The Rhode Island Energy Efficiency and Resource Management Council

March 23, 2020

VIA ELECTRONIC AND FIRST-CLASS MAIL

Luly E. Massaro
Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Boulevard
Warwick, RI 02888

RE: Energy Efficiency Savings Targets, 2021-2023

Dear Luly,

Please accept the following and attached material for filing for the above-referenced matter.

The Energy Efficiency and Resource Management Council ("the Council" or "EERMC") conducted in-depth analysis via a Market Potential Study, and supplemented it with additional research and stakeholder engagement to establish all cost-effective levels of energy efficiency to inform proposed energy savings targets ("Targets") to support development of a triennial and annual energy efficiency plans. Similar processes were undertaken in 2010, 2013 and 2016, which has proven to be a critical component in supporting planning and implementation consistent with Least Cost Procurement ("LCP") objectives.

The proposed Targets and LCP Standards will guide LCP activities for the 2021-2023 implementation period and will inform National Grid's Three-Year planning process, and the subsequent Annual Implementation plans. Both the Three-Year Plan, and each Annual Plan will be submitted for review and approval to the PUC. These Plans will convert the Targets, referencing LCP Standards, into increasingly detailed strategic documents with budgets, implementation strategies, cost-effectiveness analysis, and specified outcomes to maximize the acquisition of least cost resources for Rhode Island customers.

The attached Memorandum provides the basis and rationale for the Council's proposed targets.

As a result of EERMC deliberations at the February 27 and March 19, 2020 Council meetings, and public comments provided at the meetings, the EERMC voted at the March 19, 2020 Council meeting to recommend the following Targets as described below:

The following tables show the recommended energy savings targets associated with each of electric, natural gas, and delivered fuels energy efficiency. The targets in Table 1 are denominated in their respective energy units; are not additive; represent targets for the full portfolio of efficiency measures across all sectors, building types, and end uses within each fuel; and correspond to the Maximum Achievable energy savings estimated in the Market Potential Study for each fuel.

Table 1. Energy Savings Targets (Lifetime Energy Savings), Option 1

Year	Electric Energy (MWh)	Natural Gas Energy (MMBtu)	Delivered Fuel Energy (MMBtu)
2021	**1,949,782**	**9,598,108**	**3,709,796**
2022	**2,037,314**	**9,948,779**	**3,731,665**
2023	**2,059,265**	**9,958,127**	**3,806,532**

Table 2 represents the electric peak demand reduction targets associated with the maximum achievable potential estimates drawn from both the electric energy efficiency and demand response modules of the Market Potential Study. The central recommended target is a single peak demand reduction target denominated in first-year annual MW, shown in the second column of Table 2. This target is intended to cover both passive peak demand reductions from energy efficiency measures, as well as active peak demand reductions from demand response programs, and be eligible to be met through a combination of these types of program offerings.

Table 2. Electric Peak Demand Reduction Targets (Annual MW), Option 1

Year	Total Electric Peak Demand Reductions	Energy Efficiency Passive Peak Demand Reduction	Active Demand Response Peak Demand Reduction
2021	**64.7**	*30.8*	*33.9*
2022	**85.9**	*33.2*	*52.7*
2023	**108**	*33.5*	*74.5*

Note on Table 2: 'Total Electric Peak Demand Reductions' is the sum of 'Energy Efficiency Passive Peak Demand Reduction' and 'Active Demand Response Peak Demand Reduction' in each year.

Table 3 shows the electric energy and electric peak demand reductions associated with the Maximum Achievable scenario from the combined heat and power (CHP) module of the Market Potential Study. Because CHP installations tend to be harder to predict, and large projects can represent significant percentages of overall electric energy savings from efficiency programs, = these data have been provided separately from the results of the energy efficiency and demand response modules. In particular, CHP savings targets have been denominated in *average annual achievable savings*, due to the aforementioned forecasting challenges, and should thus be shown separately from targets for electric energy and peak demand reduction savings derived from energy efficiency and demand response.

Table 3. CHP Electric Energy Savings and Peak Demand Reduction Targets, Option 1

Year	CHP Electric Energy Savings (Lifetime MWh)	CHP Peak Demand Reduction (Annual MW)
2021	**723,337**	**11.1**
2022	**723,337**	**11.1**
2023	**723,337**	**11.1**

The EERMC believes that the process (discussed in the Memorandum) for inclusion of National Grid, the Office of Energy Resources, the Division of Public Utilities and Carriers, parties to the Energy Efficiency and System Reliability Technical Working Groups and other affected parties has helped ensure essential input among the key players in Rhode Island so that these Targets will provide appropriate guidance to the implementation of LCP in Rhode Island in the 2021-2023 time period.

Respectfully submitted,
Rhode Island Energy Efficiency
Resource Management Council
By its Attorney

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CERTIFICATION

I hereby certify that I filed an original and one copy of the within memorandum and a true copy, via electronic mail, on this 23rd day of March, 2020 to the Service List for Docket #5015 and to:

Luly.massaro@puc.ri.gov
Luly E. Massaro, Commission Clerk
Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888

Marisa Desautel

Recommended Targets for Energy Efficiency and Peak Demand Reduction Savings for 2021-2023

Prepared for

STATE OF RHODE ISLAND
ENERGY EFFICIENCY & RESOURCE MANAGEMENT COUNCIL

Prepared by:

The Rhode Island Energy Efficiency and Resource Management Council Consultant Team

Lead Authors: Mike Guerard, Sam Ross / Optimal Energy, Inc.

March 19, 2020

Table of Contents

I. INTRODUCTION

This Memorandum presents proposed Three-Year Savings Targets ("Targets") for National Grid's upcoming 2021-2023 Energy Efficiency Procurement Plan ("Three-Year Plan"). These recommendations are based on the Energy Efficiency & Resource Management Council's ("EERMC") Consultant Team's oversight and review of findings of the EERMC-funded Market Potential Study, conducted by Dunsky Energy Consulting; discussions with stakeholders and EERMC members; and review and alignment with relevant legislative and regulatory guidance on Target setting. Upon EERMC approval of Targets, as recommended or with modification, the EERMC's counsel will submit the proposed Targets to the Rhode Island Public Utilities Commission (PUC).

This will be the fourth submittal of triennial Targets by the EERMC to the PUC since the promulgation of the 2006 Comprehensive Energy Conservation, Efficiency and Affordability Act, or "Least-Cost Procurement (LCP) Law." This process has also served to meet the EERMC's legislated requirement in R.I. Gen. Laws § 39-1-27.7(c)(1):

> *"The commissioner of the office of energy resources and the energy efficiency and resources management council, either jointly or separately, shall provide the commission findings and recommendations with regard to system reliability and energy efficiency and conservation procurement on or before March 1, 2008, and triennially on or before March 1*[1]*, thereafter through March 1, 2024. The report shall be made public and be posted electronically on the website of the office of energy resources."*

The proposed Targets presented by the Consultant Team are for Electric, Natural Gas, and Delivered Fuel Energy Efficiency energy savings, as well as electric peak demand reductions, in each of the three years from 2021 to 2023, with combined heat and power (CHP) targets separated from targets which cover other opportunities to capture energy savings and electric peak demand reductions. A key change from previous proposed Targets is a shift to presenting the Targets in lifetime savings instead of annual, a preference strongly encouraged by stakeholders and approved by the EERMC.

Purpose of the Targets

The purpose of energy efficiency targets as recommended by the EERMC to the PUC has been consistent in the three previous Target submittals, as clearly articulated in the September 1, 2014 filing when the EERMC stated:

> *The EERMC and the parties understand that the efficiency savings targets are intended to serve as guideposts as the utility develops its Three-Year EE Procurement Plan and more detailed annual EE Program plans. As the parties described in a joint brief filed with the Commission in Docket 4202 on April 1, 2011:*[2] *"It is important to note that the energy efficiency savings targets*

[1] Due to time required complete the savings projection portion of the Market Potential Study, the EERMC vote on Targets was moved to the March 19, which was communicated to the PUC

[2] The joint brief is available at: http://www.ripuc.org/eventsactions/docket/4202-EEMRC-JointRR(4-1-11).pdf

are just that, targets of what the EERMC assessment estimates is potentially available for cost-effective efficiency…

…The 2010 legislation recognizes that the energy savings targets themselves do <u>not</u> constitute a plan, but rather ***the targets are just high-level estimates of the potentially available cost-effective efficiency****, whose function is to guide the development of actual Three-year LCP and annual efficiency plans."*

The purpose of the Targets is clear in its focus on establishing what is "potentially available cost-effective efficiency." It is meant to guide the ensuing purpose of establishing savings goals to be established in Three-Year EE Procurement Plans and Annual EE Plans, which also require the consideration of additional analysis covering factors such as prudency and reliability, as directed in the PUC's LCP Standards[3]. In previous target-setting cycles, this quantification of Targets has been undertaken in good faith by the EERMC's Consultant Team and other stakeholders including National Grid and the Rhode Island Office of Energy Resources, referencing an Opportunity Report conducted in 2010, which was nominally designed to cover ten years. Due to the increasingly outdated nature of this quantification of the potentially available all cost-effective efficiency in more recent planning cycles, the results needed to be significantly modified, generally through reliance on more recent data drawn from National Grid's efficiency business-as-usual program performance data. This process of updating an old estimate with recent program data was necessary in lieu of a more up-to-date, third-party quantification of the potential for all cost-effective energy efficiency in Rhode Island, and was subject to significant limitations. These limitations included the implicit application of a wide array of considerations and constraints typically incorporated in efficiency program planning and implementation, and associated program performance data, that are outside the intended purpose of the efficiency targets as just described.

To overcome these limitations, the EERMC solicited via a competitive RFP process a Market Potential Study for Rhode Island to provide an objective estimate of all potentially available cost-effective energy efficiency resources to inform the targets for the three-year period from 2021 to 2023. The scope and application of this Market Potential Study to savings targets are summarized in Section III of this memorandum, while the results of the study are drawn upon to inform the recommended targets described in Section IV. Appendix A contains the presentation on the study's high-level results which have sufficient granularity to inform Targets. A final report will be issued in May 2020 with the full narrative and documentation.

This memorandum presents for the EERMC the Consultant Team's recommendations for 2021-2023 savings targets for National Grid's upcoming Three-Year Plan and ensuing Annual Plans for consideration by the EERMC in their deliberations regarding the savings targets they will recommend to the PUC. These proposed targets are derived primarily from the Market Potential Study, which provided a comprehensive, analytical process to determine all cost-effective energy savings. The Market Potential

[3] http://www.ripuc.ri.gov/eventsactions/docket/4684-LCP-Standards-FINAL.pdf

Study included a range of modeling scenarios to help understand the landscape for energy efficiency in Rhode Island, and to quantify the impact of different modeling assumptions. Importantly, the final report will contain detailed information on the full range of scenarios. However, the Consultant Team views the scenario referred to as 'Maximum Achievable' as appropriate to rely on to inform targets, based on the purpose of the Targets as just summarized, as this scenario corresponds to the full potential for all cost-effective energy efficiency savings available in Rhode Island. Additionally, we conducted a close review of the three prior submittals of Targets to the PUC; reviewed the LCP legislation and current LCP Standards; considered input from stakeholders, including the RI Energy Efficiency Technical Working Group coordinated by National Grid; and factored input from the EERMC during Council meetings and during individual meetings held with council members and OER to inform our recommendation.

Further, to support consideration of the distinction between Targets and the goals associated with Three-Year EE Procurement Plans and Annual EE Plans, we acknowledge that while the 2021-2023 electric and natural gas savings targets have been developed using the best information and data available at this time, additional relevant information is likely to be learned as time passes. Consequently, the annual savings targets, including considerations such as their associated budgets as estimated during the planning process, should be reviewed each year during the development of the Annual Plans. Following this review, the plan goals should either be determined to remain identical to the Targets, or revised in light of new information, as described further in Section II of this memorandum and in the proposed Least Cost Procurement Standards for 2021-2023.[4] The parties participating in the Annual Plan development should agree that revisions to the annual energy savings targets should be based only on clearly documented changes in cost-effective resource availability, or unforeseeable and/or unavoidable constraints to their full pursuit and achievement.

II. OVERVIEW OF TARGETS RELATION TO PLANNING PROCESS

In 2010, the legislature adopted the ratemaking concept of revenue decoupling, in R.I. Gen. Laws § 39-1-27.7.1. Pursuant to § 39-1-27.7.1(f). The EERMC was required to submit proposed energy savings targets to the PUC by September 1, 2010. The purpose of these targets was to give the utility guidance on all the potentially available cost-effective efficiency resources in the state that would feed into the normal LCP Three-Year and Annual efficiency program planning processes under § 39-1-27.7.

During the Three-Year and Annual planning processes required by Rhode Island law, the efficiency strategies, programs and budgets are developed by the utility and the cost-effectiveness of the budgets and programs is reviewed and approved by the EERMC before being filed with the PUC for their consideration and action. It is during these planning activities that a wide range of factors are considered and fully vetted, in a transparent way with significant stakeholder engagement, to inform what percentage of the total cost-effective energy savings potential could be realized during the three

[4] "The Utility shall include a preliminary budget for the Three-Year Plan covering the three-year period that identifies the projected costs, benefits, and initial energy saving targets of the portfolio for each year. The budget shall identify, at the portfolio level, the projected cost of efficiency resources in cents/ lifetime kWh or cents/lifetime MMBtu. The preliminary budget and initial energy saving targets may be updated, as necessary, in the Utility's Annual Energy Efficiency Plan." Section 1.3. B. iv. b.

year period, and more accurately in ensuing annual plans based on evolving market trends and other factors. In particular, this is where "prudent and reliable" portion of the LCP law, which directs National Grid to secure all cost-effective energy efficiency that is less than the cost of supply and is prudent and reliable, should be applied.

Appropriately, the Consultant Team anticipates that once the prudent and reliable filter impacts are documented, there will be gaps between the potential study-informed Targets, which capture all cost-effective efficiency savings, and Three-Year and Annual Plan Goals, which represent the portion of Targets that will be proposed as Plan savings goals with associated budgets. The process for understanding the size of this difference includes a full review and vetting of all barriers that preclude reaching the full Maximum Achievable savings. This is a collaboration between National Grid, the EERMC and its Consultant Team, the Office of Energy Resources, and other stakeholders, and takes the form of a well-documented, transparent process involving full stakeholder engagement and input. At the end of this process, National Grid's Annual Plans will be able to clearly detail the various reasons that Plan goals are below targets and justify the magnitude of the gap.

Factors that typically are analyzed during this process include overall costs, rate and bill considerations, workforce factors, environmental, equity, and other non-energy considerations, market characteristics such as EE equipment supply chains and consumer education and awareness, and State policy objectives including carbon emissions reductions and associated clean energy goals, among others. Many of these factors represent constraints on the 'all cost-effective potential' reflected in the Targets, which can be alleviated over time through program design innovation, capacity building, and policies to support growth and competition in efficiency product and service markets. As a result, even when Targets are set consistently from year to year as is the case for the Targets presented in Section IV, it is very reasonable for the detailed, granular planning process to generate Plan savings goals which ramp toward those Targets over time in the Three-Year and associated Annual Plans, while also supporting the removal of barriers for future Three-Year Plans.

III. MARKET POTENTIAL STUDY SCOPE AND APPLICATION

Context and Industry Overview

Market Potential Studies are widely used as a best-in-class, data-driven resource to inform efficiency program targets, as they represent a quantitative estimate of the efficiency resource that is available for efficiency programs to pursue. As examples, efficiency boards and/or utility commissions in nearby states including Massachusetts, New Jersey, New Hampshire, Pennsylvania, and Delaware, among others, are currently or have recently had market potential studies conducted to help inform efficiency program targets in their respective jurisdictions. This section summarizes the scope and purpose of the Market Potential Study covering Rhode Island, whose results inform the recommended targets presented in Section IV.

Market Potential Study and Savings Targets

The EERMC issued an RFP in the spring of 2019 for the implementation of a Market Potential Study covering electric, natural gas, and delivered fuel energy efficiency; electric demand response; combined heat and power; heating electrification; and behind-the-meter renewable energy. Importantly, only the results from first three modules of the Market Potential Study, energy efficiency, demand response, and combined heat and power, will be drawn on in the recommended targets presented in Section IV. Additionally, it is important to note that the Market Potential Study contains a range of results associated with different scenarios, which correspond to different sets of modeling assumptions. The result set viewed by the Consultant Team as most consistent with the purpose and requirements of the target-setting process is the Maximum Achievable ('Max') scenario. This is because this scenario's assumptions and outputs adhere most closely to the definition of targets quoted above, "…*high-level estimates of the potentially available cost-effective efficiency…".*

It is important to recognize that the mandate for the targets just described differs significantly from the mandate for the 2021-2023 Three-Year ***Plan*** and associated Annual ***Plans***, as summarized in Section II of this memorandum. In particular, the goals within these plans, which have not yet been developed, are expected to diverge from the targets described in Section IV for a range of reasons, and this should not be construed as a limitation or failure either of the target-setting process or of the subsequent plan development processes. Specifically, per the LCP Standards, considerations regarding prudency and reliability are directed at the Company to explore and apply in Plans. Rather, the targets define all potentially available cost-effective efficiency, which is the directive from LCP law and prior target filings. The savings goals developed through the planning process and included in the Plans will necessarily be modified as a range of factors associated with prudency and reliability are identified, discussed, quantified, and balanced in the planning process, with full engagement of stakeholders proving input to the Company. These factors may include, but are not limited to, considerations such as program costs and associated rate and bill impacts; availability of the skilled workforce necessary to implement the suite of efficiency programs that will be needed to pursue all cost-effective efficiency; time and resources needed to train and develop additional workforce to fill any gaps between current workforce capability and the aforementioned need; balancing the cost of savings and benefits derived from driving market transformations today through efficiency program support and the cost of savings and benefits that will be obtained once markets begin to transform; other policy priorities such as equity or carbon emissions reductions and other environmental considerations; and other considerations not identified here.

The Consultant Team's recommended efficiency Targets in the following section are proposed in the context of the overarching purpose of the Targets as established in this memorandum, and with full awareness of the expected differences in purpose and in numeric value between the saving targets and subsequent Three-Year and Annual saving goals.

IV. CONCLUSION AND RECOMMENDED EFFICIENCY SAVINGS TARGETS

As discussed above, the Consultant Team engaged in an extensive process to identify the achievable potential of electric, natural gas and delivered fuel energy efficiency savings and electric peak demand reduction opportunities in Rhode Island for the 2021-2023 period, based primarily on the findings of the

Market Potential Study. While there is some level of uncertainty in forecasting the future, the Consultant Team has high confidence that the process undertaken estimates the maximum achievable cost-effective potential energy efficiency savings and peak demand reductions according to accepted industry practices for Market Potential Studies.

Table 1, below, shows the recommended energy savings targets associated with each of electric, natural gas, and delivered fuels energy efficiency. These targets are denominated in their respective energy units; are not additive; represent targets for the full portfolio of efficiency measures across all sectors, building types, and end uses within each fuel; and correspond to the Maximum Achievable energy savings estimated in the Market Potential Study for each fuel.

Table 1. Energy Savings Targets (Lifetime Energy Savings), Option 1

Year	Electric Energy (MWh)	Natural Gas Energy (MMBtu)	Delivered Fuel Energy (MMBtu)
2021	**1,949,782**	**9,598,108**	**3,709,796**
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Table 2 represents the electric peak demand reduction targets associated with the maximum achievable potential estimates drawn from both the electric energy efficiency and demand response modules of the Market Potential Study. The central recommended target is a single peak demand reduction target denominated in first-year annual MW. This target is intended to cover both passive peak demand reductions from energy efficiency measures, as well as active peak demand reductions from demand response programs, and be eligible to be met through a combination of these types of program offerings.

Table 2. Electric Peak Demand Reduction Targets (Annual MW), Option 1

Year	Total Electric Peak Demand Reductions	Energy Efficiency Passive Peak Demand Reduction	Active Demand Response Peak Demand Reduction
2021	**64.7**	*30.8*	*33.9*
2022	**85.9**	*33.2*	*52.7*
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Note on Table 2: 'Total Electric Peak Demand Reductions' is the sum of 'Energy Efficiency Passive Peak Demand Reduction' and 'Active Demand Response Peak Demand Reduction' in each year.

Table 3 shows the electric energy and electric peak demand reductions associated with the Maximum Achievable scenario from the combined heat and power (CHP) module of the Market Potential Study. Because CHP installations tend to be harder to predict, and large projects can represent significant percentages of overall electric energy savings from efficiency programs, the Consultant Team has opted to provide these data separately from the results of the energy efficiency and demand response modules. In particular, CHP savings targets have been denominated in *average annual achievable savings*, due to the aforementioned forecasting challenges, and should thus be shown separately from targets for electric energy and peak demand reduction savings derived from energy efficiency and demand response.

Table 3. CHP Electric Energy Savings and Peak Demand Reduction Targets, Option 1

Year	CHP Electric Energy Savings (Lifetime MWh)	CHP Peak Demand Reduction (Annual MW)
2021	**723,337**	**11.1**
2022	**723,337**	**11.1**
2023	**723,337**	**11.1**

For context, the following two figures show the historical tracking of targets, associated annual plans and actual results alongside the proposed electric and natural gas energy savings targets' associated annual savings impacts. Note that these figures are in *annual savings,* not *lifetime* savings, for historical comparability, so the numbers in these charts for 2021-2023 do not match the numbers in the tables above. Rather, they correspond to the same set of Maximum Achievable model results from the Market Potential Study as the lifetime energy savings targets in Tables 1-3. The percentages in these figures represent percent of sales as defined during each three-year planning cycle, while the savings in energy units are captured on the y-axis. Lastly, as expected, there are only Target values for 2021-2023, as plans have not yet been developed for this period, and only Target and Planned values for 2020 but not Actuals, since the program year is not complete.

Figure 1. Rhode Island Annual Electric Energy Savings Targets, Plan Goals, and Actual Savings

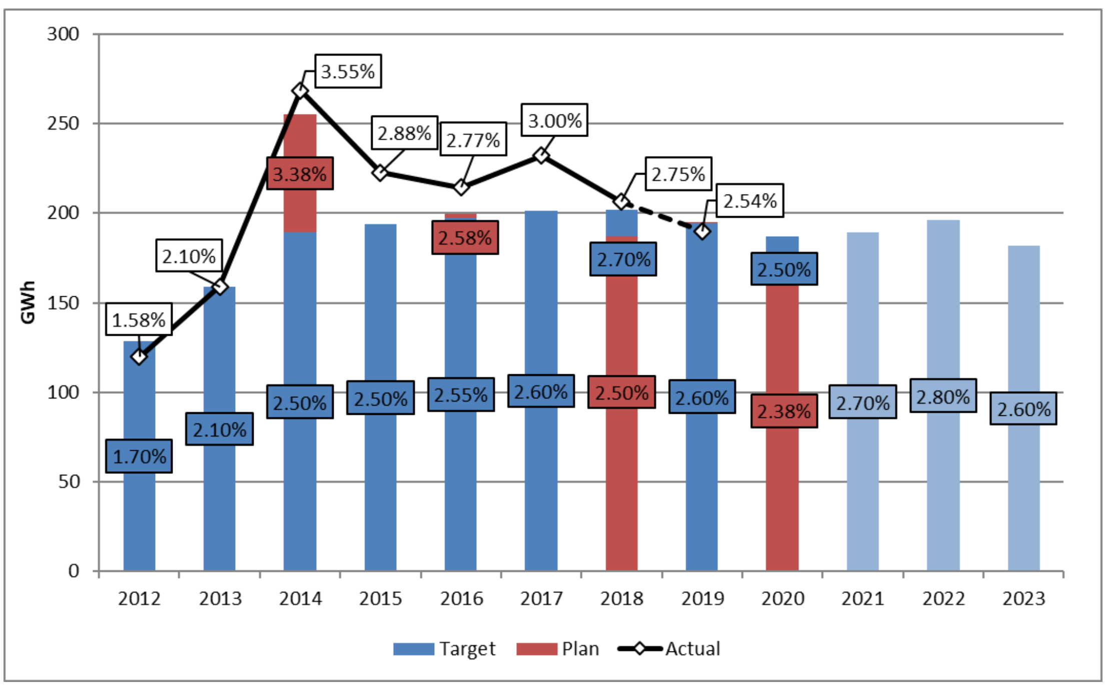
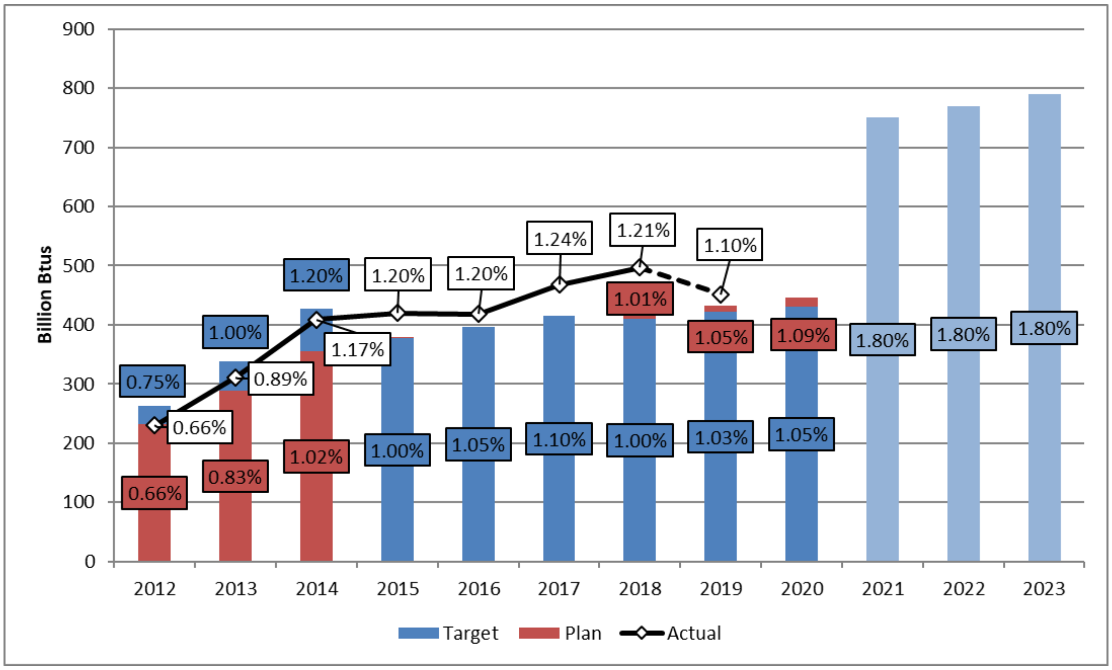


Figure 2. Rhode Island Annual Gas Energy Savings Targets, Plan Goals, and Actual Savings



APPENDIX A: MARKET POTENTIAL STUDY OVERVIEW

Rhode Island Energy Efficiency Market Potential Study

Final Results

March 13, 2020

Agenda

dunsky

Introduction

Study Overview

Results
- Energy Efficiency
- Demand Response
- Combined Heat and Power
- Heating Electrification
- Cumulative impact on energy sales

Conclusions

Study Overview

Study Overview: Key Parameters

Study Period	2021 to 2026
Study Geography	Rhode Island*
Sectors	Residential ▪ Low-Income Residential ▪ Commercial ▪ Industrial
Savings Streams	Energy Efficiency ▪ Combined Heat & Power ▪ Demand Response Heating Electrification ▪ Distributed Generation
Fuels	Electricity ▪ Natural Gas ▪ Oil ▪ Propane
DEEP Model	Applies bottom up models, using detailed RI markets and measures

*Savings are estimated based on National Grid's customer territory and will be scaled for Block Island Utility District and Pascoag Utility District
Results presented in this slide deck represent savings for National Grid customers only

Energy Efficiency (EE)

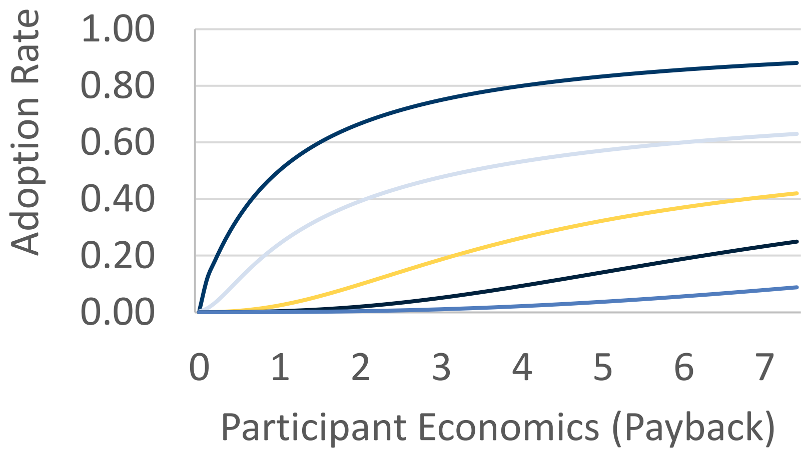
EE: Achievable Scenarios

Three program scenarios are explored in this study:

Low	Applies incentives and enabling activities in line with National Grid's 2020 Energy Efficiency Plan to simulate **business as usual**
Mid	Increases incentives and enabling activities **above and beyond** levels within National Grid's 2020 Energy Efficiency Plan
Max	Completely eliminates customer costs and further reduces customer adoption barriers to estimate **maximum achievable potential**

EE: DEEP Model

	TECHNICAL	ECONOMIC	ACHIEVABLE
MEASURE INTERACTIONS	Chaining		
ECONOMIC SCREENING	n/a	RI Test	n/a
MARKET BARRIERS	No Barriers	No Barriers	Adoption Curves
COMPETING MEASURES	Winner takes all (most efficient)		Competition Groups
NET SAVINGS	Gross	Gross	Program NTGR, Measure RR



- Achievable adoption is based on U.S. Department of Energy adoption curves, which estimate customer adoption as a function of the customer's economic payback.

EE: Significant changes since February EERMC Meeting

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Additional quality control resulted in the following changes:

- Electric savings **increased** primarily due to model calibration on lighting measures where preliminary results were significantly under estimating savings as compared to current program savings.
- Gas savings **decreased** – particularly in the study's initial years – due to program ramp rates for measures that have low adoption in existing programs, but that have market data suggesting a larger opportunity exists.
  - Gas savings slightly **increased** in the study's later years as gas measures ramped up to full potential and savings increased for a small number of measures due to additional refinements

Percent change to 2021-2023 average savings since preliminary results presented to EERMC on February 27, 2020

Fuel	Lifetime	Annual
Electric	+8.2%	+6.4%
Gas	-2.3%	-2.4%

EE: Electric Savings Potential

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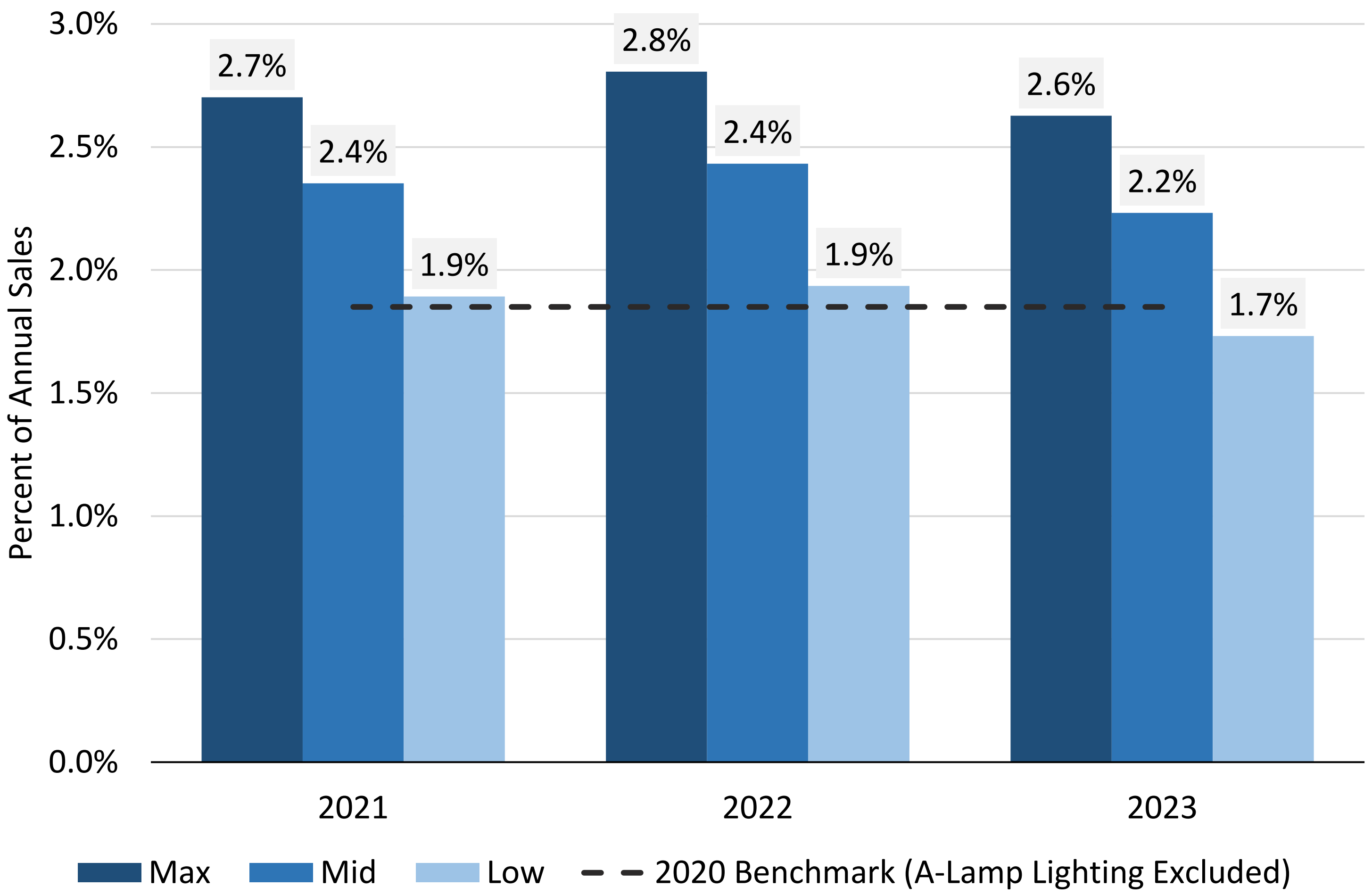
Annual Electric Savings as Percentage of Forecasted Electricity Sales*



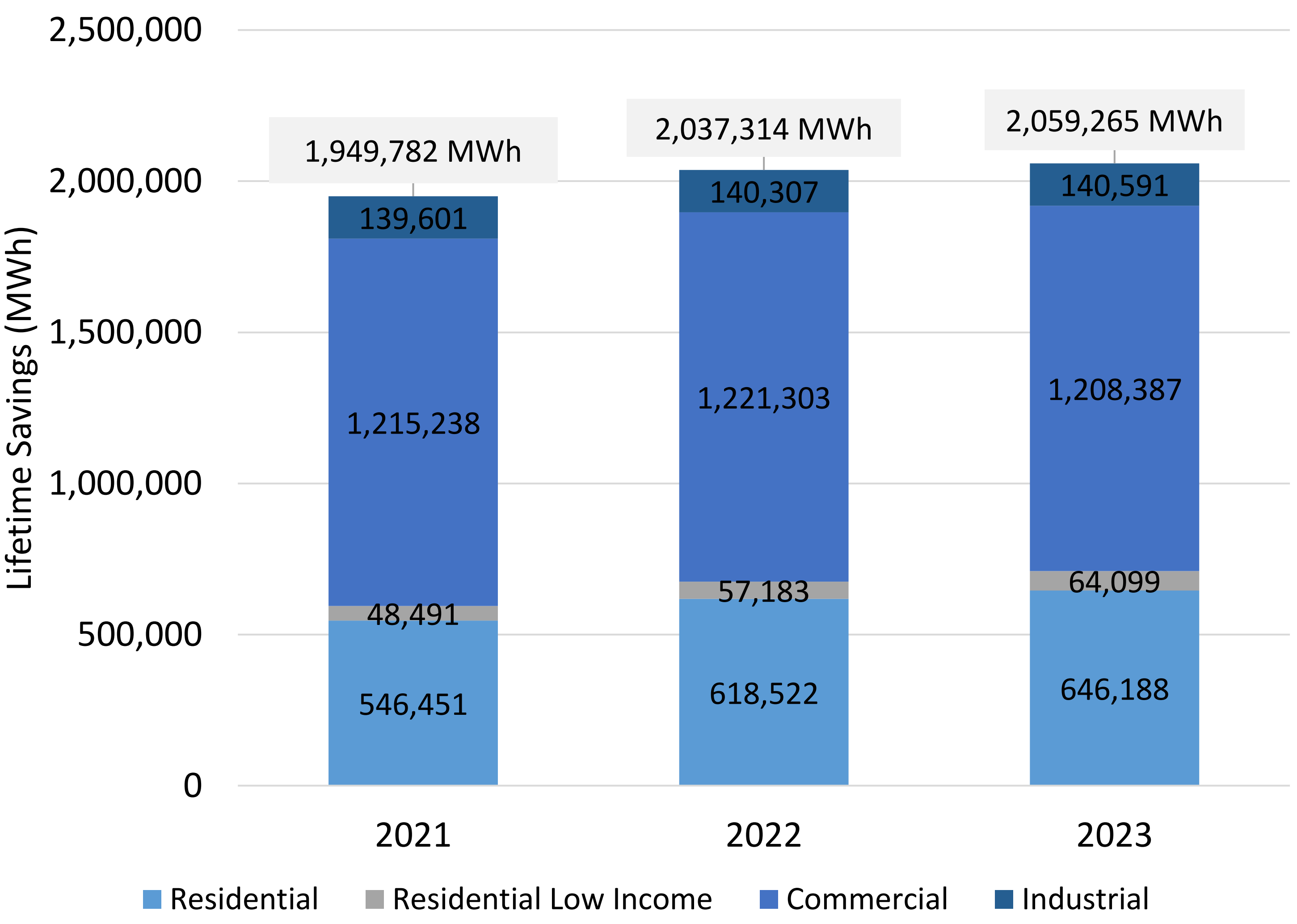
- Low Scenario aligns with 2020 Plan savings when A-Lamp savings are excluded.
- Savings decline in 2023 as significant lighting measures leave the programs and saturation of other lighting measures.

Benchmark	Savings
2019 Program Results	2.8%
2020 RI EE Plan	2.6%
2020 RI EE Plan (w/o A Lamps)	1.8%
2021 Potential National Grid (MA)	
BAU	2.1%
MAX	2.7%

*Dunsky treated National Grid's 2021-2026 forecasted electric sales to remove assumed EE savings to estimate percent savings for each year of the study.

EE: Electric Savings Potential

Lifetime Electric Savings by Sector (Max)



- Bulk of electric savings come from residential and commercial sectors
- Lifetime savings increase slightly year-over-year even while annual savings decline in 2023 (previous slide) as longer-lived measures ramp up and replace reduced lighting savings

EE: Electric Savings Potential

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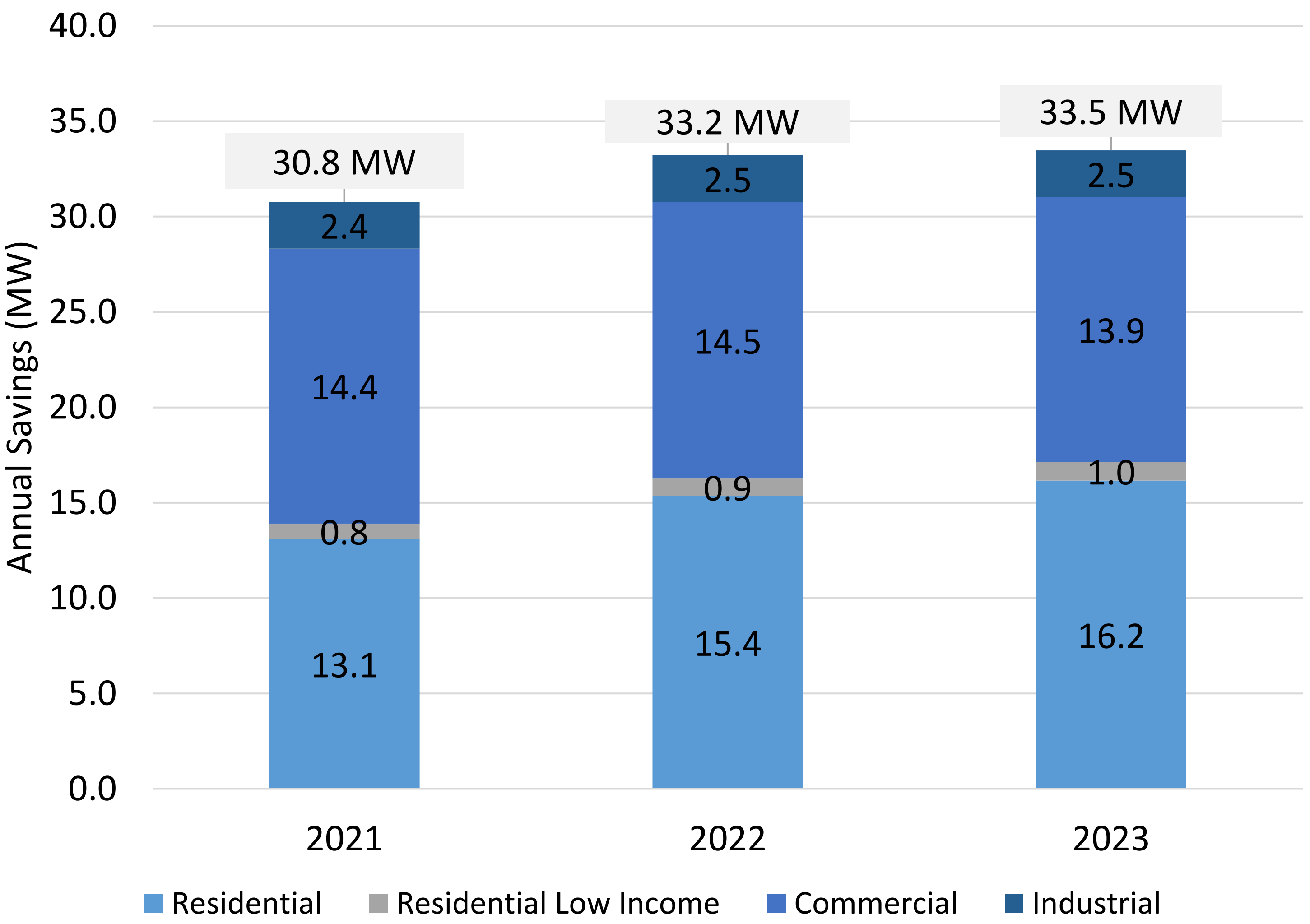
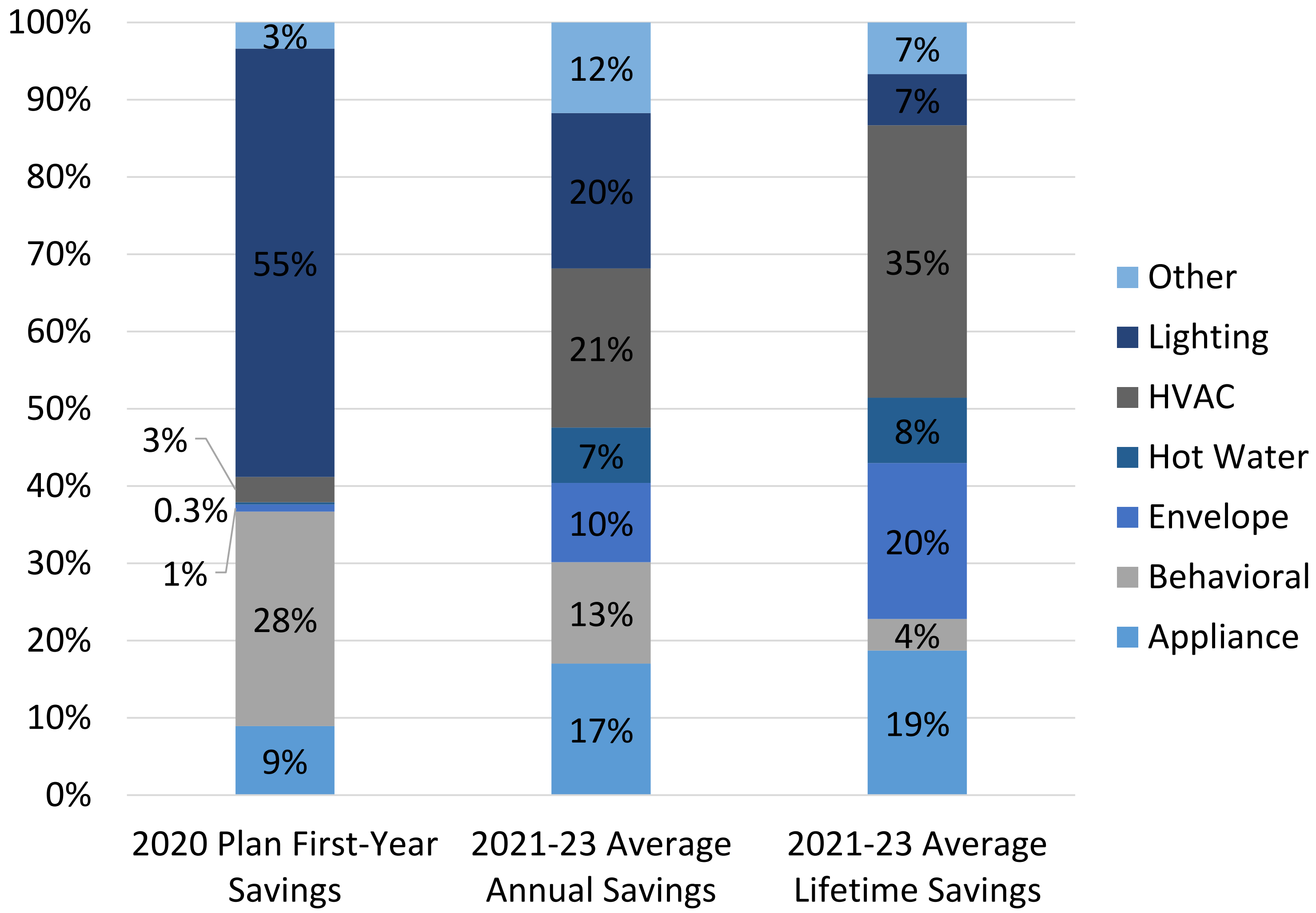
Annual Passive Peak Demand Reduction by Sector (Max)



- Similar to energy savings, bulk of passive demand savings come from residential and commercial sectors

EE: Electric Savings Potential, Residential

Proportion of Residential Savings by End Use

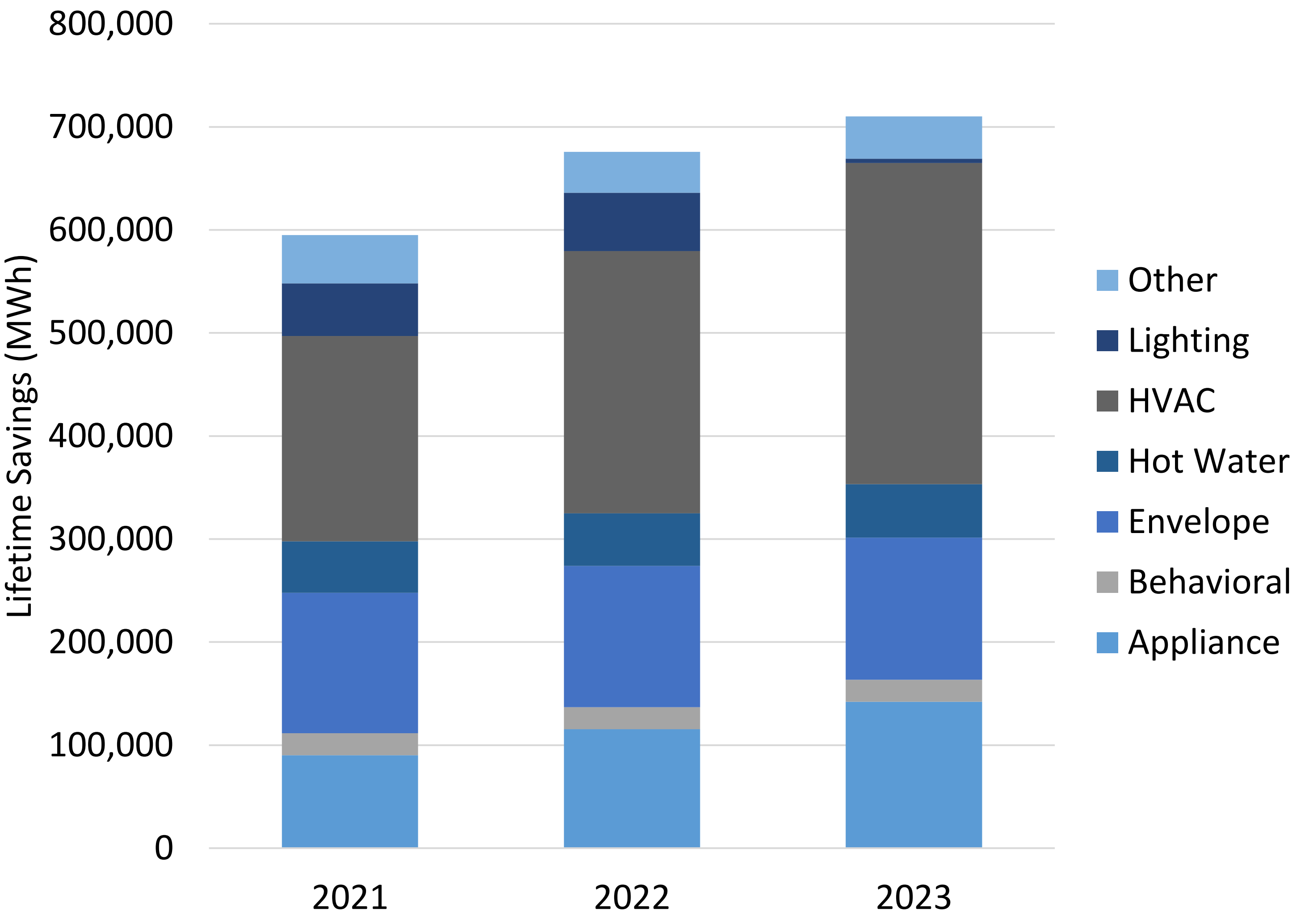


- Savings move quickly away from lighting and towards other end uses as lighting market transforms to LEDs.
- In terms of annual savings, 2021-2023 residential savings are distributed among end-uses
- From a lifetime perspective, the relative impact of HVAC and envelope measures increase significantly – while lighting, behavioral, and other decrease – when compared to annual savings.

EE: Electric Savings, Residential Lighting

dunsky

Despite loss of lighting, lifetime residential savings grow



- In the residential sector, increased lifetime savings from long-lived measures (HVAC and appliance) more than make up for reduction of lighting savings in 2023 as the market transforms
- However, in annual terms, savings drop in 2023 as lighting exits the market

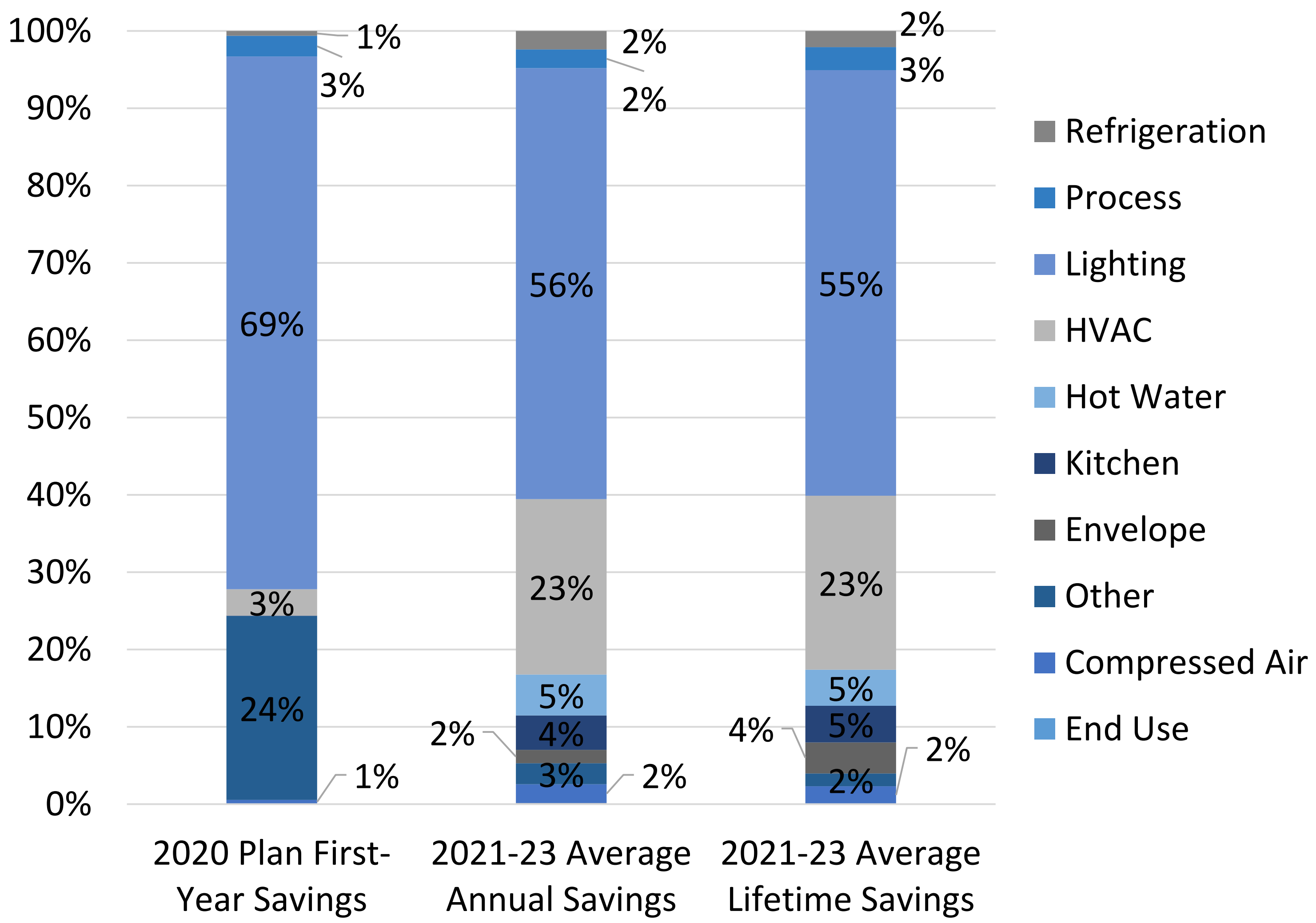
Residential EE Savings, Max Scenario (MWh)

Savings	2021	2022	2023
Annual	78,231	84,722	72,917
Lifetime	594,943	675,705	710,287

*Graph shows combined savings for both residential and low-income residential customers

EE: Electric Savings Potential, Non-Residential

Proportion of Non-Residential Savings by End Use



- Lighting savings drop significantly as compared to 2020 EE Plan as markets transform.
- Still, the majority of non-residential savings are driven by lighting (linear) and lighting controls, with HVAC savings representing a growing and significant opportunity
- There is less difference between average annual savings and lifetime savings compared to residential sector because the spread in measure lives is less.

EE: Estimated Electric Program Costs

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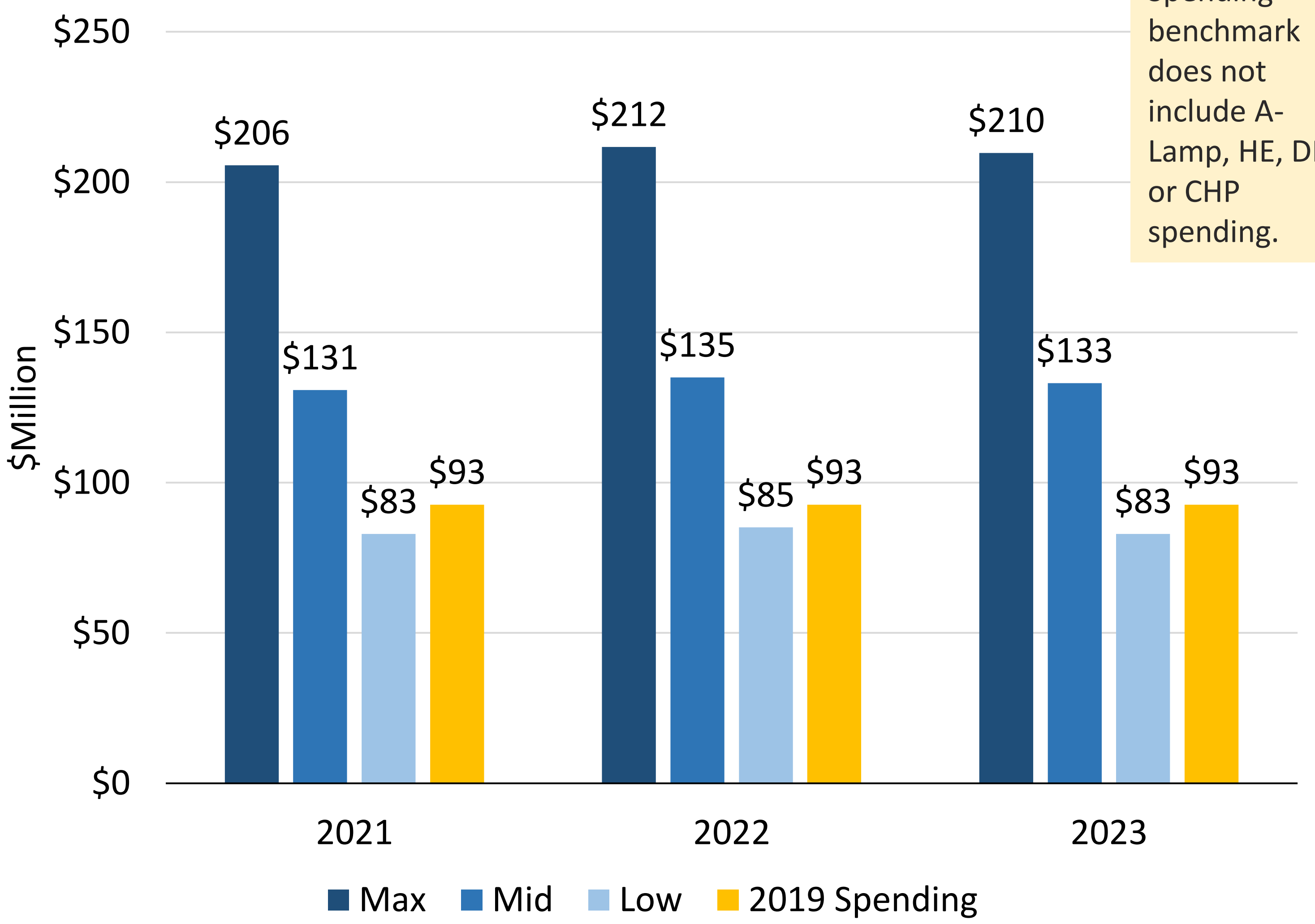
Estimated Annual Electric Program Costs



Note: 2019 Spending benchmark does not include A-Lamp, HE, DR, or CHP spending.

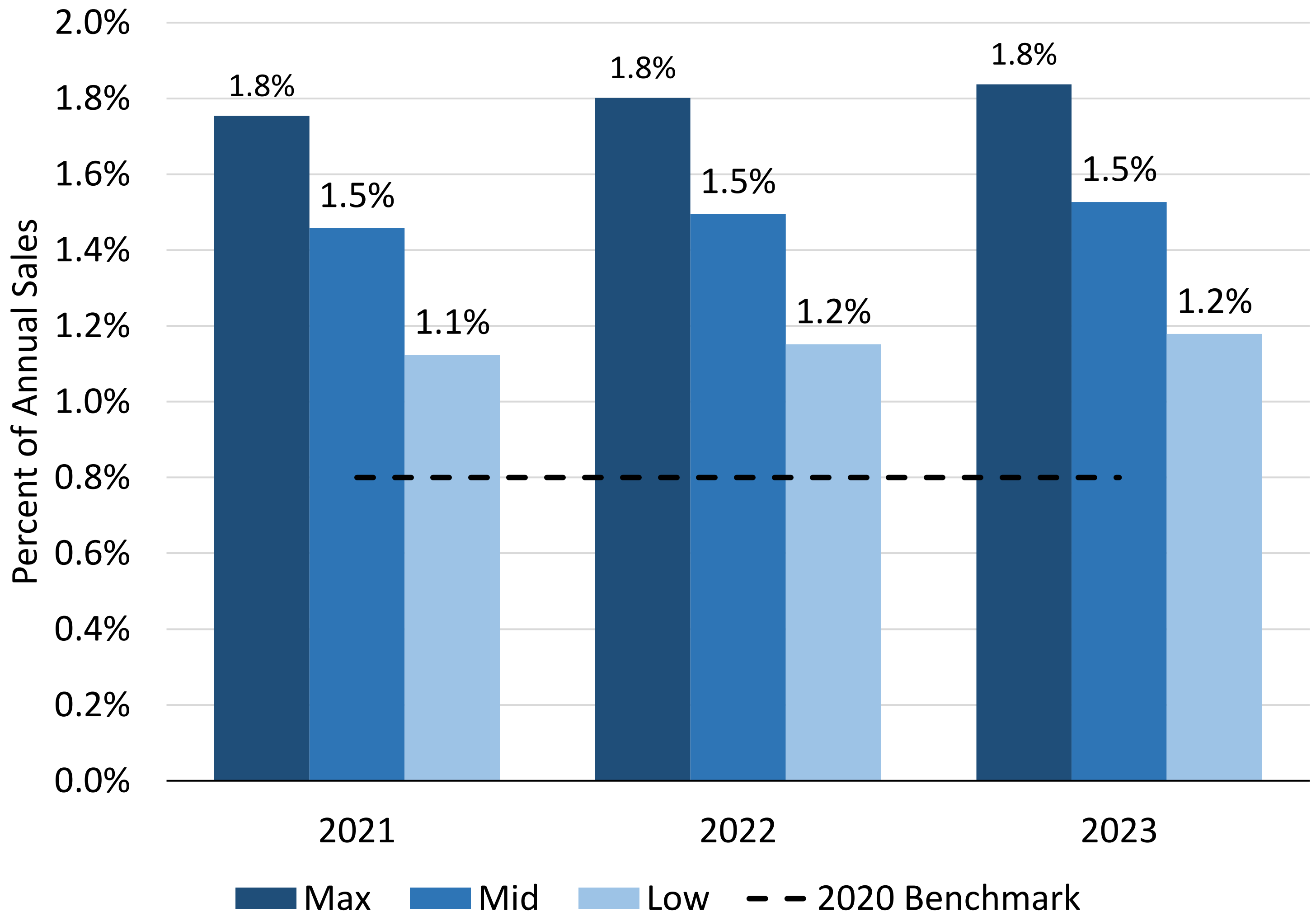
- Total costs and marginal cost per unit savings increase with savings
- Potential study estimated budgets do not account for portfolio optimization and program design improvements

Estimated 2021 Acquisition Costs

Scenario	$ per First-year kWh	$ per Lifetime kWh
Max	$1.09	$0.105
Mid	$0.80	$0.080
Low	$0.63	$0.066
2019 Results	$0.55	$0.065

EE: Natural Gas Savings Potential

Annual Gas Savings as Percentage of Forecasted Gas Sales*



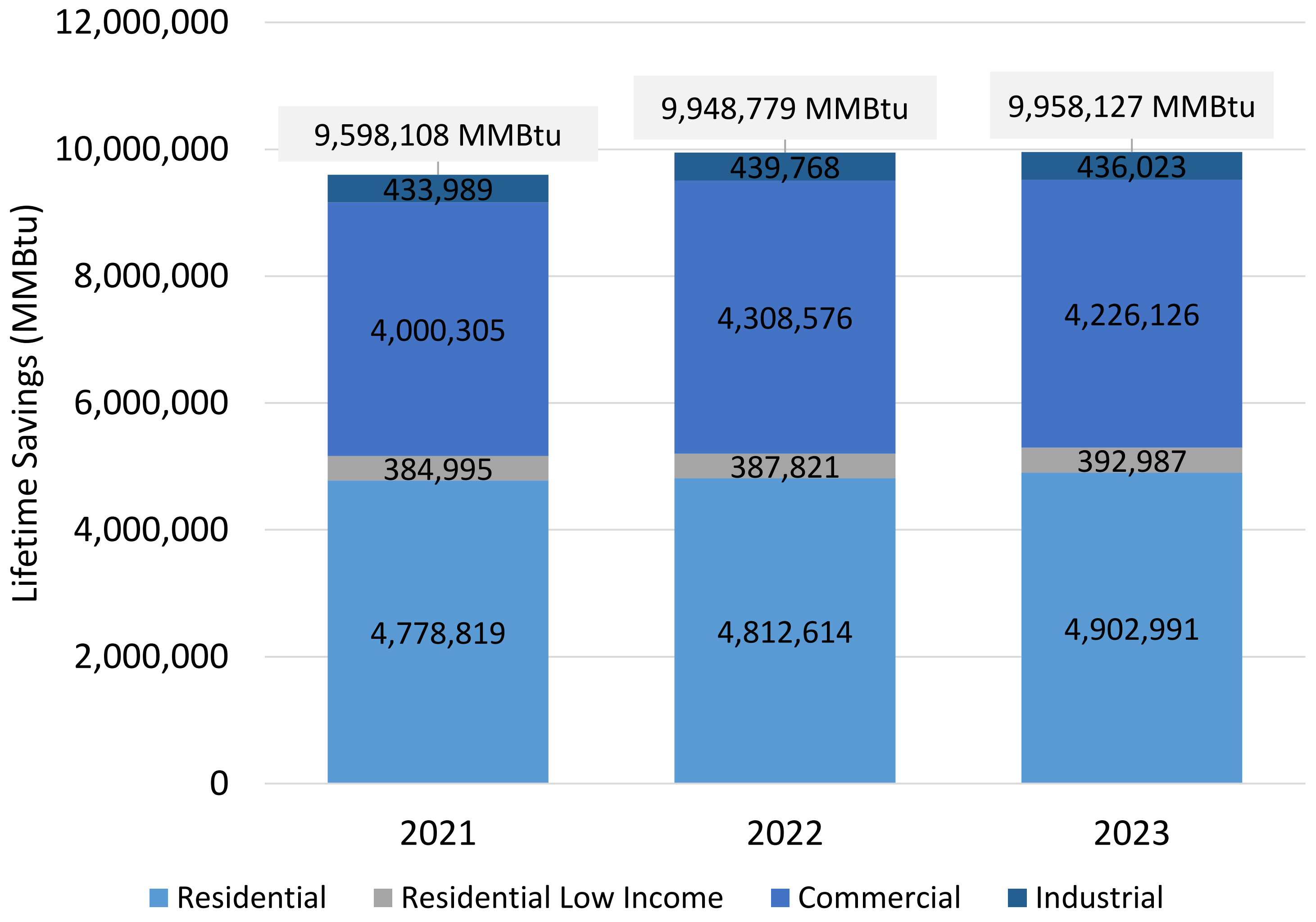
- Low Scenario exceeds 2020 plan, but is similar to 2019 portfolio results
- Mid and Max show notable upside potential

Benchmark	Savings
2019 Programs	1.1%
2020 RI BCR	0.8%
2021 Potential National Grid (MA)	
Low	0.8%
MAX	1.0%

*Dunsky treated National Grid's 2021-2026 forecasted gas sales to remove assumed EE savings to estimate percent savings for each year of the study.

EE: Natural Gas Savings Potential

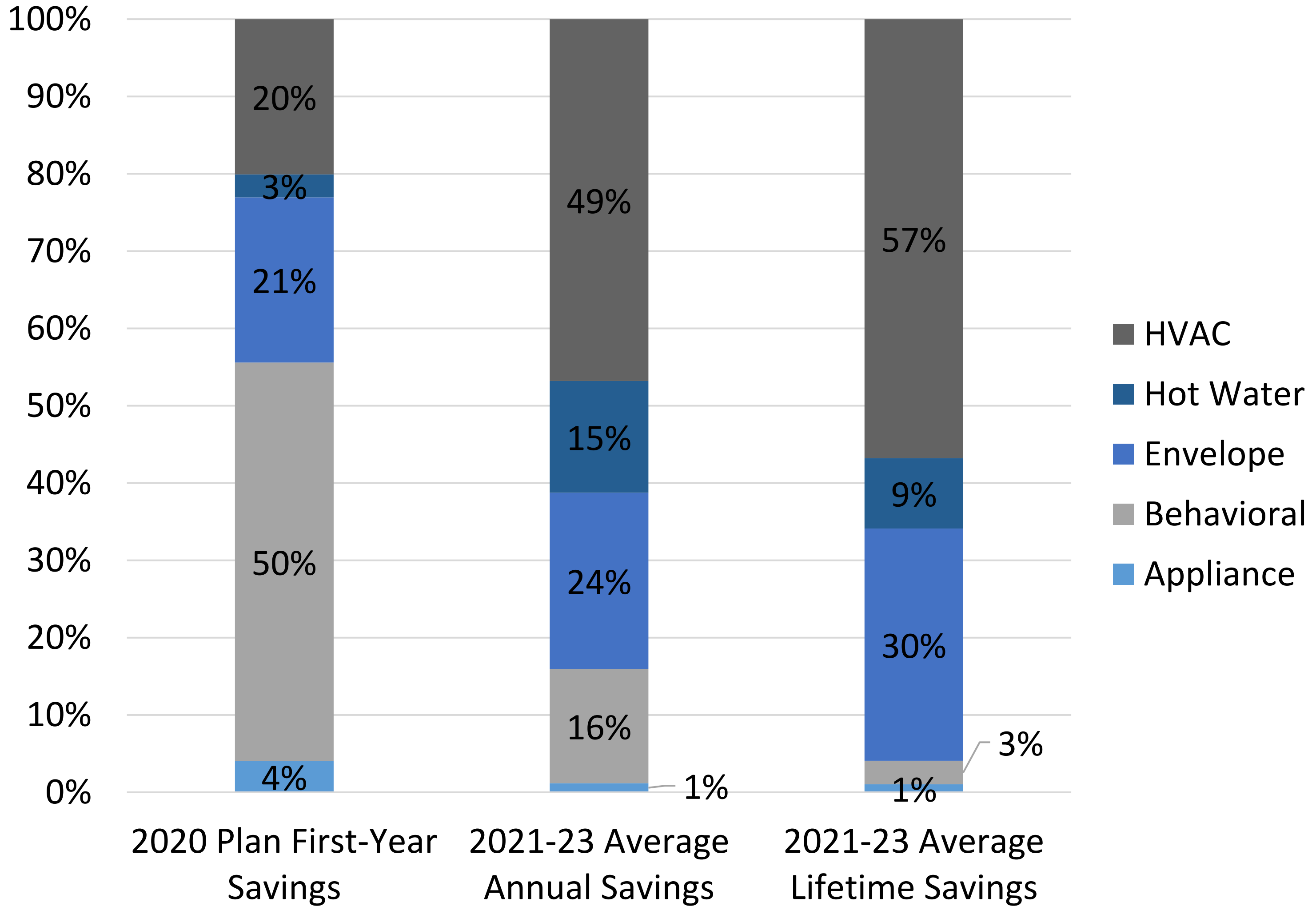
Lifetime Gas Savings by Sector (Max)



- Commercial sector is the slight majority of EE gas savings
    - Residential sector savings driven by single family segment.
    - Commercial sector savings driven office, retail, education/campus and lodging segments.
- Residential sector shows significant upside between Low and Mid scenarios – increasing by 50%

EE: Natural Gas Savings Potential, Residential

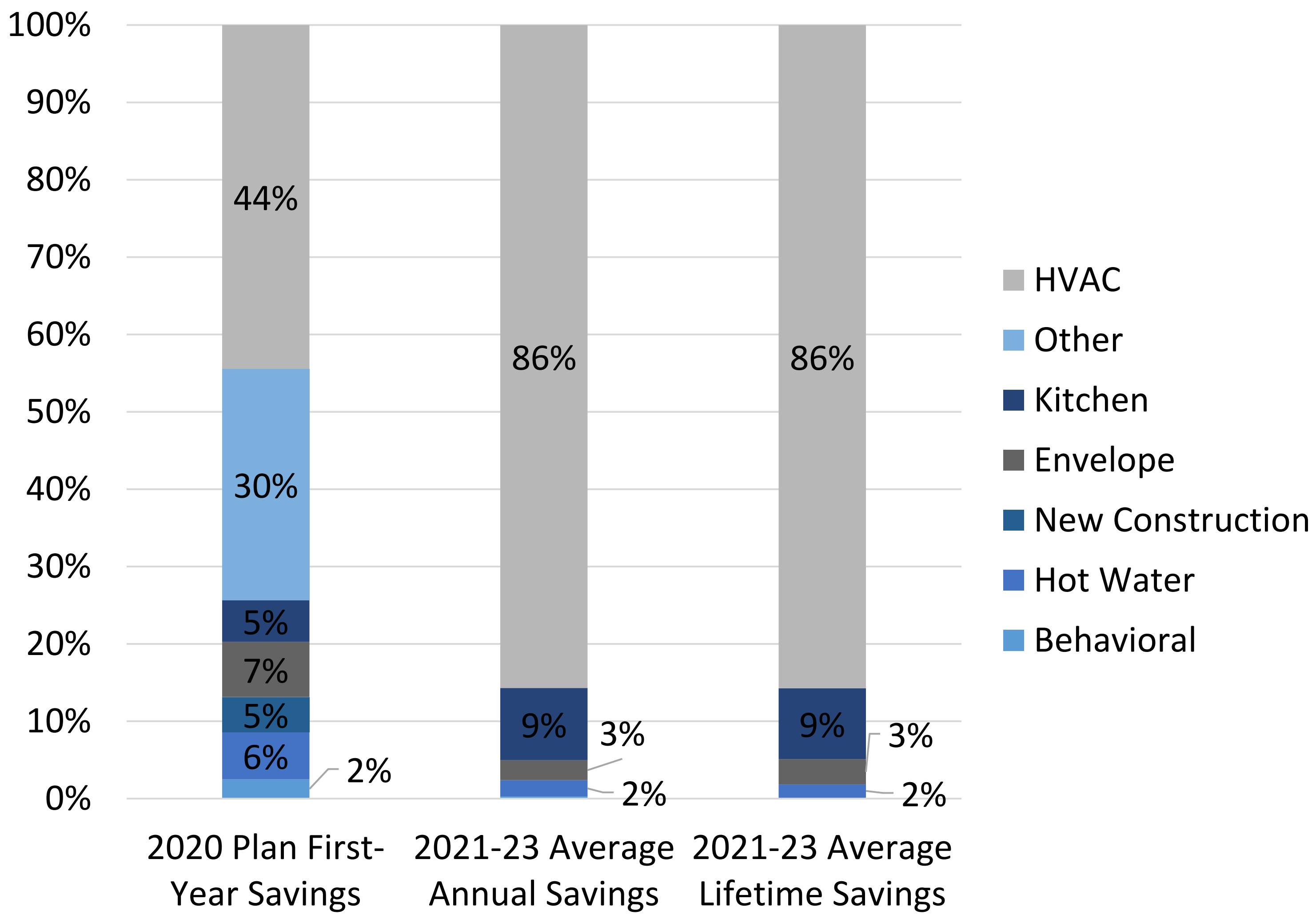
Proportion of Residential Savings by End Use



- On an annual basis, nearly half of residential savings come from HVAC measures
- The impact of HVAC and envelope measures increases when viewed from a lifetime savings perspective, while the behavioral savings portion drops

EE: Natural Gas Savings Potential, Non-Residential

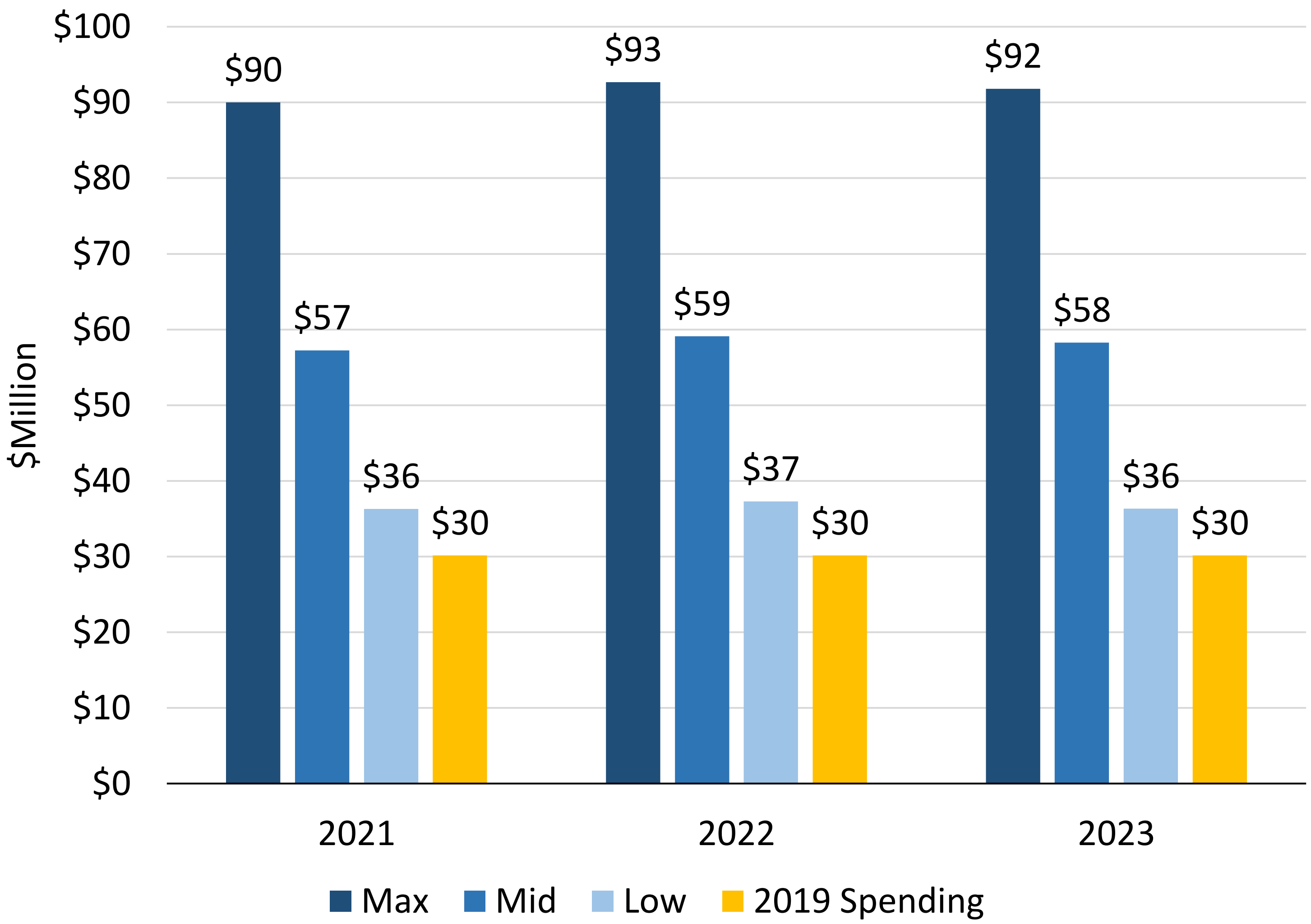
Proportion of Non-Residential Savings by End Use



- Majority of non-residential gas savings are found in HVAC measures
- There is not a significant difference in proportional savings when viewed from annual and lifetime basis

EE: Estimated Gas Program Costs

Estimated Annual Gas Program Expenditures



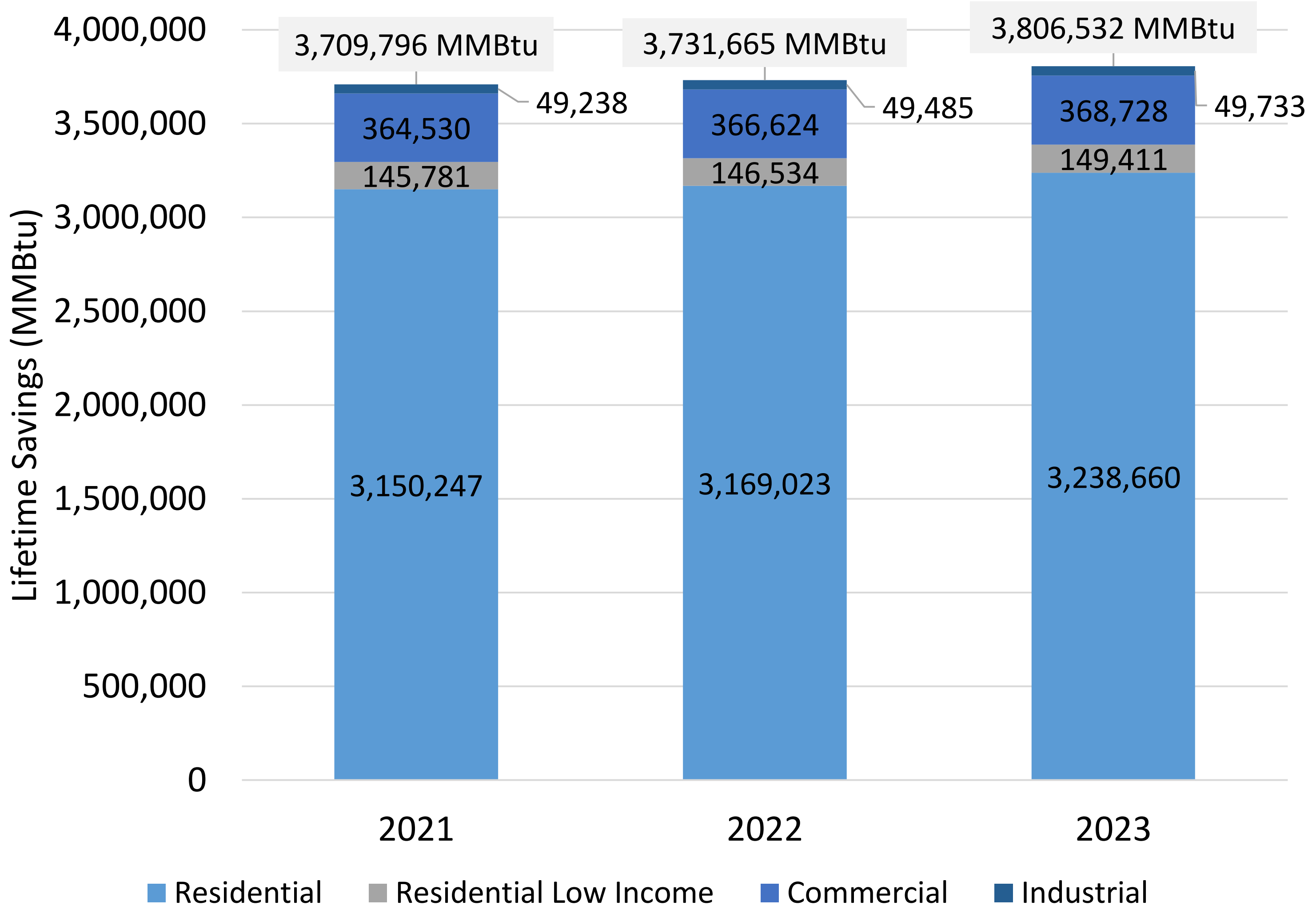
- Estimated total costs and marginal cost per unit savings increase with savings
- Potential study estimated budgets do not account for portfolio optimization and program design improvements.

Estimated 2021 Acquisition Costs

Scenario	$ per Annual MMBtu	$ per Lifetime MMBtu
Max	$120.09	$9.38
Mid	$91.92	$7.65
Low	$75.62	$6.95
2019 Results	$66.79	$6.66

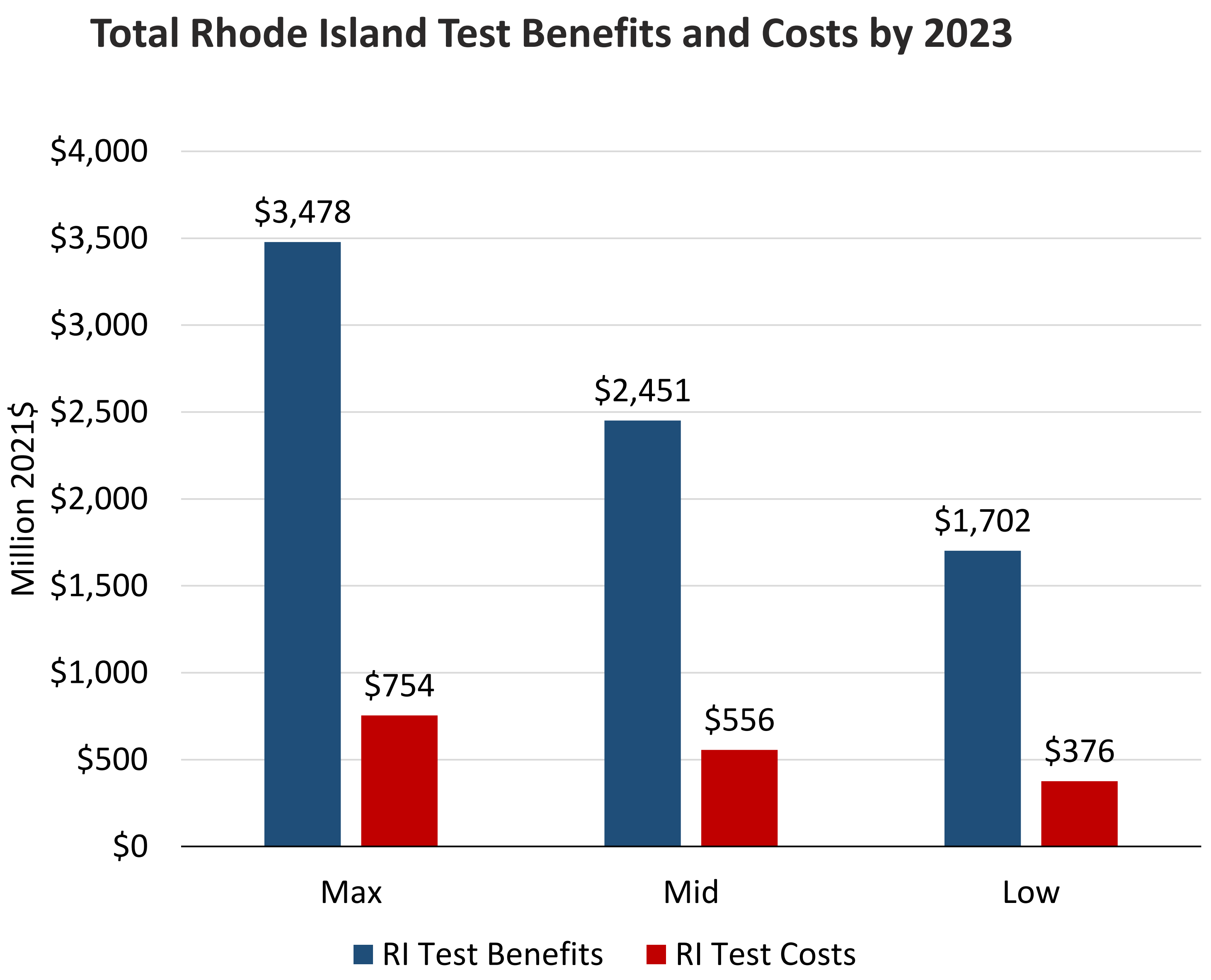
EE: Delivered Fuel Savings Potential

Lifetime Delivered Fuel Savings by Sector (Max)



- The bulk of delivered fuel savings come from the single-family residential customers
- Oil measures account for approximately 94% of delivered fuel savings

EE: Rhode Island Test



- Regardless of program scenario, efficiency programs create significant net benefits under the Rhode Island Test
- BCR ratio decreases slightly under Mid and Max program scenarios, however each scenario is highly cost-effective
- For the first 3 program years, net benefits range from $1.4B to $2.8B

Scenario	Net Benefits	RI Test Ratio	2020 Plan RI Test Ratio
Max	$2,758M	4.63	4.32
Mid	$1,928M	4.42	
Low	$1,361M	4.56	

EE: Customer Benefits

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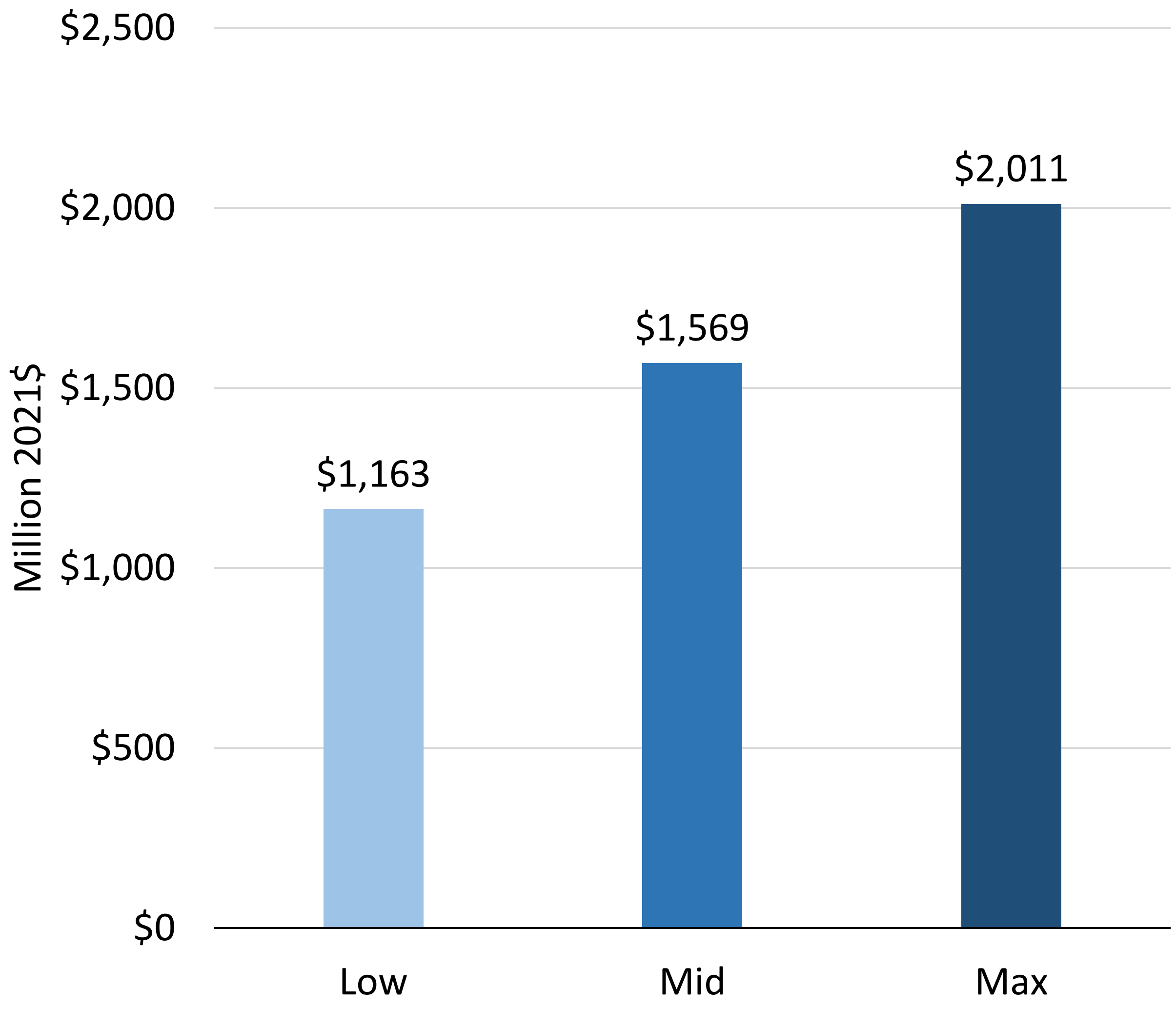
Total Lifetime Customer Net Benefits by 2023



- Efficiency programs create significant customer savings

Low Income Customer Benefits by 2023 (Max Scenario)

Savings	Max Scenario
Electric Savings	25.28 GWh
Gas Savings	80,339 MMBtu
Delivered Fuel Savings	24,262 MMBtu
Customer Savings	$54.3M

EE: Key Takeaways

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1. Electric annual savings are likely to drop as lighting markets become increasingly transformed… *however*, new opportunities exist and can be exploited in a cost-effective manner and savings can continue to increase when considered from a lifetime perspective.

2. Gas savings appear to be growing in importance in the EE portfolio, and the residential sector may offer significant upside potential through higher investments.

3. Program costs to capture non-lighting savings could be somewhat higher that historical program results… *however*, the 3-year portfolio can offer up to $2.8Bn in net benefits to Rhode Islanders.

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Demand Response

DR: Achievable Scenarios

Three program scenarios are explored in this study:

Low	Current DR programs and incentives, expanded across the full possible market.
Mid	Expanded DR programs with mid-point incentives (relative to maximum and benchmarked to other jurisdictions)
Max	Expanded DR programs with maximum cost-effective incentives.

DR: Changes since February EERMC Meeting

Integration of other studies:

- Energy efficiency, heating electrification, distributed generation, and EV adoption impacts were integrated into the utility load curve, and the changes to the utility load shape and peak result in an **increase in DR potential.**

Apply National Grid Feedback:

- Updated assumptions for battery energy storage and commercial curtailment leading to **increased potential**

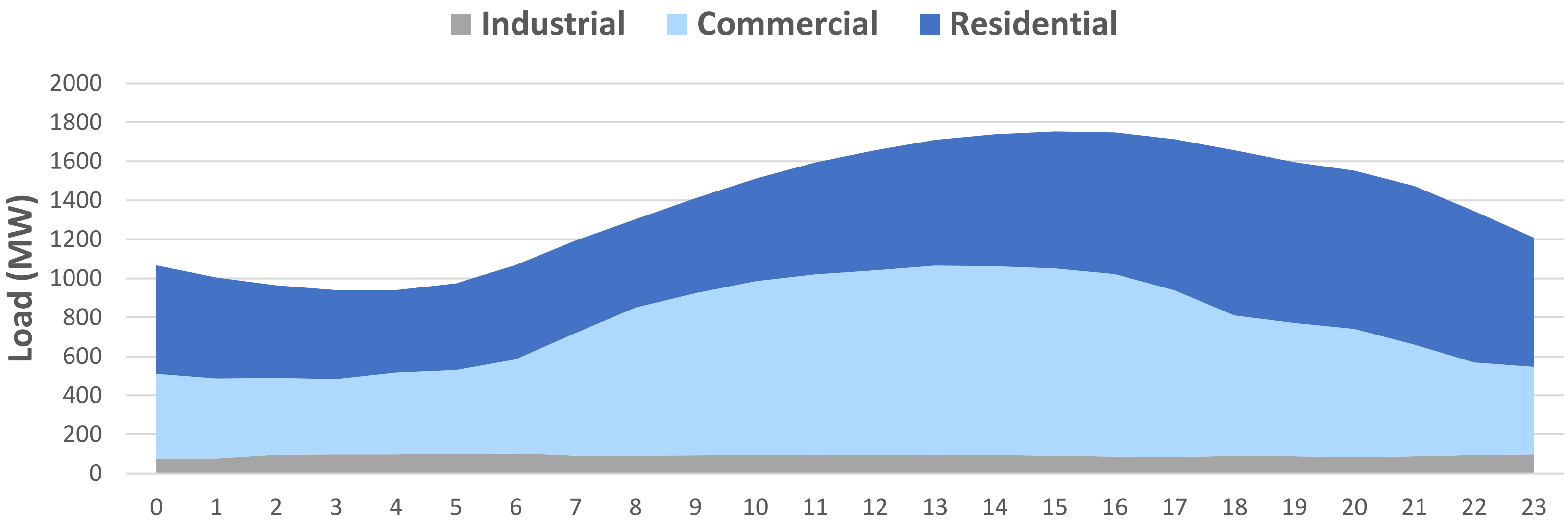
Model Refinement:

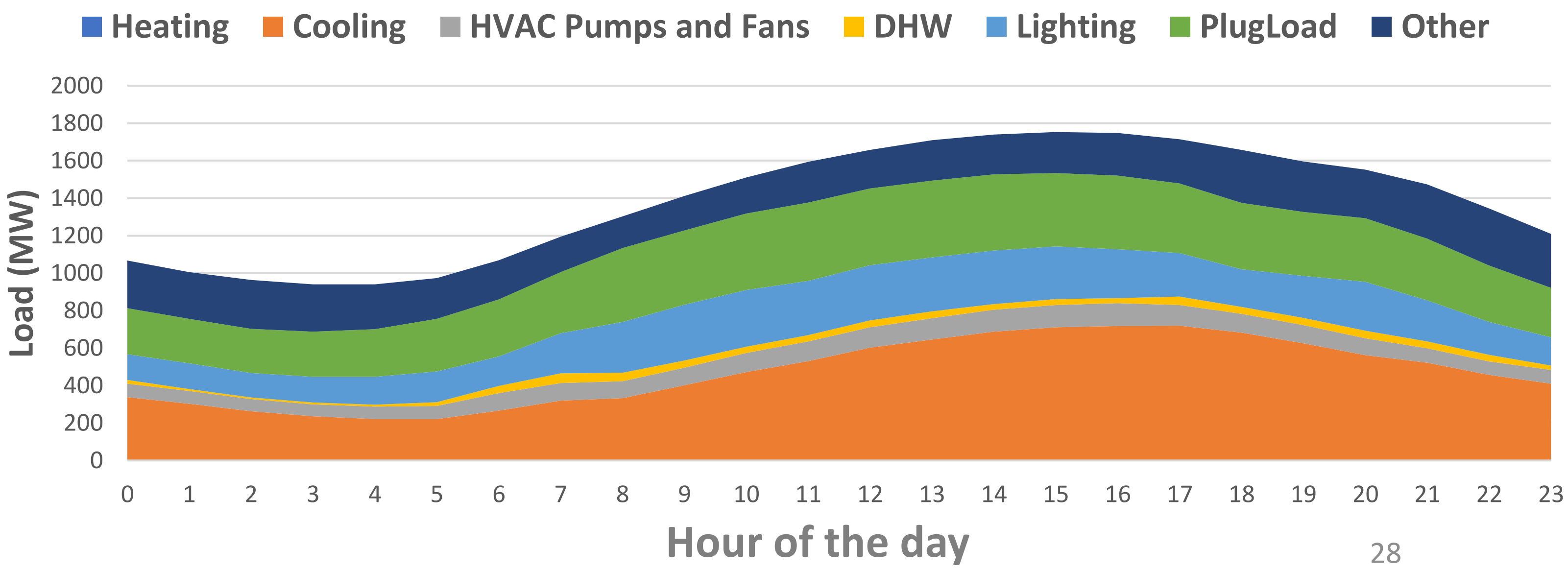
- Changes in adoption for large commercial and industrial to better reflect existing programs resulting is a **small decrease** in potential (smaller impact than the changes made by the feedback above)

DR: Peak Load Breakdown

- Cooling driven peak from 12:00 - 18:00
- Limited industrial load relative to peak

Year	Peak Forecast (MW) (accounting for EE, DG, EVs)
2021	1,753
2022	1,748
2023	1,752
2024	1,750
2025	1,744
2026	1,746





DR: Overview

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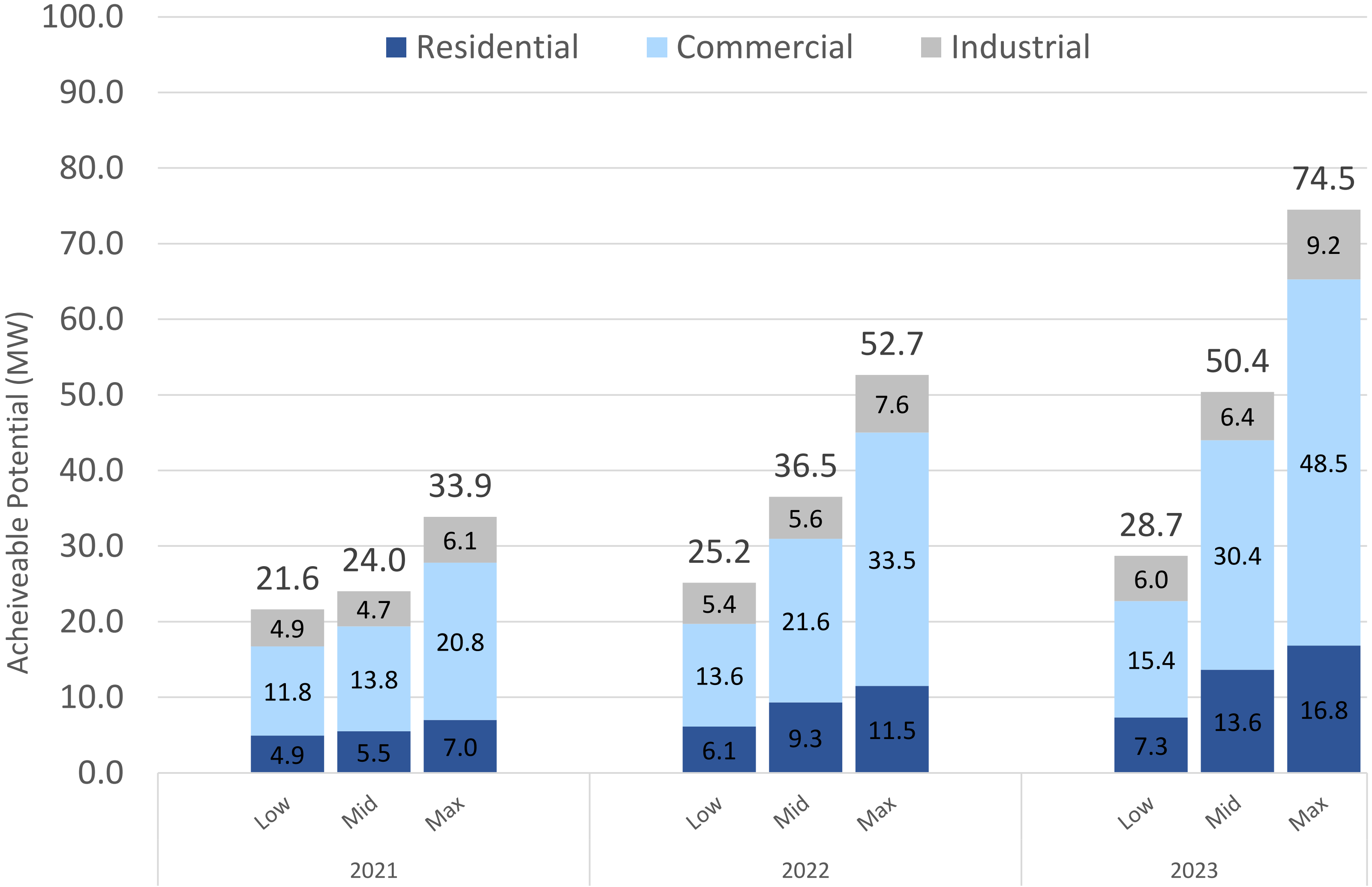
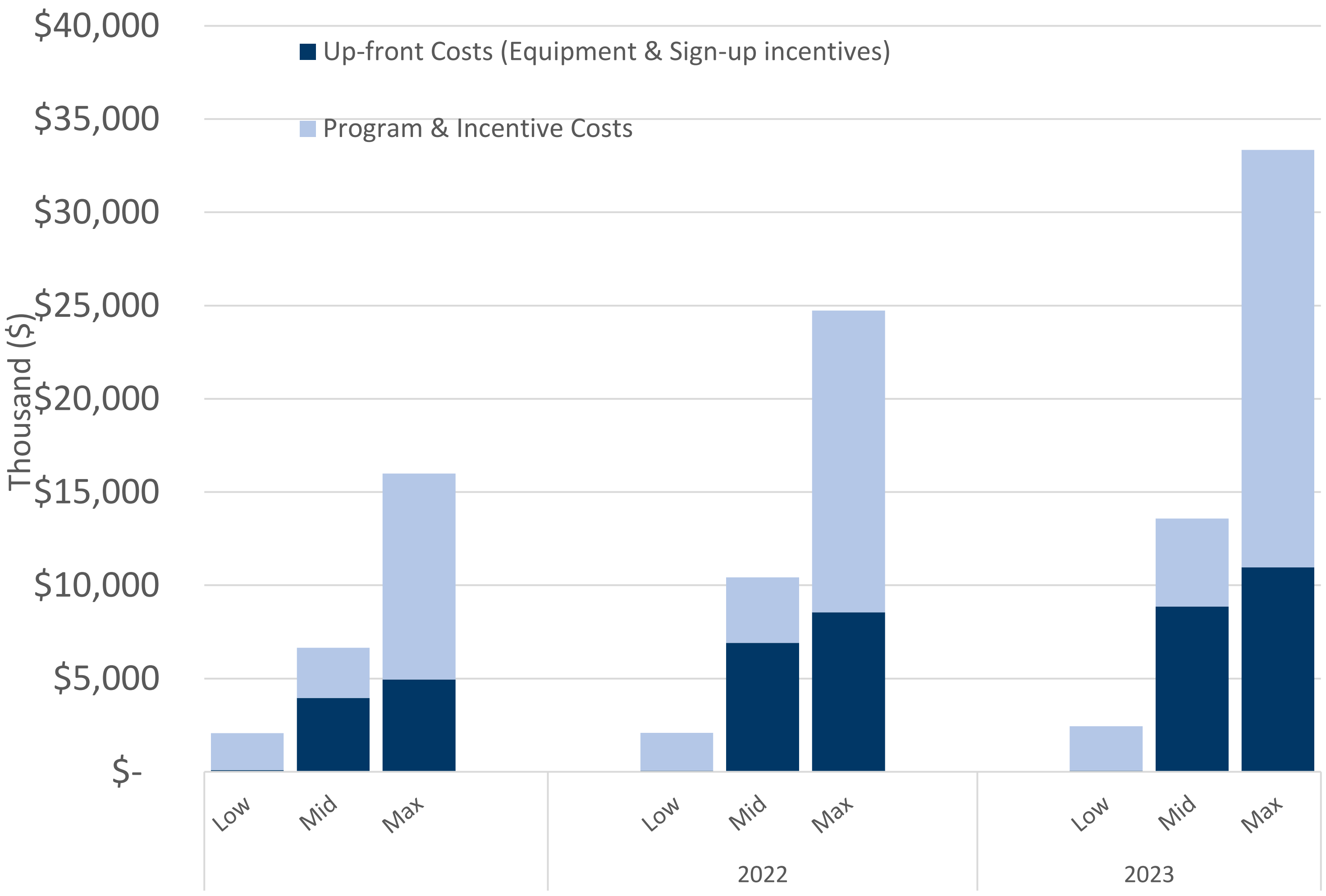
Achievable Annual Peak Demand Reduction from DR (MW) by Scenario



- Economic potential assessed at: 125 MW*
- Residential DR has lots of room to grow
- Expanding programs has bigger effect than simply raising incentives
- Budgets range from $2M to $33M per year. Mid scenario appears to offer best savings/cost balance.

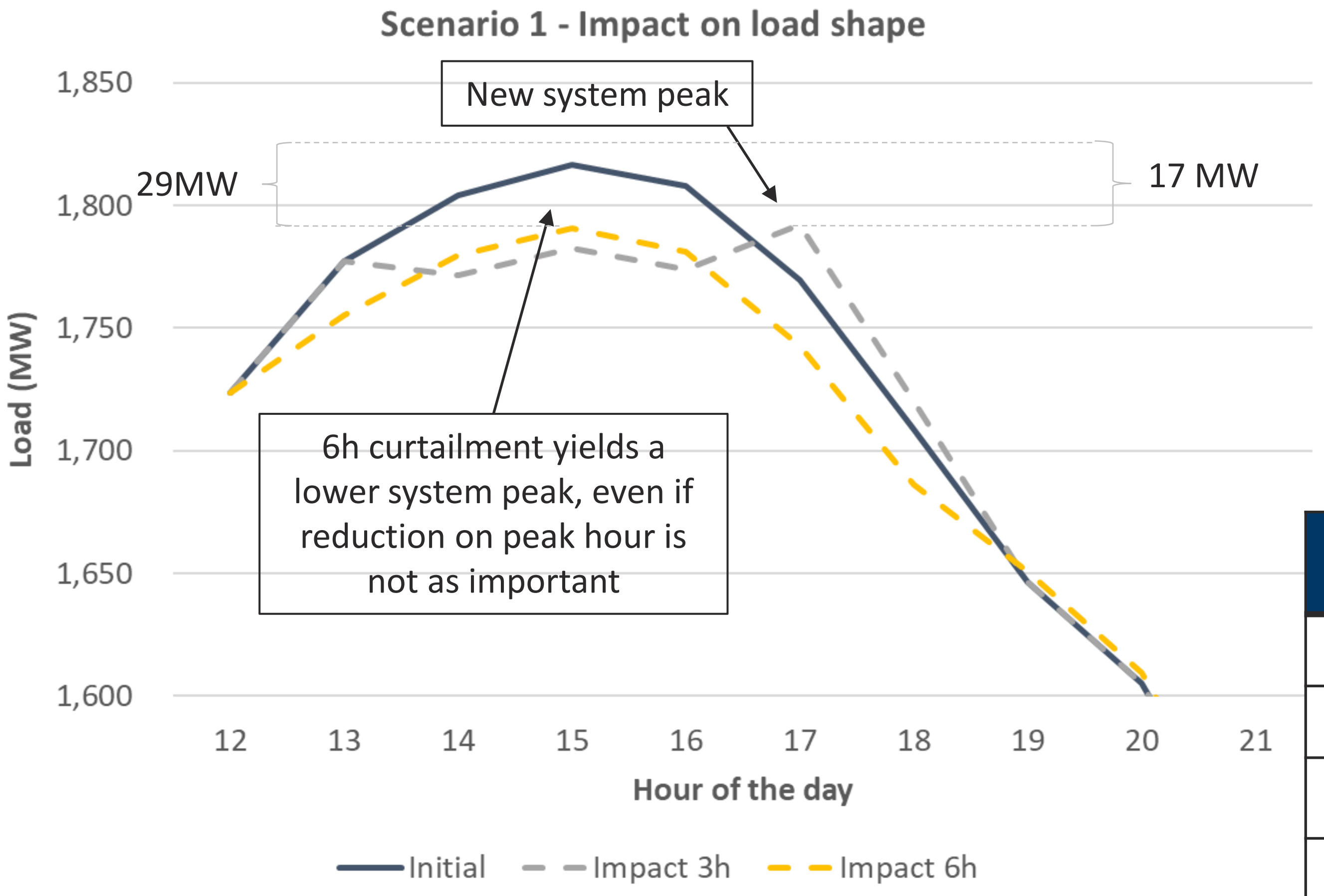
DR: Program Costs

DR Portfolio Costs ($1000) by scenario



- Increasing impact come at significantly increased cost
- Mid and Max scenarios involve notable investment in early years to install equipment (controls, battery storage, etc
- The Max scenario is more focused on high curtailment incentives, which need to be paid each year to drive peak reductions.
- Keep in mind: DR savings only persist for as long as the programs are active (study assumed that measures deliver savings for a 10 year program life)

DR: Low Scenario (net impacts)

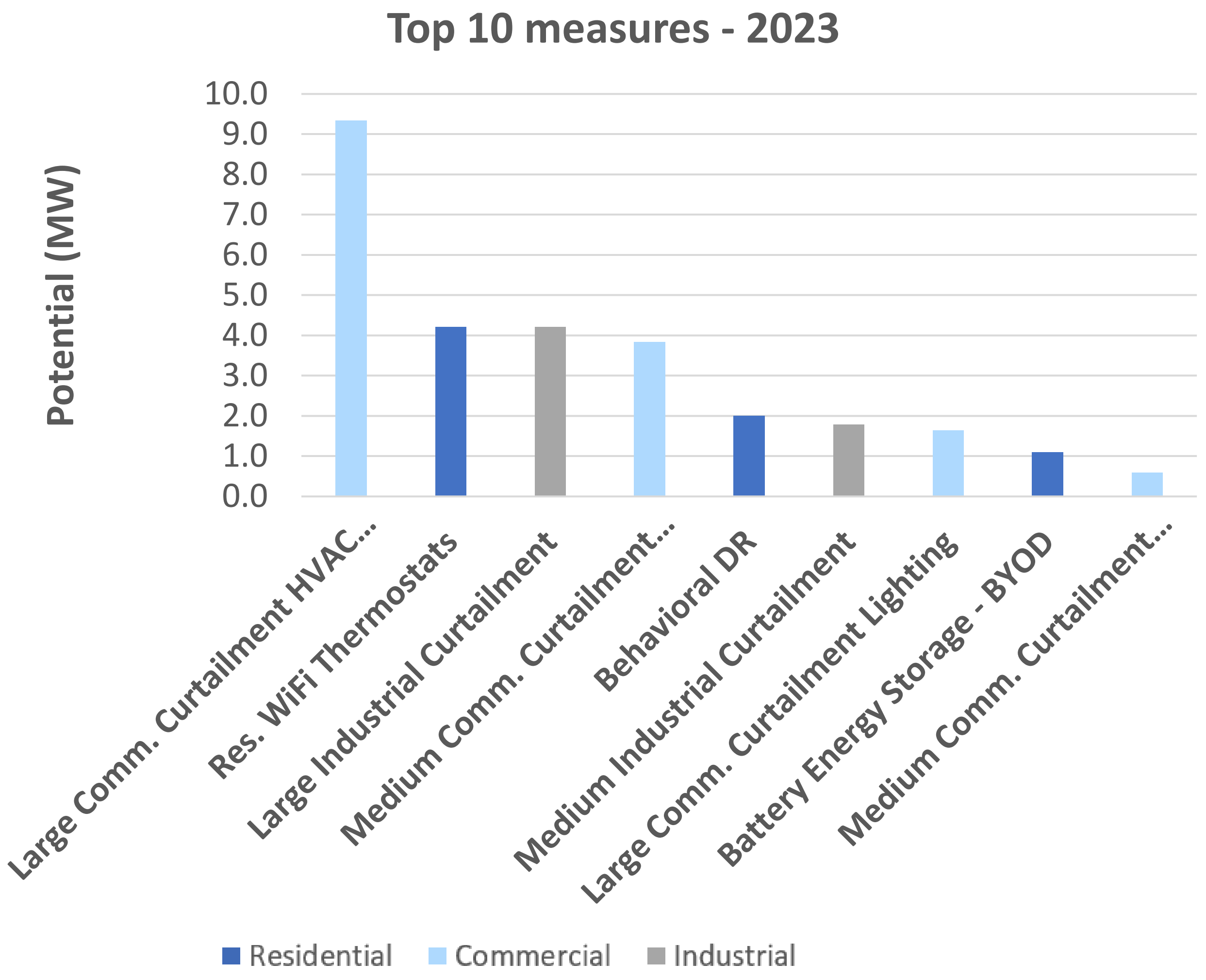


- Assessed net commercial impacts are lower than what is measured on an hourly basis
- Interactions among measures can further deteriorate net impact
- 3-hour window is limiting: Expanding the duration of DR measures could improve potential for new measures

Measure	Current Program	Potential (2021)
Residential WiFi Thermostat BYOT	2.3	2.4
Residential Battery BYOD	0.07	0.5
Residential Behavioral	2.5	2.0
Commercial and Industrial Curtailment	29.3	16.7

DR: Low Scenario

Top 10 Measures: 2023 Achievable Potential (MW)

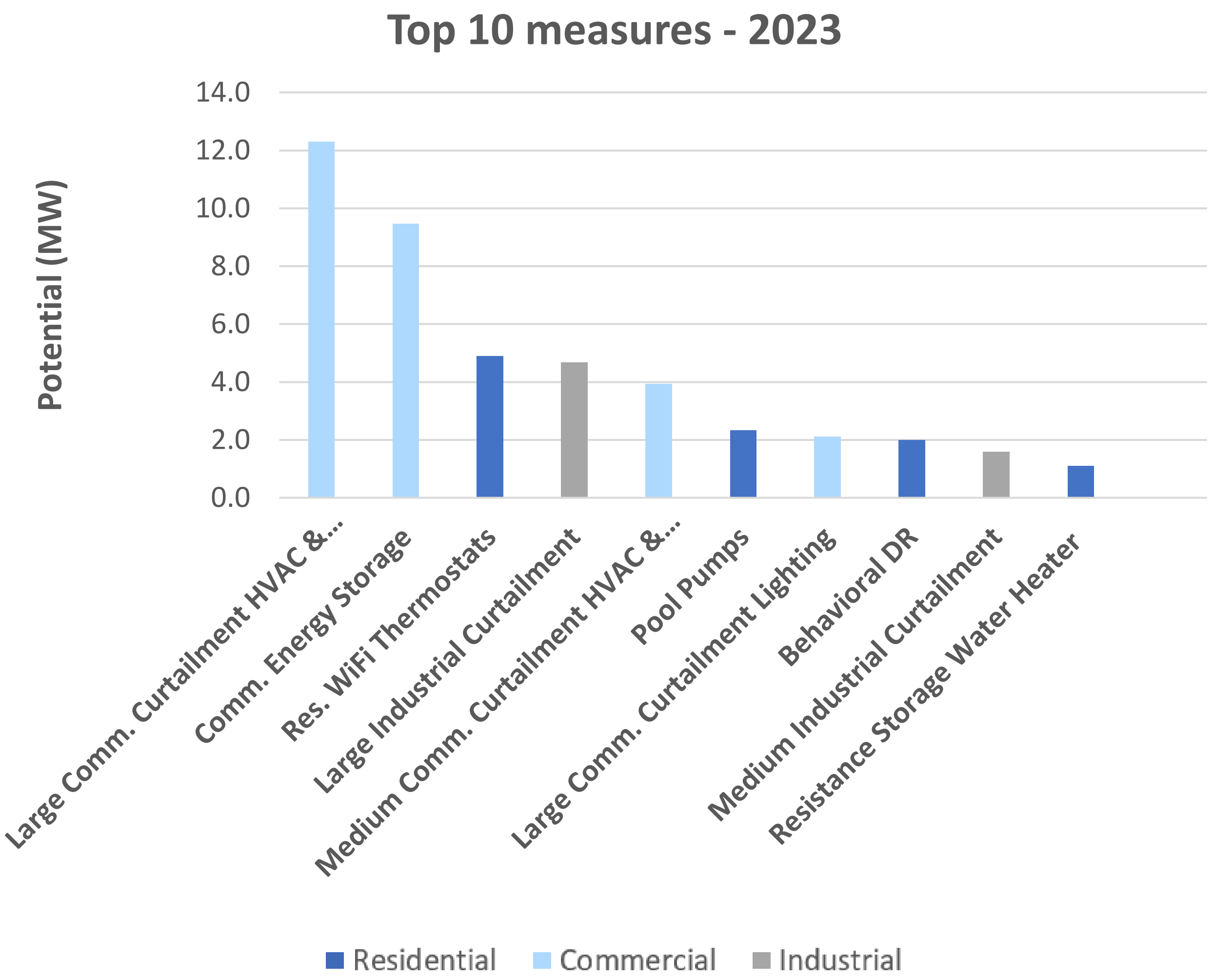


- Central AC shows notable potential for current program expansion, could integrate with efficient AC incentives
- Did not apply any growth to Behavioral DR

Program (2023)	RI Test	Savings (MW)
Residential BYOD	1.5	5.3
Medium & Large Commercial Curtailment	7.4	15.4
Medium & Large Industrial Curtailment	7.4	6.0
Res. Behavioral DR	41.7	2.0

DR: Mid-Scenario

Top 10 Measures: 2023 Achievable Potential (MW)

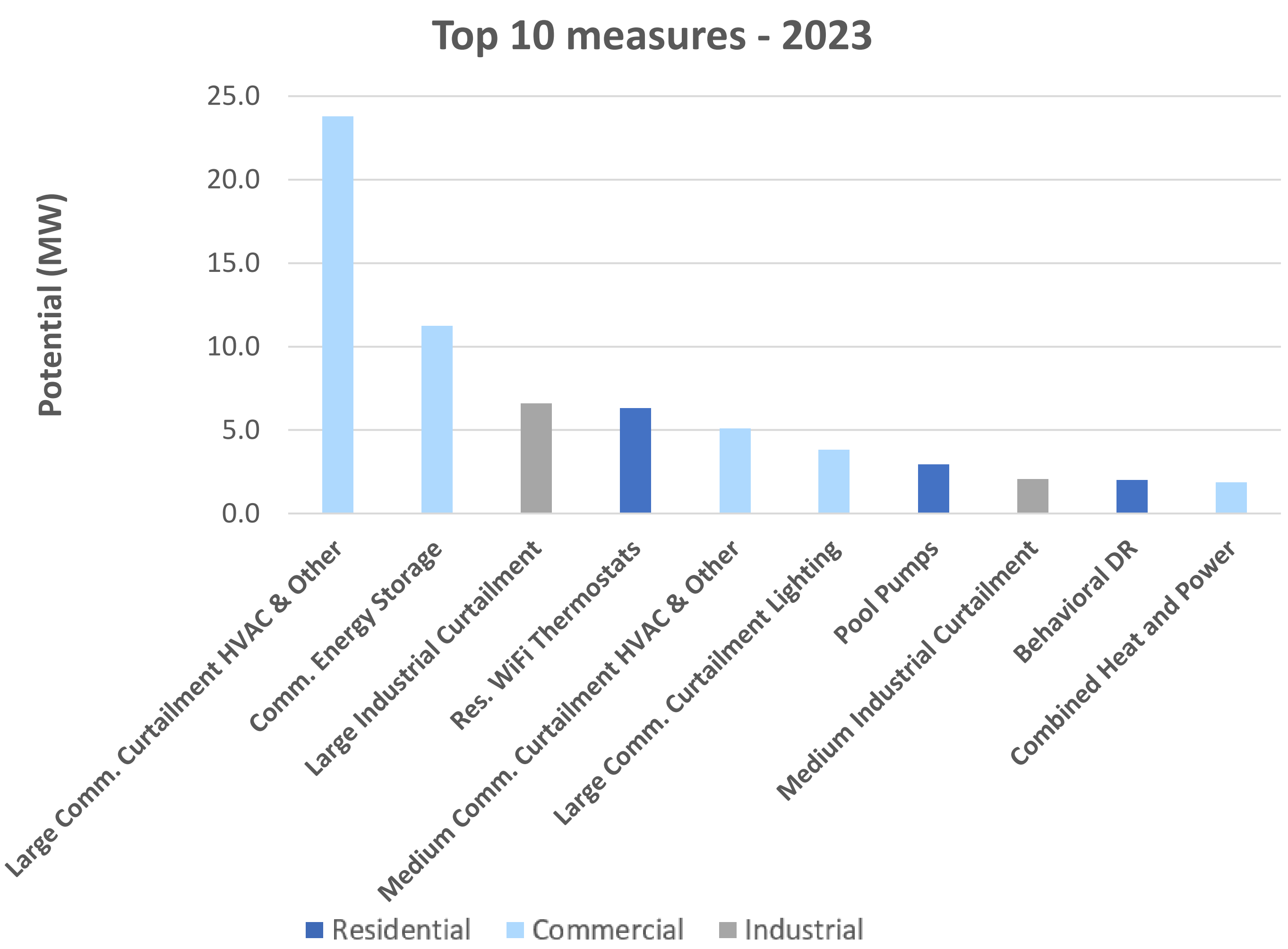


- Commercial curtailment and residential program expansion are driving the savings
- Commercial energy storage plays a key role in this scenario.
  - Note: Commercial energy storage is excluded from the Low Scenario as this technology is not currently participating in existing programs

Program (2023)	RI Test	Savings (MW)
Res. DLC	2.3	5.8
Res. BYOD	2.0	5.8
Small Comm. BYOD	0.2	2.9
Small Comm. DLC	1.3	10.4
Med. & Large Comm. Curtailment	4.2	19.8
Med. & Large Industrial Curtailment	4.6	6.4
Res. Behavioral DR	41.7	2.0

DR: Max Scenario

Top 10 Measures: 2023 Achievable Potential (MW)



- Results in a notable change in top measure mix to be more focussed on C&I curtailment, compared to Mid scenario

Program (2023)	RI Test	Savings (MW)
Res. DLC	0.8	7.2
Res. BYOD	0.7	7.6
Small Comm. BYOD	0.8	0.3
Small Comm. DLC	0.8	7.2
Med. & Large Comm. Curtailment	0.8	35.8
Med. & Large Industrial Curtailment	0.8	9.2
Res. Behavioral DR	41.7	2.0

DR: Key Takeaways

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1. Residential programs offer steady potential for growth over full study period.

2. Expanding programs to new measures (low to mid) has bigger effect than raising incentives (mid to max)

3. Overall, estimated potential aligns with other recent DR studies:

	Rhode Island (2020)	Massachusetts (2018)	Michigan (2017)	Northwest Power (2014)
Portion of Peak Load	2.8% (2023) 4.0% (2026)	3.5% - 4.0% (summer peak)	4.4%-7.7% (summer peak)	8.2% (summer peak)
Avoided Costs	$200 / kW	$290 / kW	$140 / kW	n/a

Combined Heat and Power (CHP)

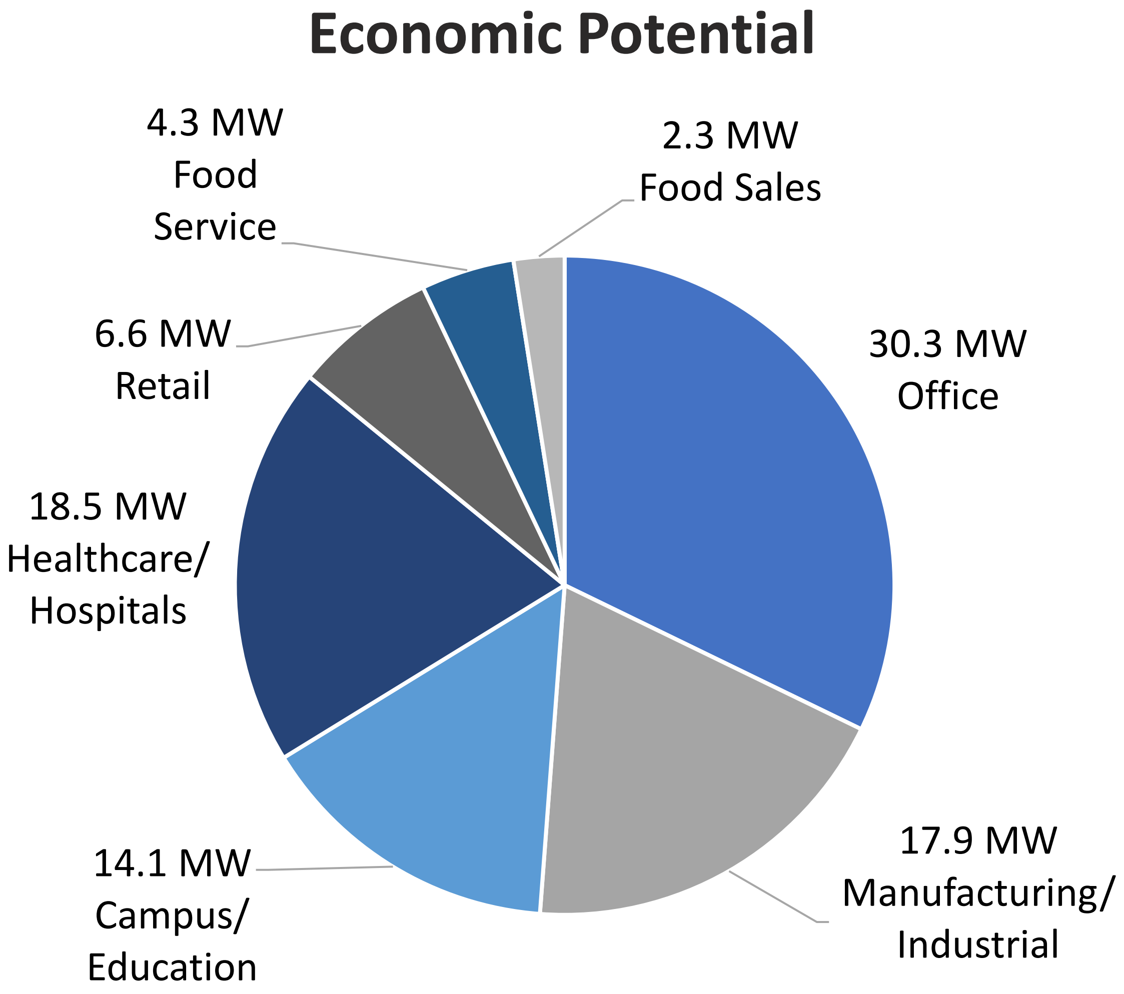
CHP: Achievable Scenarios

Three program scenarios are explored in this study:

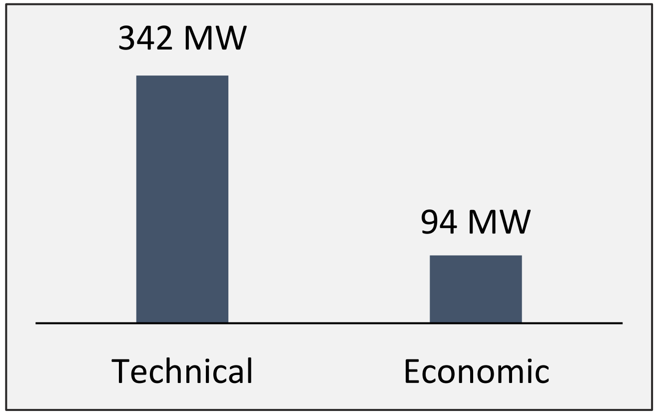
Low	Incentive levels set at **maximum allowable incentive (70%)**
Mid	Incentive levels set at maximum allowable incentive (70%) with **additional barrier level decrease**
Max	Incentive levels set at **100%** with same barrier level decrease as mid scenario

CHP: Economic Potential

CHP Economic Potential Installed Capacity Potential by Segment (MW)

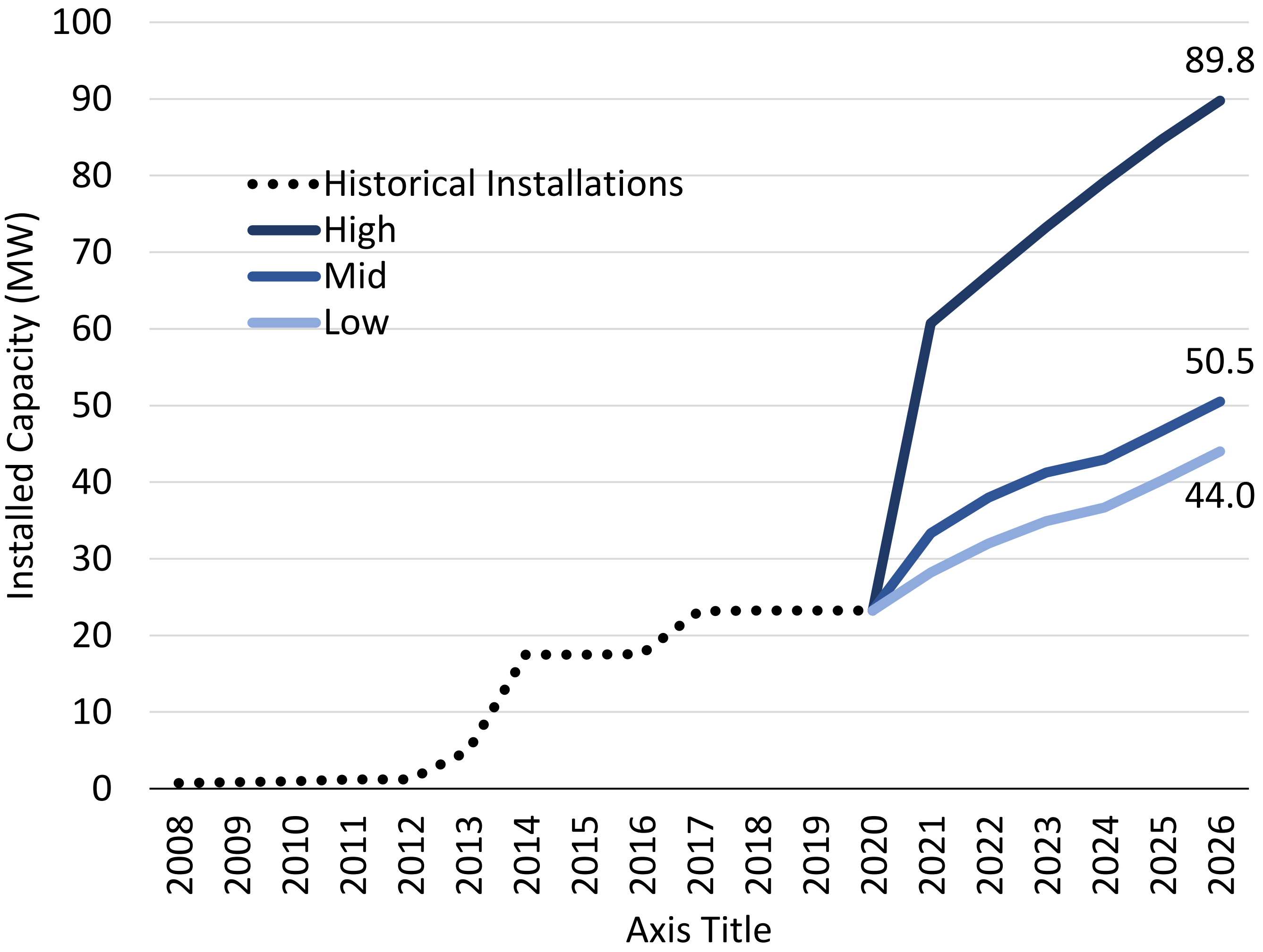


- Significant technical potential exists, but the majority does not pass economic screening
- Office, Healthcare, Campus/Education and Industrial segments have greatest potential



CHP: Installed Capacity

Historical Installed Capacity and Achievable Adoption Projections



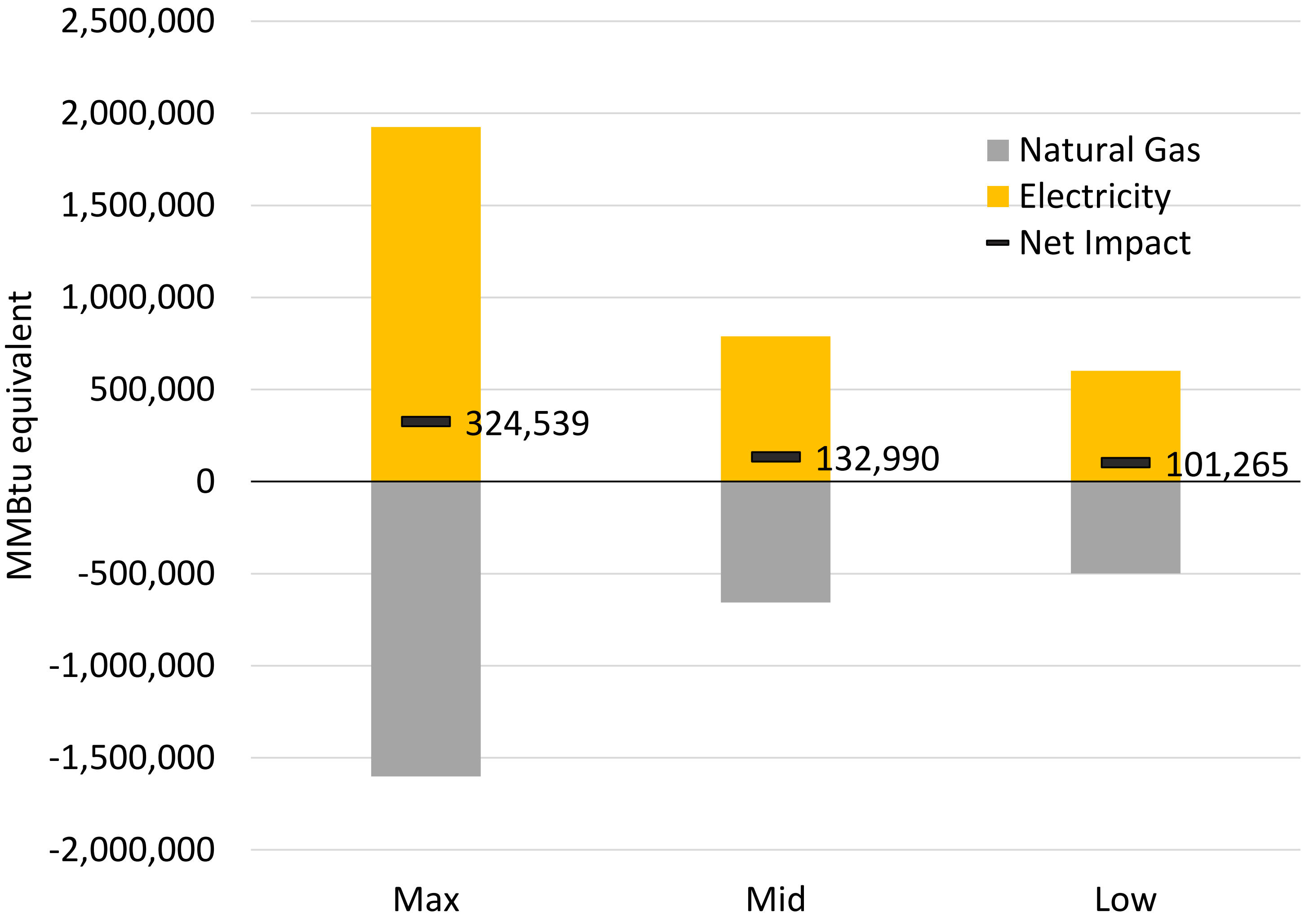
Average impacts (2021-2026)

Impact	Max	Mid	Low
Annual Capacity Additions (MW)	11.1	4.5	3.5
Annual Electric Savings (MWh)	45,209	18,526	14,106
Lifetime Electric Savings (MWh)	723,337	296,409	225,700
Peak Demand Reduction (MW)	4.12	1.69	1.28
Annual Gas Consumption Increase (MMBtu)	266,891	109,366	83,277
Annual Program Spending (Million $2021)	$29.6M	$9.0M	$6.7M

- Adoption estimates are best interpreted by study period averages
- **Benchmark:** 3.6MW installed annually between 2014 and 2018

CHP: Net Savings

Total Net Energy Savings Including Grid Electricity Embedded Energy by 2026



- When the embedded energy of grid electricity production is considered, CHP adoption results in net energy savings
- Note: Analysis assumes marginal heat rate of 7,100 Btu/kWh (AESC 2018)

CHP: Key Takeaways

1. Additional CHP potential exists and current incentive levels can encourage additional adoption commensurate with recent years.

2. The biggest opportunities are in the Office, Healthcare, Education & Campus, and Industrial segments.

3. Reducing non-financial barriers through enabling activities may move the market a little, but overall impact is small compared to increasing customer payback (e.g. increased incentives).

Heating Electrification (HE)

HE: Achievable Scenarios

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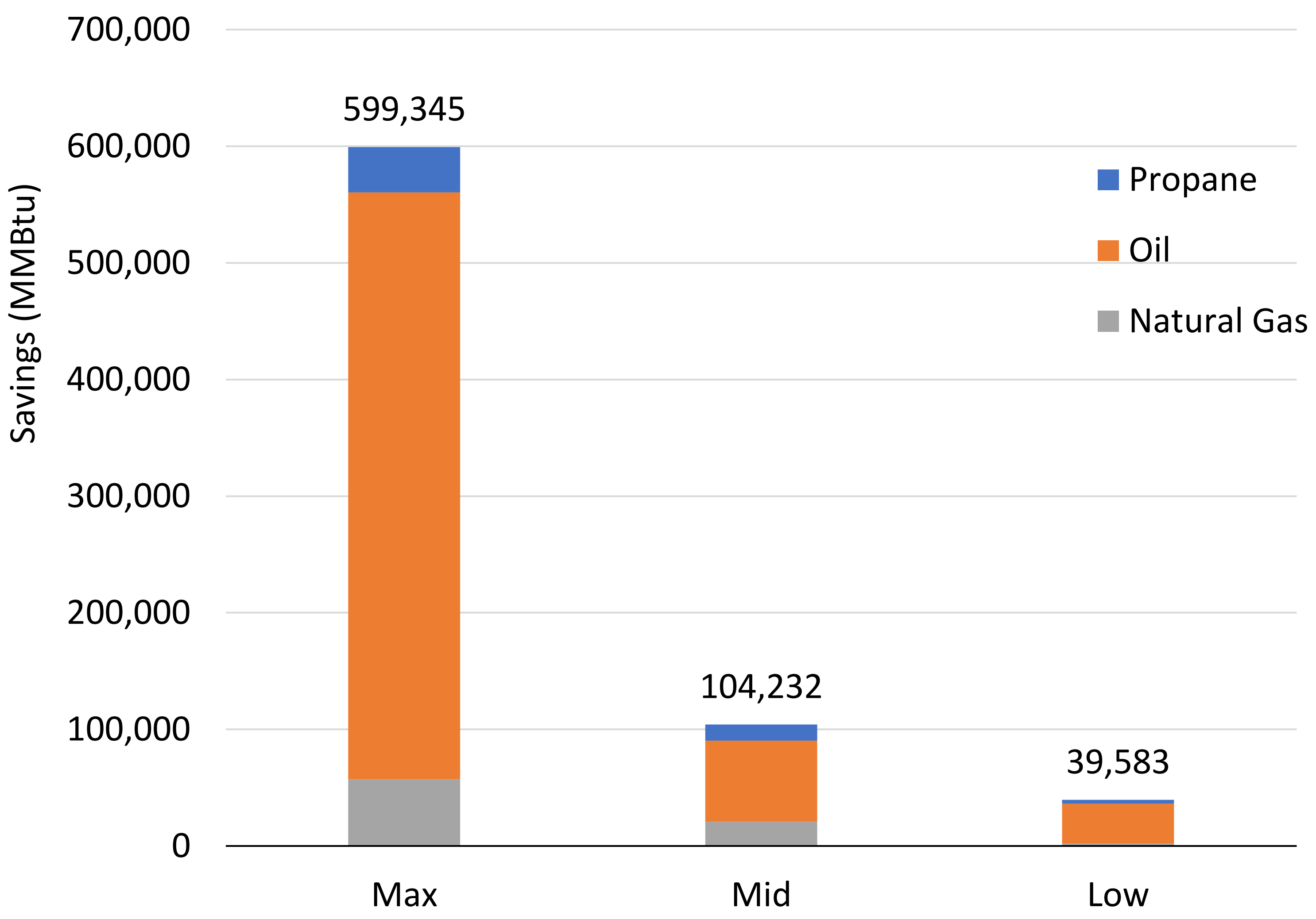
Three program scenarios are explored in this study:

Low	Applies **25%** incentives and enabling activities (half-step barrier reduction) in line with National Grid's 2020 Energy Efficiency Plan
Mid	Applies **50%** incentives and additional enabling strategies (full-step barrier reduction)
Max	Incentives set at **100%** to completely eliminates customer costs and applies enabling strategies (full-step barrier reduction)

HE: Fuel Savings

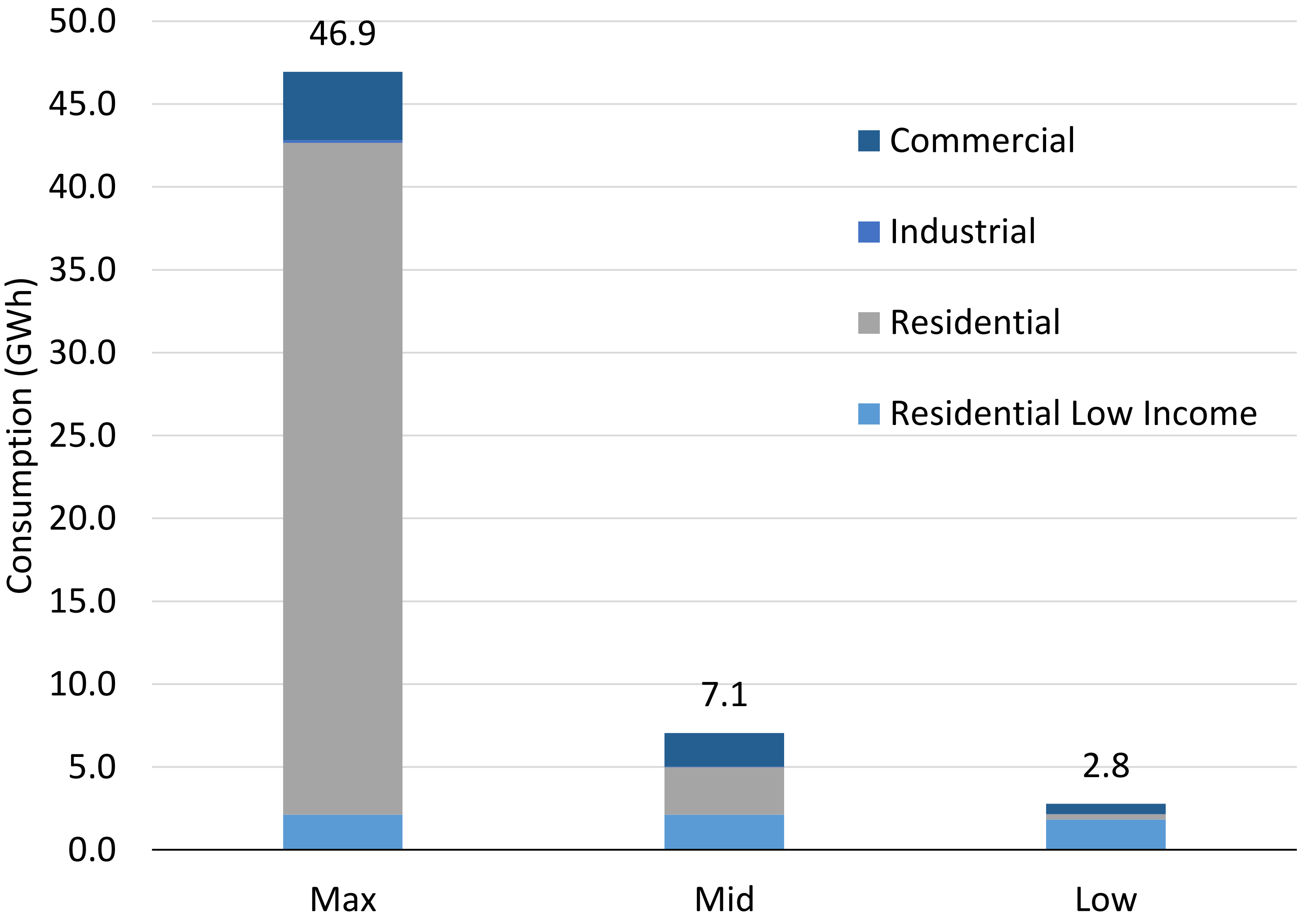
Average Annual Combustible Fuel First-Year Savings (2021-2023)



- There is significant technical potential for heating electrification in Rhode Island – particularly when natural gas is included.
- Propane and oil fuel switching are largely cost-effective, but most natural gas electrification does not pass the RI Test
- Increasing incentives and reducing barriers drives significantly more adoption compared to the Low Scenario (mostly oil savings)

HE: Electricity Consumption

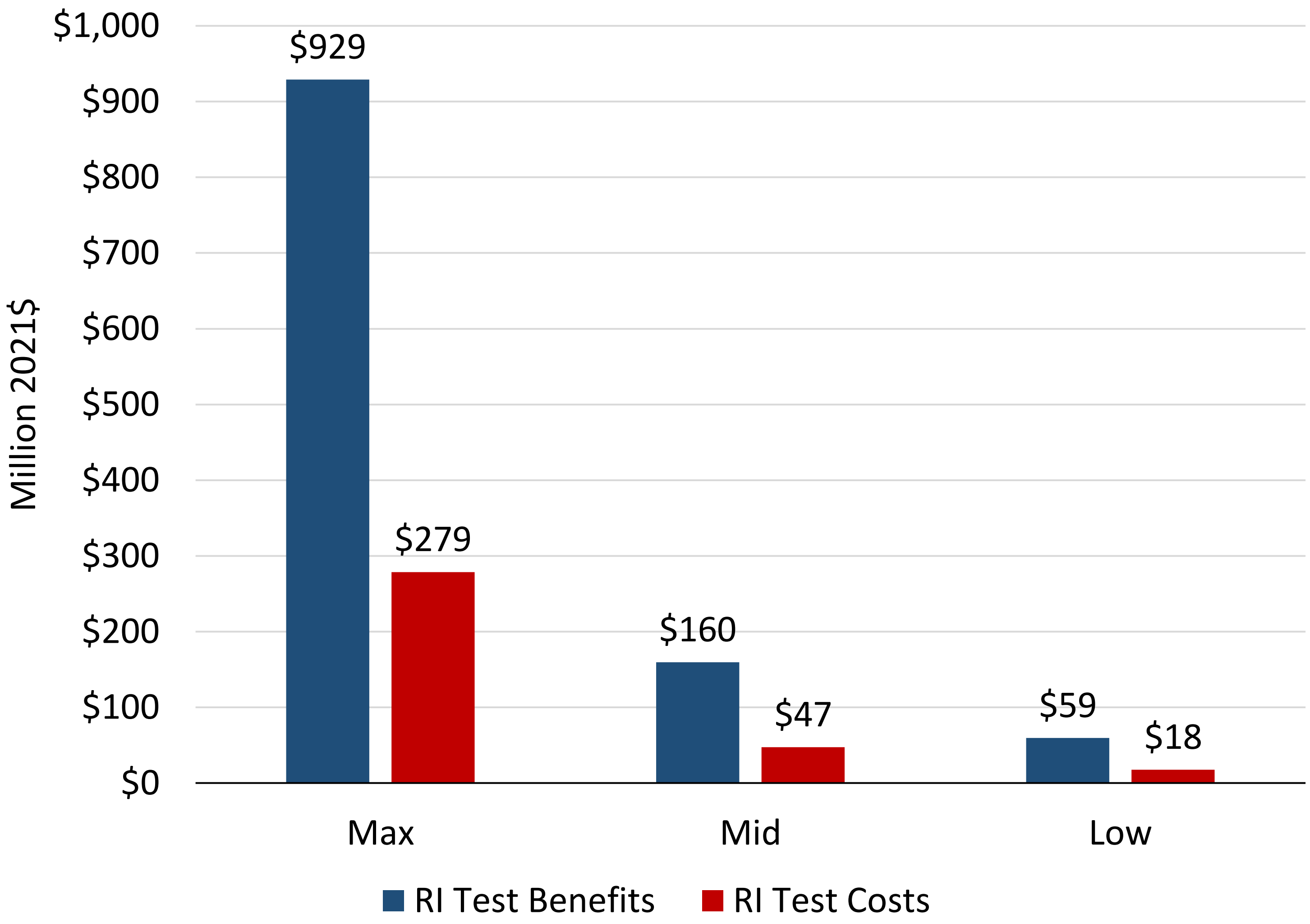
Average Annual Electricity Consumption Increase (2021-2023)



- Heating electrification has the potential to significantly increase electricity consumption
- The majority of potential is in the residential sector
- The commercial sector is constrained by economics (high cost, and limited sizing)
- Space heating dominates fuel-switching savings when compared to hot water savings

HE: Rhode Island Test

Total Rhode Island Test Benefits and Costs by 2023



- Annual estimated costs range from $6.4M (Low) to $115M (Max) per year
  - National Grid's 2019 HE spending totaled $1.8M
- Lifetime customer net benefits are significant.
  - $35.2M customer lifetime benefits by 2023 under Low Scenario over a third accruing to the residential low income sector.

Scenario	Net Benefits	BCR Ratio
Max	$650M	3.33
Mid	$112M	3.36
Low	$42M	3.36

HE: Key Takeaways

1. There is significant potential for heating electrification in Rhode Island that can create significant net benefits for the state.

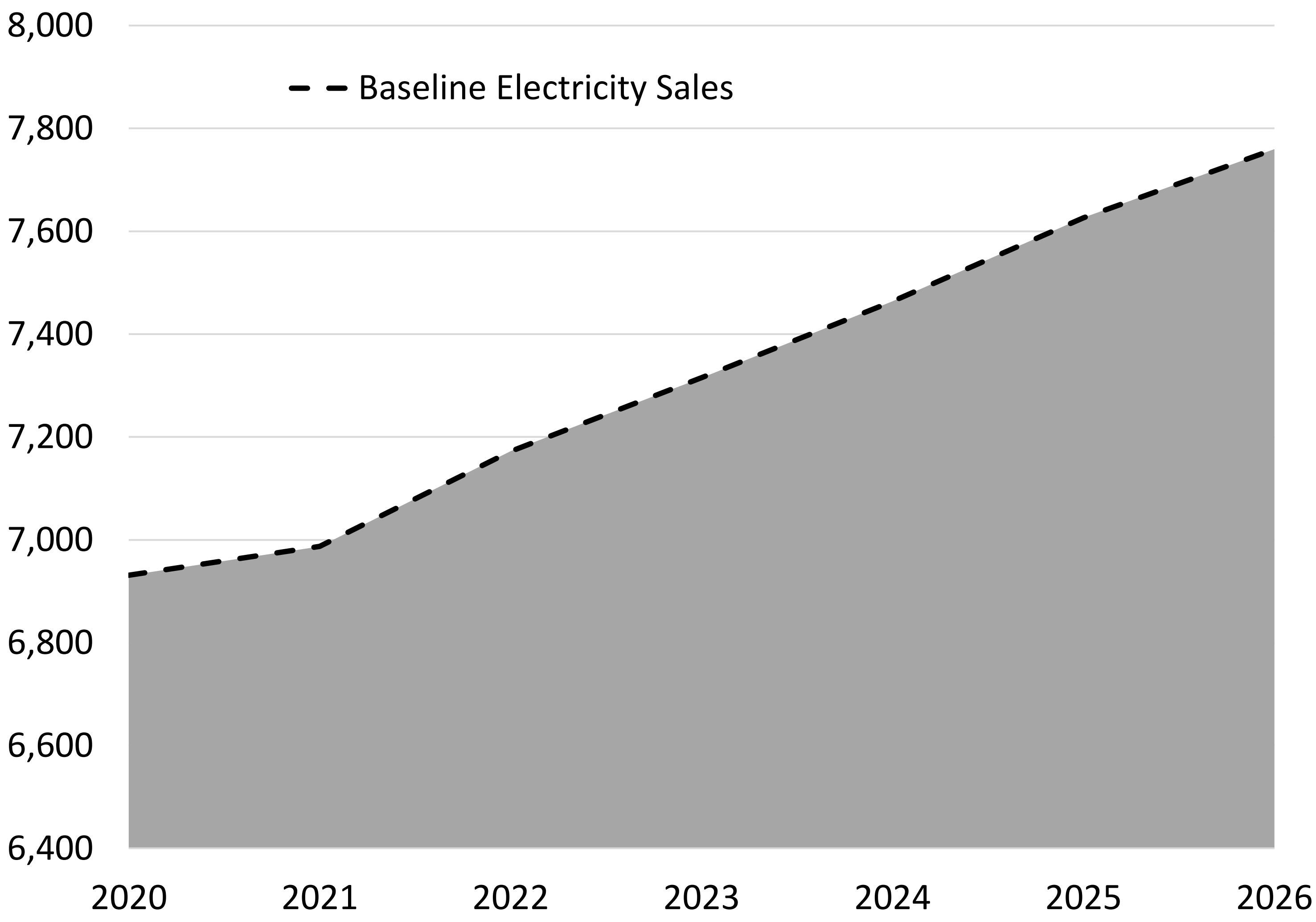
2. Savings come primarily from switching away from oil and propane heating. Most natural gas heating electrification does not pass economic screening.

3. Increasing incentives drives significantly more heating electrification, particularly between the Mid and Max scenarios.

Impacts on Sales

Cumulative Savings: Electricity Sales

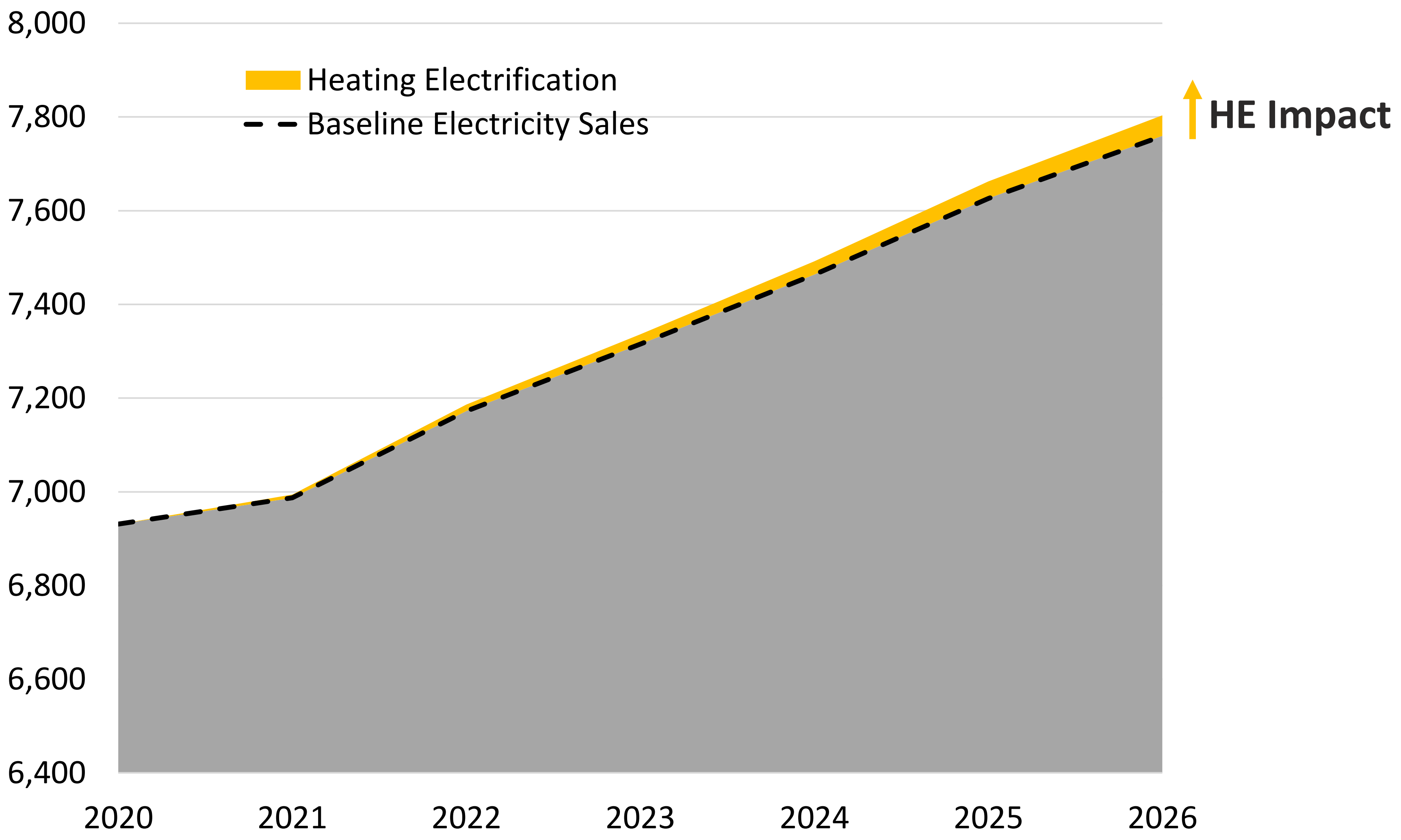
Baseline Electricity Sales (GWh)



- Without additional energy efficiency programming, electricity sales are forecasted to increase by approximately **12%** during the study period

Cumulative Savings : Electricity Sales

Mid Scenario: Electricity Sales + HE (GWh)

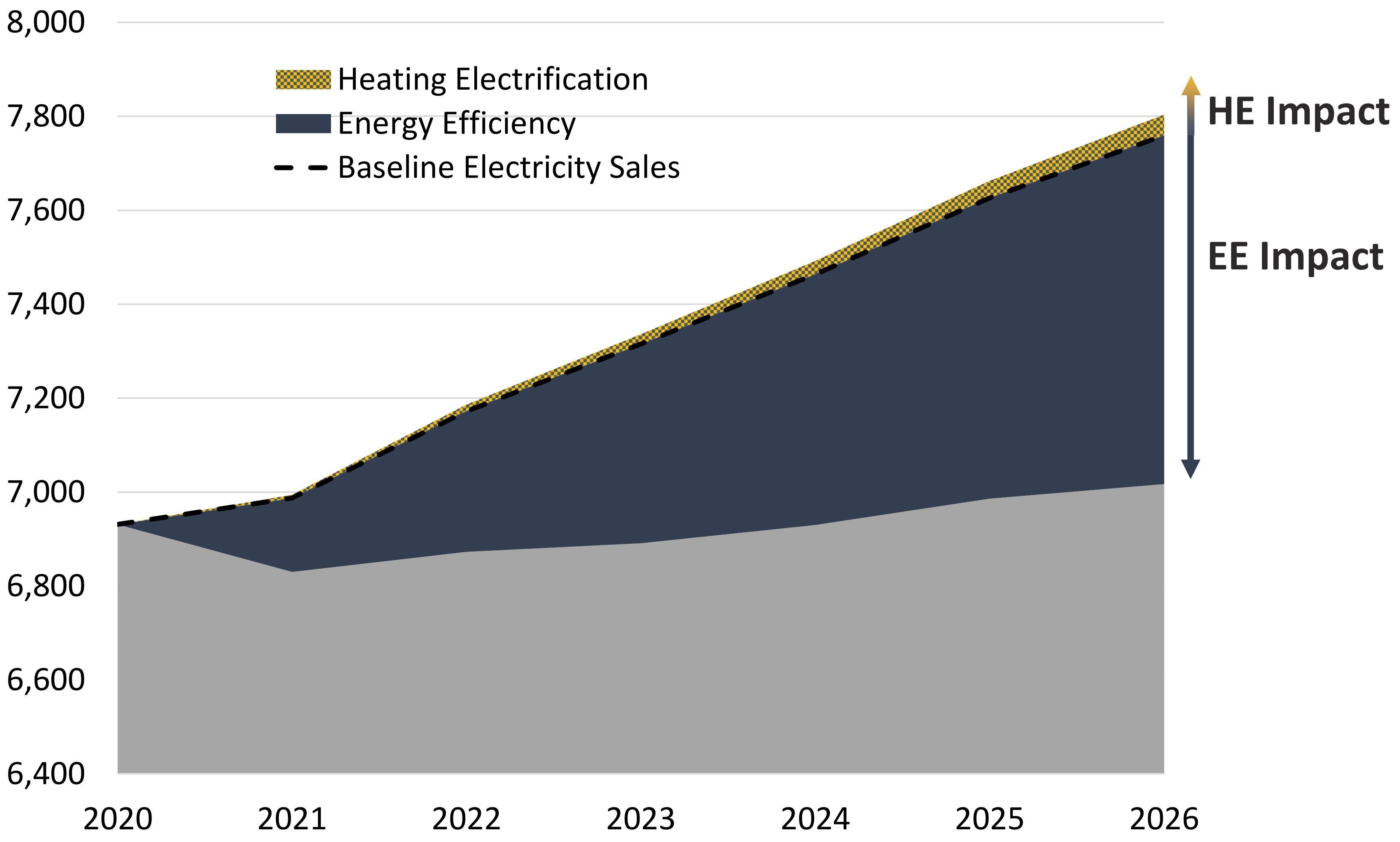


- **Heating electrification** will slightly increase annual consumption (net of reduction for more efficiency air conditioning)

Cumulative Impact on 2026 Baseline	
HE	+0.6%

Cumulative Savings: Electricity Sales

Mid Scenario: Electricity Sales + HE + EE (GWh)

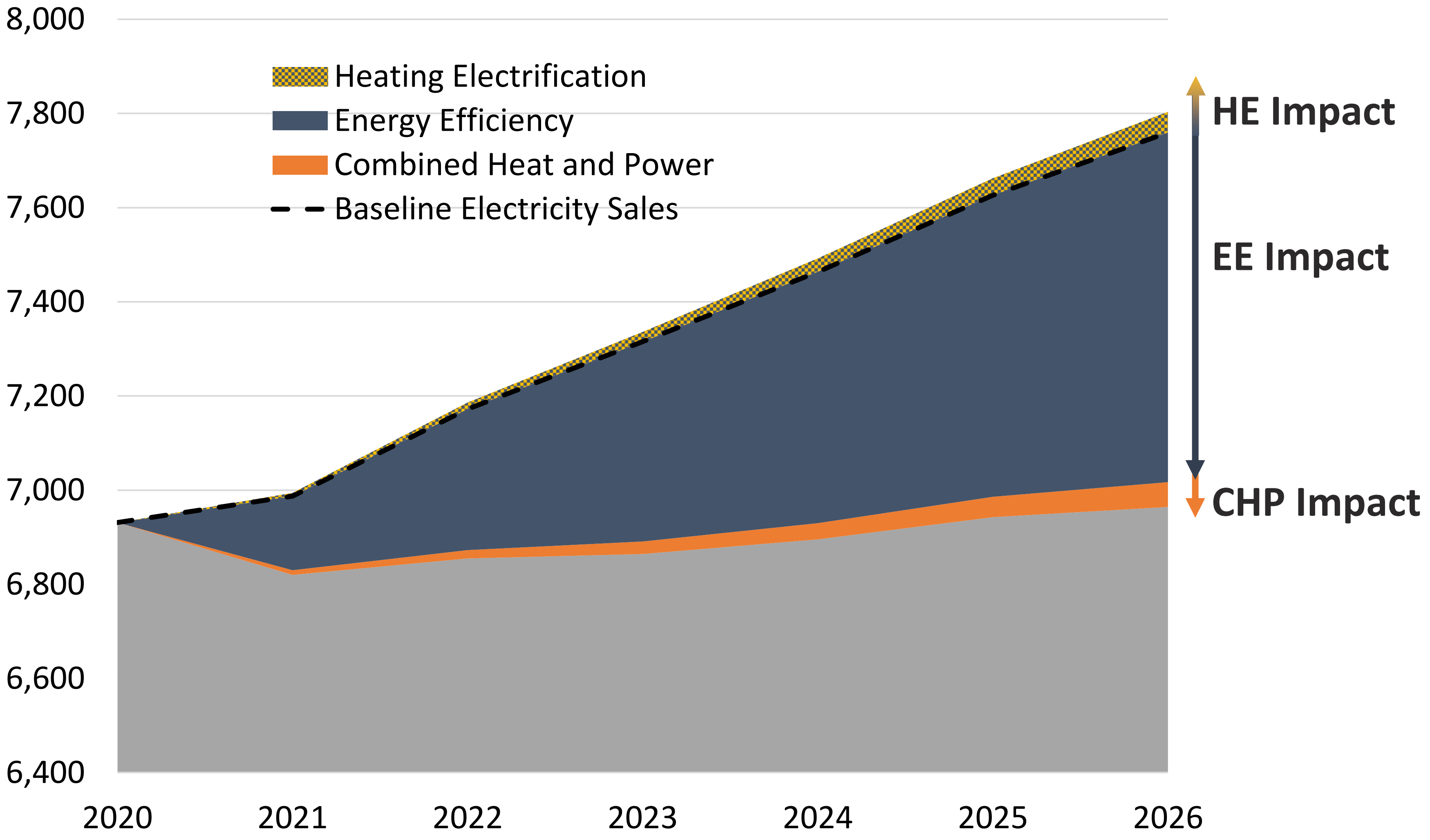


- **Energy efficiency** mitigates heating electrification impact and delivers substantial sales curtailment.

Cumulative Impact on 2026 Baseline	
HE	+0.6%
EE	-10.1%

Cumulative Savings: Electricity Sales

Mid Scenario: Electricity Sales + HE + EE + CHP (GWh)

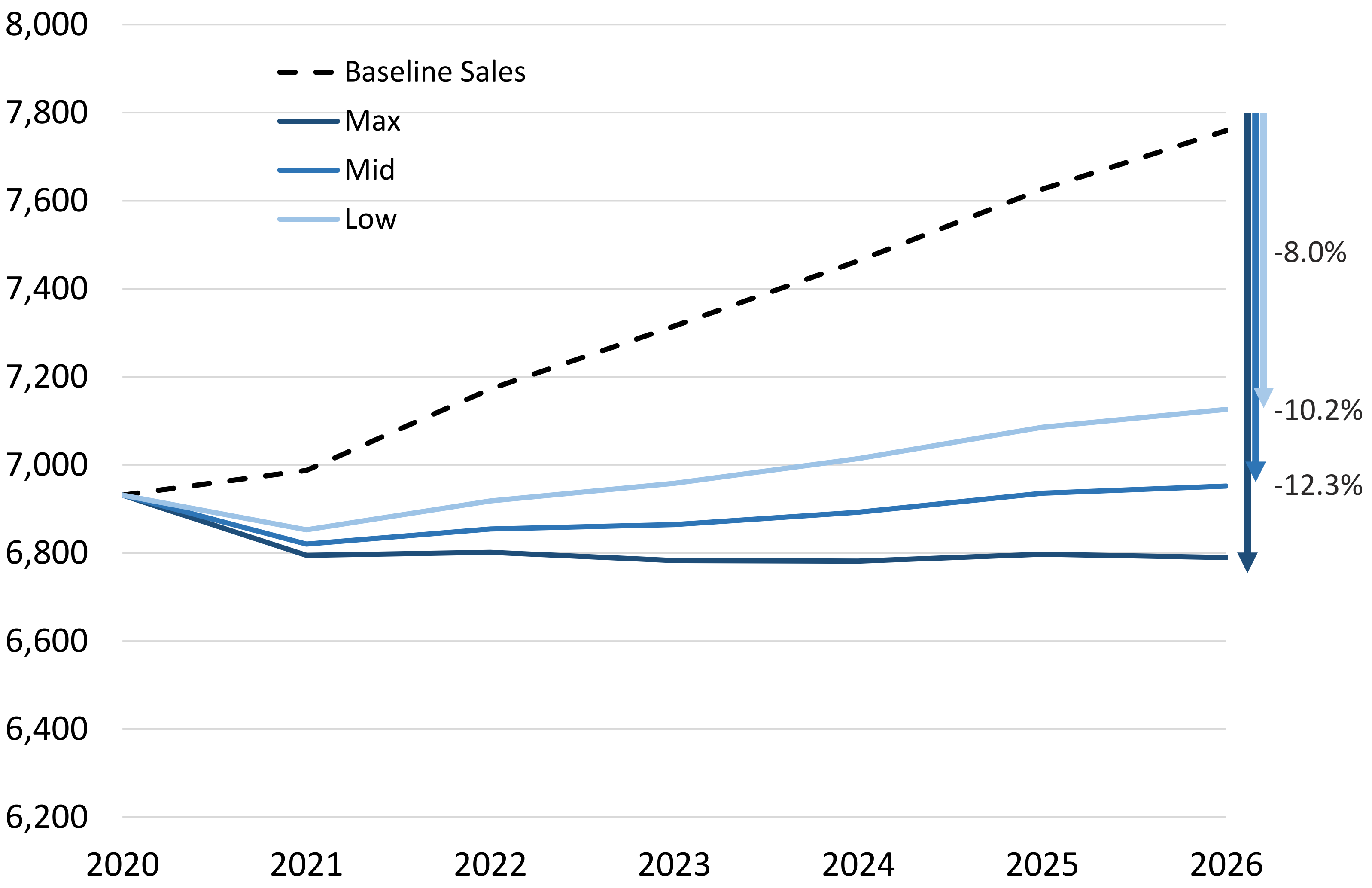


- **Combined heat and power** then further reduced electricity consumption (from the grid)

Cumulative Impact on 2026 Baseline	
HE	+0.6%
EE	-10.1%
CHP	-0.7%

Cumulative Savings: Electricity Sales

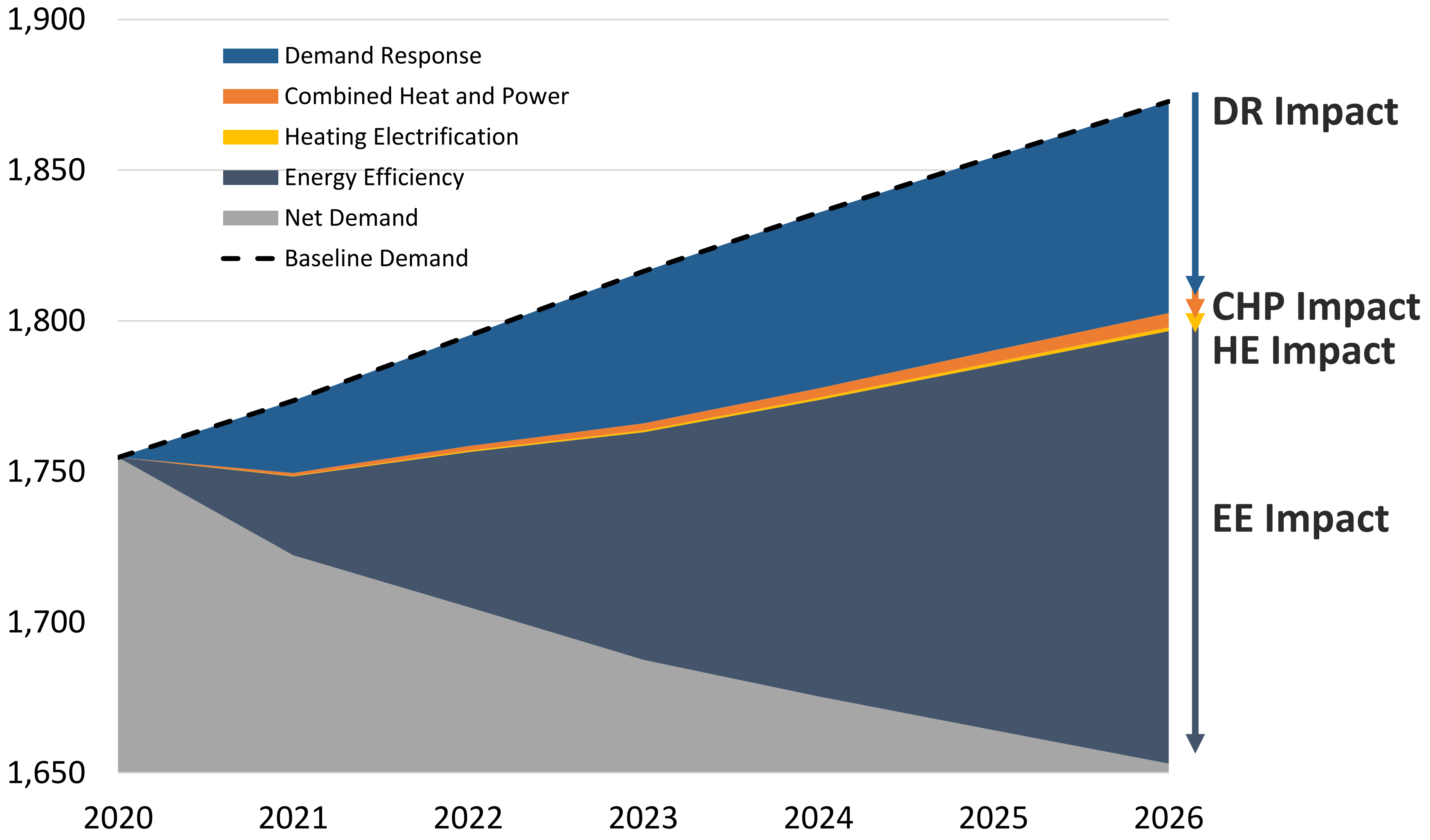
Cumulative Impact on Electric Sales (GWh)



- All scenarios are successful in curtailing RI electric consumption growth
- Max scenario leads to a slight reduction in overall consumption
- Solar PV (DG) when added will further reduce overall electricity consumption

Cumulative Savings : Electric Demand

Mid Scenario: Electric Demand (MW)

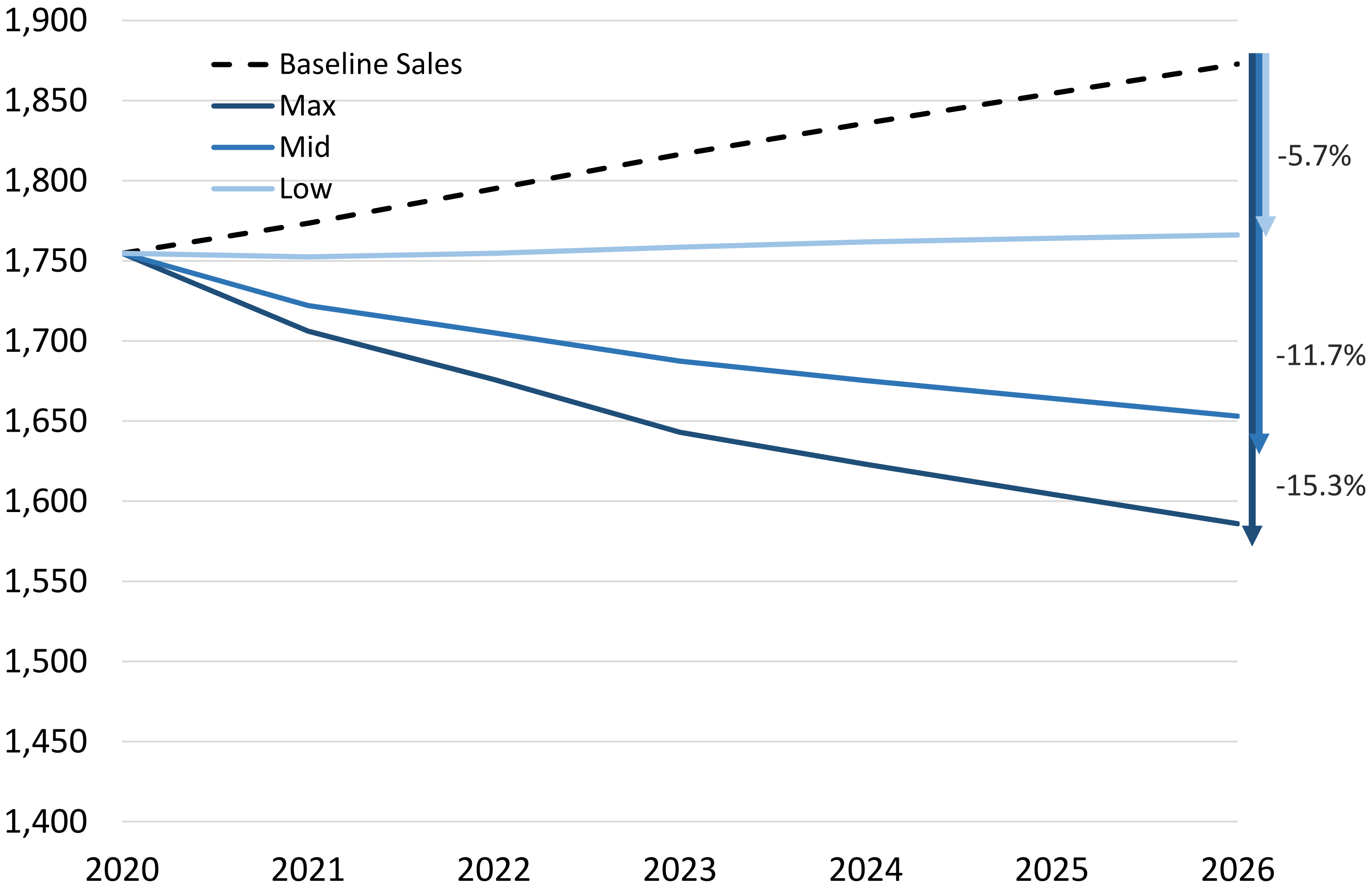


- Efficiency offers the greatest peak load reduction
- DR programs offer second-most, if expanded significantly (new measures, higher incentives)

Cumulative Impact on 2026 Baseline	
DR	-3.7%
CHP	-0.3%
HE	-0.1%
EE	-7.8%

Cumulative Savings : Electric Demand

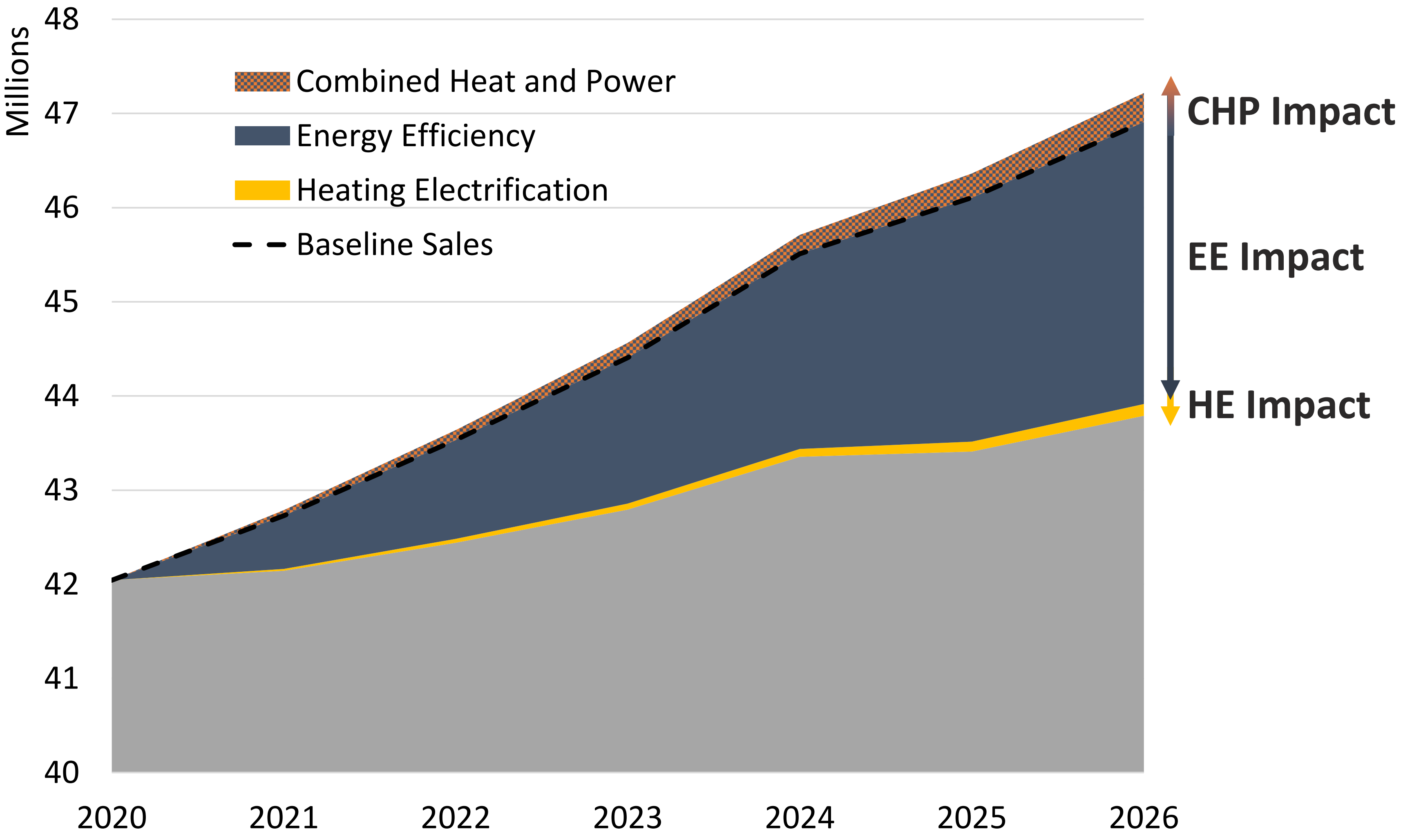
Cumulative Impact on Peak Demand (MW)



- Low Scenario nearly avoids any growth in peak demand over the study period
- Increase in DR is most significant jump in peak load reduction between Low to Mid scenarios
- Solar PV (DG) will further reduce peak load when added.

Cumulative Savings : Natural Gas Sales

Mid Scenario Natural Gas Sales + CHP + EE + HE (MMBtu)

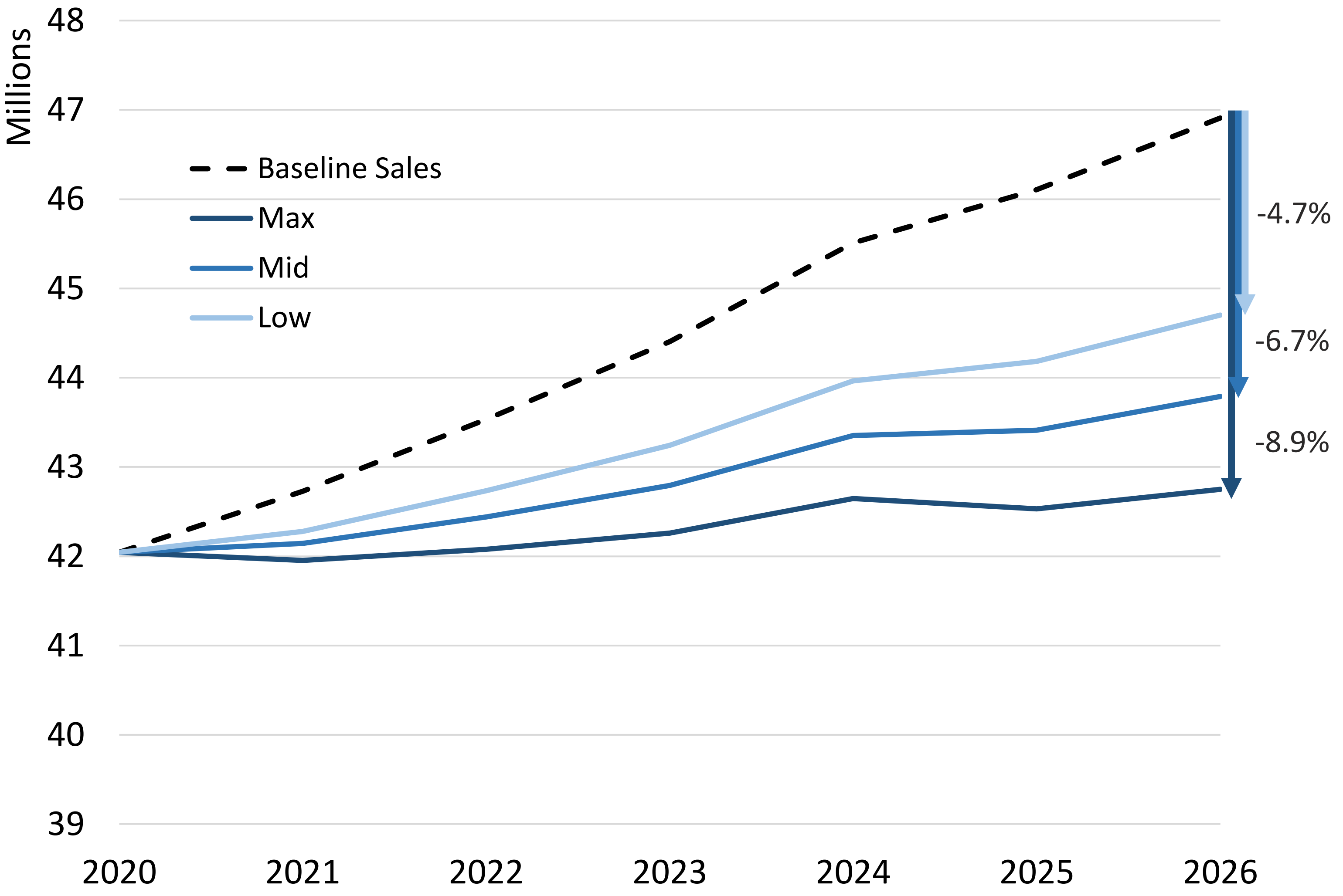


- CHP will increase on-site consumption of natural gas
- EE offers greatest opportunity to reduce natural gas sales

Cumulative Impact on 2026 Baseline	
CHP	+0.7%
EE	-7.0%
HE	-0.3%

Cumulative Savings : Natural Gas Sales

Cumulative Impact on Natural Gas Sales (MMBtu)



- Under all scenarios, an increase in gas consumption is projected to increase over the study period
- Max scenario comes near to keeping gas consumption flat over study period

Conclusions

Cumulative Savings: Overall Energy Impacts

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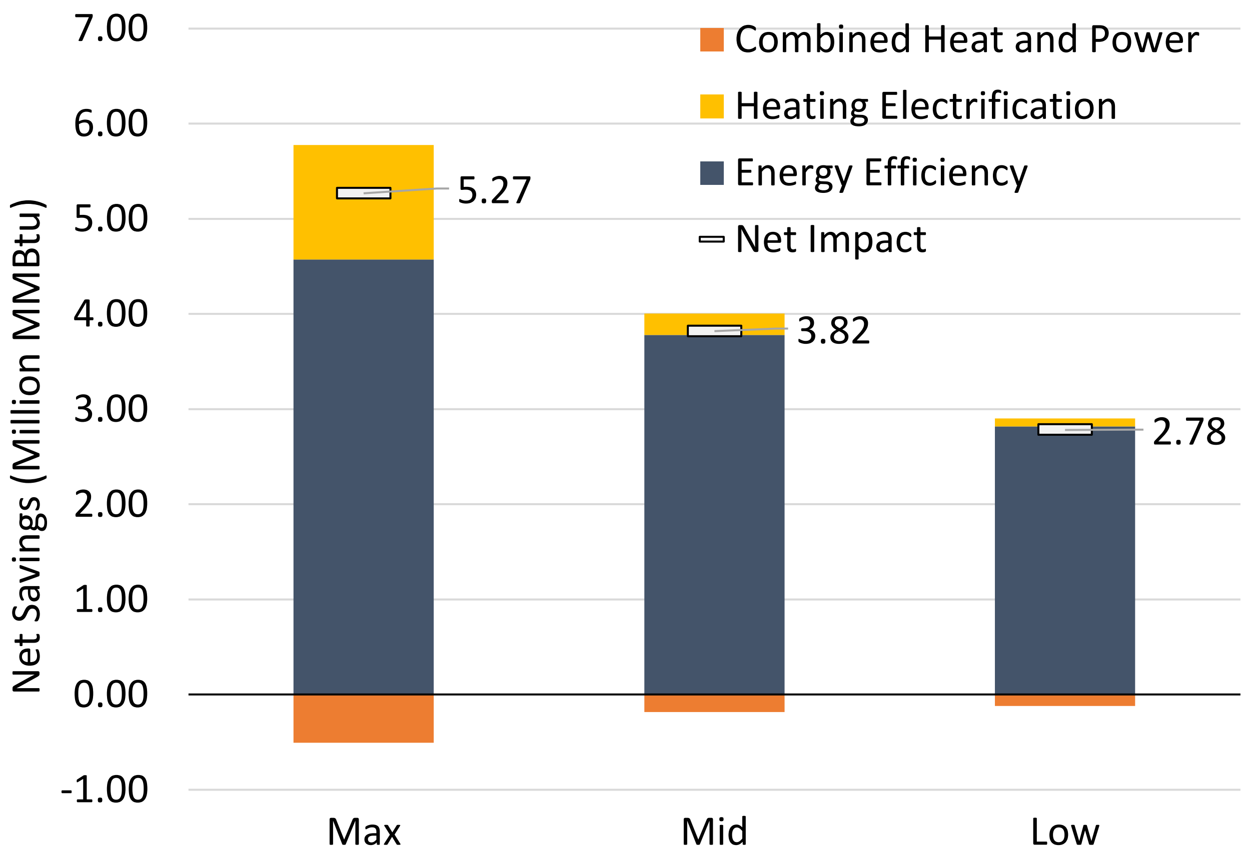
Total Net Customer Energy Savings by 2023



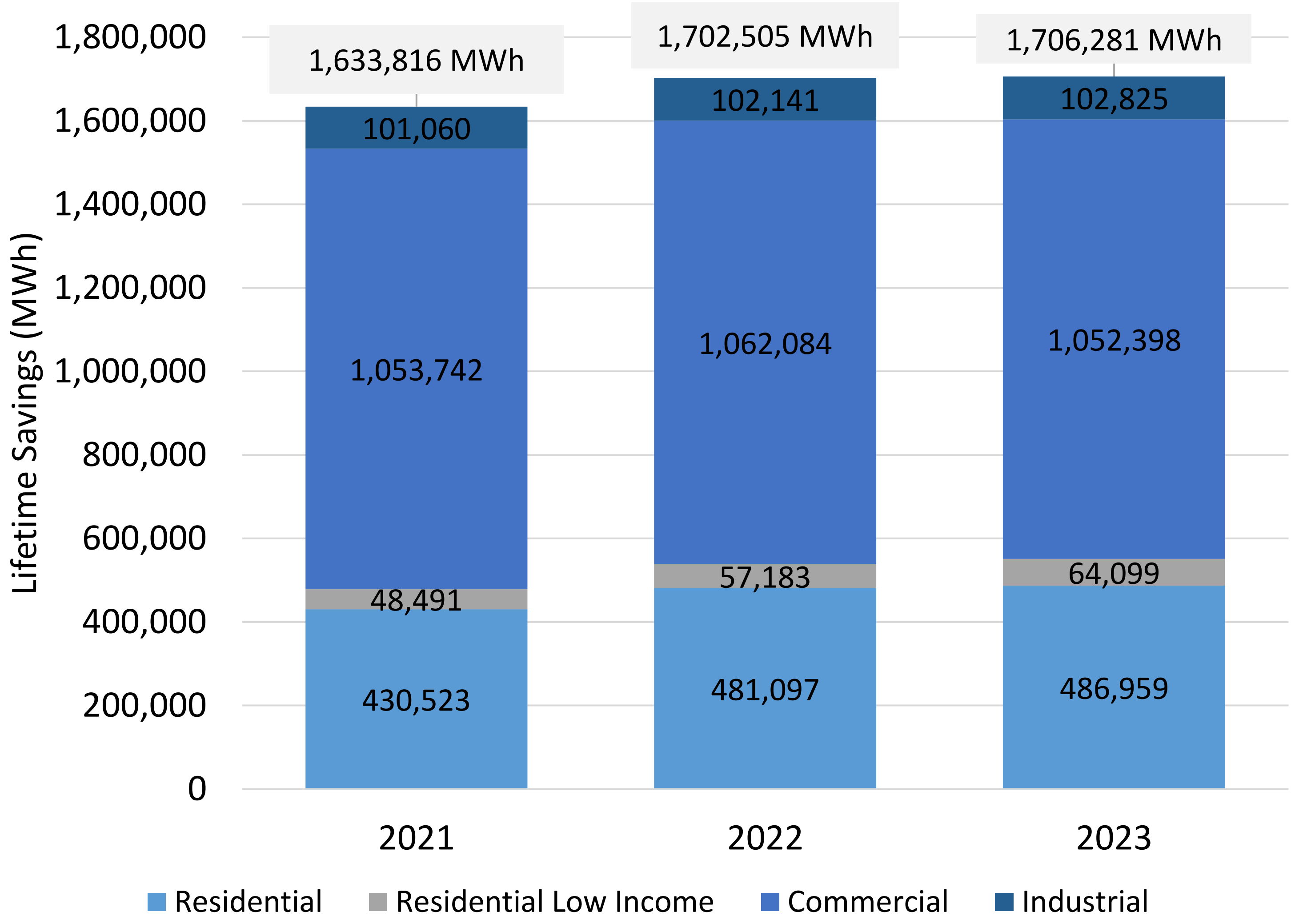
- Efficiency continues to have the largest overall impact
  - Electric savings lower than in past, but still substantial
  - Gas savings growing in importance
- CHP contributes to a slight increase in total site energy use
- HE could have notable impact, with further investments
- DR (not shown) shows room to grow with increased budgets
- Overall, the results show great potential for GHG reductions via all savings streams. In the future, GHGs may provide a useful basis for combined target setting.

Note: This graph does not consider savings at the generator, which would show CHP as a net positive energy savings.

Appendix

EE: Electric Savings Potential

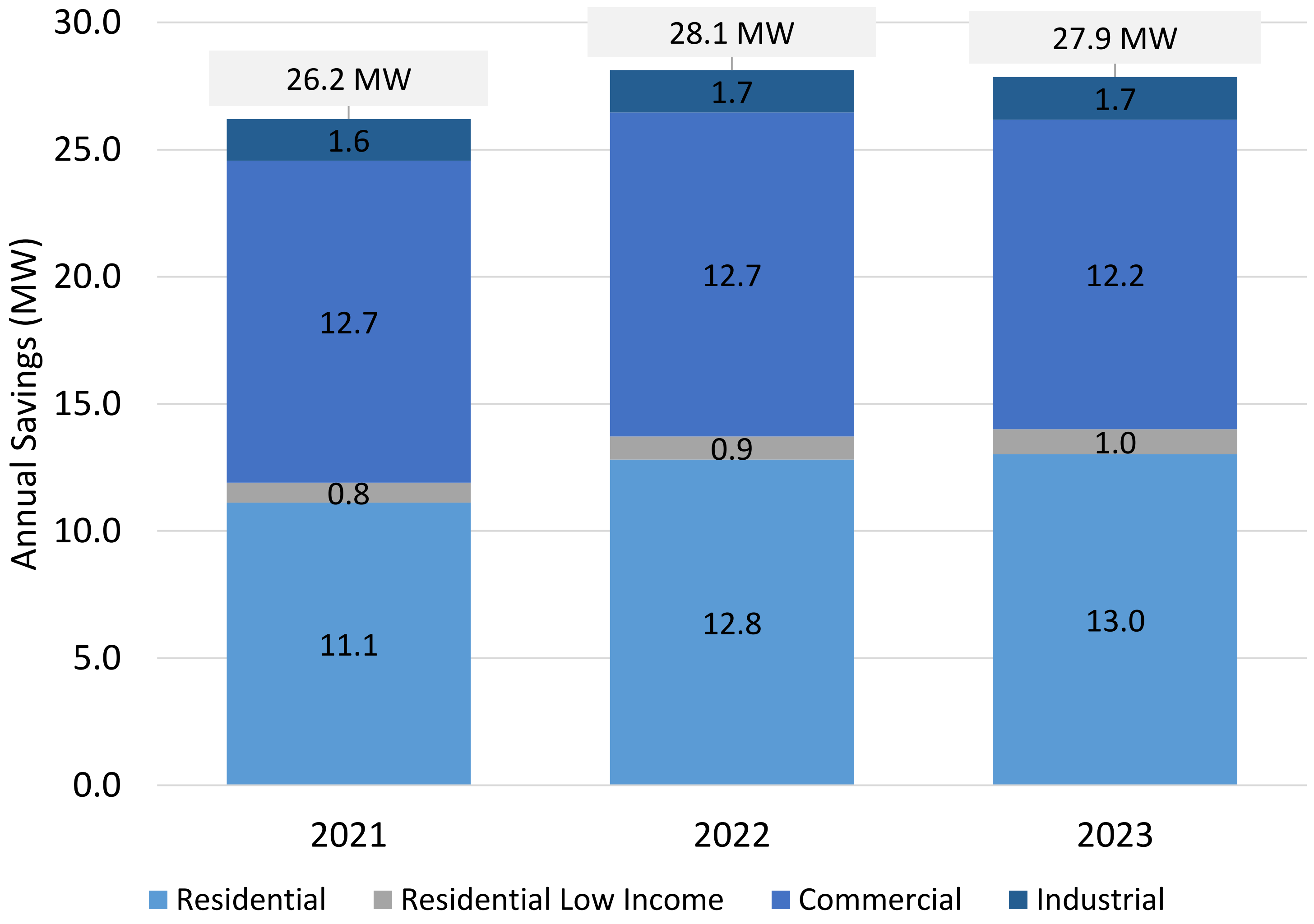
Lifetime Electric Savings by Sector (Mid)



- Bulk of electric savings come from residential and commercial sectors
  - Within residential sector, savings are driven by the single family segment
  - Within commercial sector, savings are driven by office, retail, and education/campus segments.

EE: Electric Savings Potential

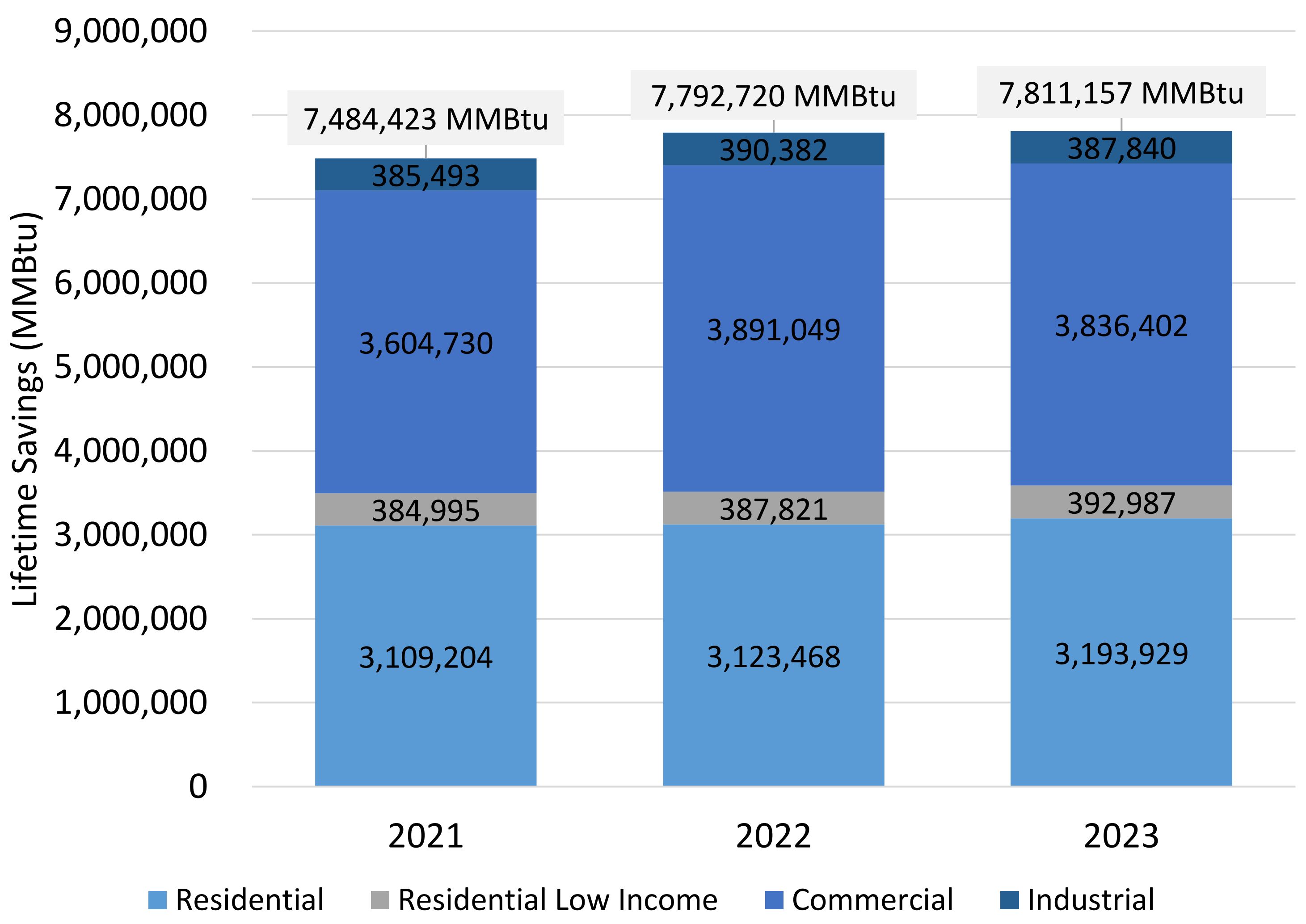
Annual Passive Peak Demand Reduction by Sector (Mid)



- Similar to energy savings, bulk of passive demand savings come from residential and commercial sectors

EE: Natural Gas Savings Potential

Lifetime Gas Savings by Sector (Mid)



- Commercial sector is the slight majority of EE gas savings under mid scenario
  - Residential sector savings driven by single family segment.
  - Commercial sector savings driven office, retail, education/campus and lodging segments.
- Residential sector shows significant upside between Low and Mid scenarios – increasing by nearly 50%

EE: Delivered Fuel Savings Potential

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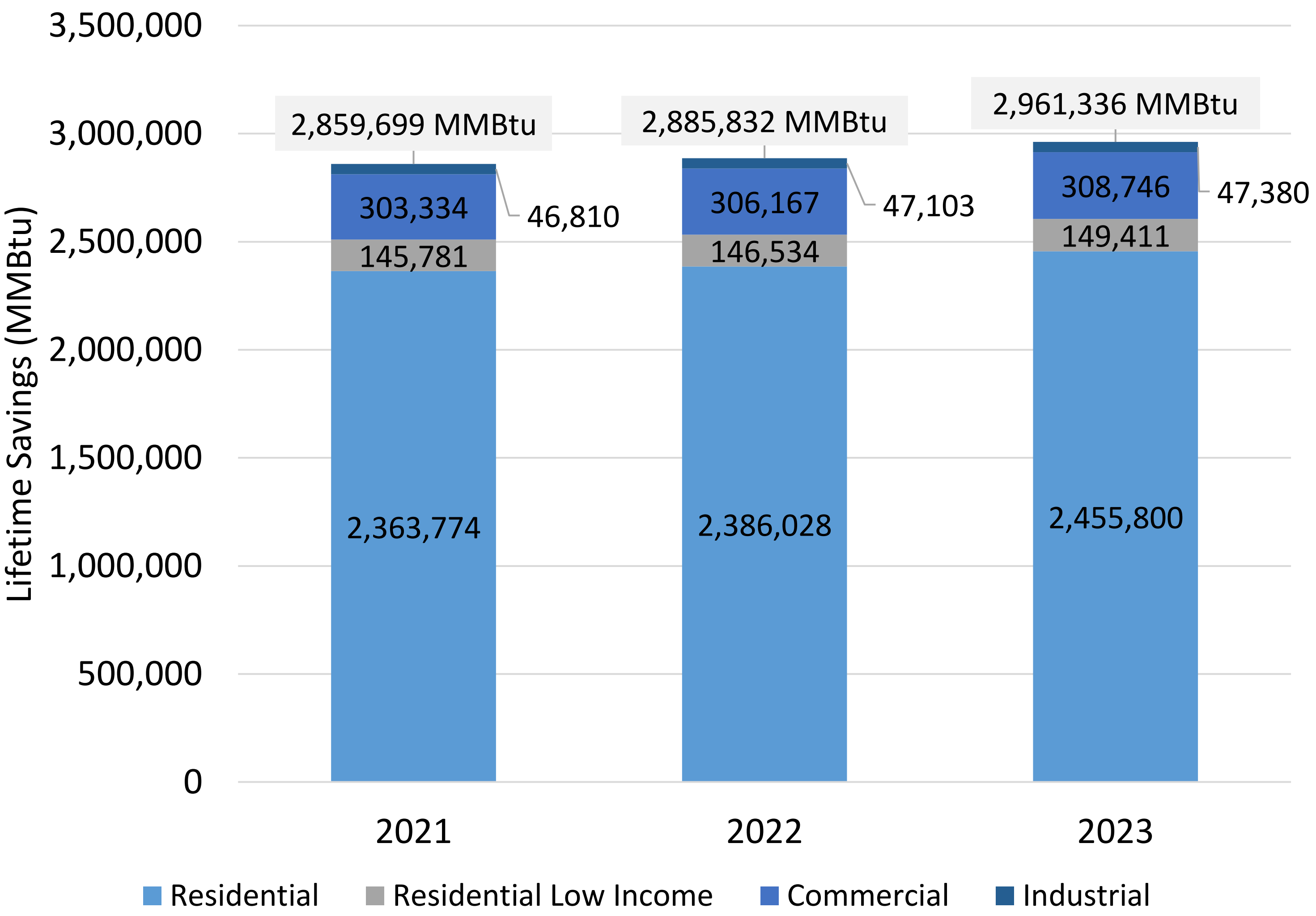
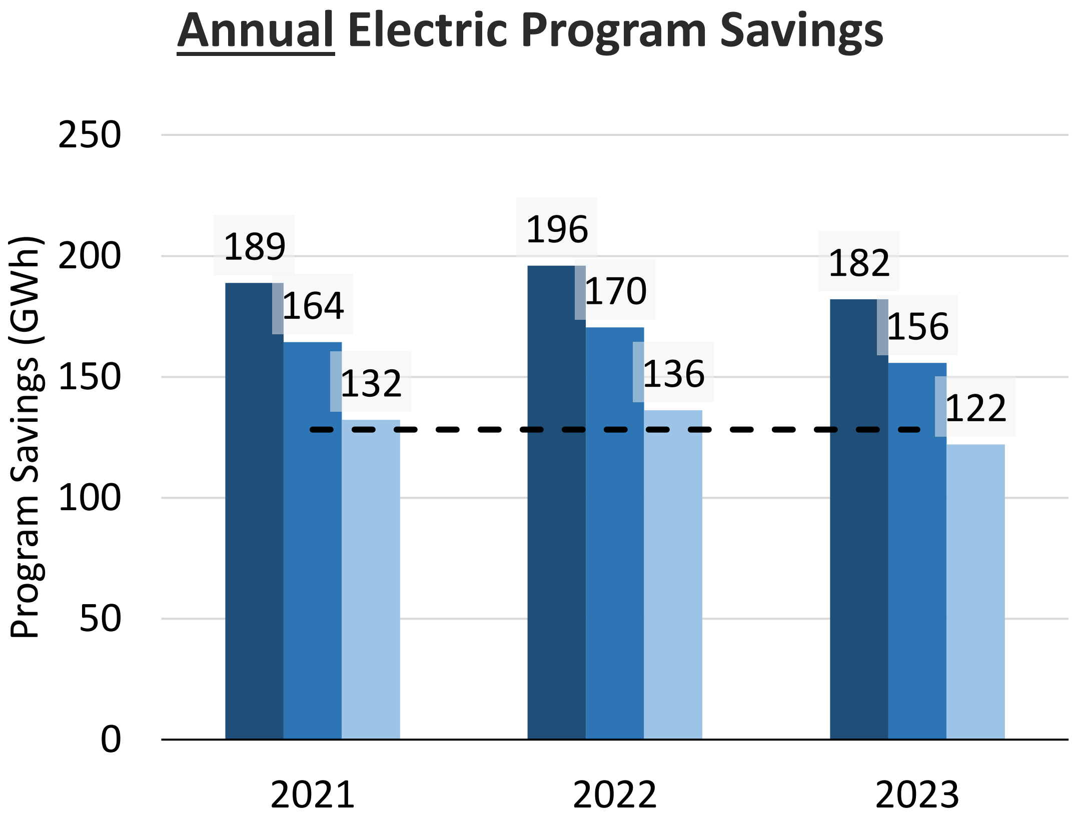
Lifetime Delivered Fuel Savings by Sector (Mid)

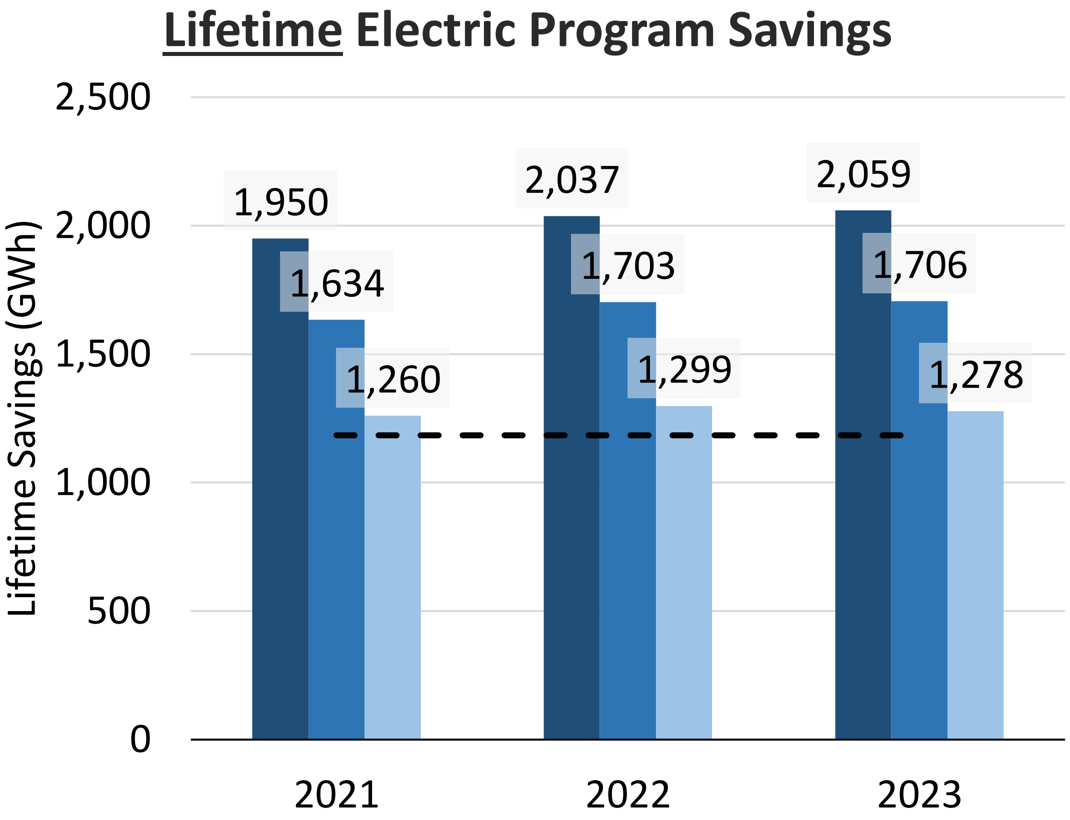


- The bulk of delivered fuel savings come from the single-family residential customers
- Oil measures account for approximately 94% of delivered fuel savings

EE: Electric Savings Potential



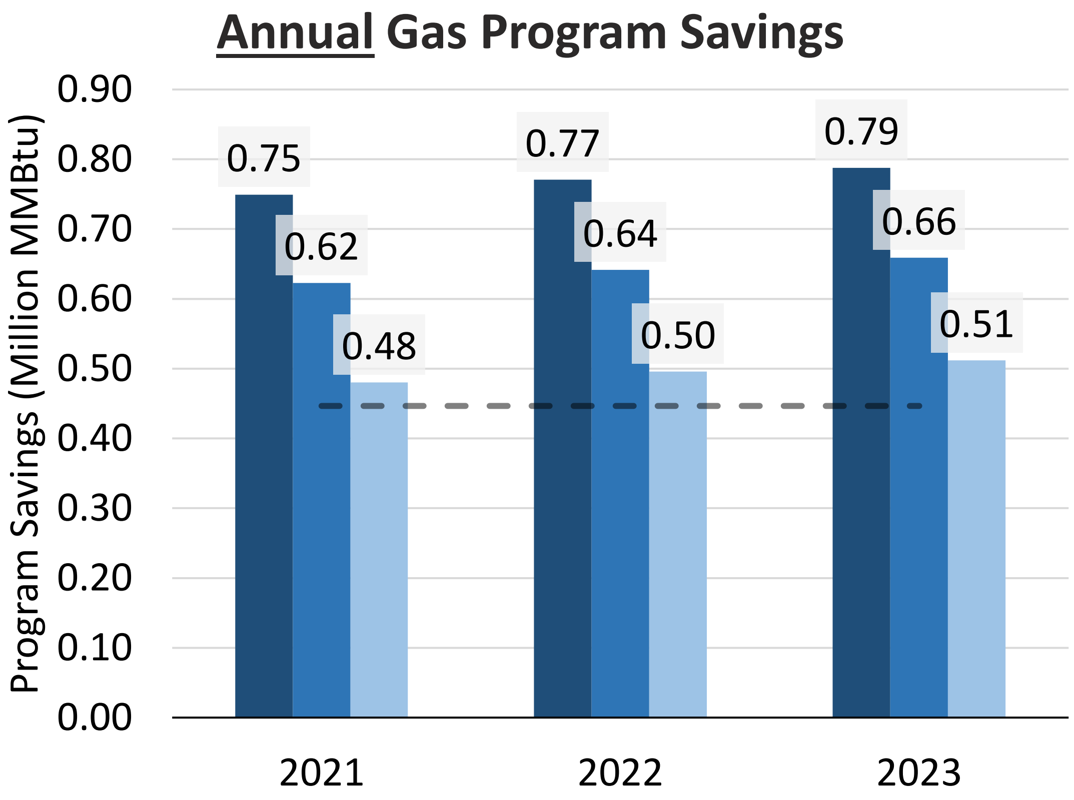
Note: 2020 Plan Benchmark savings do not include A-Lamp savings.

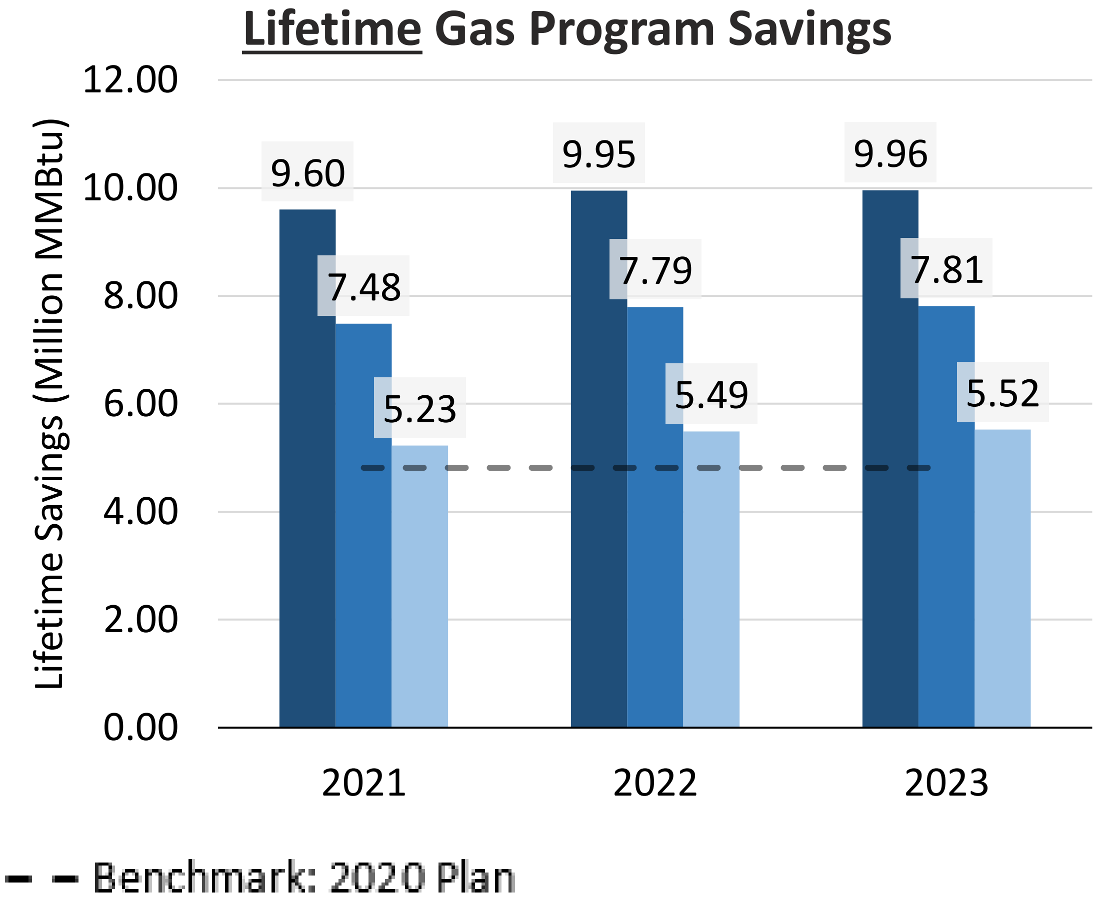


Max Mid Low Benchmark: 2020 Plan

Annual Savings: The amount of energy savings achieved in the first-year of the measure's installation.
Lifetime Savings: The amount of energy savings achieved over the entire measure's lifetime.

EE: Gas Savings Potential



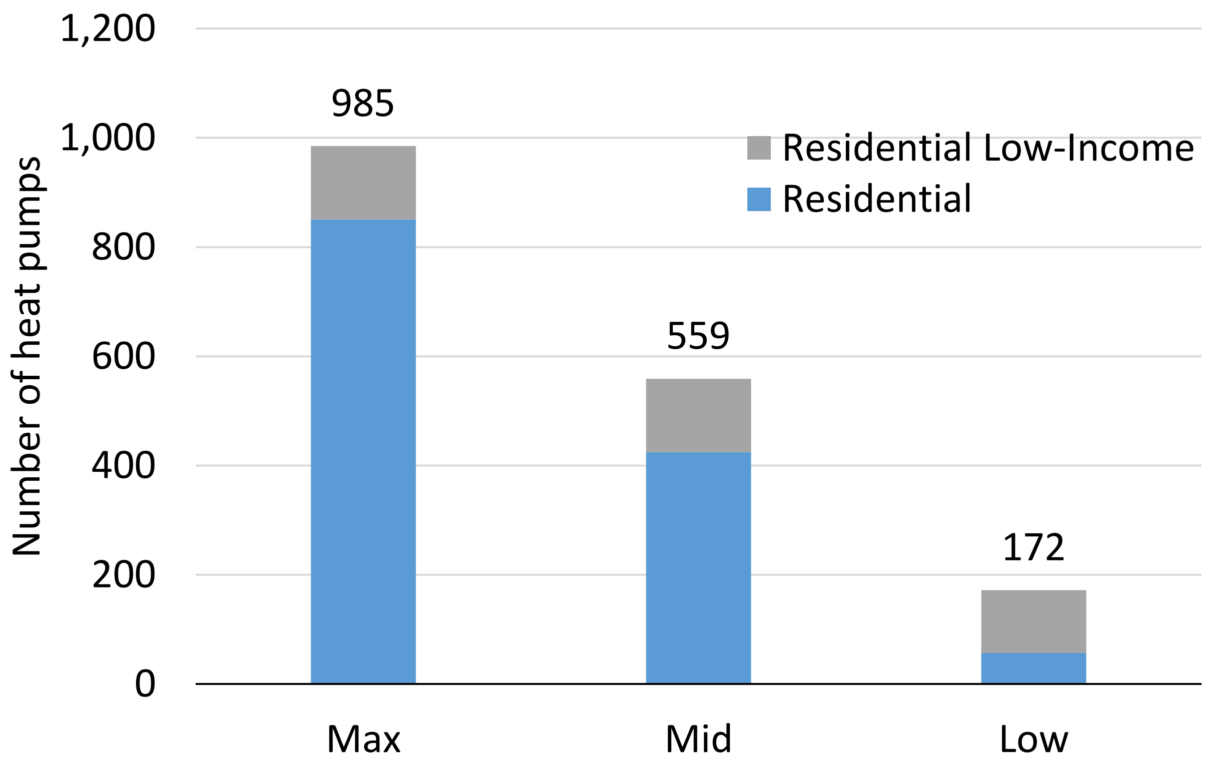


Annual Savings: The amount of energy savings achieved in the first-year of the measure's installation.
Lifetime Savings: The amount of energy savings achieved over the entire measure's lifetime.

EE: Electric Savings Potential, Residential

Measure Example: Ductless Mini-split Heat Pumps (DMSHP) for Electric Resistance Heating

Average Number of DMSHP adopted by residential customers per year (2021-2023)



- Under the Mid Scenario, over 2,000 customers adopt mini-split heat pumps to displace electric resistance heating – including 450 Low Income customers – by 2023.
- Benchmarks:
  - 2019 results: 181 heat pumps
  - 2020 plan: 325 heat pumps

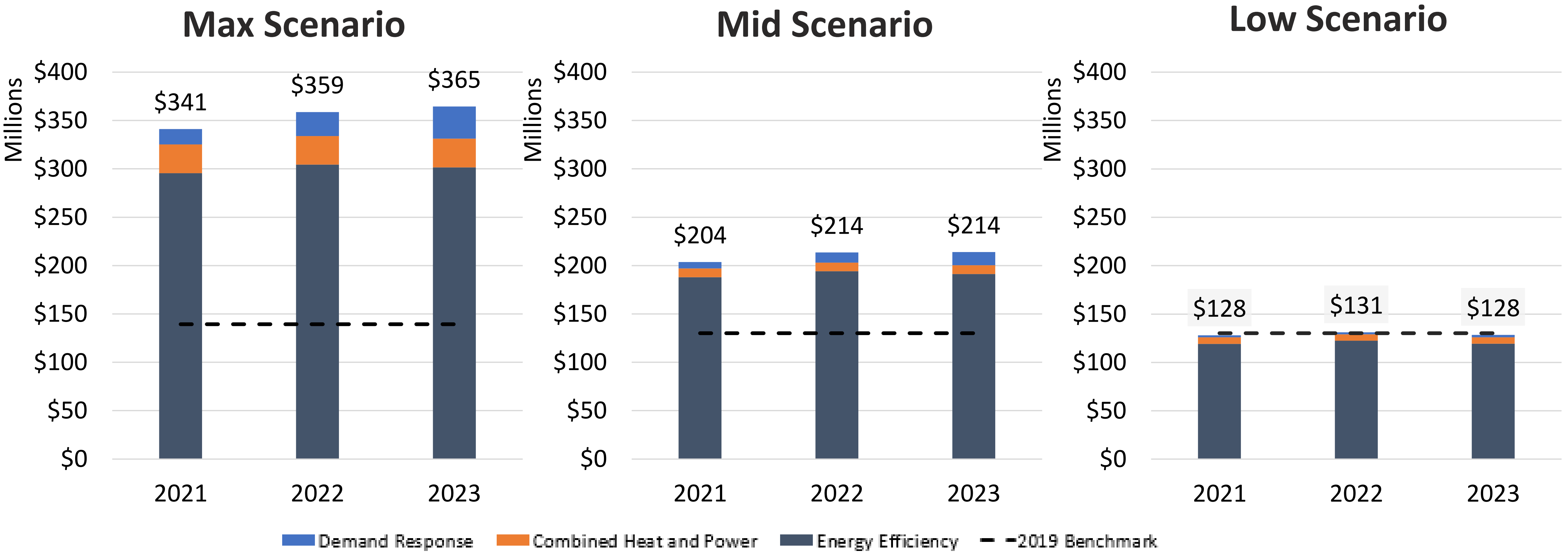
Average Annual GWh Savings (2021-2023)

	Max	Mid	Low
Residential	5.4	3.6	1.1
Residential Low-Income	0.9	0.9	0.7
Total	**6.2**	**4.5**	**1.8**

All Saving Streams: Estimated Combined Costs

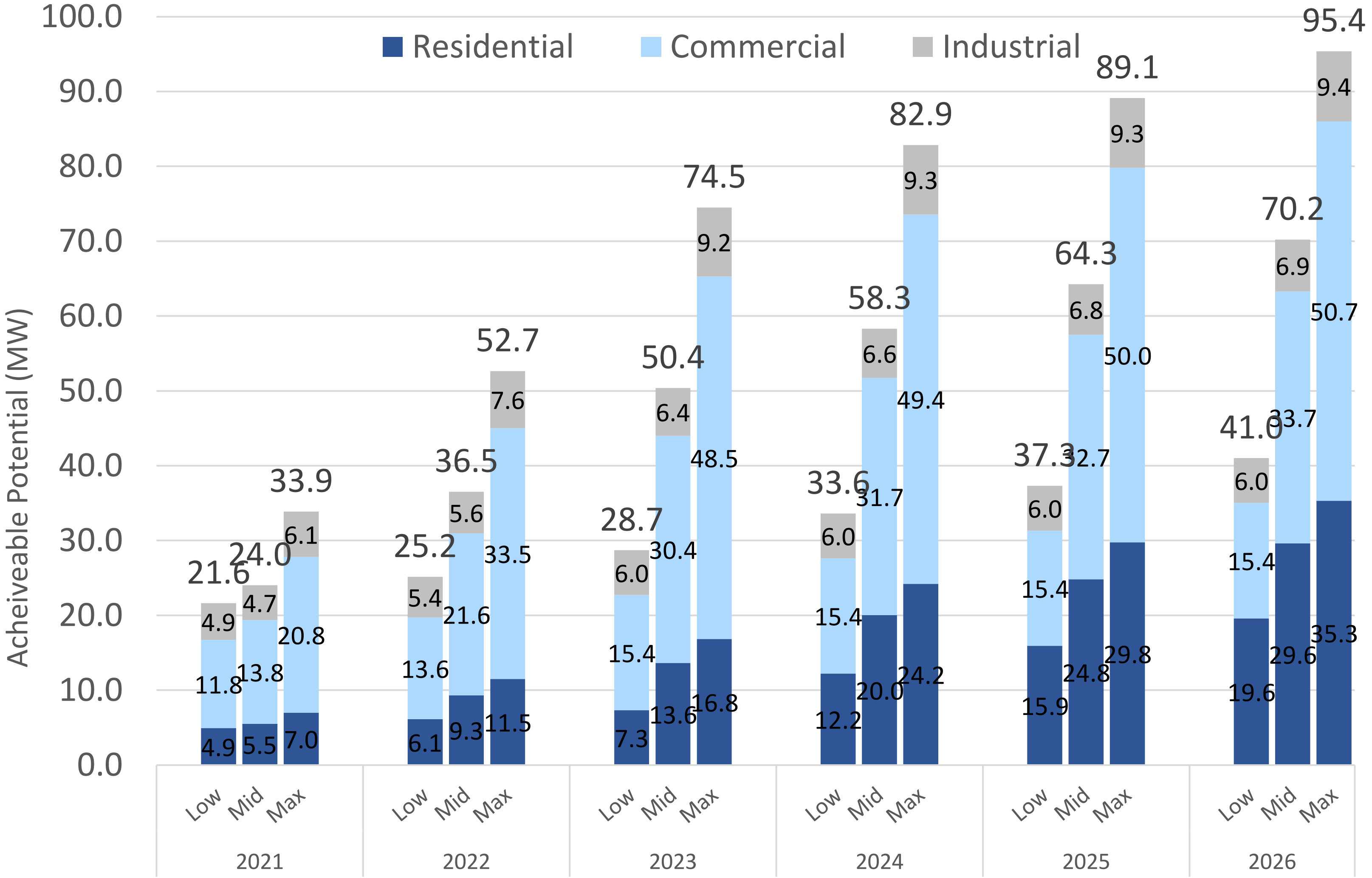
Estimated Combined Costs (EE, CHP, and DR only)

Note: 2019 Benchmark does not include Heating Electrification or A-Lamp spending.



DR: Overview

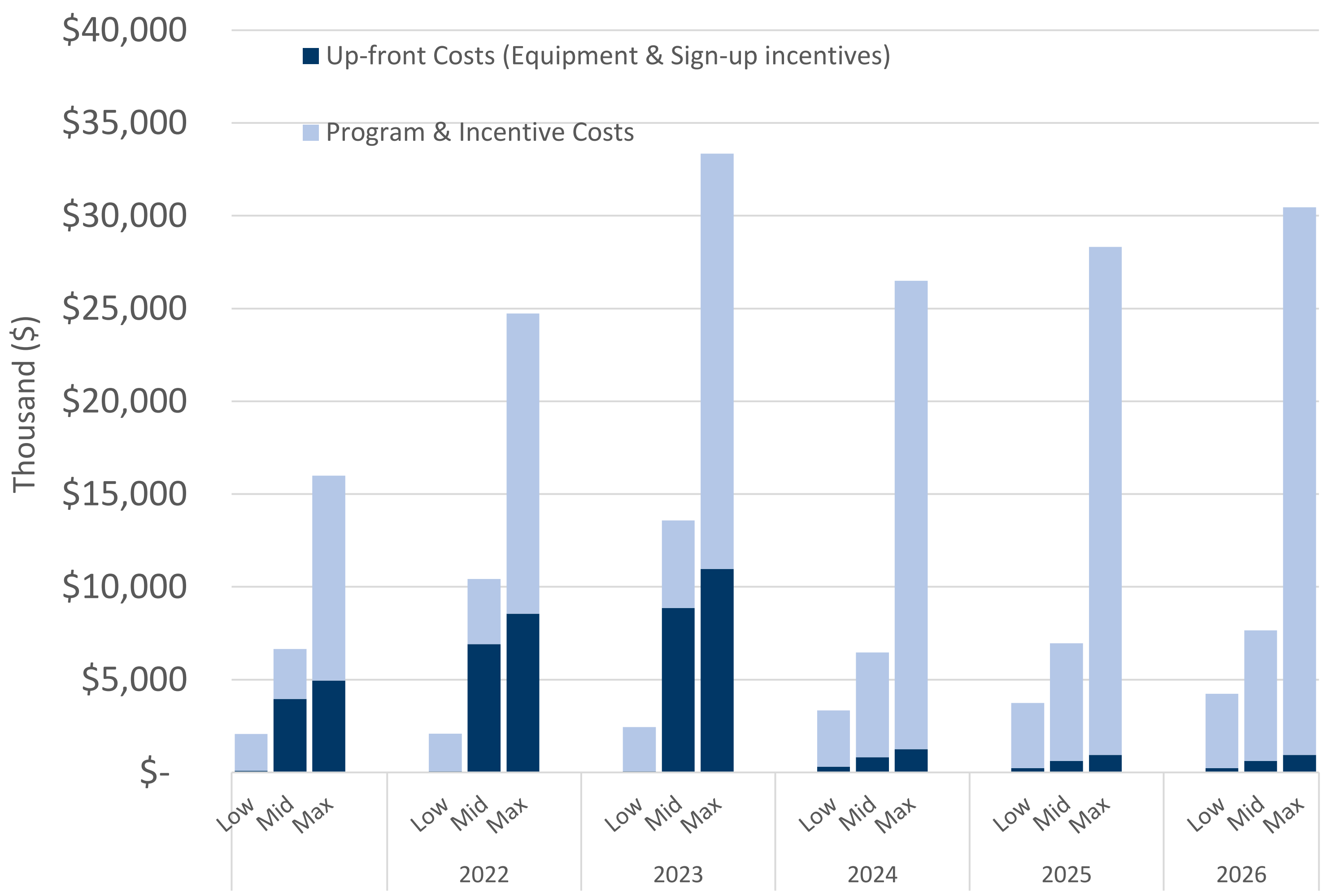
Achievable Potential (MW) by scenario



- Economic potential assessed at: 125 MW*
- Residential DR has lots of room to grow
- Expanding programs has bigger effect than simply raising incentives
- Budgets range from $2M to $33M per year. Mid scenario appears to offer best savings/cost balance.

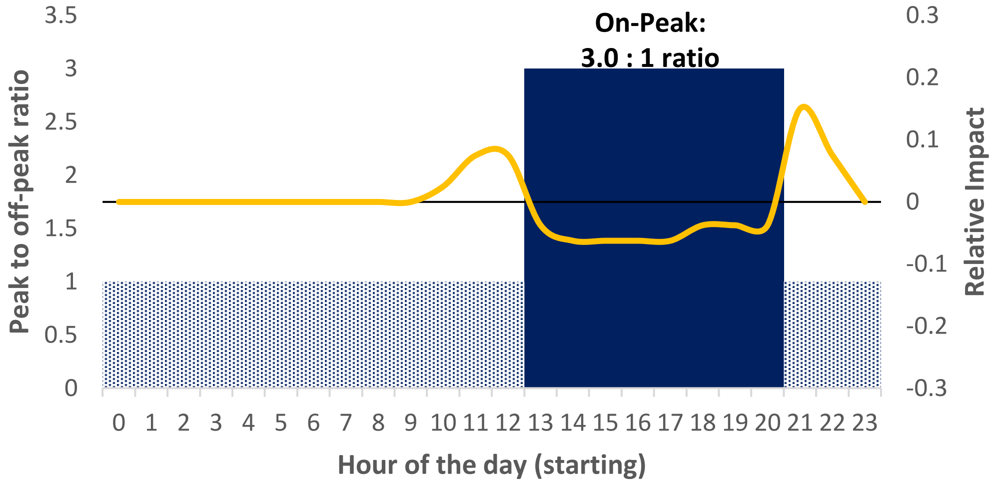
DR: Program Costs

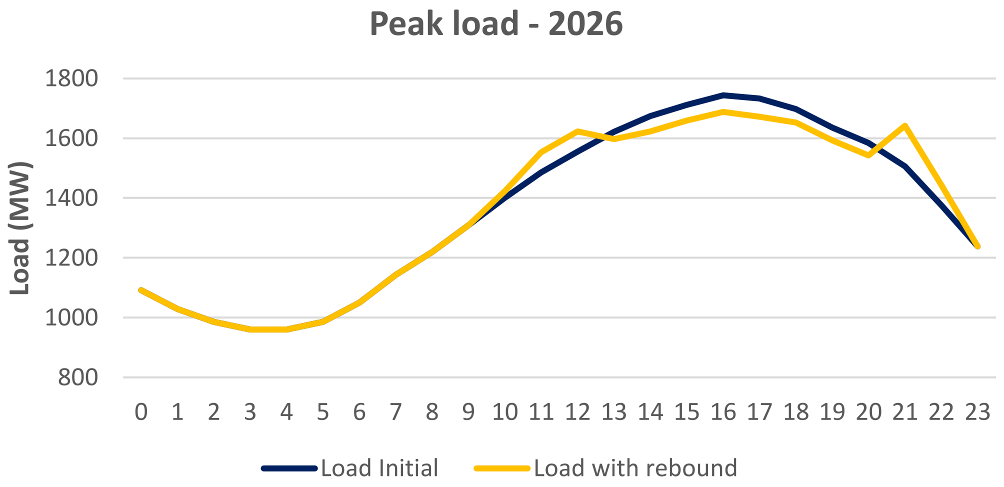
DR Portfolio Costs ($1000) by scenario



- Increasing impact come at significantly increased cost
- Mid scenario involves notable investment in early years, then reasonable budgets later as installed equipment enables peak reductions
- The Max scenario is more focussed on high curtailment incentives, which need to be paid in each year to drive peak reductions.
- <u>Keep in mind</u>: DR savings on persist for as long as the programs are active (study assumed that measures deliver savings for a 10 year program life)

DR: TOU Design





- TOU was selected:
  - Stable load shape means TOU will provide benefits even in days with lower peak demand
  - Historical heat waves comes in multiple day events, diminishing CPP effects
- Residential sector only
  - With the integration of solar, peak is shifting towards the evening. Residential is better suited for evening/early night curtailment (more residential demand)
  - A combined commercial and residential TOU cannot target the peaks without creating a new peak from 16:00 to 22:00
- On-peak for 8 hours - 13:00 to 20:59

Year	Savings (MW)
2024	56.2
2025	56.2
2026	56.3

DR: AMI Impacts - Sensitivity

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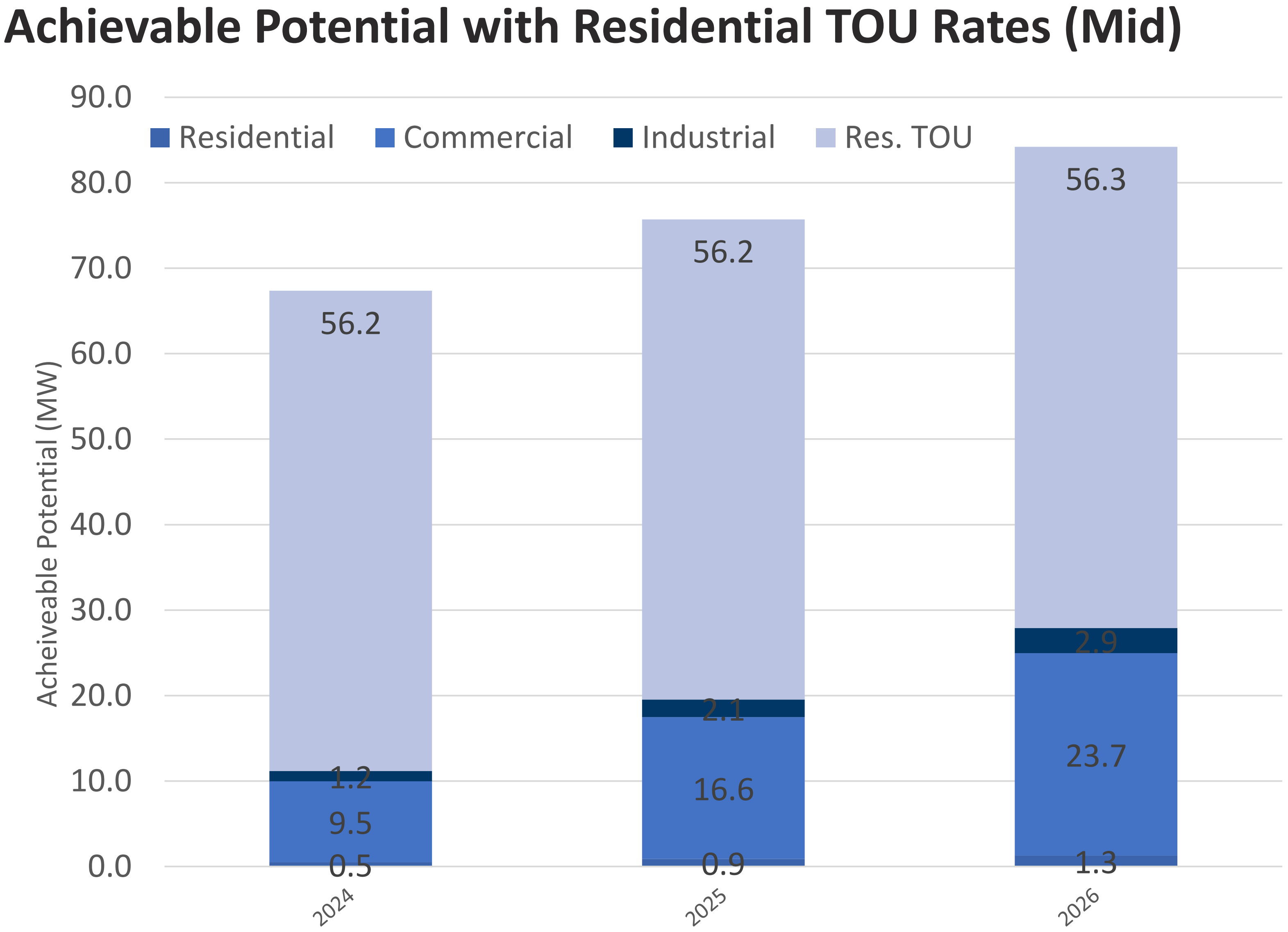

- Residential TOU rates (opt-out program) offer 56MW of potential savings when acting alone.
- However, TOU rates lowers the potential for other measures that may become largely redundant in a TOU model and as the load curve is shifted by TOU impacts.
- The net impact of adding TOU rates is an increase of 10MW of overall peak reduction potential by 2026 in the Mid scenario