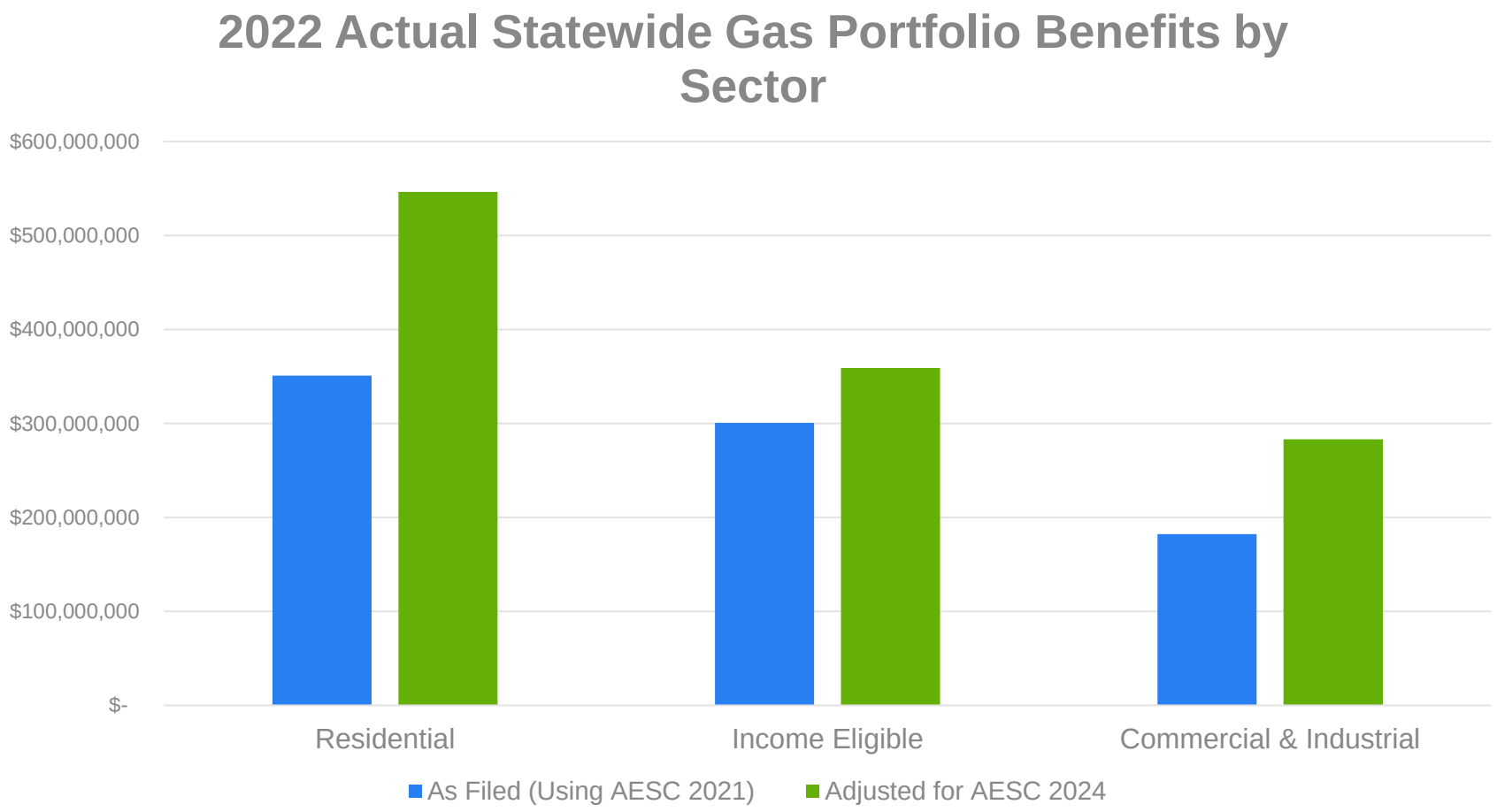
Propane | **Fuel Oil** | **Gas** | **Electric Capacity** | **Electric Energy**

Illustrative Impact on Electric Portfolio Benefits



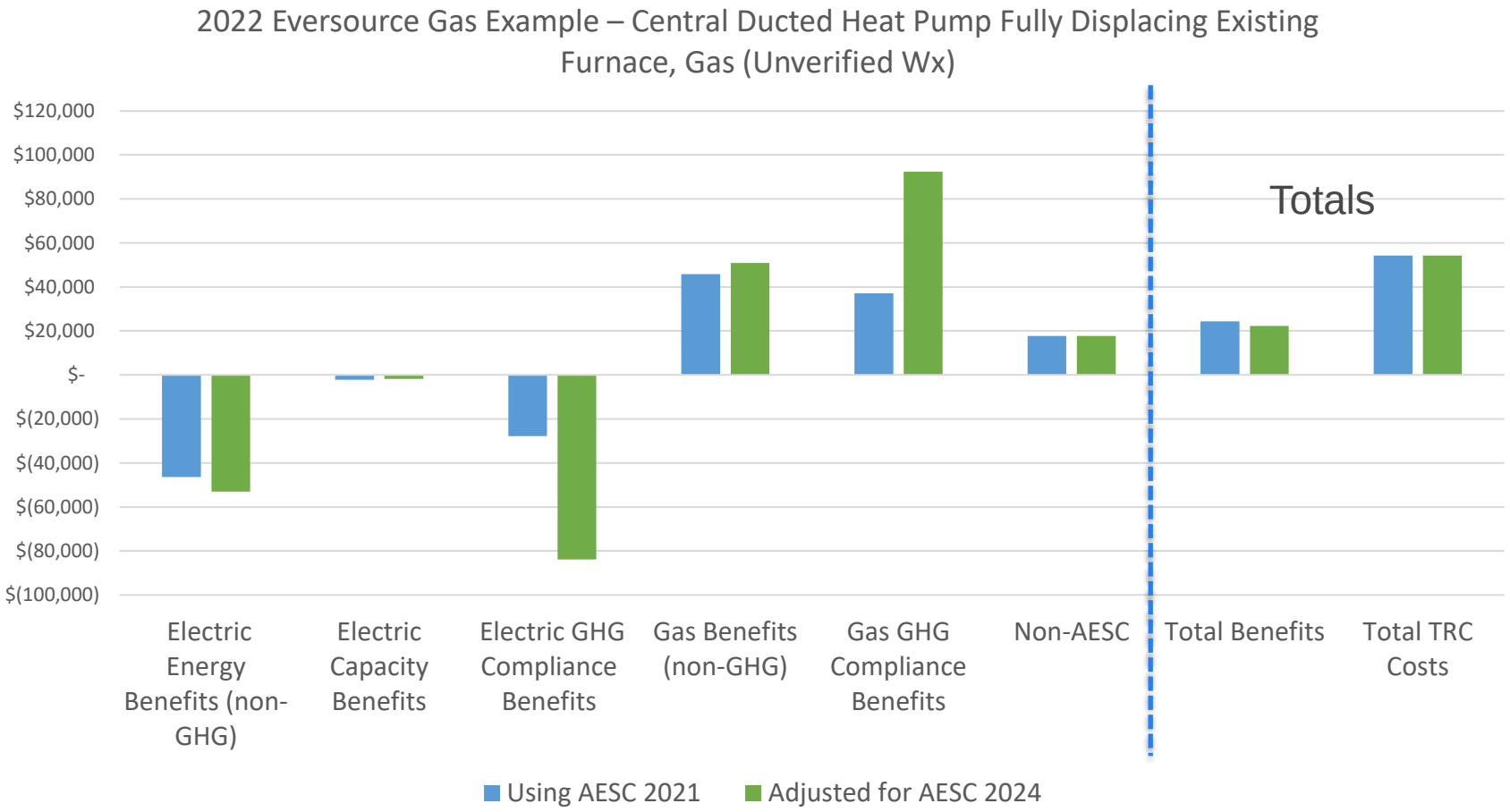
Note: Illustrative analysis applies 1.5% SCC adjustment to all measures. This may overstate benefits for measures using Marginal Abatement Cost (MAC) approach in BCR model.

Illustrative Impact on Gas Portfolio Benefits



Note: Illustrative analysis applies 1.5% SCC adjustment to all measures. This may overstate benefits for measures using Marginal Abatement Cost (MAC) approach in BCR model.

Illustrative Heat Pump Example



- Represents single measure line item from 2022 evaluated Eversource Gas BCR model
- Updated AESC results in change in BCR from 0.45 to 0.41.
- Includes estimated NEIs Residential Heat Pump NEIs Study (MA21X21-E-RHPNEI)
- Illustrative analysis applies 1.5% SCC adjustment

Application of Marginal Abatement Cost

- PAs currently barred in statute from claiming “social value of greenhouse gas emissions reductions” in “cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling."
- 2021 AESC New England-based MAC, derived from the electric sector, was used for these measures in the 2022-2024 Plan
- In 2024 AESC modeling, at EEA’s direction, all modeled counterfactuals assume compliance with the sum of relevant MA GHG sublimits
- Because counterfactuals exclude programmatic DSM components, sublimits achieved via renewable natural gas (RNG) blending
- This essentially embeds an appropriate MAC into the avoided cost of natural gas.
- Therefore, EEAC Consultants recommend that MAC not be applied in 2025-2027 Plan. Recommendation currently under consideration by PAs.

Inclusion of Upstream Impacts in Social Value of GHG Emissions

- New in 2024 AESC, modeling estimates which resources contribute to marginality.
- Allows quantification of “upstream” emissions.
- Upstream emissions impacts include extraction, transportation, etc.
- Statute specifies “social value” of GHG emissions.
- EEAC Consultants recommend the inclusions of these upstream emissions impacts, consistent with this perspective.

Thank you!

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Discussion

Discussion Topics

- Using the 1.5% discount rate for the social cost of carbon
- Discontinuation of Marginal Abatement Cost (MAC) benefits in “cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling“ for the 2025-2027 Plan
- Treatment of “upstream” emissions impacts in the cost-benefit analysis for the 2025-2027 Plan

Appendix

Modeled Counterfactual Scenarios in 2024 AESC

Table 40. Counterfactual scenarios and sensitivities discussed for modeling in AESC 2024

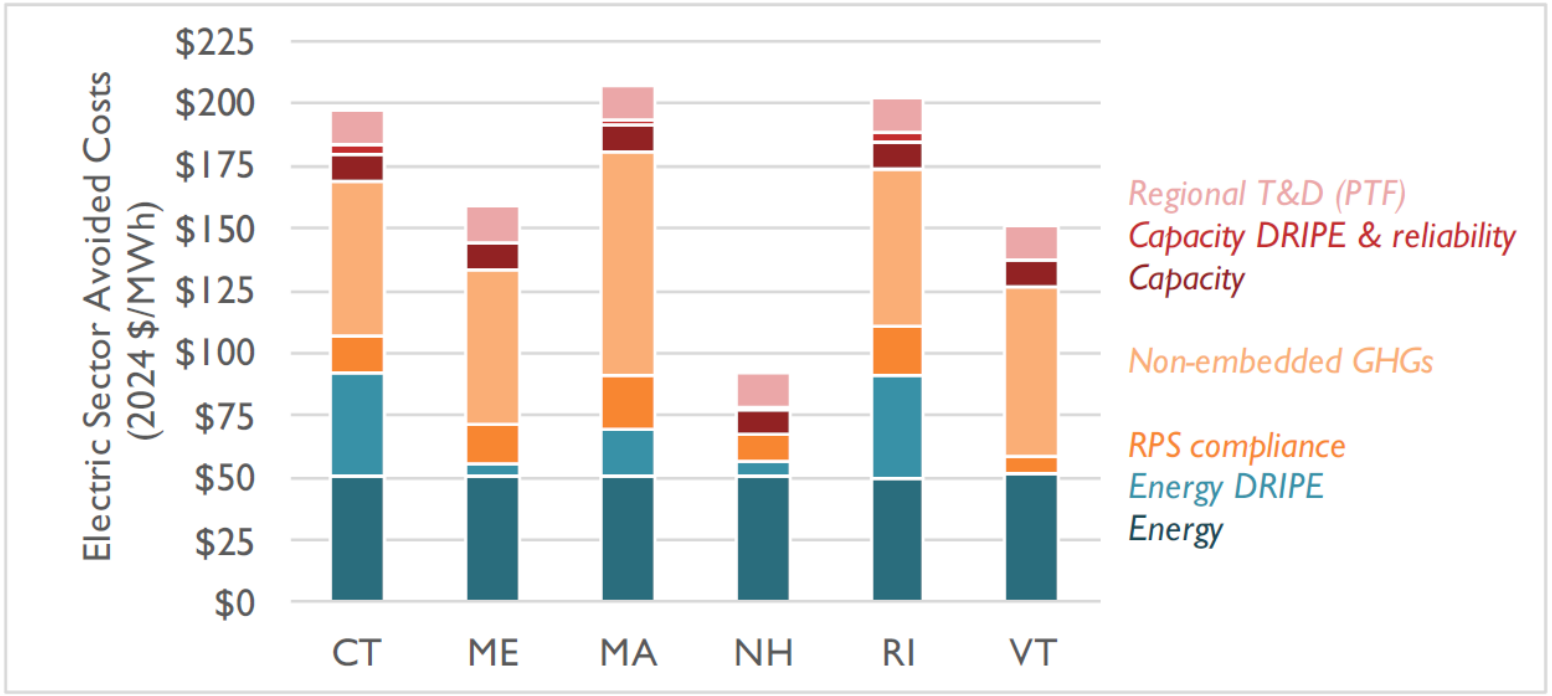
	Counterfactual #1 "AESC Classic": Avoided costs for EE, ADM, and building electrification	Counterfactual #2 Avoided costs for building electrification only	Counterfactual #3 Avoided costs for EE only	Counterfactual #4 Avoided costs for DR and BTM Storage only	Counterfactual #5 All-in DERs	Counterfactual #6 Avoided costs for BTM Storage only: Programmatic *and* non-programmatic measures	Sensitivity #1 High Gas Price *(sensitivity on Counterfactual #1)*	Sensitivity #2 Increased Clean Electricity *(sensitivity on Counterfactual #5)*
Energy Efficiency	*No*	Yes	*No*	Yes	Yes	Yes	*No*	Yes
Building Electrification	*No*	*No*	Yes	Yes	Yes	Yes	*No*	Yes
Demand Response	*No*	Yes	Yes	*No*	Yes	Yes	*No*	Yes
BTM Storage	*No*	Yes	Yes	*No*	Yes	*No (Programmatic and non-programmatic)*	*No*	Yes
Transportation Electrification	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distributed Generation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likely to transition to winter peaking in study period?	*No*	*No*	Yes (likely transition by 2035)	Yes (likely transition by 2035)	Yes (likely transition by 2035)	Yes (likely transition by 2035)	*No*	Yes (likely transition by 2035)
RPS and other renewable policies	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7	As described in Chapter 7, plus an IRCEP policy described in Chapter 12

Notes: A "Yes" indicates that the relevant DSM component is included (e.g., modeled) within that counterfactual. A "No" indicates that the DSM component is not incorporated into the modeling in 2024 or any future year. Unless otherwise stated, a "No" only removes the programmatic resources associated with each DSM component (e.g., energy efficiency associated with codes and standards is modeled in all scenarios, as is storage or demand response owned or funded by entities other than program administrators). The "IRCEP" policy is described in detail in Chapter 12: Sensitivity Analysis.

- MA likely to use CF#1 for most or all measure types

Avoided Costs by State

Figure 1. Illustrative application of AESC 2024 wholesale avoided costs (Counterfactual #1) to a hypothetical energy efficiency measure



Notes: Major differences among the states include modeling differences with respect to energy, capacity, and other values, as well as differences in terms of tabulation (e.g., in terms of how DRIPE is counted or marginal emission rates are calculated), and in terms of which avoided costs are applied within certain categories (e.g., whether a social cost of greenhouse gas is being used, versus some other approach for estimating non-embedded greenhouse gas costs).

Source: AESC-2024 Draft Report (results may change in final report)