APPENDIX A: MARKET POTENTIAL STUDY REFRESH OVERVIEW

STATE OF RHODE ISLAND
ENERGY EFFICIENCY & RESOURCE MANAGEMENT COUNCIL

Rhode Island Energy Efficiency Market Potential Study Refresh

Final Results

6th April, 2023

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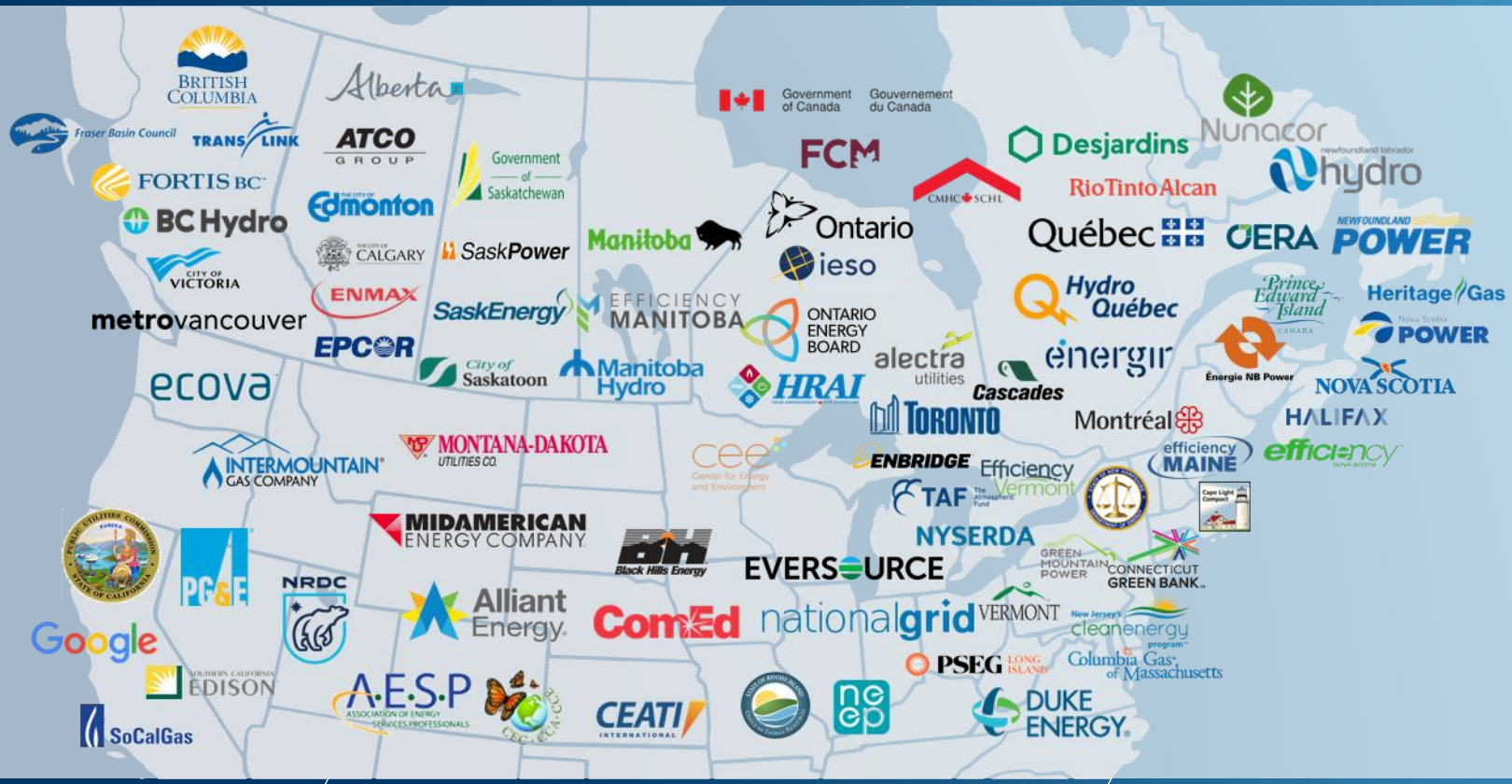
BUILDINGS | **MOBILITY** | **INDUSTRY** | **ENERGY**



GOVERNMENTS | UTILITIES | CORPORATE + NON-PROFIT

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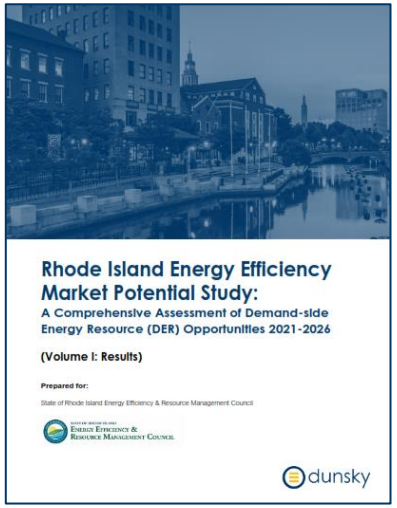
Study Refresh Overview

This study is an update to the Rhode Island Energy Efficiency Market Potential Study (MPS) conducted in 2019.



The objective of the analysis is to update key model inputs to reflect new information made available since the previous study including:

- Updated codes and standards
- Updated evaluated measure savings
- More recent avoided cost estimates

Study Parameters

Parameter	Study Refresh	Original Study
Study Period	2024 through 2026 (**three** years)	2021 through 2026 (six years)
Geography	Rhode Island	Rhode Island
Sectors	Residential, Low-Income Residential, Commercial, Industrial	Residential, Low-Income Residential, Commercial, Industrial
Fuels	Electricity (kWh, kW), natural gas, delivered fuels (oil and propane)	Electricity (kWh, kW), natural gas, delivered fuels (oil and propane)
Savings sources	EE and DR **only**	EE, DR, HE, CHP, PV
Potential Assessment	Technical, economic, and **single** achievable scenario.	Technical, economic, and three achievable scenarios.

Acronyms: Energy Efficiency (EE), Demand Response (DR), Heating Electrification (HE), Combined Heat and Power (CHP), Solar Photovoltaics (PV)
*Key differences from original study are **bolded**.*

Summary of Key Study Updates

- **The Study Refresh focused on updating data sources and input data anticipated to have a significant impact (+/- 20% of a measure's savings) on study results.**
- **A description of model input and assumption updates is provided in an accompanying memo.**

Key updates reflect:

- Updated measure baselines to reflect new standards (i.e., Appliance and Equipment Energy and Water Efficiency Standards Act of 2021)
- New measure evaluations since previous study
- Updated LED saturation assumptions
- AESC 2021 avoided costs

Potential Modeling & Achievable Scenario

The Study Refresh evaluates updated technical and economic potential assessments and evaluated a single achievable scenario.

The achievable scenario parameters were defined in collaboration with the MPS Management Team (MPSMT) and RI Energy.

For **energy efficiency**, the achievable scenario sets incentives at the midpoint between the Mid and Max scenarios of the original study for most modeled programs.

For **demand response,** the achievable scenario sets incentives at the same levels as the Mid Scenario in the original study.

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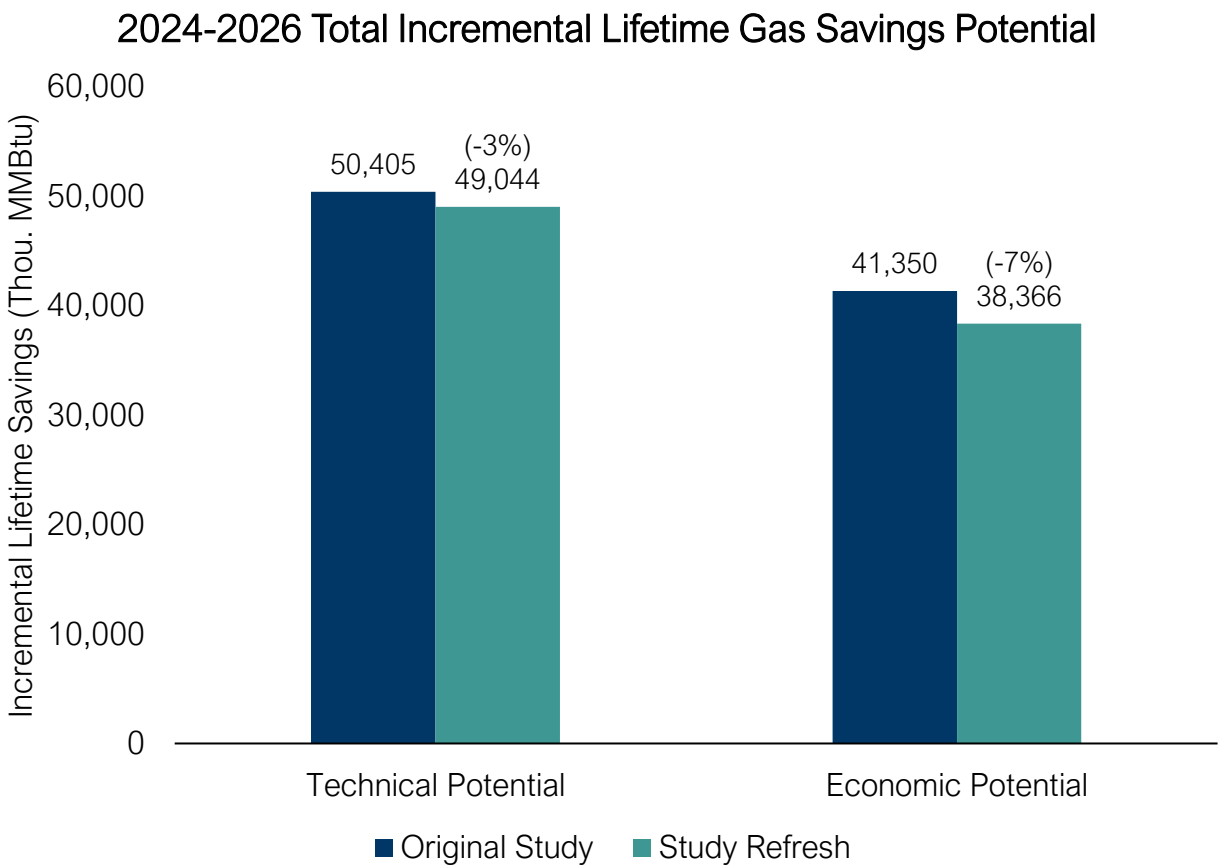
Energy Efficiency: Gas Programs

Gas Potential: Technical and Economic Savings

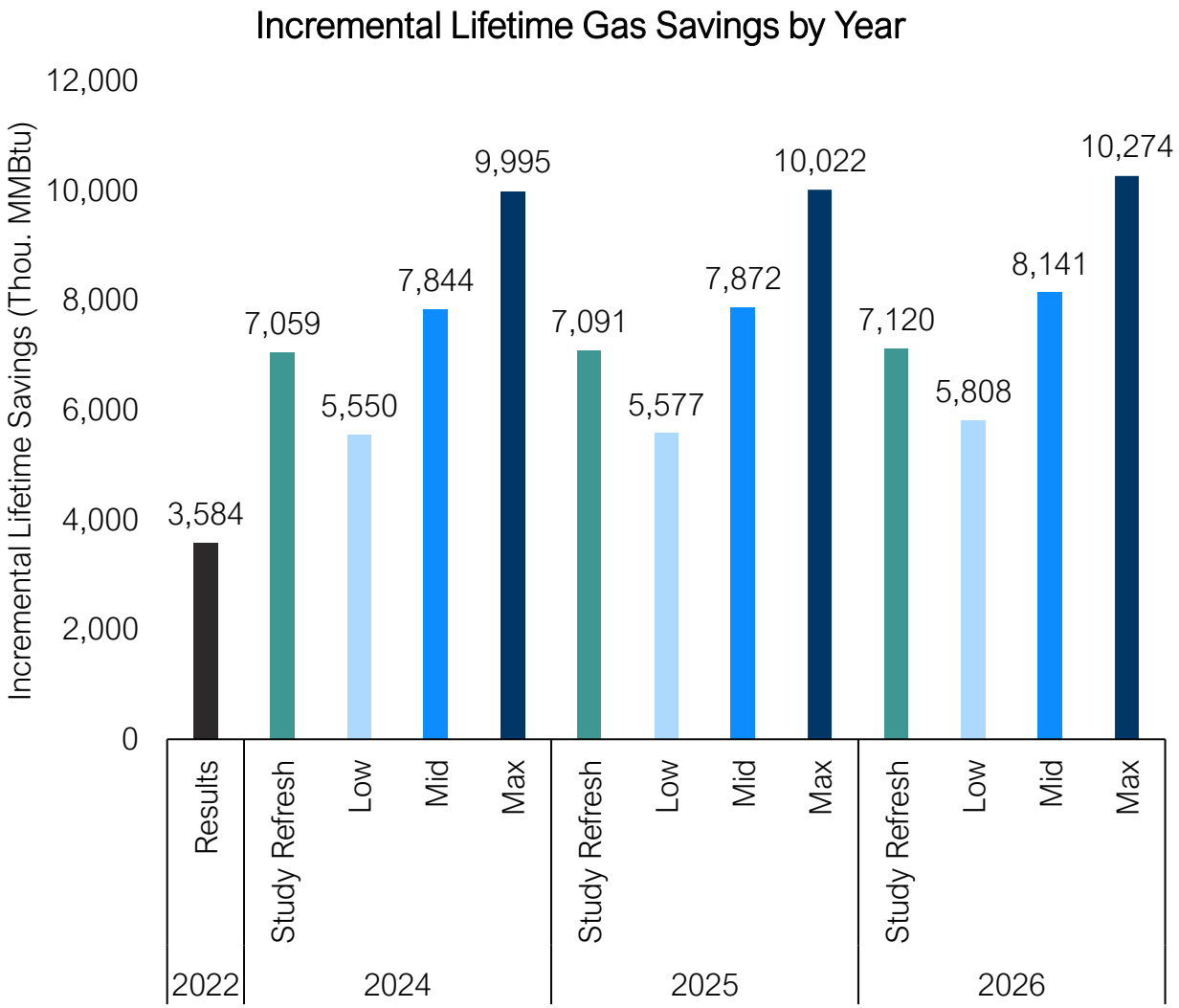
- **Updates to state appliance standards reduce technical and economic potential**
  - Kitchen and low flow water fixture measures primarily affected
- **Greater proportional reduction in economic potential due to additional measures failed cost-effectiveness criteria**
  - Gas avoided costs slightly declined with 2021 AESC
  - Standards updates decreased benefits for some measures due to increased baseline



Note: Technical and economic potential expressed as gross savings.

Gas Potential: Achievable Energy Savings

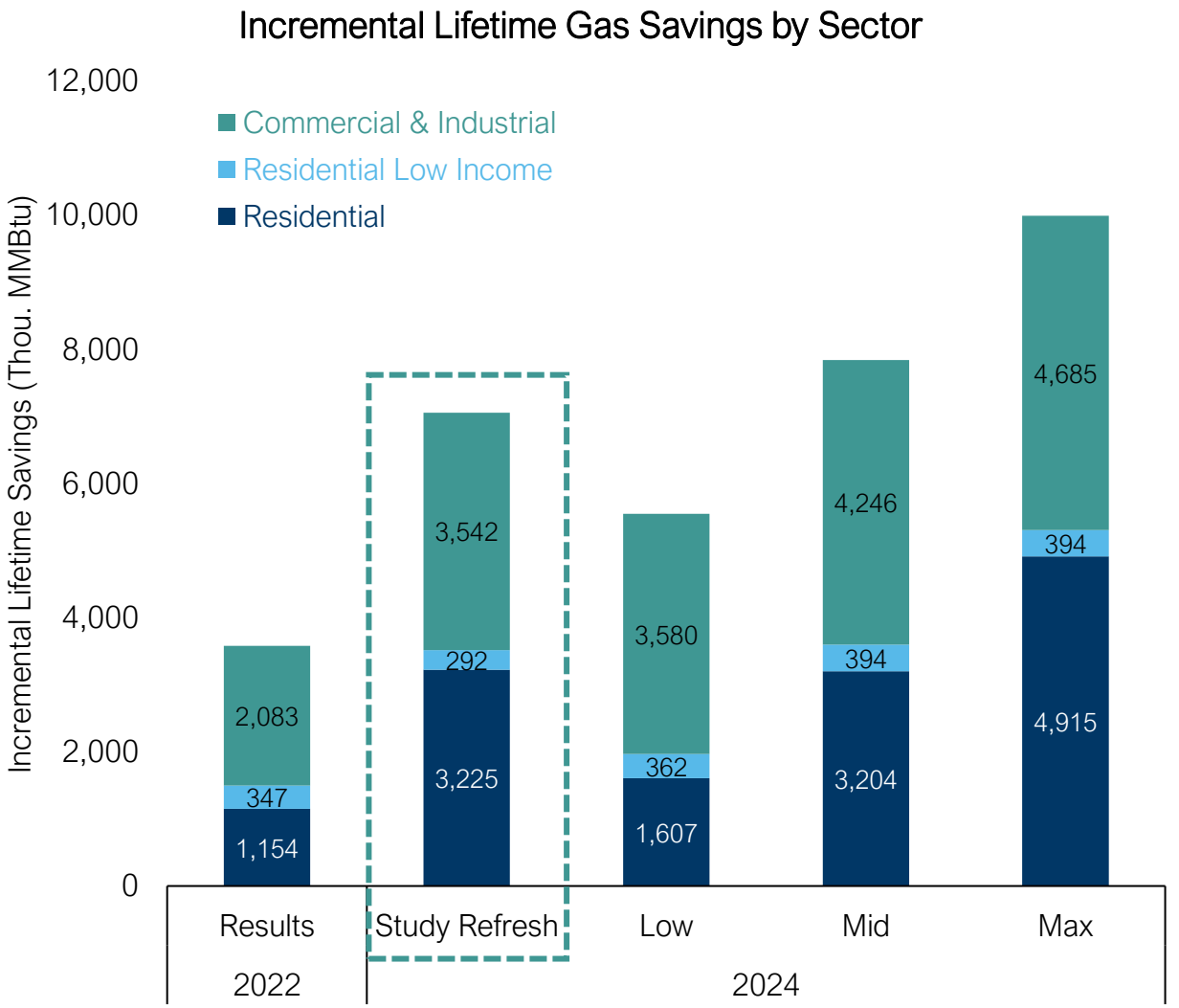
- **Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels**
  - Similar to technical and economic potential, **updates to state appliance standards** reduce achievable potential
  - Additionally, **updated net-to-gross assumptions** generally reduced claimable gas savings
    - Original Study: 7% reduction in gross savings
    - Study Refresh: 19% reduction in gross savings



Note: Achievable potential expressed as net savings.

Gas Potential: Savings by Sector

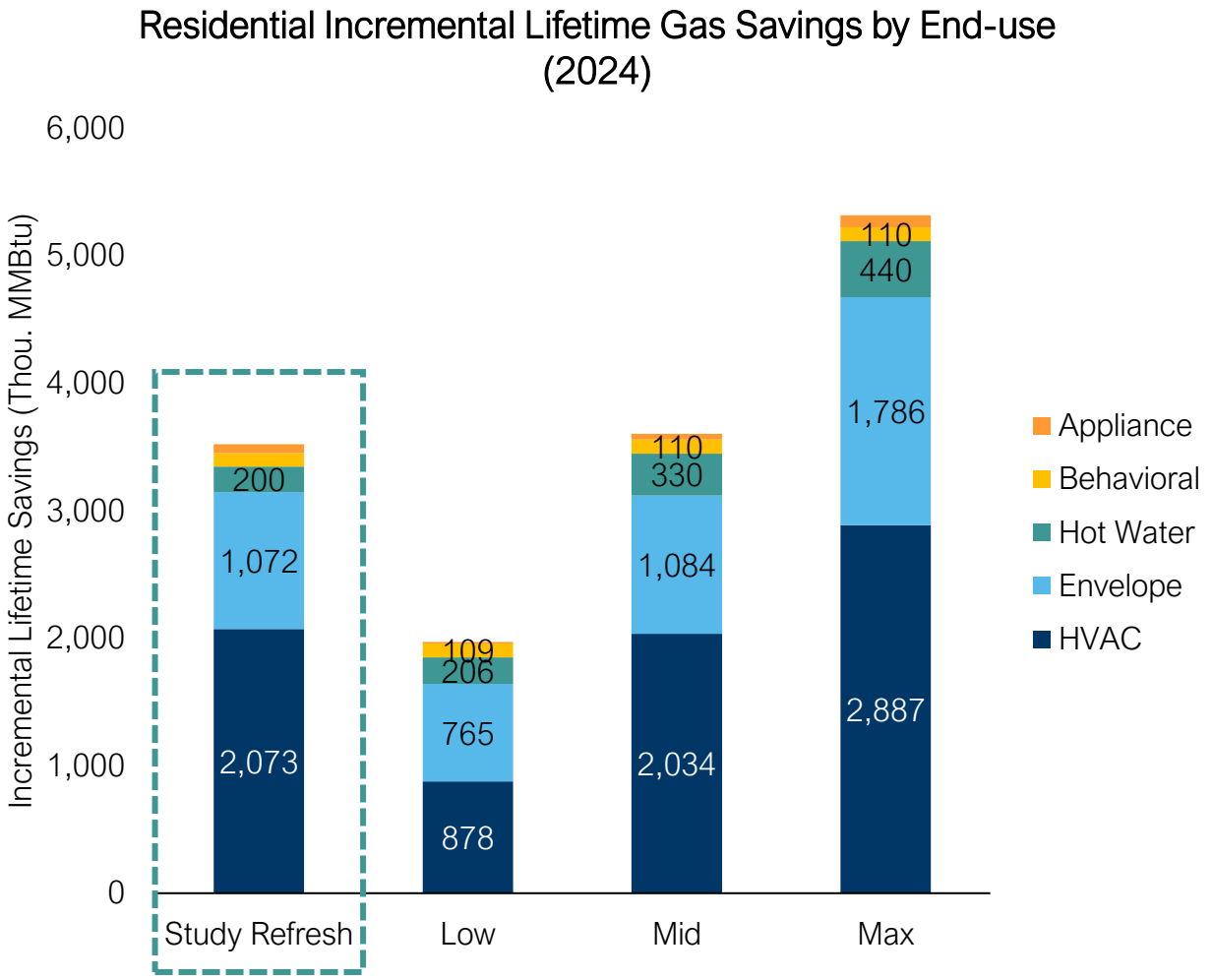
- **Commercial & Industrial**
  - Savings fall below Low scenario primarily due to loss of kitchen-related savings opportunities
- **Residential Low Income**
  - Savings fall below Low scenario primarily due to loss of low flow fixture savings, which were substantial source of savings in original study
- **Residential**
  - Savings similar to Mid scenario as characterization updates for some measures offset loses due to standards updates



Note: Achievable potential expressed as net savings.

Residential Savings by End-use

- **HVAC and Envelope savings remain primary source of residential gas savings**
- **Hot water savings decline due to reduction in low-flow fixture savings**

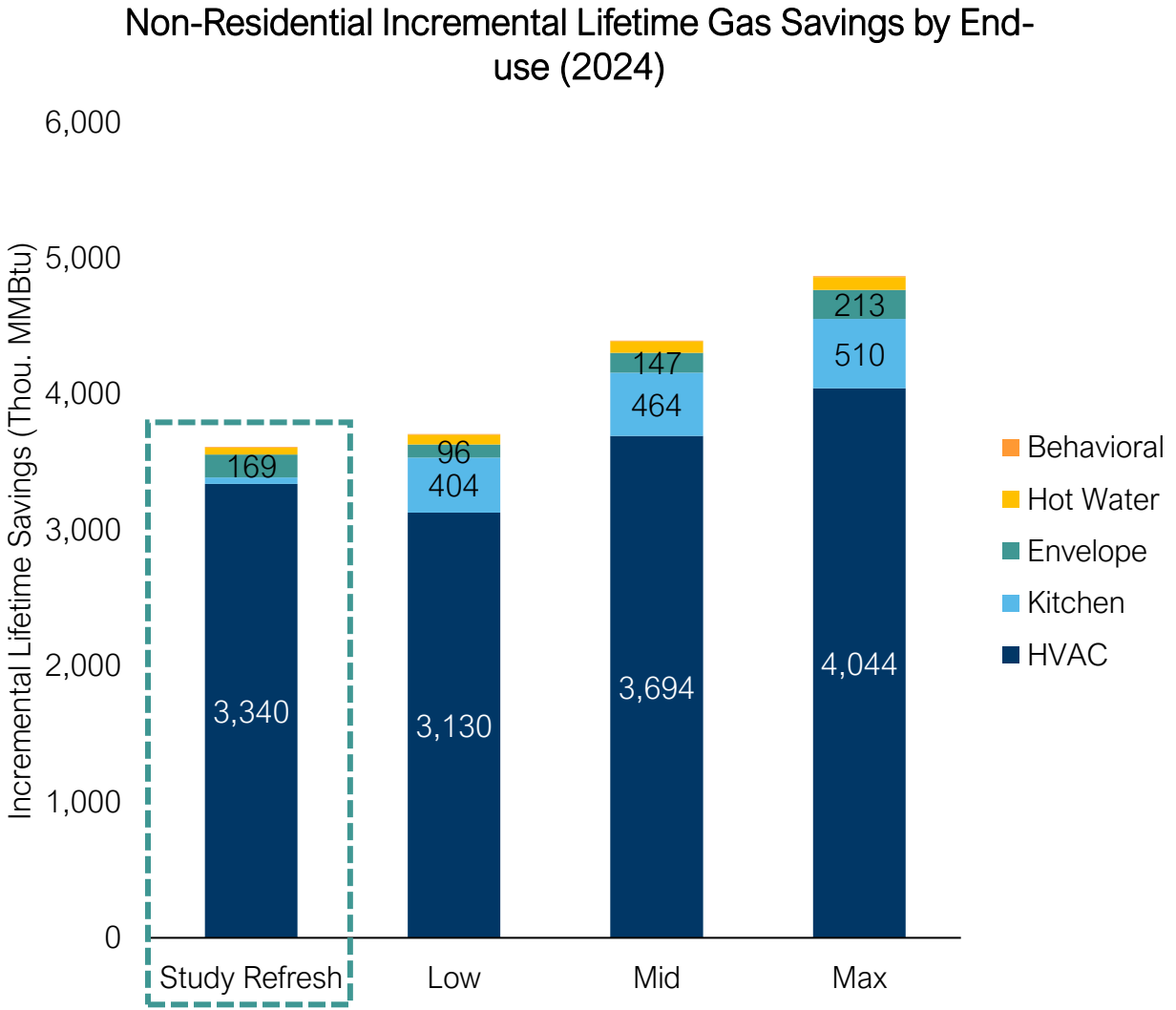


Beyond the changes in savings noted here, study results remain largely the same relative to the original study. The original study's narrative report provides additional detail and descriptions regarding savings potential including discussion of remaining potential by end-use and building types.

Note: Achievable potential expressed as net savings. Residential savings in figure include both market-rate and low income residential savings. Figure excludes indirect negative savings from lighting measures.

Non-Residential Savings by End-use

- **HVAC savings remain primary source of non-residential gas savings**
- **Kitchen savings almost entirely eliminated due to appliance standards updates**



Note: Achievable potential expressed as net savings.

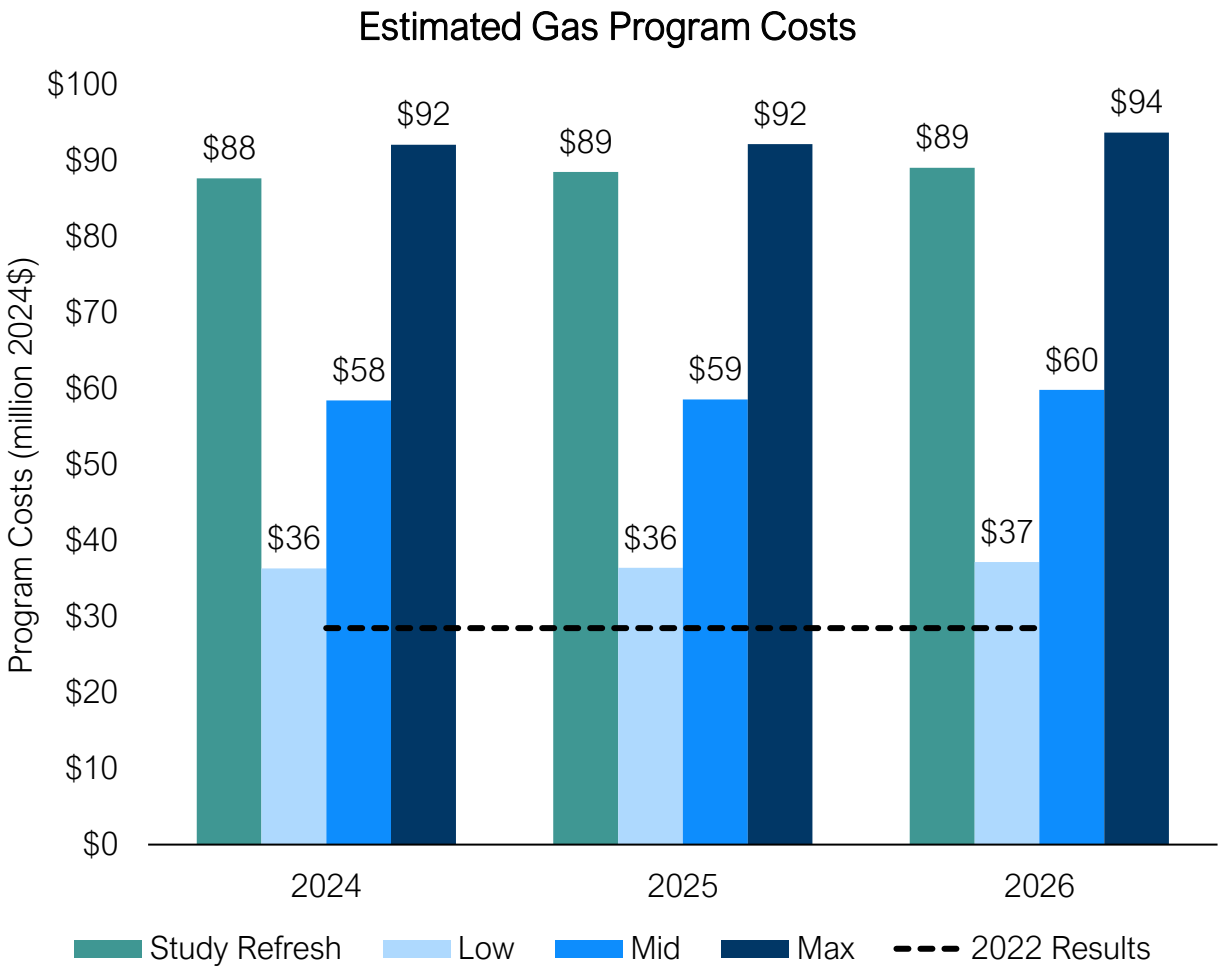
Beyond the changes in savings noted here, study results remain largely the same relative to the original study. The original study's narrative report provides additional detail and descriptions regarding savings potential including discussion of remaining potential by end-use and building types.

Gas Program Costs

- **Average acquisition costs increase due to lower NTG factors, higher incentives, and higher administrative program costs**
- **Estimated costs do not account for portfolio optimization and program design improvements**

Estimated Average Acquisition Costs

	$ per Incremental Annual MMBtu	$ per Incremental Lifetime MMBtu
Study Refresh	**$144.88**	**$12.53**
Low	$75.62	$6.95
Mid	$91.92	$7.65
Max	$120.09	$9.38
2022 Results	$75.17	$7.94



Note: Program costs include incentive and administrative costs for gas measures. 2022 Results exclude costs related to programs that do not claim savings.

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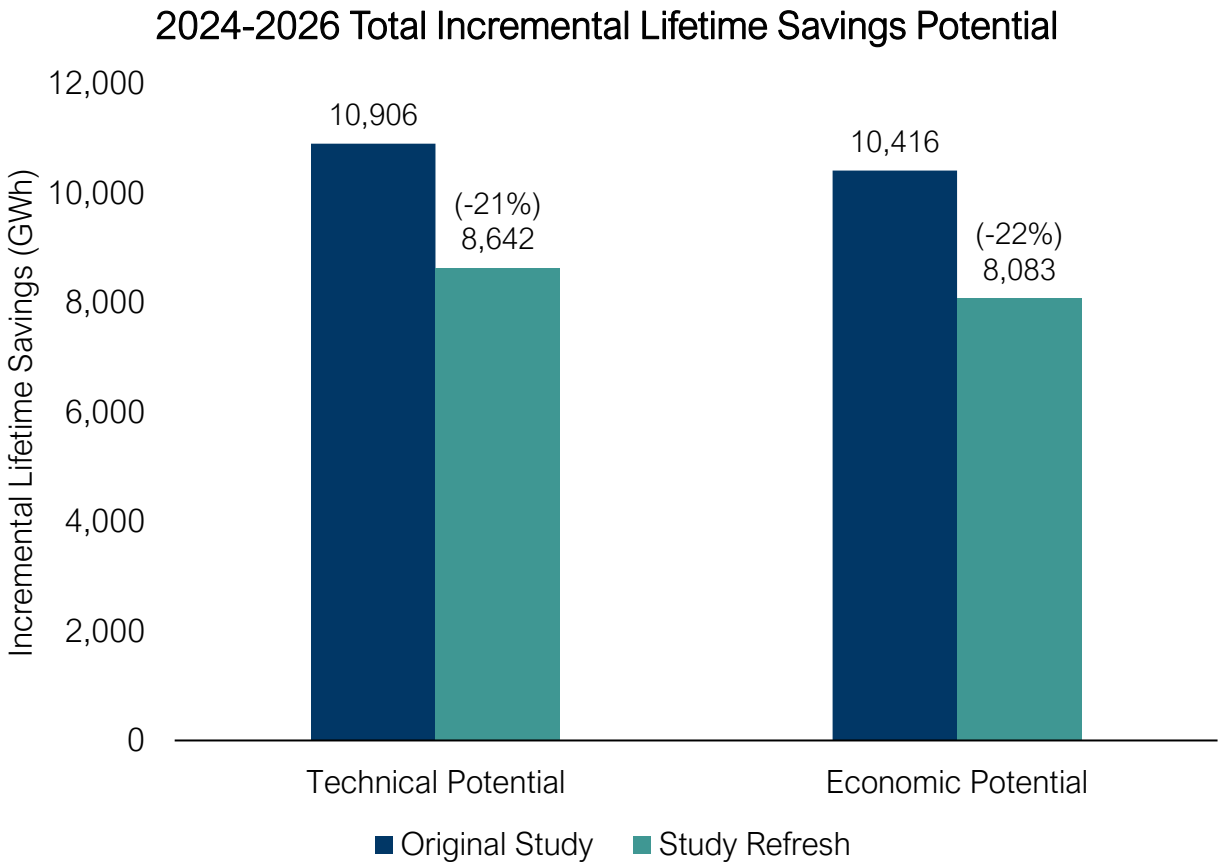
Energy Efficiency: Electric Programs

Technical and Economic Savings

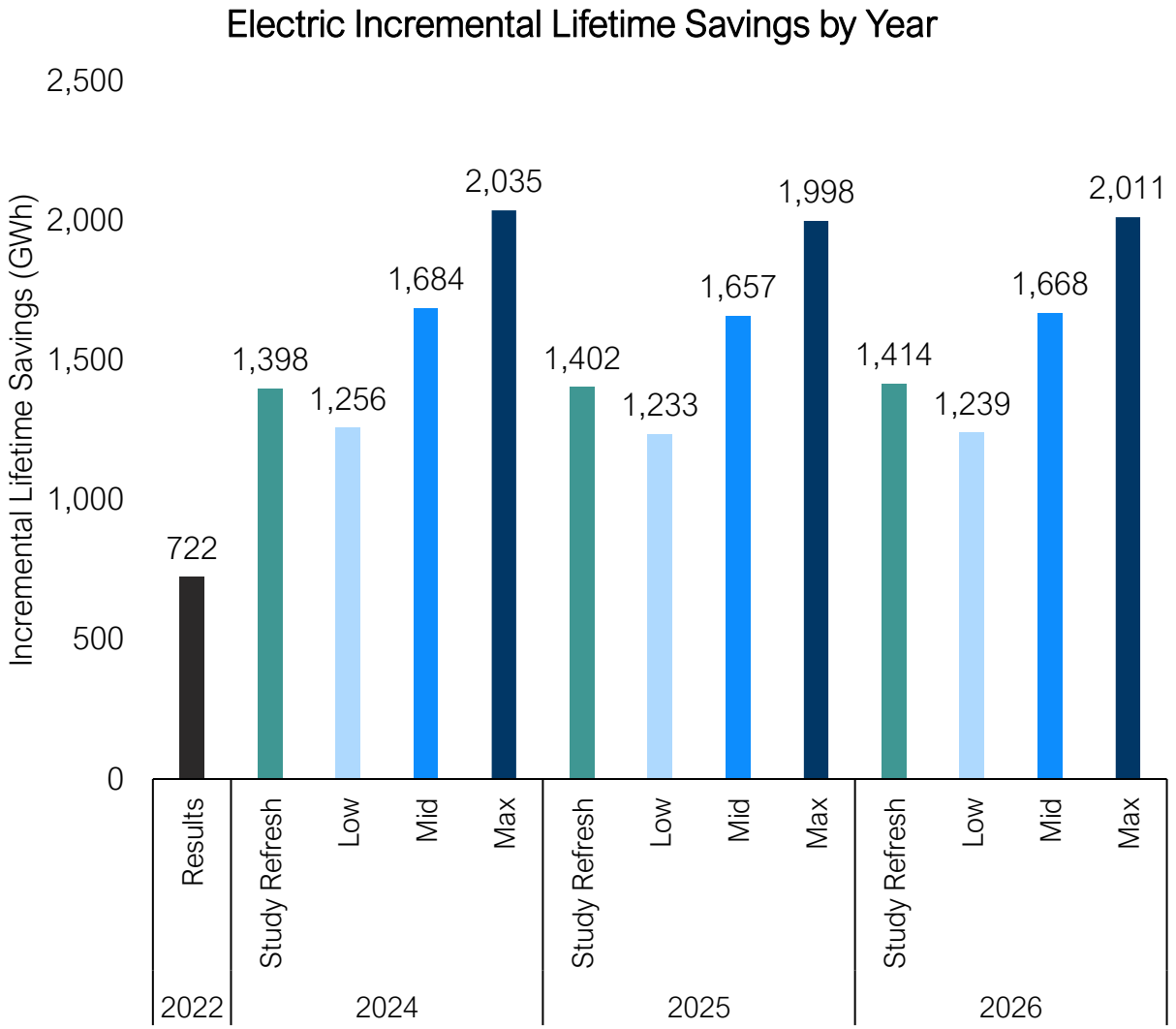
- **Decline in lighting opportunities drives reduction in technical and economic potential**
  - Increasing saturation of LED lighting, particularly in the C&I sector where most lighting savings remained in original study
  - Additionally, updated assumptions regarding C&I lighting measure lives reduce claimable lifetime savings
- **Updates to state appliance standards further reduce potential**
- **Slightly less technical savings pass the TRC screening threshold with updated AESC values**



Note: Technical and economic potential expressed as gross savings.

Achievable Energy Savings

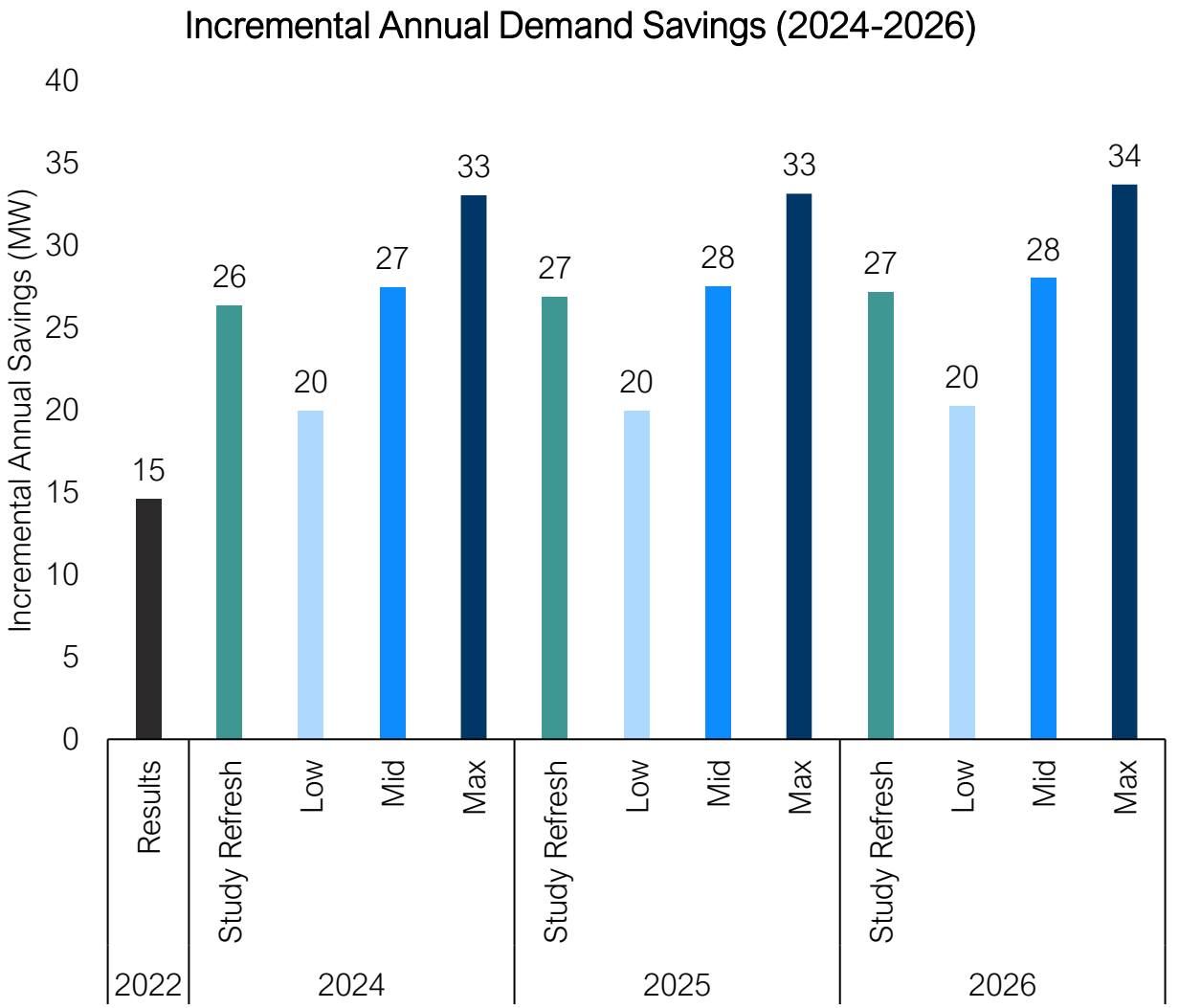
- **Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels**
  - Similar to technical and economic potential, **updates to LED saturation and measure life assumptions** reduce achievable lifetime lighting savings
  - Updated net-to-gross assumptions slightly improve net savings relative to gross
    - Original Study: 21% reduction in gross savings
    - Study Refresh: 20% reduction in gross savings



Note: Achievable potential expressed as net savings.

Achievable Passive Demand Savings

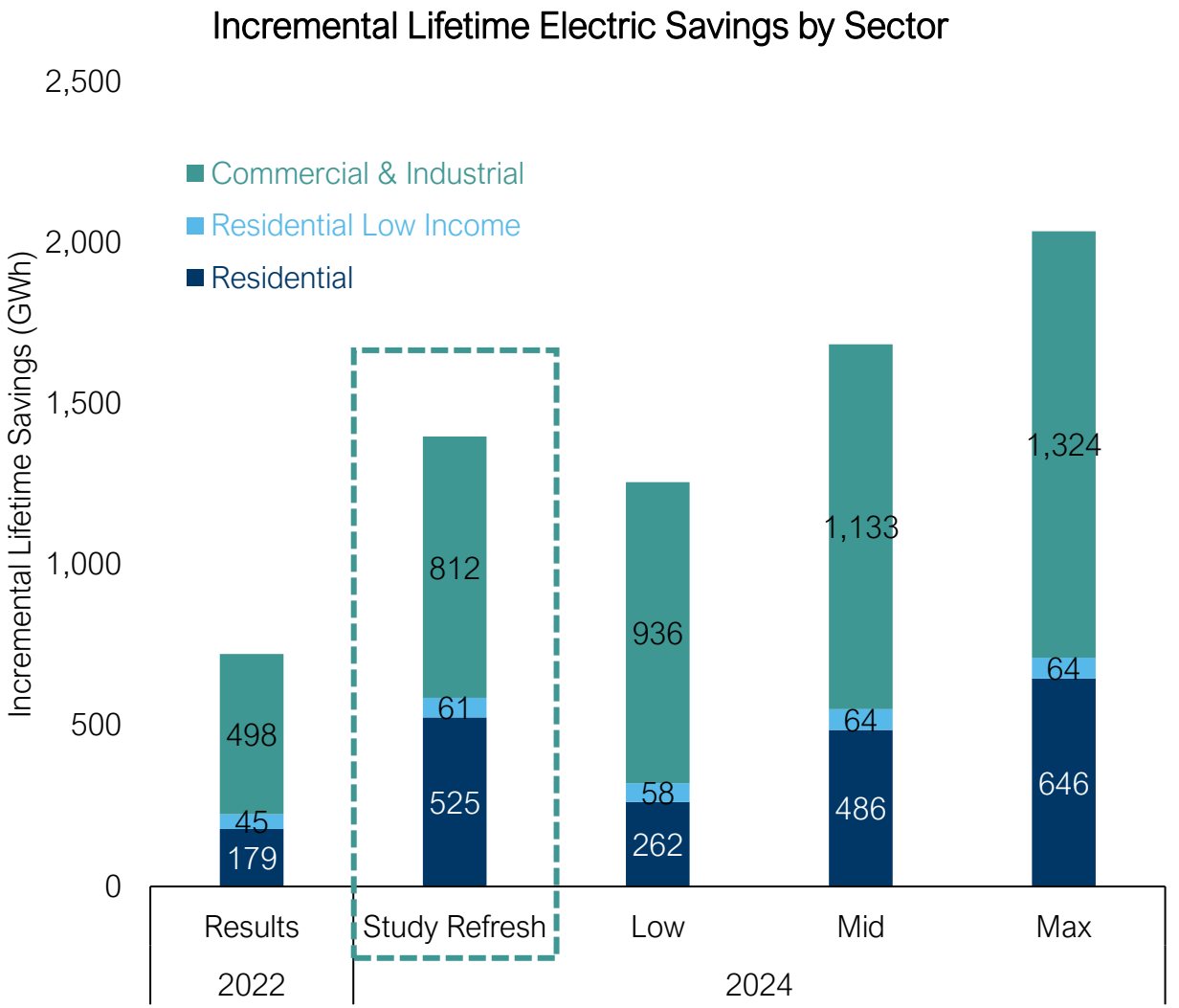
- **For passive demand savings (kW), changes relative to the original study mirror changes to energy (kWh) savings**
  - Technical and economic potential experience similar proportional decreases (13% and 15%, respectively)
  - The Study Refresh scenario savings fall slightly below the Mid scenario



Note: Achievable potential expressed as net savings.

Savings by Sector

- **Commercial & Industrial**
  - Savings similar to Low scenario despite higher incentives primarily due to loss of lighting-related savings opportunities
- **Residential Low Income**
  - Savings largely unchanged from original study relative to Mid and Max scenario.
- **Residential**
  - Savings fall between original study's Mid and Max scenario

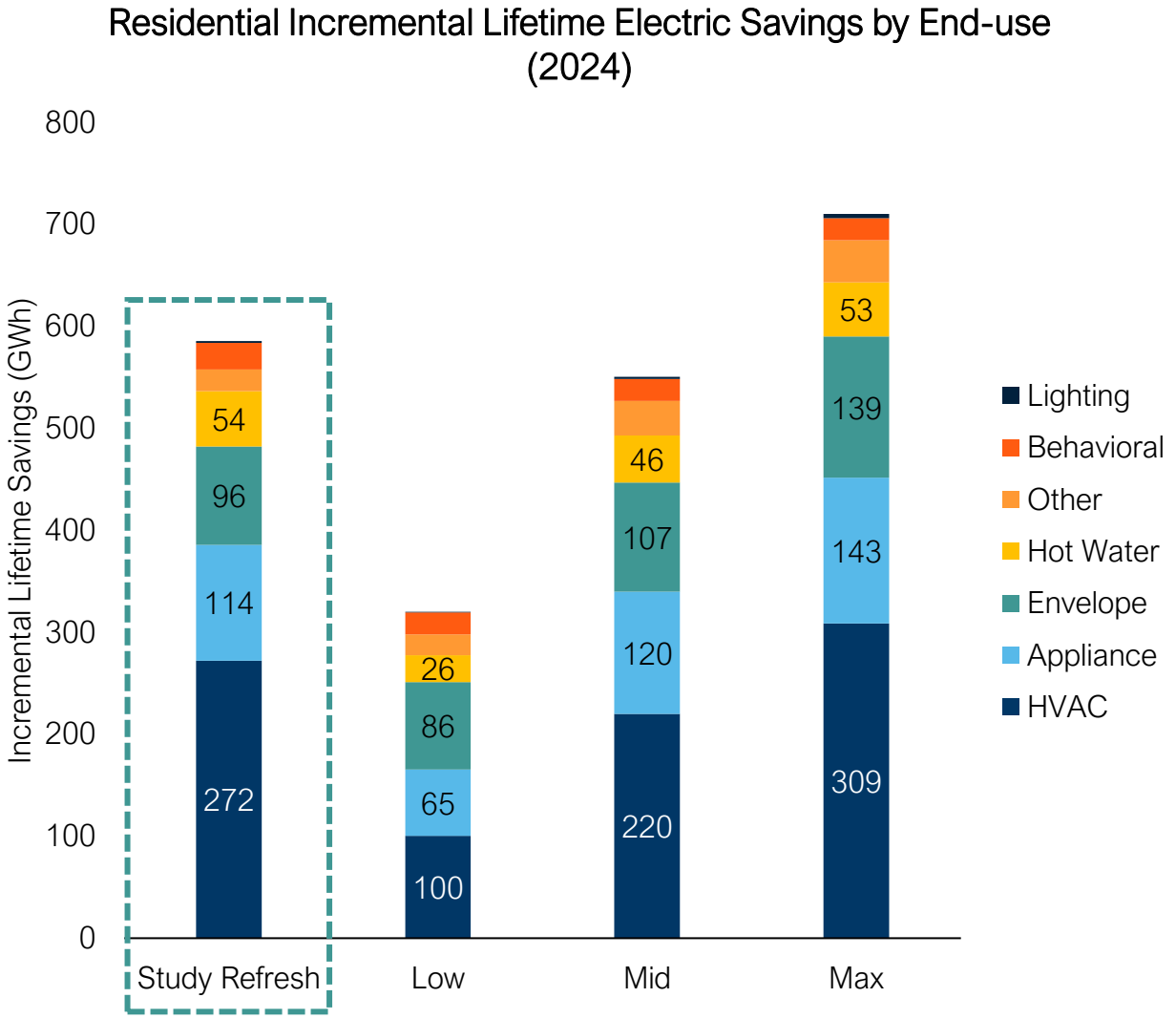


Note: Achievable potential expressed as net savings.

Residential Savings by End-use

- **HVAC savings remain the primary source of residential electric savings opportunities**
  - Nearly 50% of the HVAC opportunity is from displacing electric resistance heating with ductless heat pumps

Beyond the changes in savings noted here, study results remain largely the same relative to the original study. The original study's narrative report provides additional detail and descriptions regarding savings potential including discussion of remaining potential by end-use and building types.

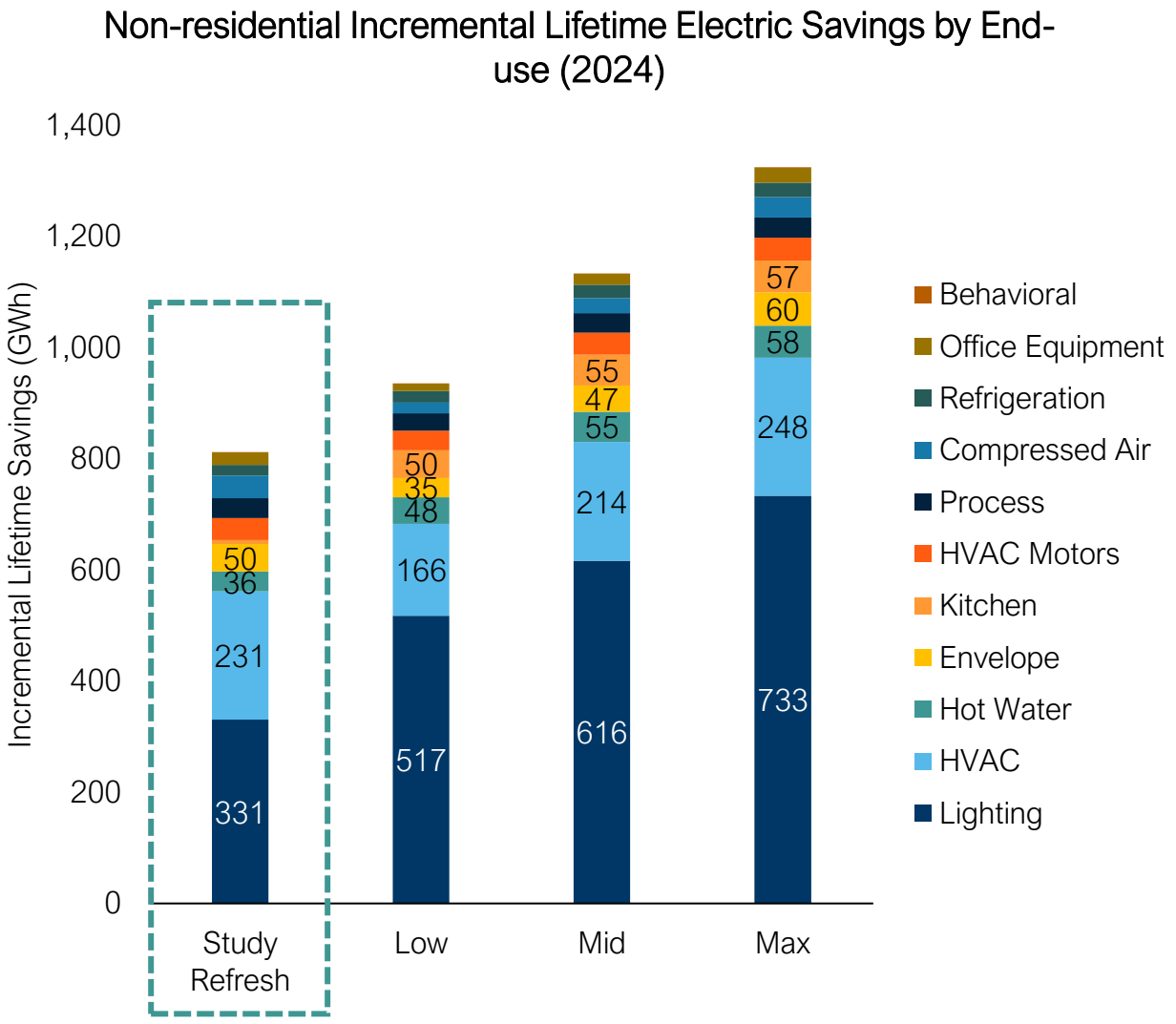


Note: Achievable potential expressed as net savings. Residential savings in figure include both market-rate and low income residential savings.

Non-Residential Savings by End-use

- **Lighting savings continue to be the primary source of savings in the non-residential sector, despite the transforming market**
  - Lighting opportunities in terms of incremental lifetime savings are also further reduced due to updated adjusted measure lives per the August 2022 RI C&I Lighting Market Study.
- **HVAC opportunities – driven by heat pumps and controls – are the second largest opportunity**

Beyond the changes in savings noted here, study results remain largely the same relative to the original study. The original study's narrative report provides additional detail and descriptions regarding savings potential including discussion of remaining potential by end-use and building types.

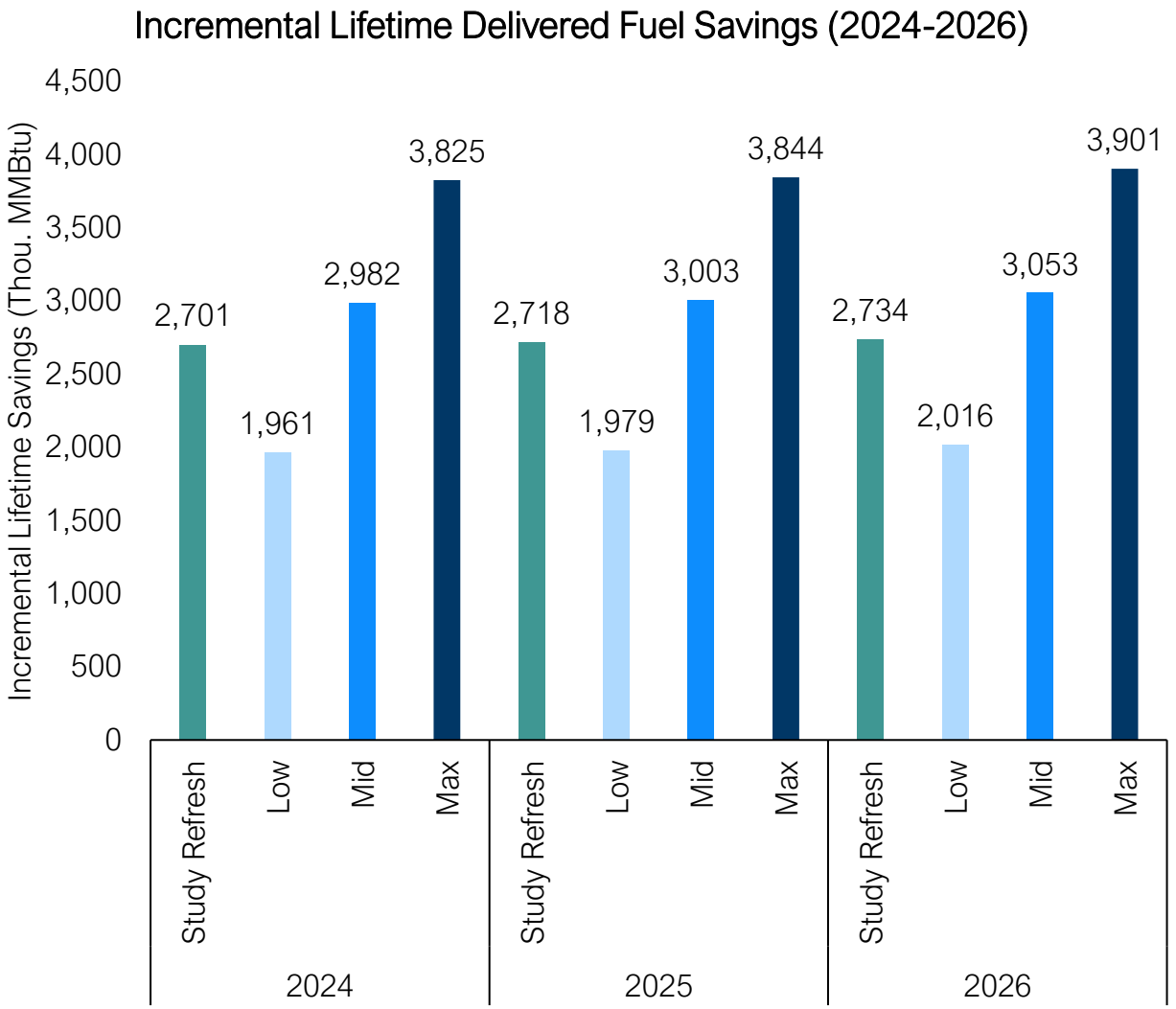


Note: Achievable potential expressed as net savings.

Achievable Delivered Fuel Savings

Relative to the original study, the Study Refresh scenario savings fall below the Mid scenario despite higher incentive levels

- Reduction almost entirely driven by **updated net-to-gross assumptions**
  - Original Study: 5% reduction in gross savings
  - Study Refresh: 22% reduction in gross savings
- Technical and economic potential largely unchanged



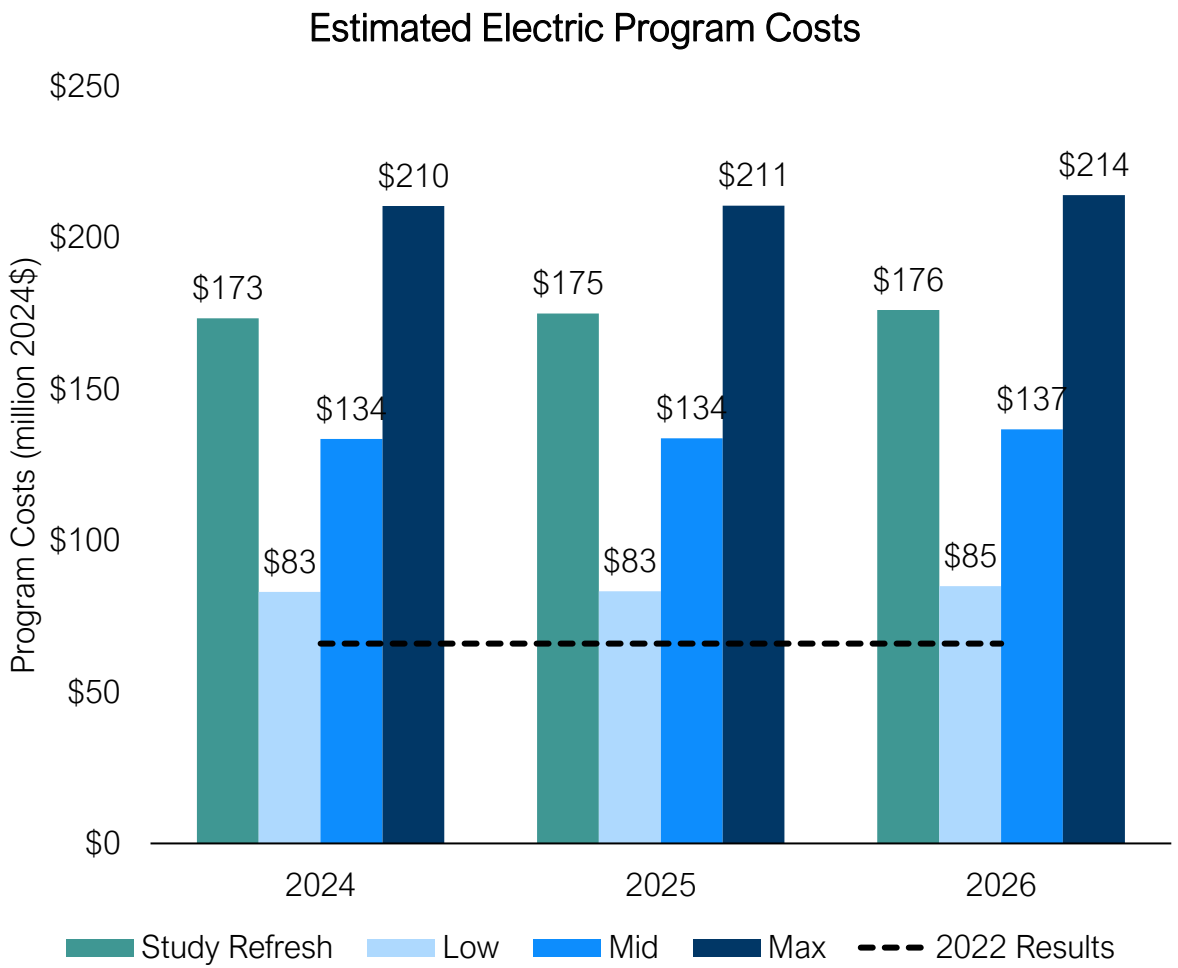
Note: Achievable potential expressed as net savings.

Electric Program Costs

- **Average acquisition costs increase due to higher incentives, higher administrative program costs, lower NTGs for delivered fuel measures, and loss of (cheaper) lighting savings**
- **Estimated costs do not account for portfolio optimization and program design improvements**

Estimated Average Acquisition Costs

	$ per Incremental Annual kWh	$ per Incremental Lifetime kWh
Study Refresh	**$1.20**	**$0.11**
Low	$0.63	$0.07
Mid	$0.80	$0.08
Max	$1.09	$0.11
2022 Results	$0.64	$0.09

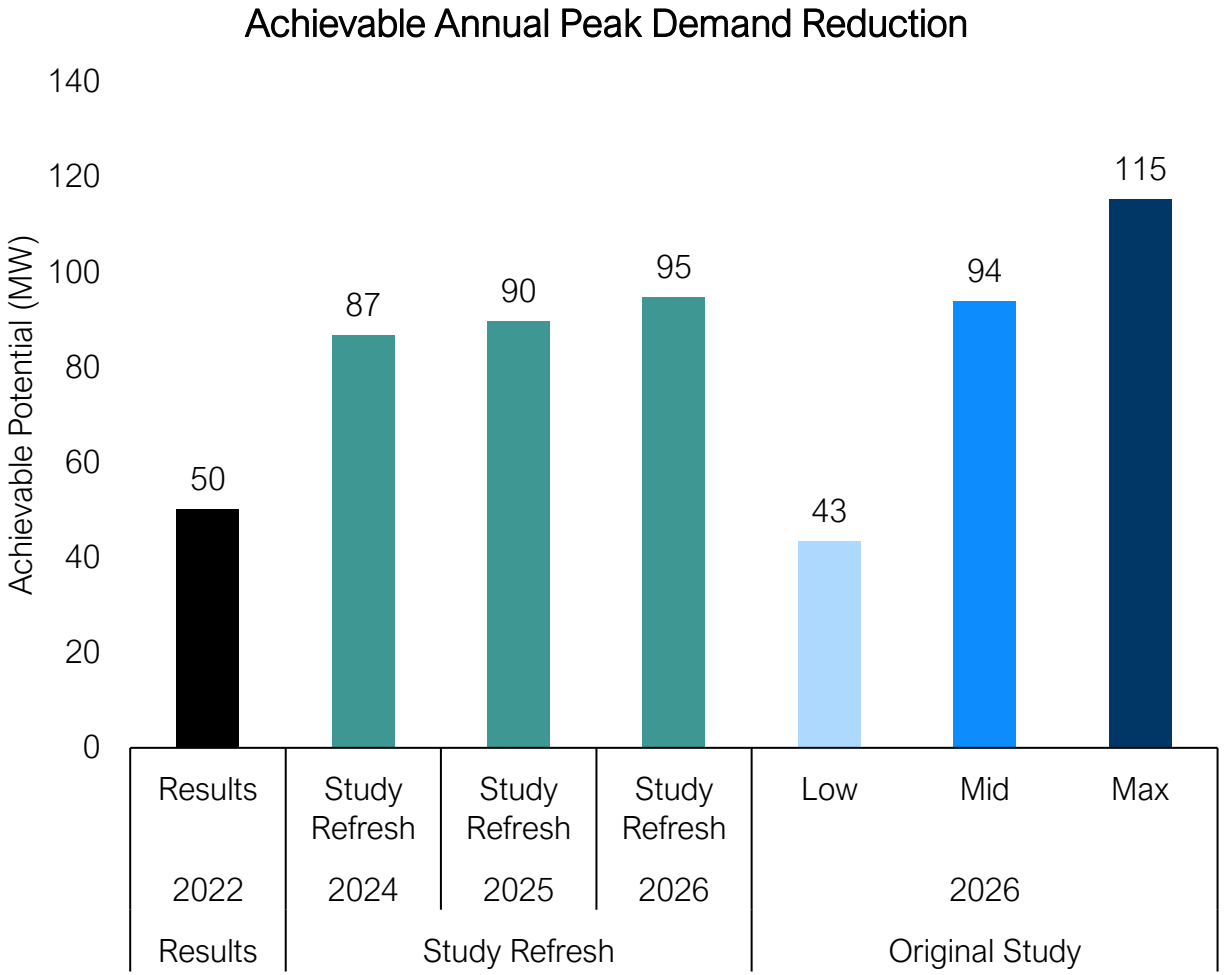


Note: Program costs include incentive and administrative costs for electric and delivered fuel measures. 2022 Results exclude costs related to programs that do not claim savings.

04
Active Demand Response

Achievable Annual Peak Demand Reduction

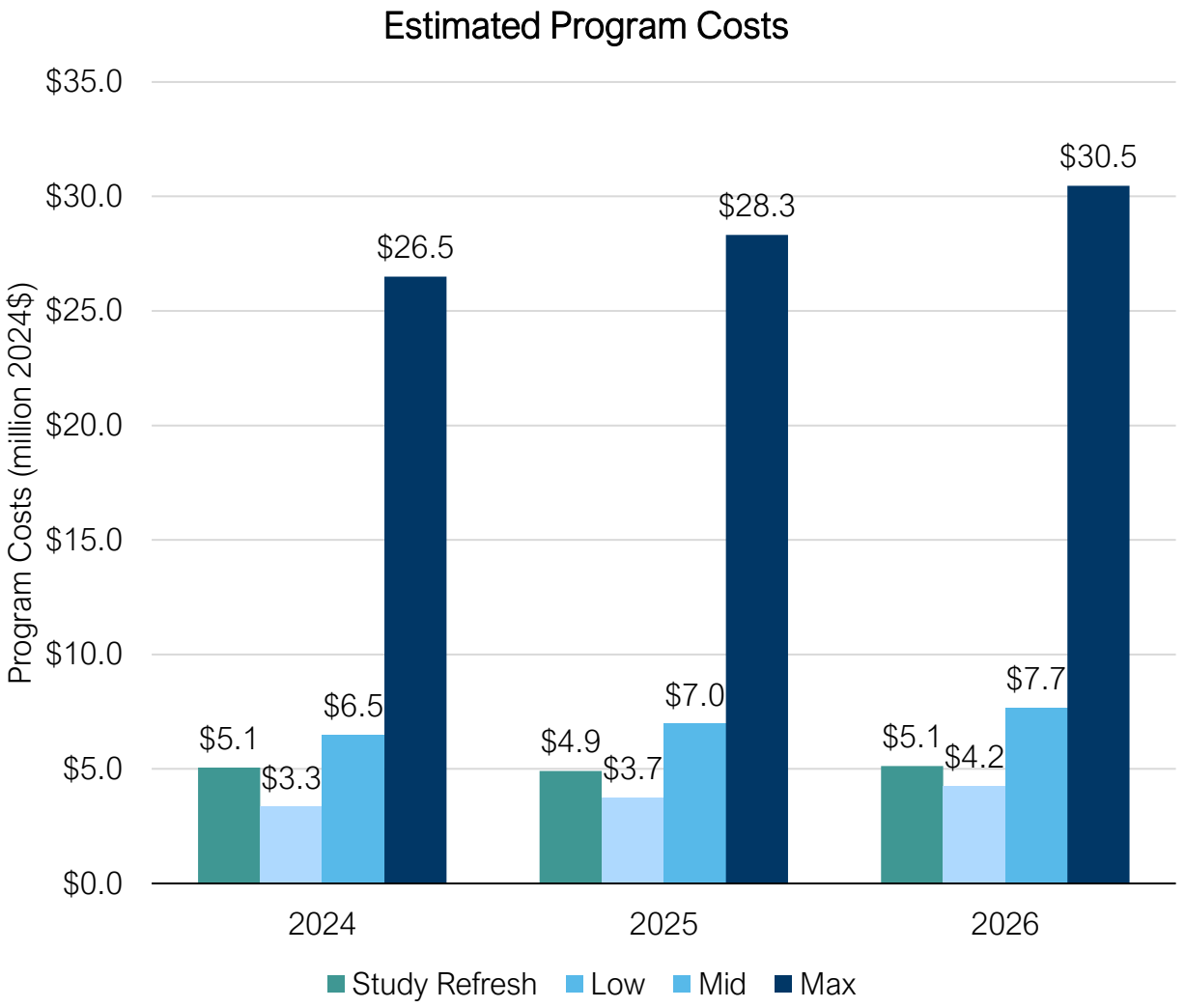
- **Relative to the original study, the Study Refresh scenario savings largely mirror the Mid scenario**
  - Limited changes made to model inputs and assumptions
  - Slight increase in 2026 achievable savings (relative to Mid scenario) driven by updated baseline program participation assumptions



Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

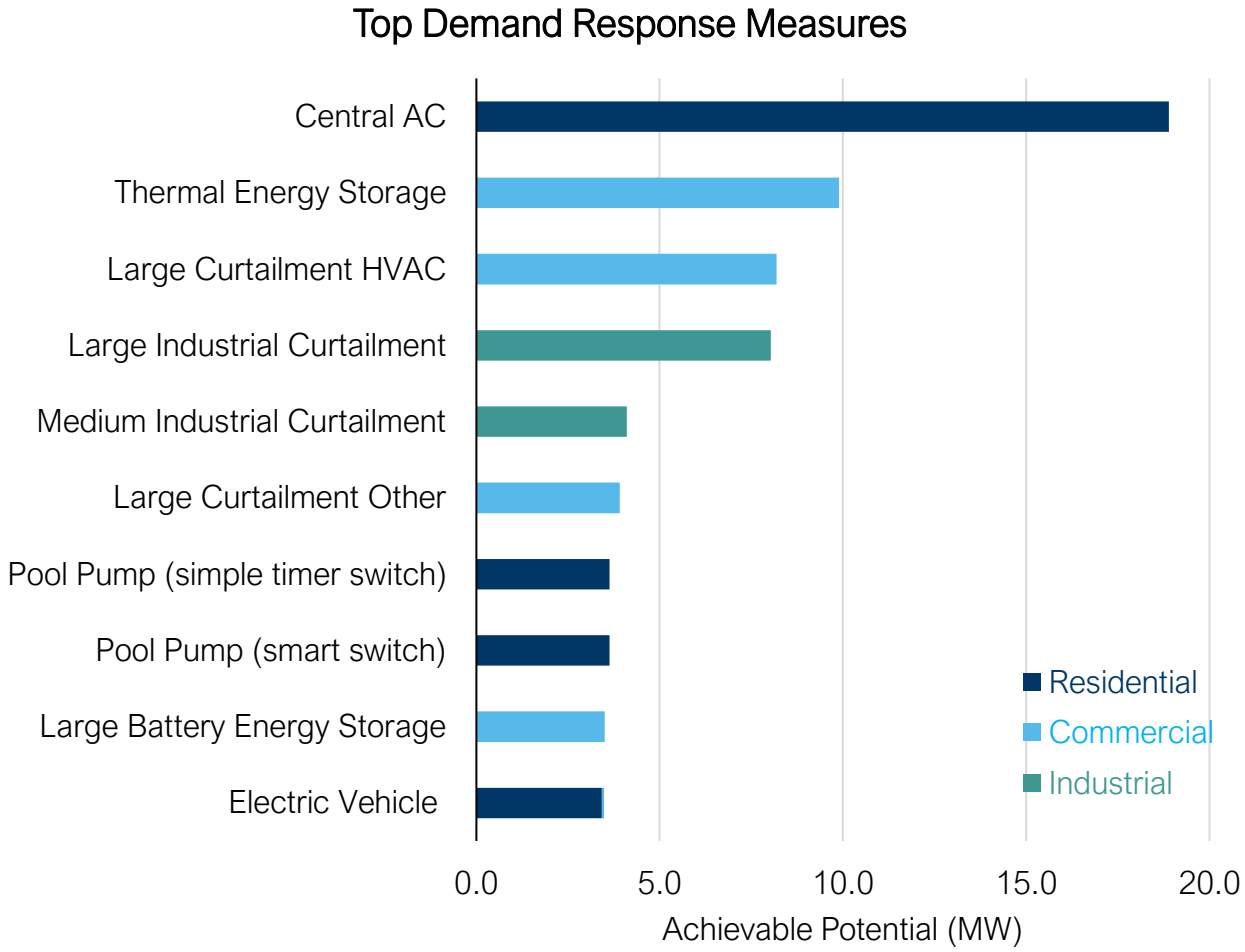
Estimated Budget

- **Relative to the original study, the Study Refresh scenario costs are slightly below the Mid scenario**
  - The Study Refresh assumes advanced metering infrastructure (AMI) is deployed during the study period – negating the initial costs associated with telemetry for applicable measures.



High Impact Measures

- **Central AC controls represent the biggest opportunity in the Residential sector**
- **For the Commercial and Industrial sectors, curtailment measures and thermal energy storage represent the bulk of the opportunity**
- **EV load management opportunities are growing with increased EV adoption**



Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

Cost-effectiveness

- **Modeled programs are highly cost-effective**
  - High avoided distribution costs ($/kW) and reduction in incremental telemetry costs with the rollout of AMI improve the cost-effectiveness
- **Incentives can be increased to drive additional participation while maintaining cost-effectiveness**

Program	RI Test Ratio	2026 Savings (MW)
Residential BYOD	1.7	8.8
Residential DLC	2.8	26.1
Small Commercial BYOD	1.4	0.8
Small Commercial DLC	5.1	12.7
Medium & Large Commercial Curtailment	4.7	30.5
Medium & Large Industrial Curtailment	4.7	12.7
Residential Behavioural DR	N/A	2.0

Note: Results are reported in terms of claimable reduction during the ISO New England peak period. The original study largely reported results in terms of net reductions to National Grid's peak load after accounting for snapback effects, which resulted in lower assessed achievable potential.

05
Key Takeaways

Key Takeaways

1. **Diminishing lighting opportunities.** As customers increasingly adopt LEDs, program opportunities for lighting savings are diminishing.

2. **State appliance standards reduce program opportunities.** While the improved efficiency of Rhode Island's appliance standards will decrease energy consumption in the state, it decreases claimable savings for voluntary incentive programs.

3. **Increasing free ridership.** Based on updated impact factors, free ridership is increasingly reducing net savings – particularly for natural gas and delivered fuel efficiency measures. This also increases acquisition costs as incentives go towards unclaimable savings.

4. **Demand response is cost-effective.** With the rollout of AMI and high avoided distribution capacity costs, demand response savings are becoming increasingly cost-effective in Rhode Island.

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