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March 20, 2020

Public Utilities Commission
89 Jefferson Boulevard
Warwick, RI 02888

RE: Energy Efficiency Savings Targets, 2021-2023

Dear Chair Curran, Commissioner Anthony, and Commissioner Gold,

The Energy Efficiency and Resource Management Council (“the Council” or “EERMC”) conducted in-depth analysis, 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, subject to the PUC’s approval, will guide LCP 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 and 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 Targets captured in the table below to the PUC.

[INSERT THE TARGETS TABLES THAT THE EERMC CHOOSES AND/OR OTHER MODIFICATIONS APPROVED]

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 that these Targets will provide appropriate guidance to the implementation of LCP in Rhode Island in the 2021-2023 time period.

Respectfully Submitted, THE RHODE ISLAND ENERGY EFFICIENCY AND RESOURCE MANAGEMENT COUNCIL

By its attorney, /s/ _____

CERTIFICATE OF SERVICE I hereby certify that on the day of March 28, 2020, I delivered a true copy of the foregoing document either by first class mail or by electronic mail to the Rhode Island Public Utilities Commission as required by R.I.G.L. § 39-1-27.7.1(f).

/s/

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



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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 1¹, 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](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 not 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 prudence and reliability, as directed in the PUC’s LCP Standards³. 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. Many of these issues can be lumped in the “prudent and reliable” portion of the LCP law that directs that all cost-effective energy efficiency that is less than the cost of supply and can be reliably and prudently acquired is secured.

The Consultant Team represents that the primary obligation of the EERMC is the identification of all cost-effective savings. As spelled out in the LCP Standards, it is the Company, through the development of three year and annual plans, that is directed to determine what factors related to prudence and reliability should be applied to establish the appropriate savings goals to include in plans. It is not practical or possible for the EERMC to fully identify and vet this information ahead of the established process of planning that is currently in place. Any attempt at applying an estimate of quantification of prudent and reliable to inform how much less than all cost-effective savings is achievable is premature at the target-setting stage, and, given the established processes, unnecessary.

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 prudence 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 prudence and reliability are identified, discussed, quantified, and balanced in the planning process, with full engagement of stakeholders providing 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.

Option 1: Maximum Achievable Savings Beginning in 2021

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
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. 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, 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 for 2020 but not Actuals since year is not complete.

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

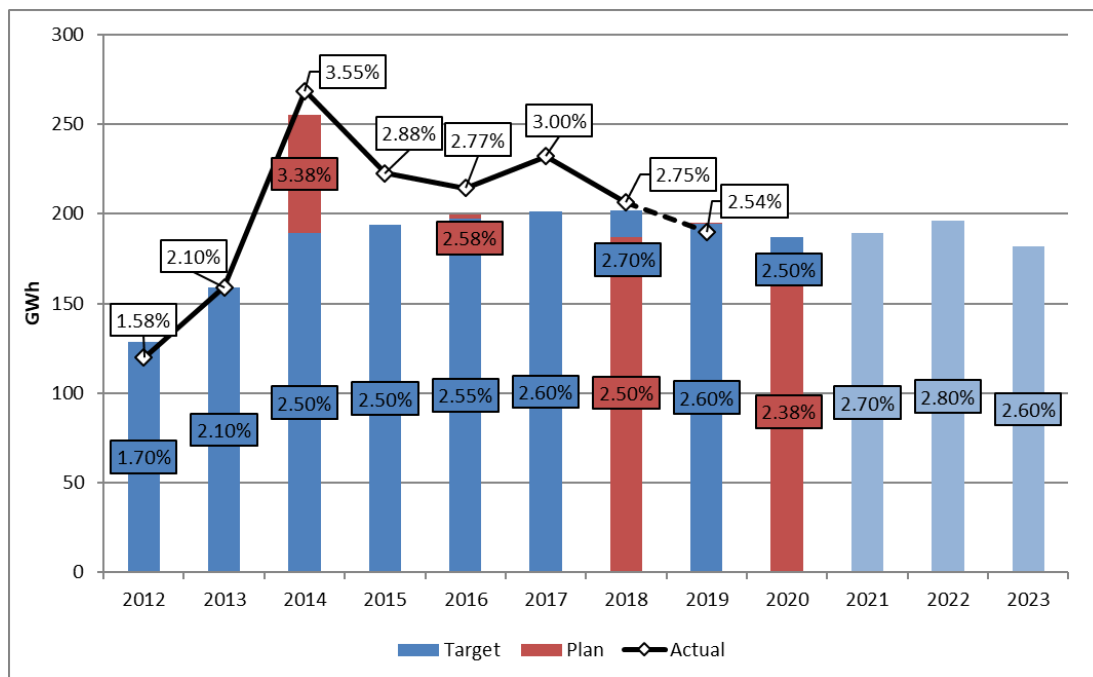
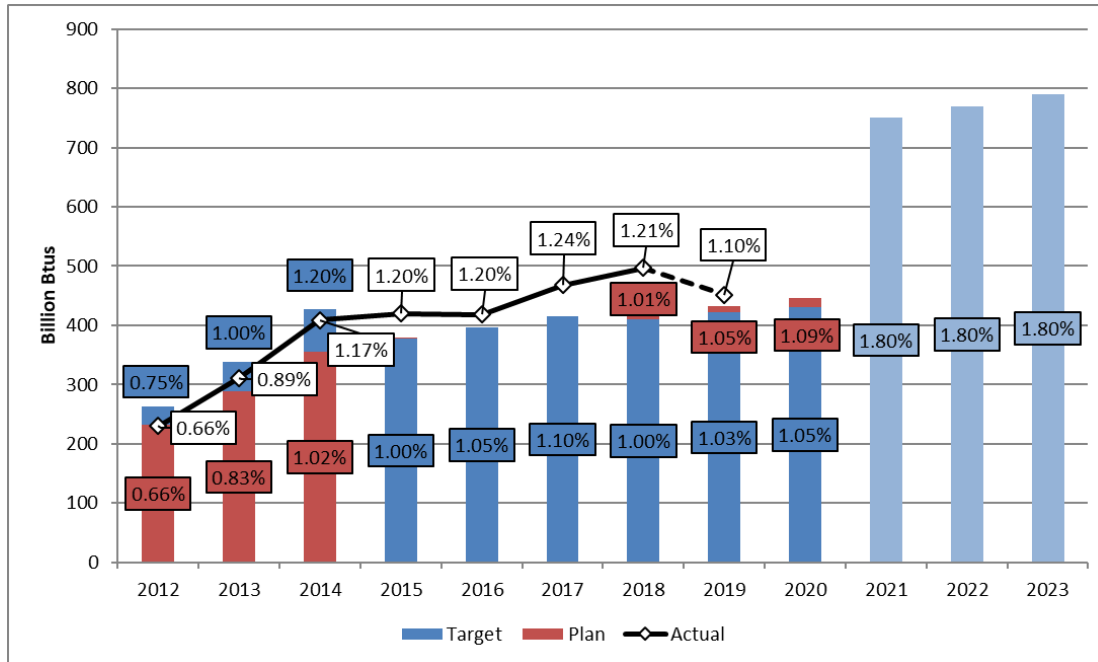


Figure 2. Rhode Island Annual Gas Energy Savings Targets, Plan Goals, and Actual Savings



Option 2: Ramp to Maximum Achievable Savings by 2023

Given that the purpose of the target-setting process is to support the legislated objective of securing all cost-effective energy efficiency less than the cost of supply, it is critical to encourage the Company to explore new approaches and program designs to capture as much of the documented available cost-effective energy efficiency savings as possible. And as covered previously in this document, a process exists via Three Year and Annual planning to work with the Company to fully review and vet all the barriers that preclude reaching the full Maximum Achievable savings in a well-documented, transparent process involving full stakeholder engagement and input. The many variables that would need to be addressed to most accurately inform the appropriate savings goals that would be achievable in each of the three years include workforce (including both external contractors and the Company staff), EE equipment supply chains, consumer education and awareness, and State policy objectives including equity and clean energy goals.

As part of the process of soliciting stakeholder input on behalf of the Council, the Consultant Team heard from the Office of Energy Resources, the Company and other stakeholders that in light of the significant gap between the Company’s current baseline performance and the full “all cost-effective” savings estimated to be available in the Market Potential Study’s Maximum Achievable Scenario, it is expected that any plan for the upcoming three years will involve Plan saving goals that ramp up toward maximum achievable savings levels over the three years. In acknowledgement of this feedback, and without benefit of the upcoming fuller process to evaluate all the barriers that would inform just how far below Maximum Achievable the Company can deliver, the Consultant Team includes an alternative set of targets below, which begin with the ‘Mid’ scenario results from the Market Potential Study in

2021, and ramp linearly to the ‘Max’ scenario by 2023. Because of this, the value for 2022 is not drawn from a specific scenario, but simply represents the midpoint between the ‘Mid’ and ‘Max’ scenarios, to reflect the time needed to ramp toward maximum achievable levels.

Table 4. Energy Savings Targets (Lifetime Energy Savings), Option 2

Year	Electric Energy (MWh)	Natural Gas Energy (MMBtu)	Delivered Fuel Energy (MMBtu)
2021	1,633,816	7,484,423	2,859,699
2022	1,846,541	8,721,275	3,333,116
2023	2,059,265	9,958,127	3,806,532

Table 5. Electric Peak Demand Reduction Targets (Annual MW), Option 2

Year	Total Electric Peak Demand Reductions	Energy Efficiency Passive Peak Demand Reduction	Active Demand Response Peak Demand Reduction
2021	50.2	26.2	24.0
2022	79.1	29.9	49.3
2023	108.0	33.5	74.5

Note on Table 5: ‘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 6. CHP Electric Energy Savings and Peak Demand Reduction Targets, Option 2

Year	CHP Electric Energy Savings (Lifetime MWh)	CHP Peak Demand Reduction (Annual MW)
2021	296,409	4.5
2022	509,873	7.8
2023	723,337	11.1

Even if this alternative set of “ramp” targets is adopted, the Consultant Team recommends the Council include a clear request to the Company to fully explain the difference between savings goals established during the planning process and the Maximum Achievable results scenario from the Market Potential Study from the first year through to the third year.

APPENDIX A: MARKET POTENTIAL STUDY OVERVIEW



Rhode Island Energy Efficiency Market Potential Study Final Results

March 13, 2020

Agenda

Introduction |

Study Overview |

Results |

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

Conclusions |

Study Overview

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

Energy Efficiency (EE)

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**

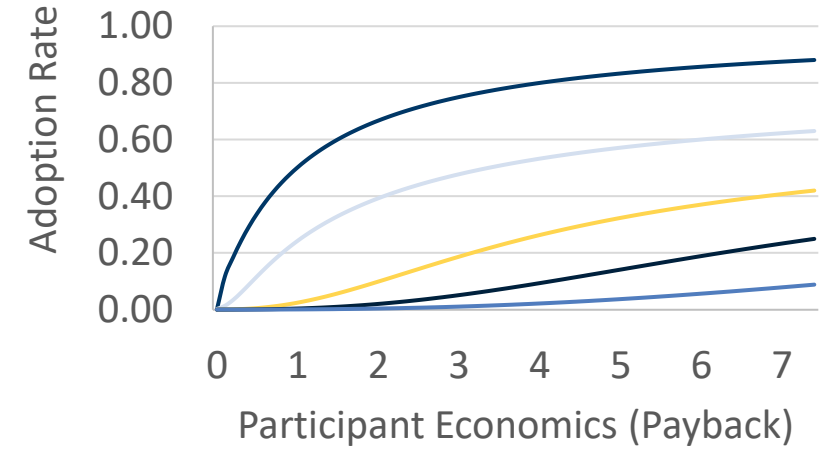
Mid

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**

	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.

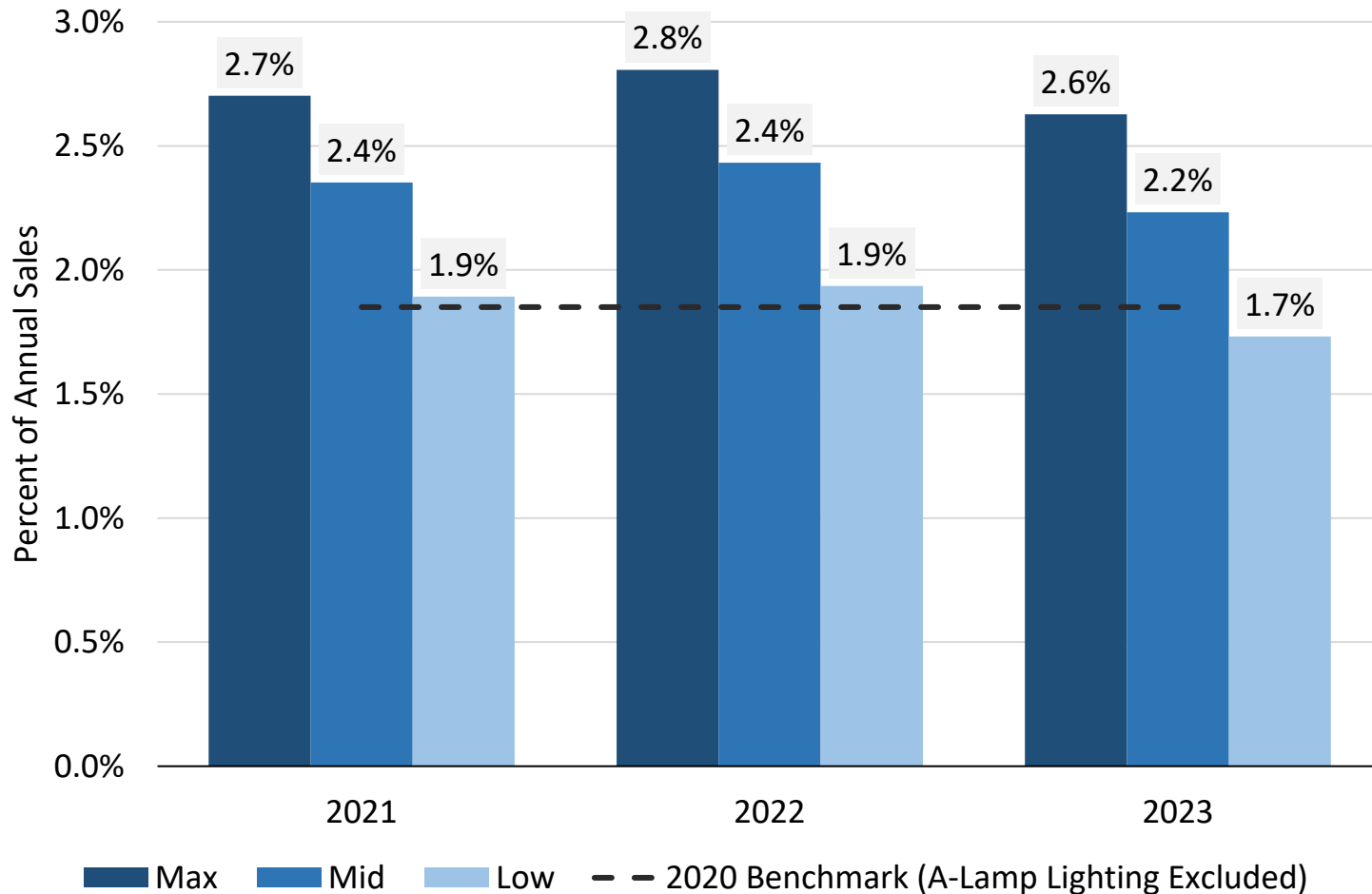
Additional quality control resulted in the following changes:

- 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%

Annual Electric Savings as Percentage of Forecasted Electricity Sales*

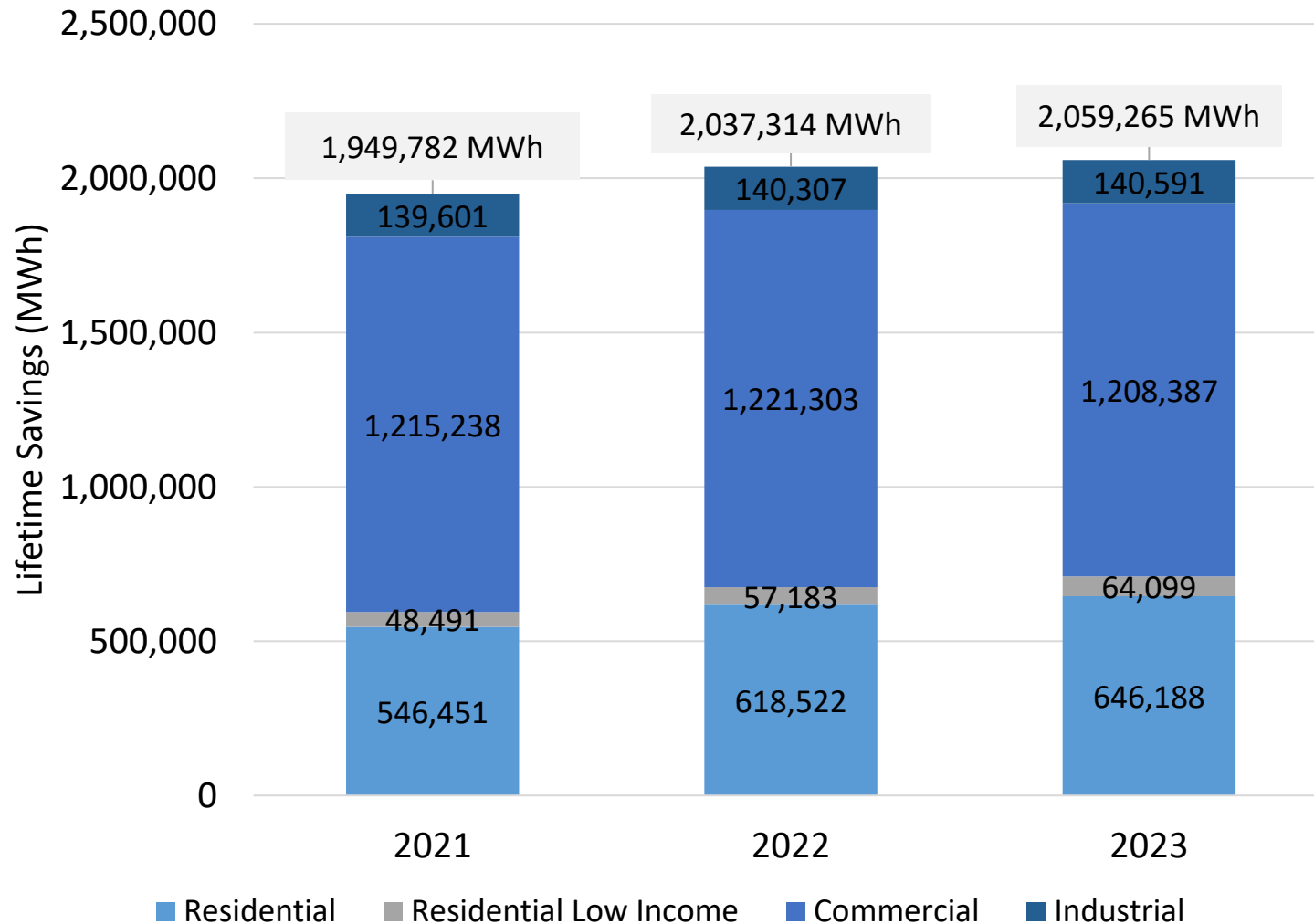


- Low Scenario aligns with 2020 Plan savings when A-Lamp savings are excluded.
- Savings decline in 2023 as significant lighting measures leave the programs and saturation of other lighting measures.

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%

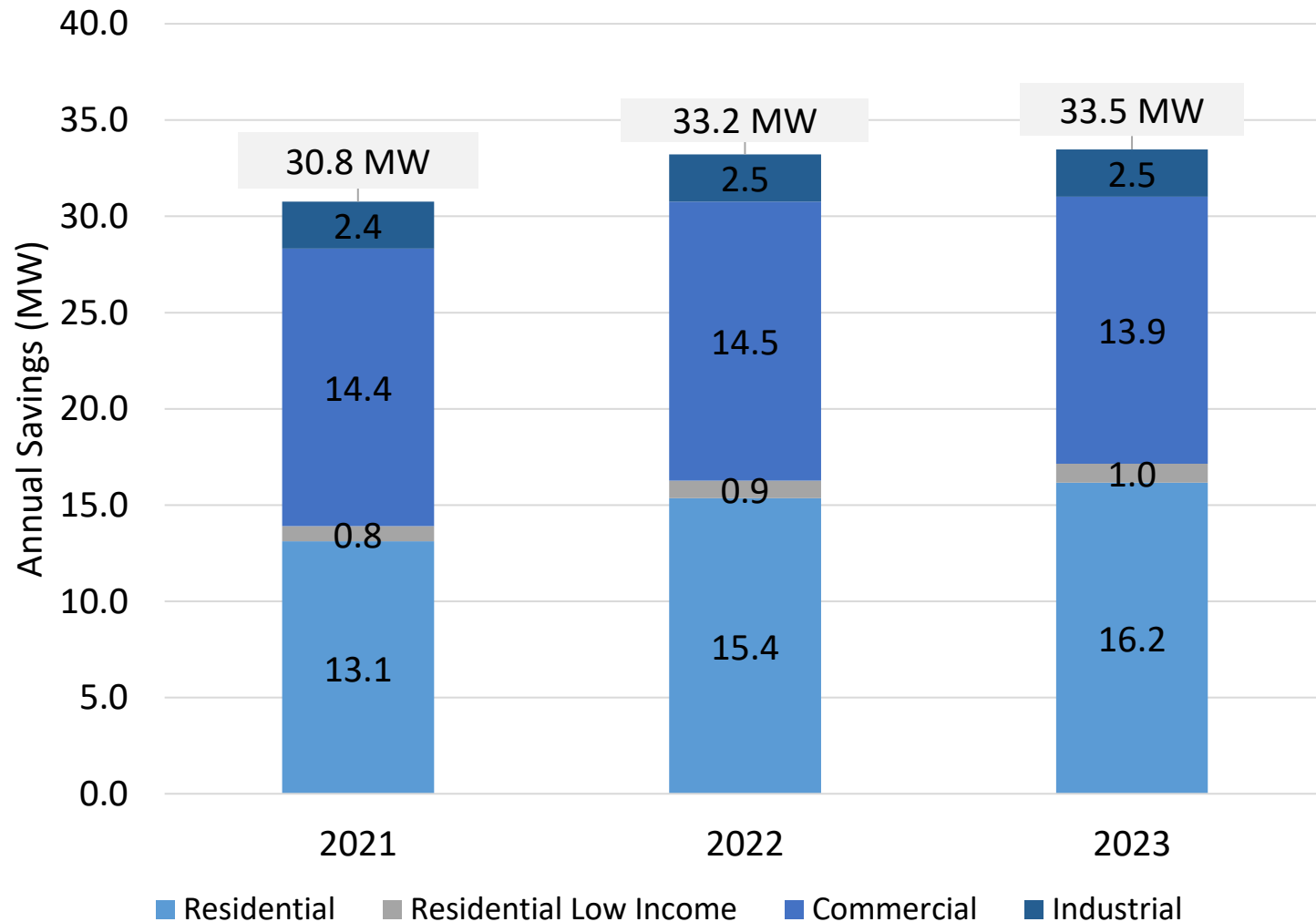
*Dunsky treated National Grid’s 2021-2026 forecasted electric sales to remove assumed EE savings to estimate percent savings for each year of the study.

Lifetime Electric Savings by Sector (Max)



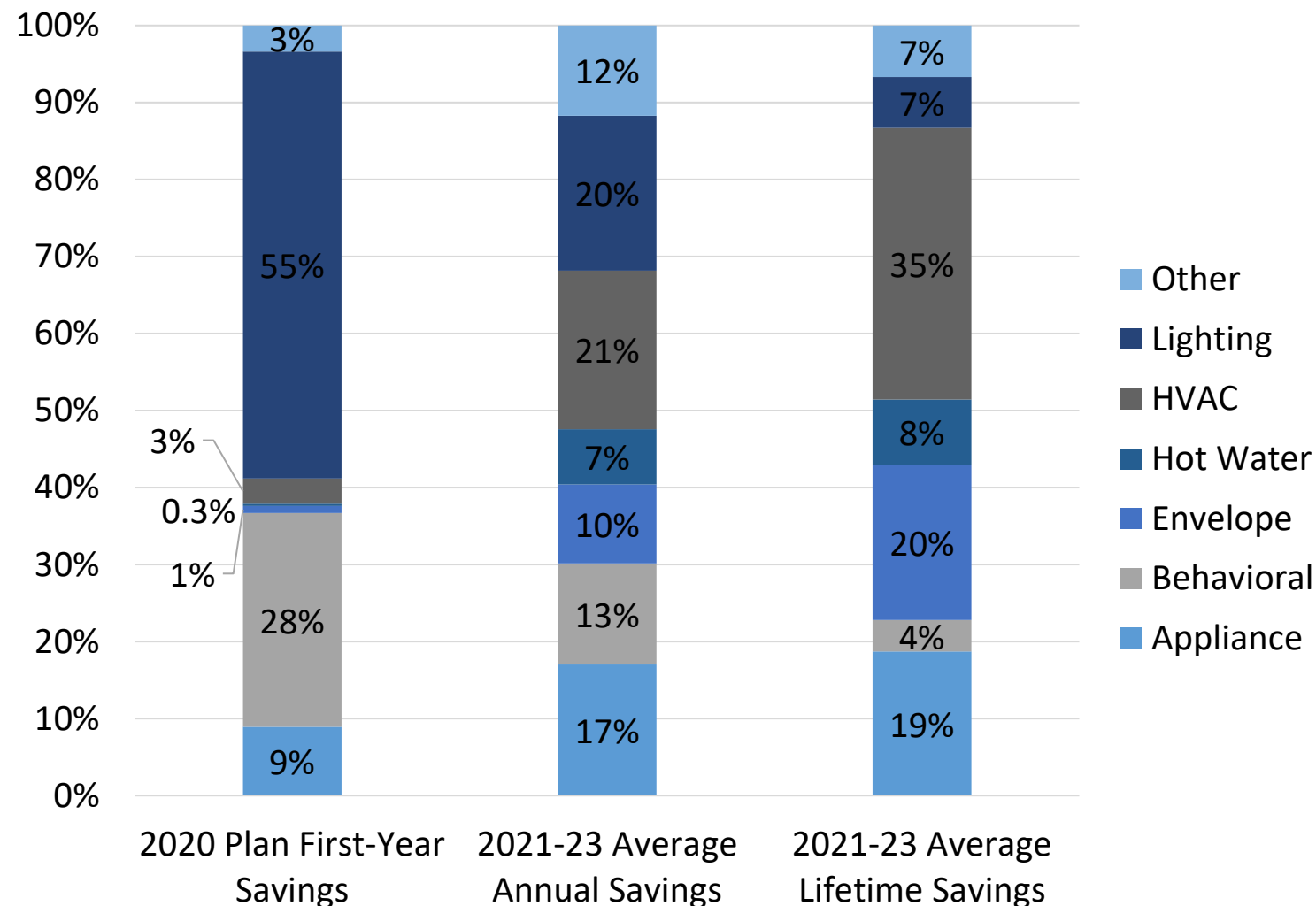
- Bulk of electric savings come from residential and commercial sectors
- Lifetime savings increase slightly year-over-year even while annual savings decline in 2023 (previous slide) as longer-lived measures ramp up and replace reduced lighting savings

Annual Passive Peak Demand Reduction by Sector (Max)



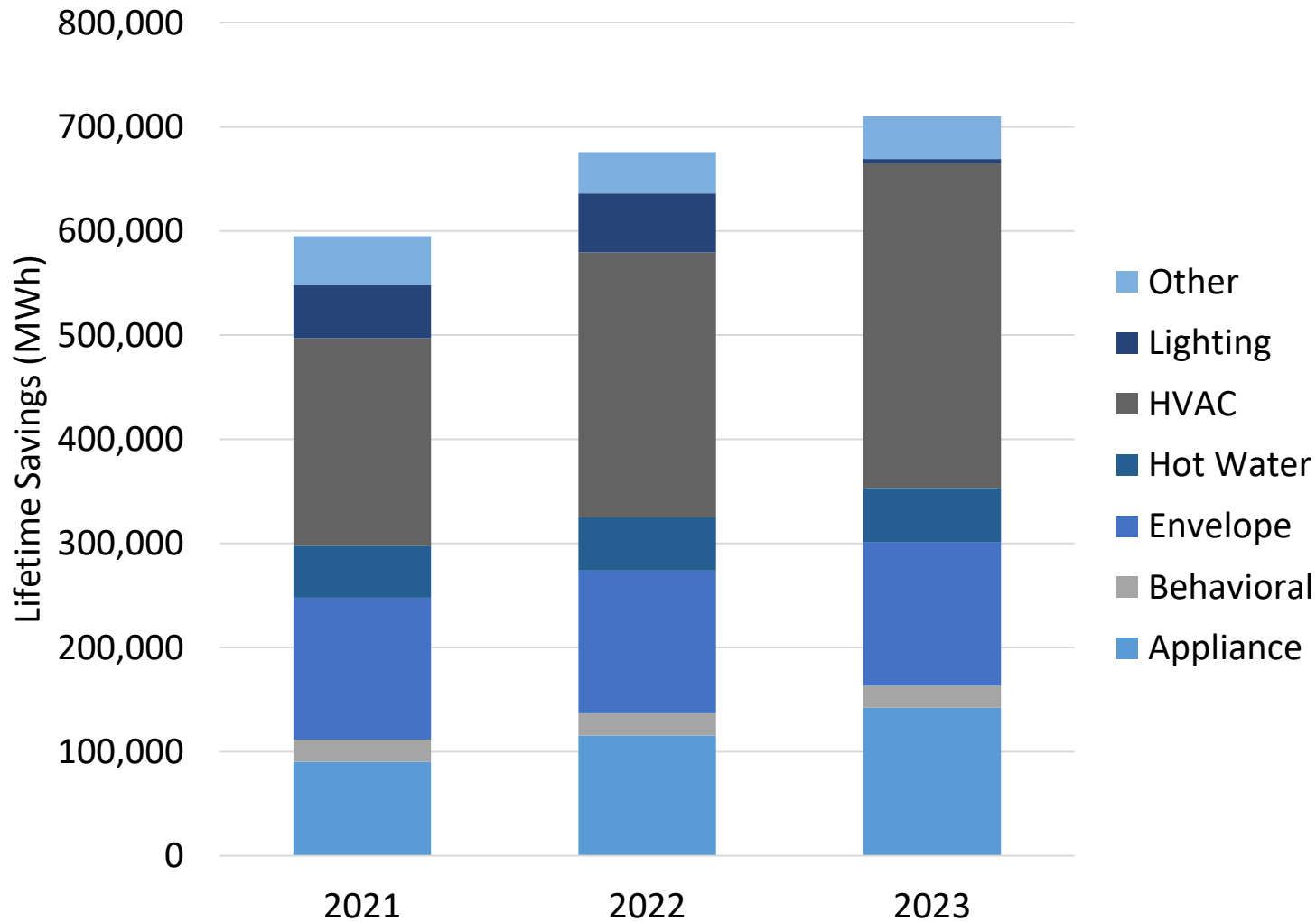
- Similar to energy savings, bulk of passive demand savings come from residential and commercial sectors

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.

Despite loss of lighting, lifetime residential savings grow



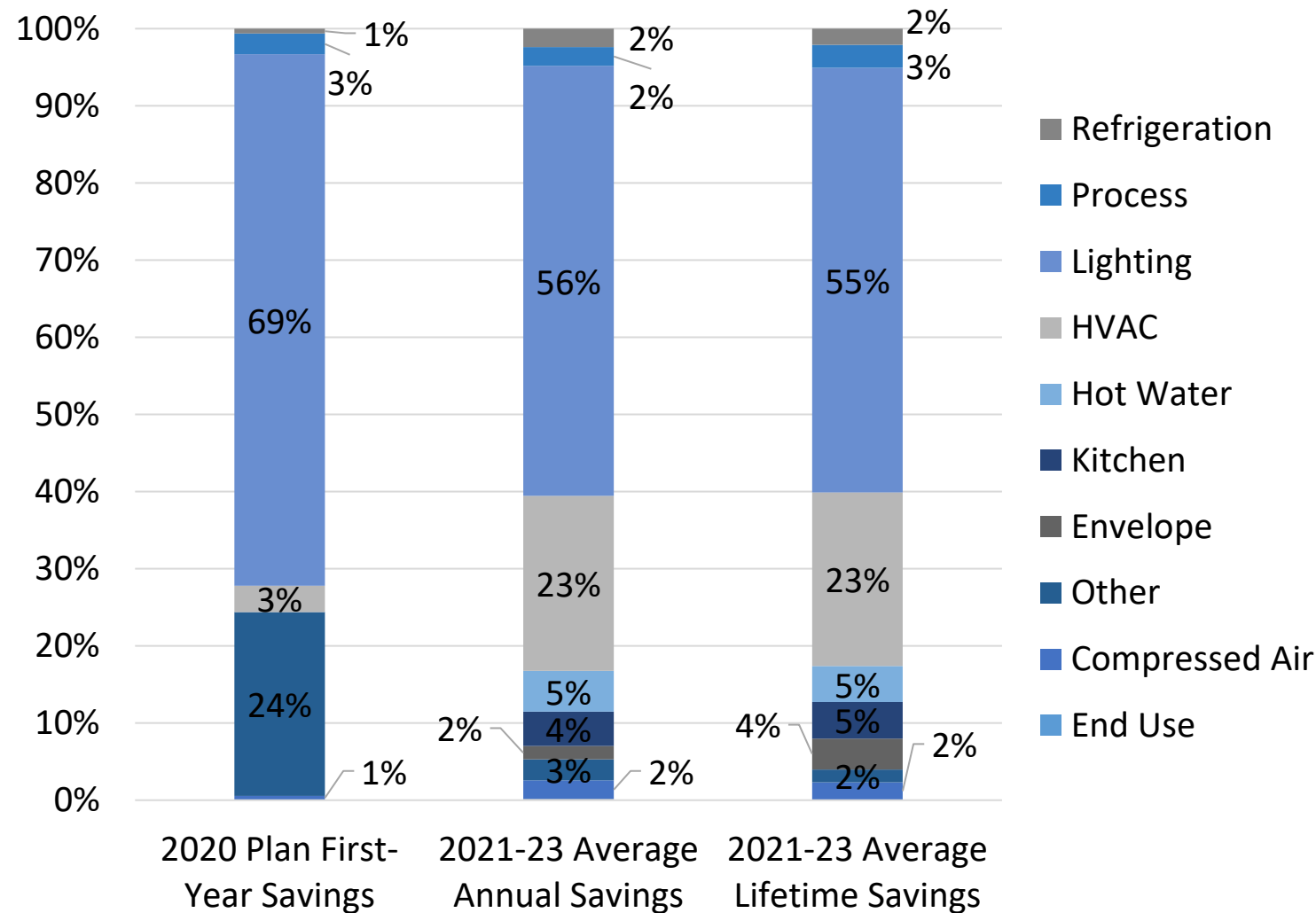
- In the residential sector, increased lifetime savings from long-lived measures (HVAC and appliance) more than make up for reduction of lighting savings in 2023 as the market transforms
- However, in annual terms, savings drop in 2023 as lighting exits the market

Residential EE Savings, Max Scenario (MWh)

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

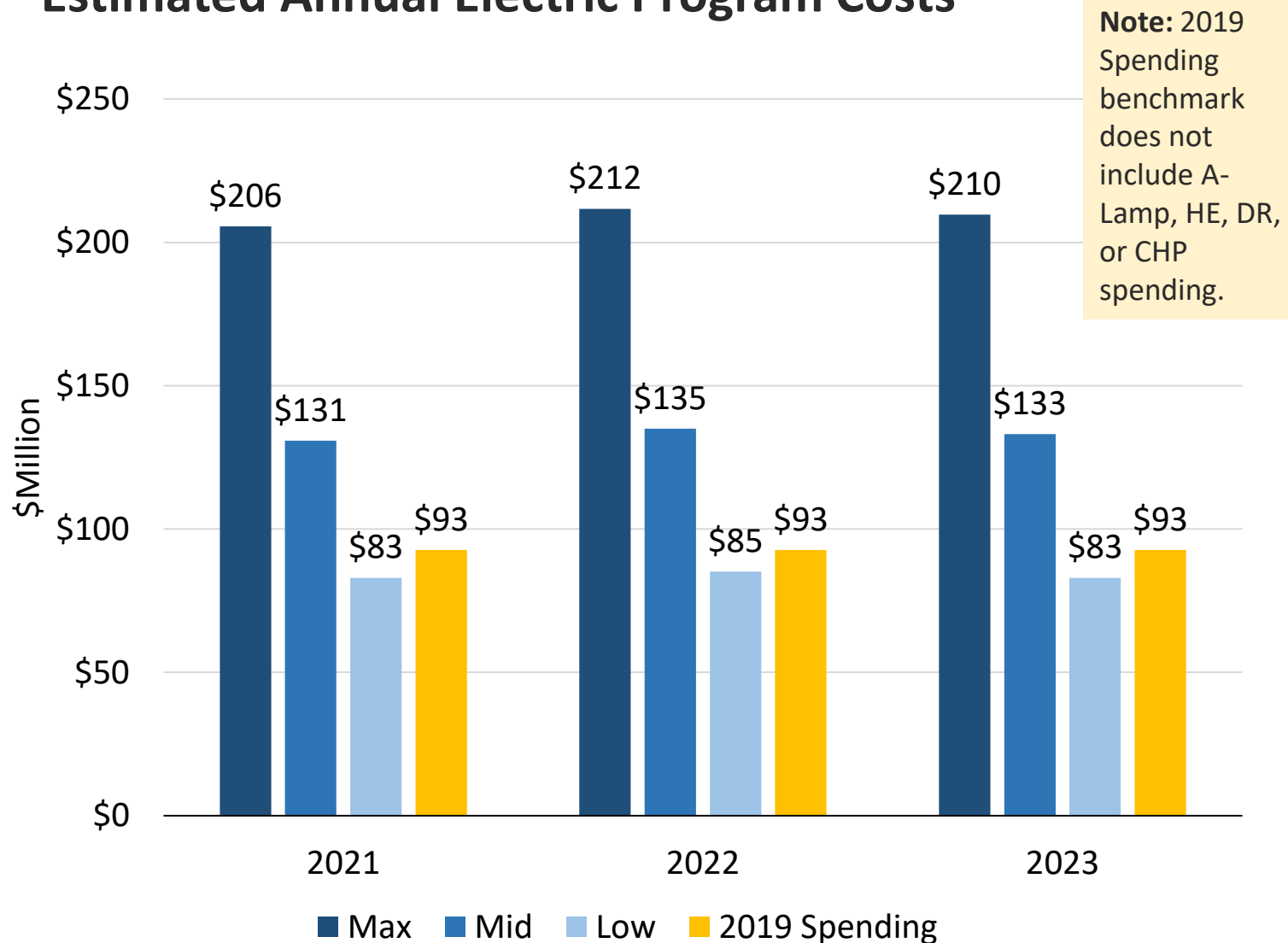
*Graph shows combined savings for both residential and low-income residential customers

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.

Estimated Annual Electric Program Costs

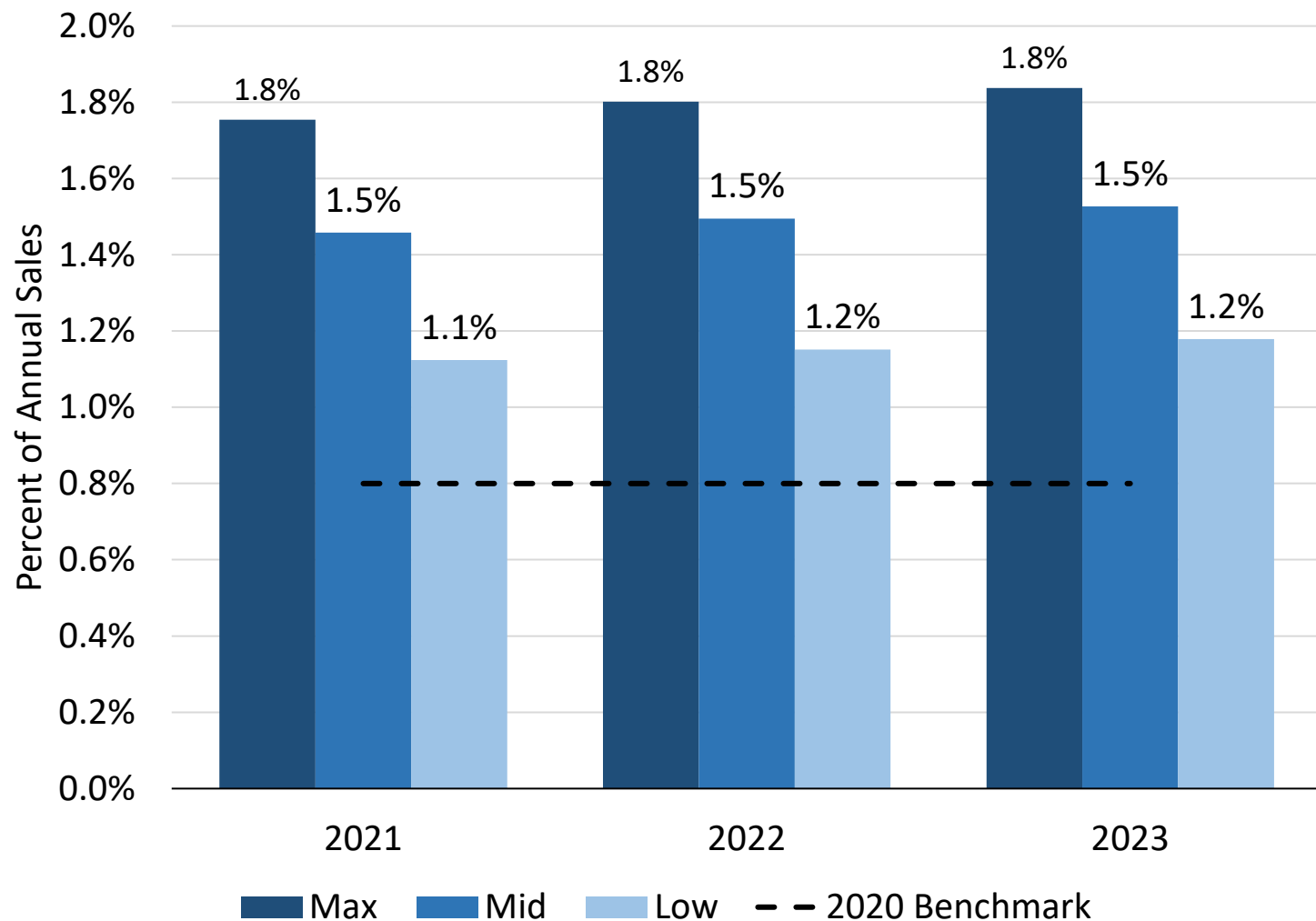


- Total costs and marginal cost per unit savings increase with savings
- Potential study estimated budgets do not account for portfolio optimization and program design improvements

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

Annual Gas Savings as Percentage of Forecasted Gas Sales*

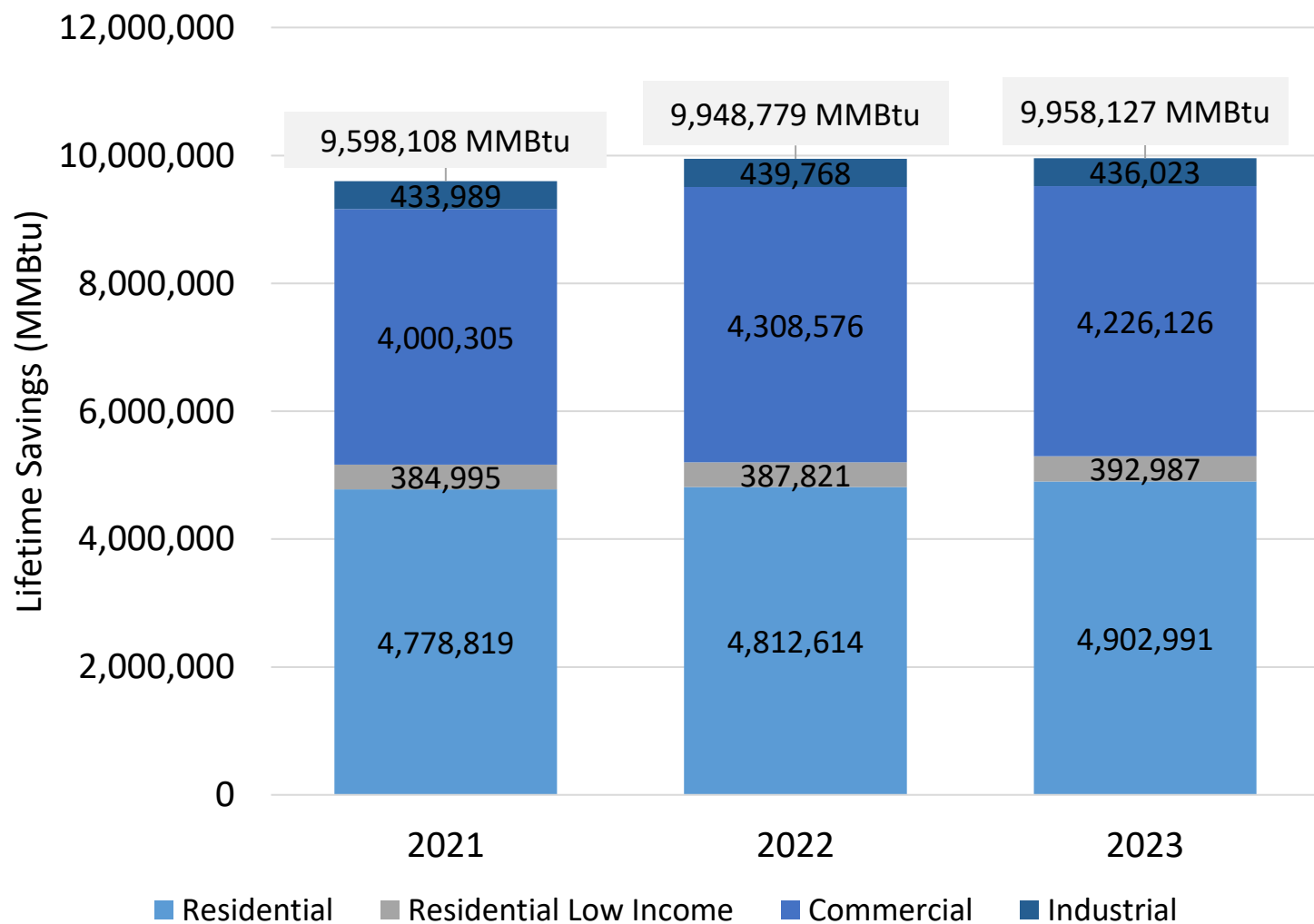


- Low Scenario exceeds 2020 plan, but is similar to 2019 portfolio results
- Mid and Max show notable upside potential

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

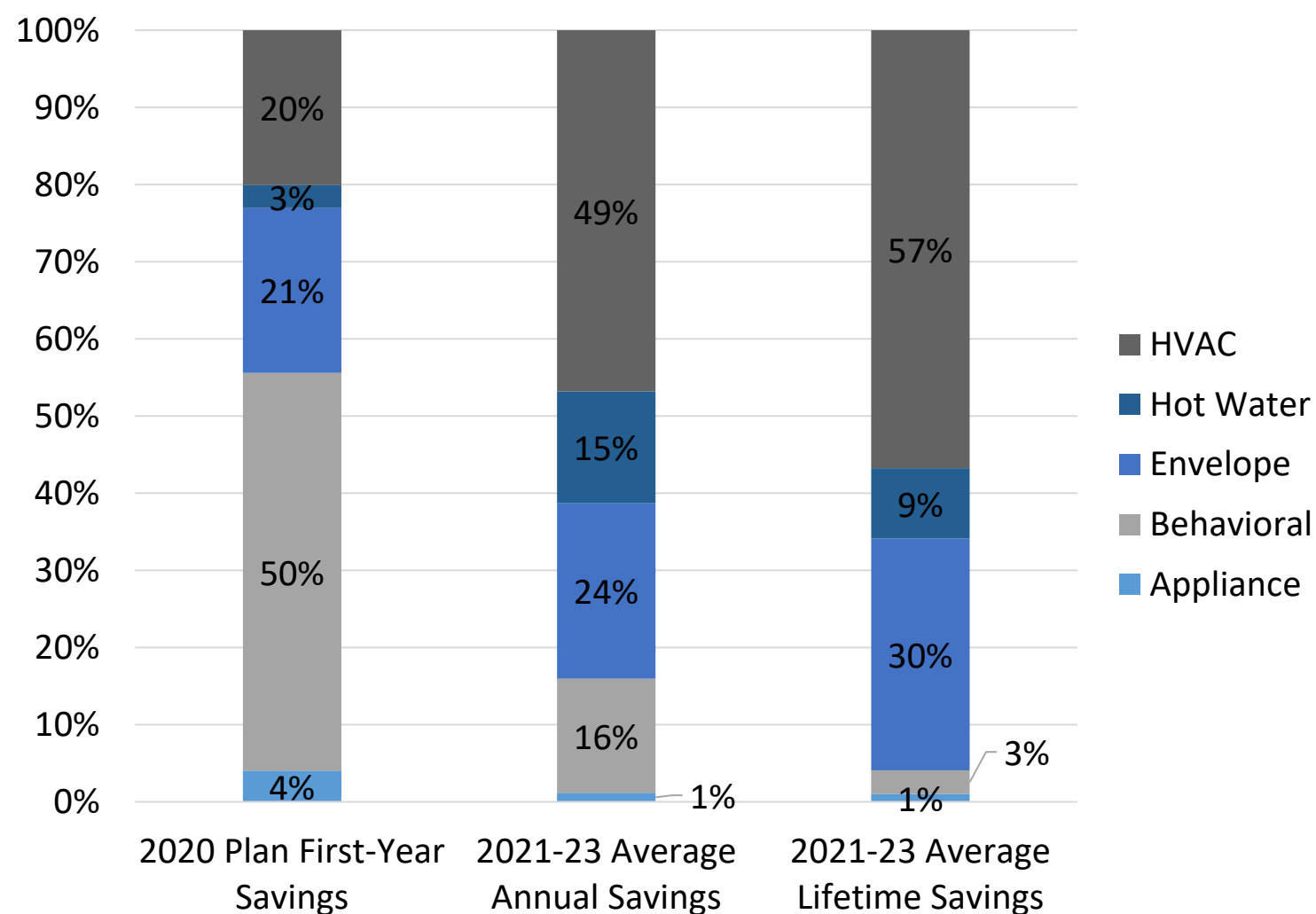
*Dunsky treated National Grid's 2021-2026 forecasted gas sales to remove assumed EE savings to estimate percent savings for each year of the study.

Lifetime Gas Savings by Sector (Max)



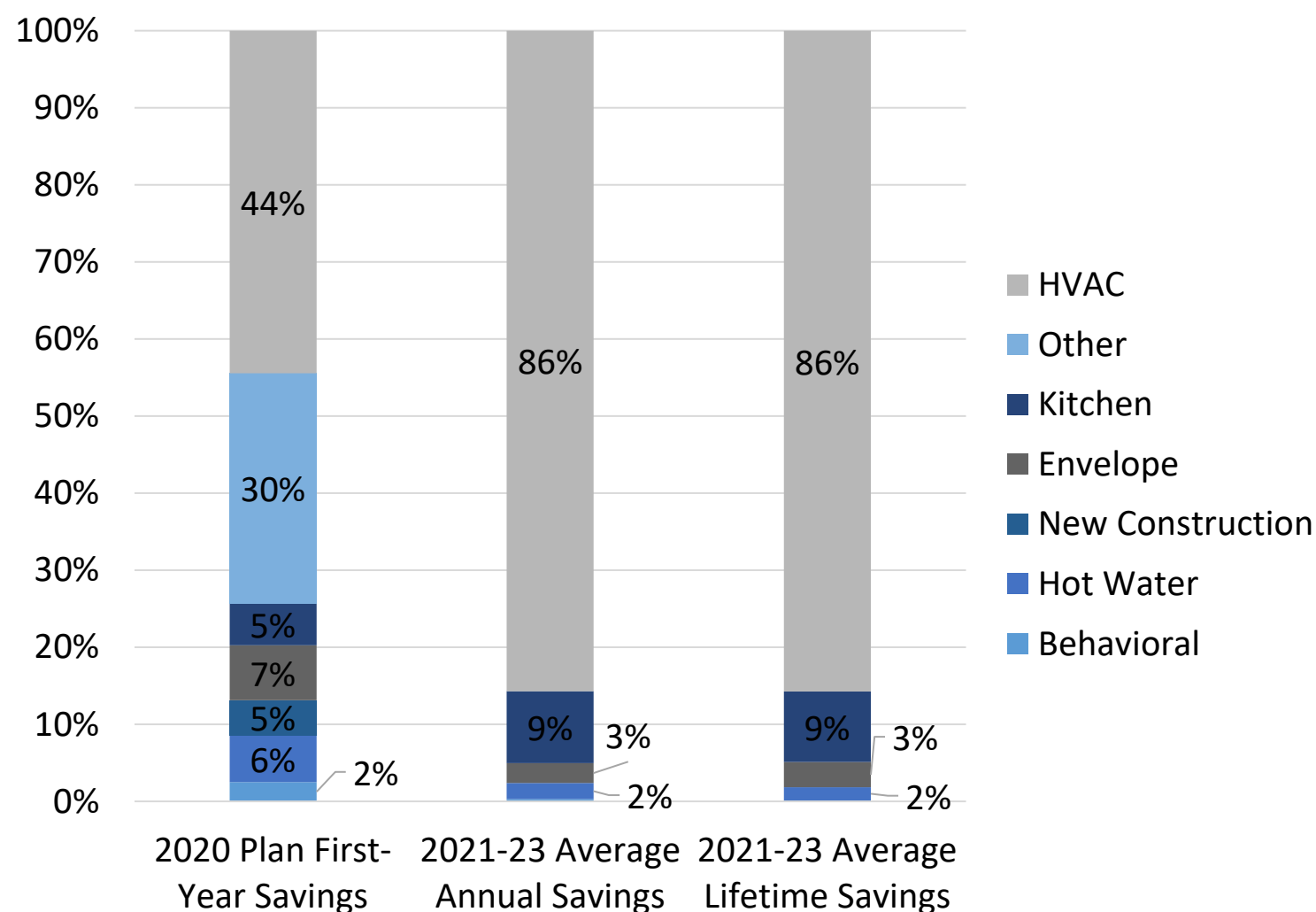
- Commercial sector is the slight majority of EE gas savings
 - Residential sector savings driven by single family segment.
 - Commercial sector savings driven office, retail, education/campus and lodging segments.
- Residential sector shows significant upside between Low and Mid scenarios – increasing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

Proportion of Residential Savings by End Use



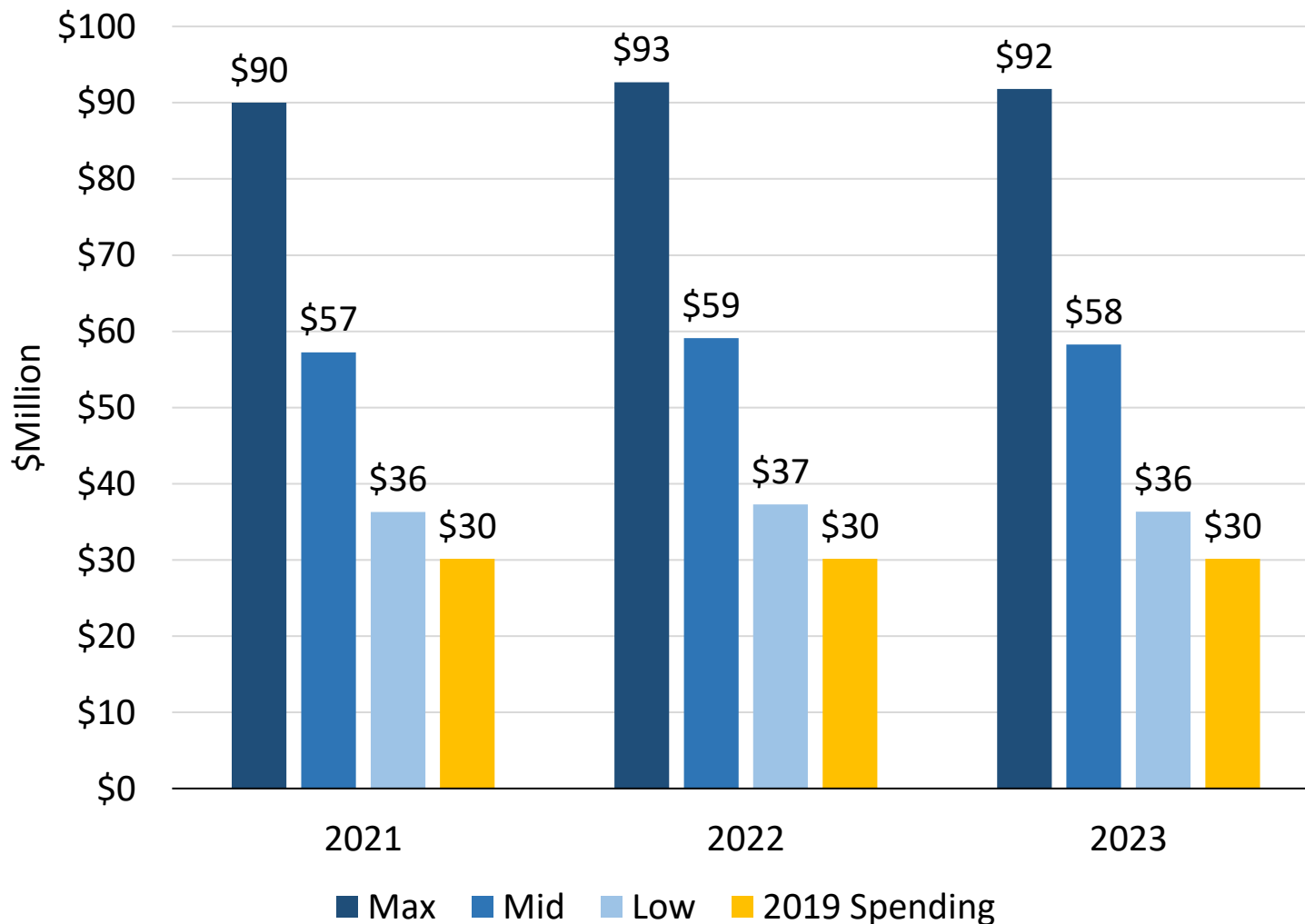
- On an annual basis, nearly half of residential savings come from HVAC measures
- The impact of HVAC and envelope measures increases when viewed from a lifetime savings perspective, while the behavioral savings portion drops

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

Estimated Annual Gas Program Expenditures

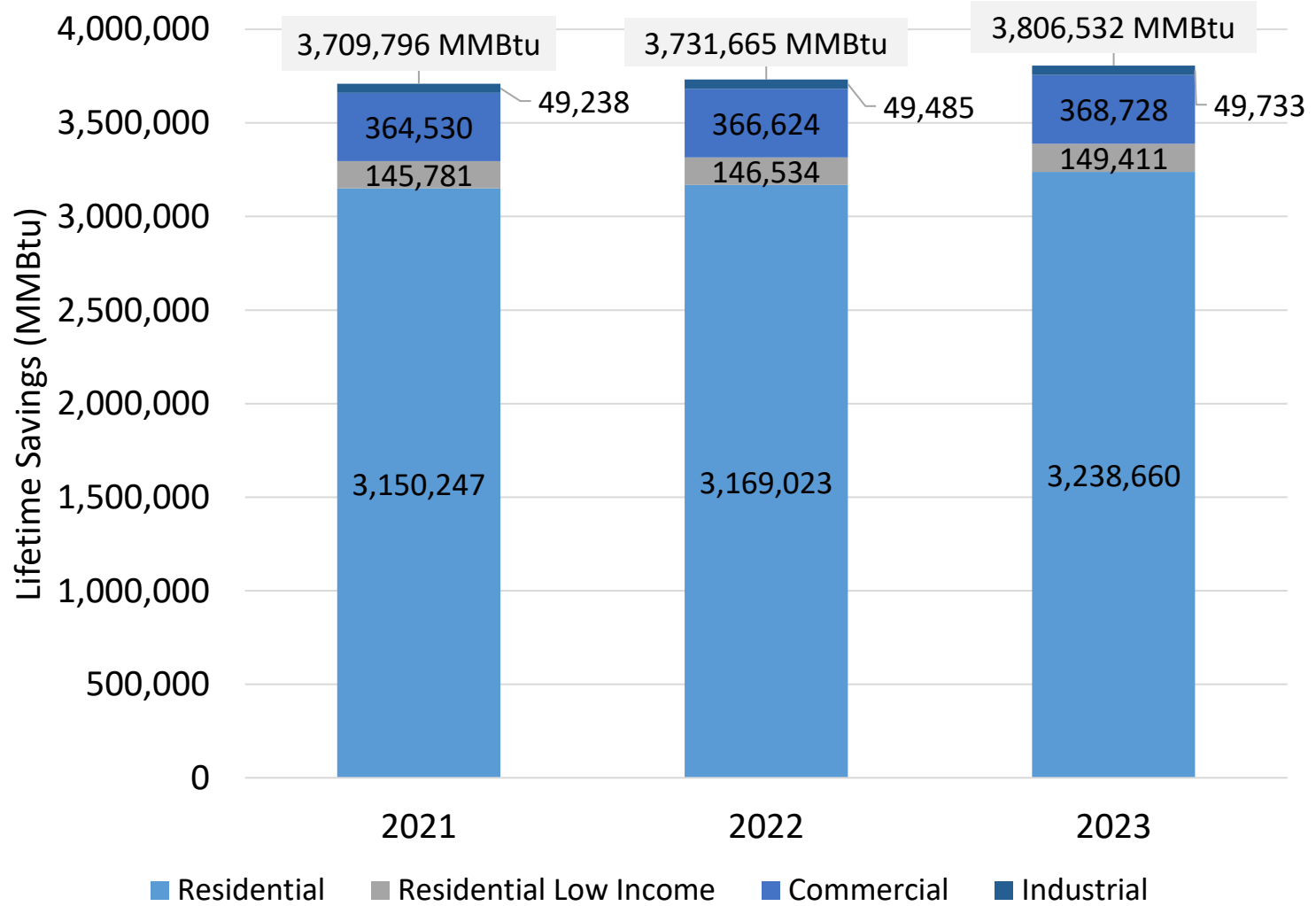


- Estimated total costs and marginal cost per unit savings increase with savings
- Potential study estimated budgets do not account for portfolio optimization and program design improvements.

Estimated 2021 Acquisition Costs

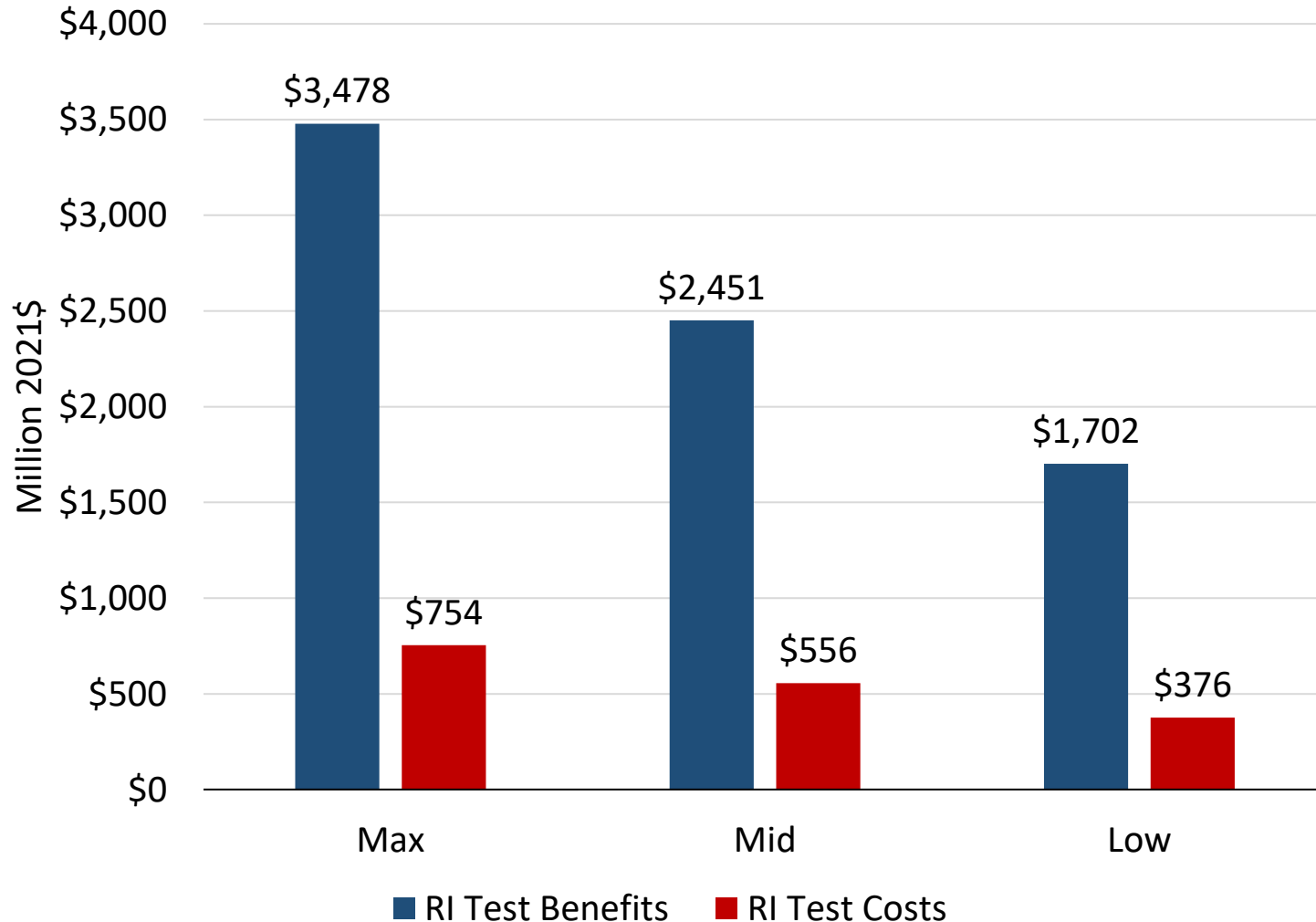
Scenario	\$ per Annual MMBtu	\$ per Lifetime MMBtu
Max	\$120.09	\$9.38
Mid	\$91.92	\$7.65
Low	\$75.62	\$6.95
2019 Results	\$66.79	\$6.66

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

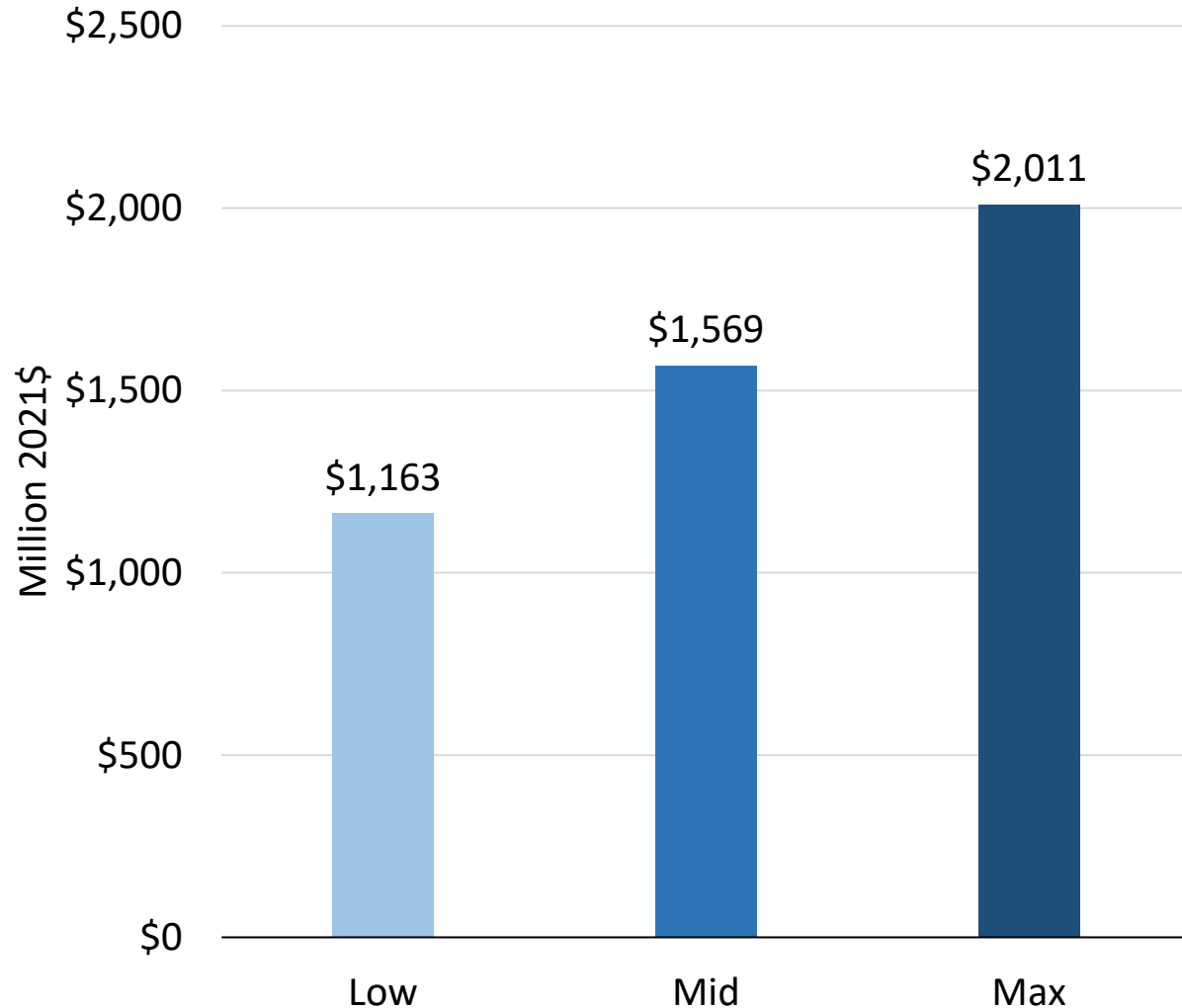
Total Rhode Island Test Benefits and Costs by 2023



- 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	

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

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 than historical program results... *however*, the 3-year portfolio can offer up to \$2.8Bn in net benefits to Rhode Islanders.

Demand Response

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.

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**

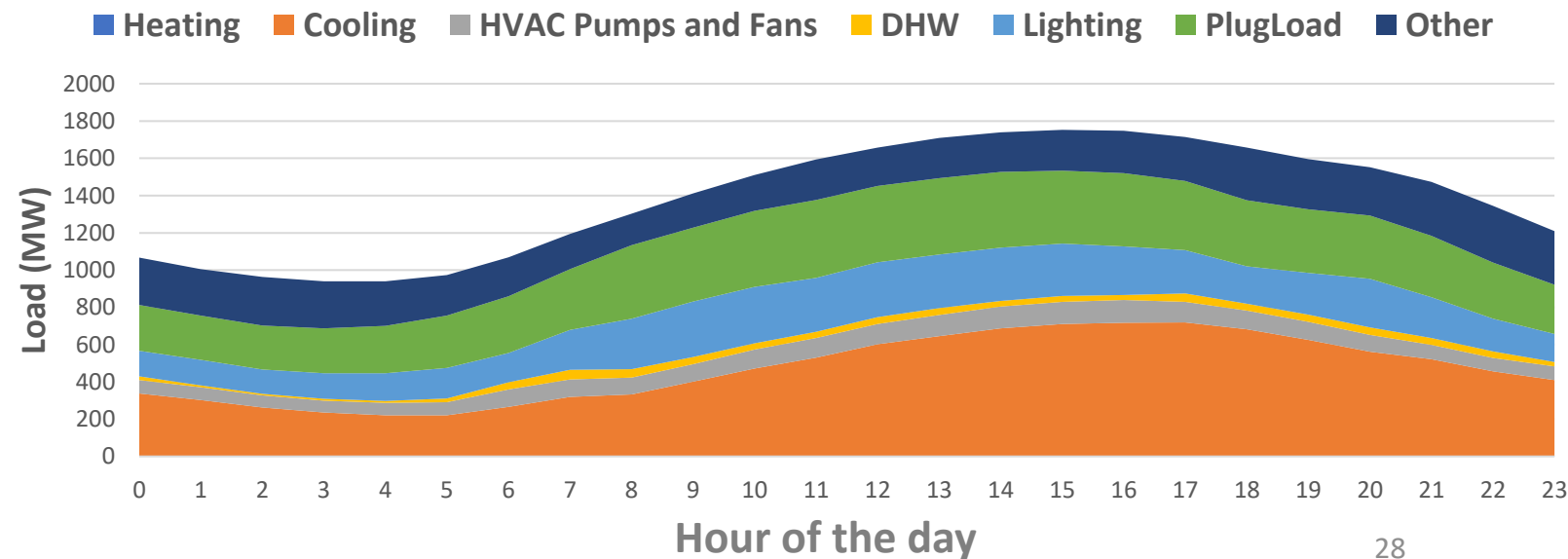
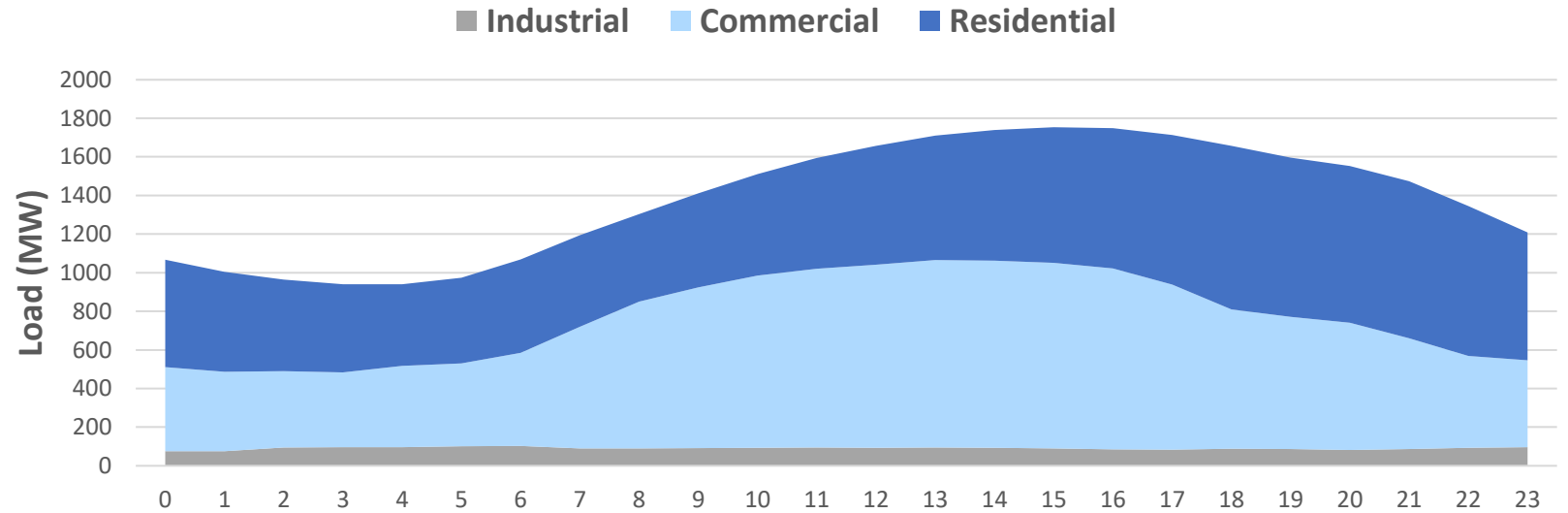
Model Refinement:

- 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)

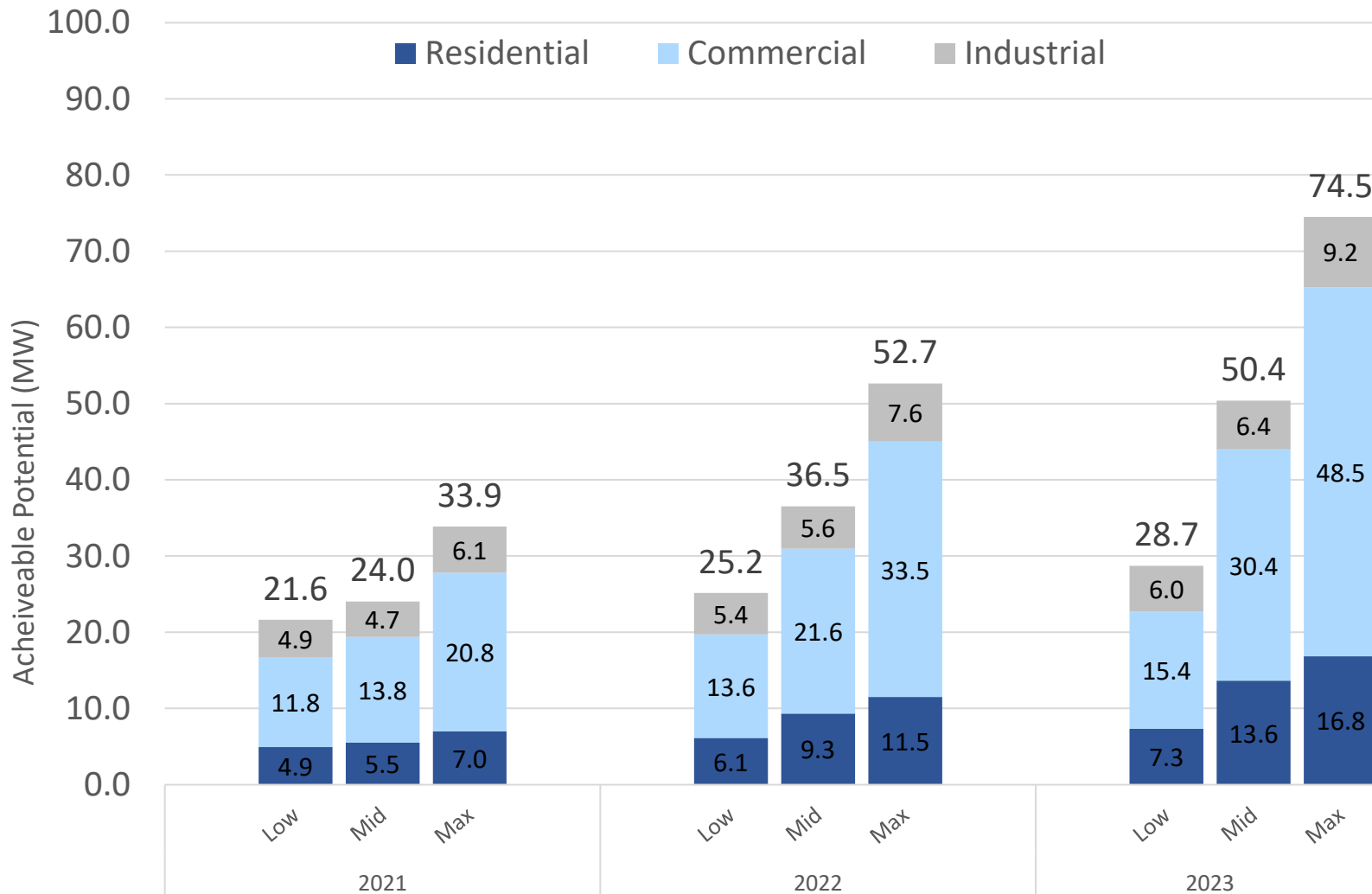
DR: Peak Load Breakdown

- 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

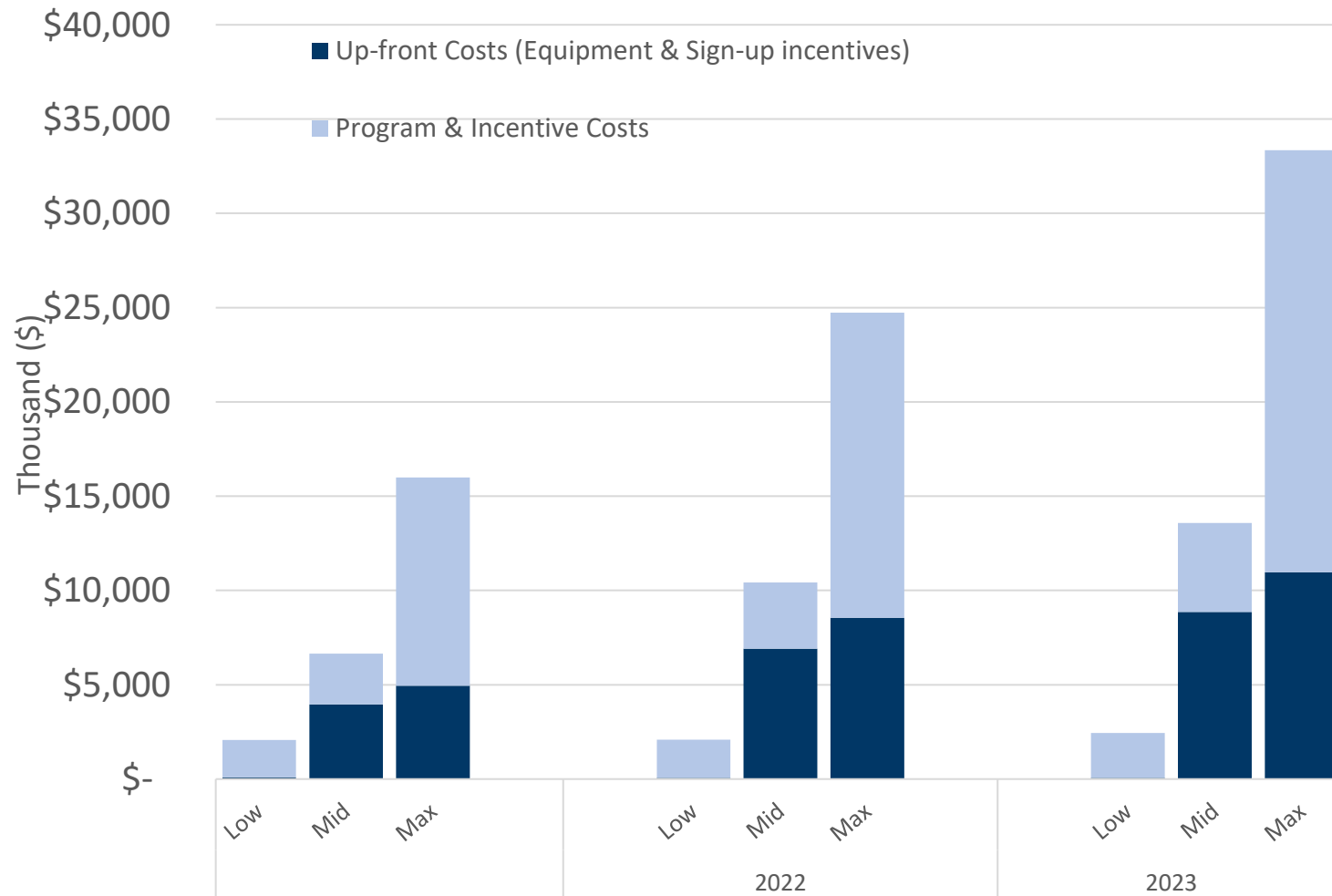


Achievable Annual Peak Demand Reduction from DR (MW) by Scenario

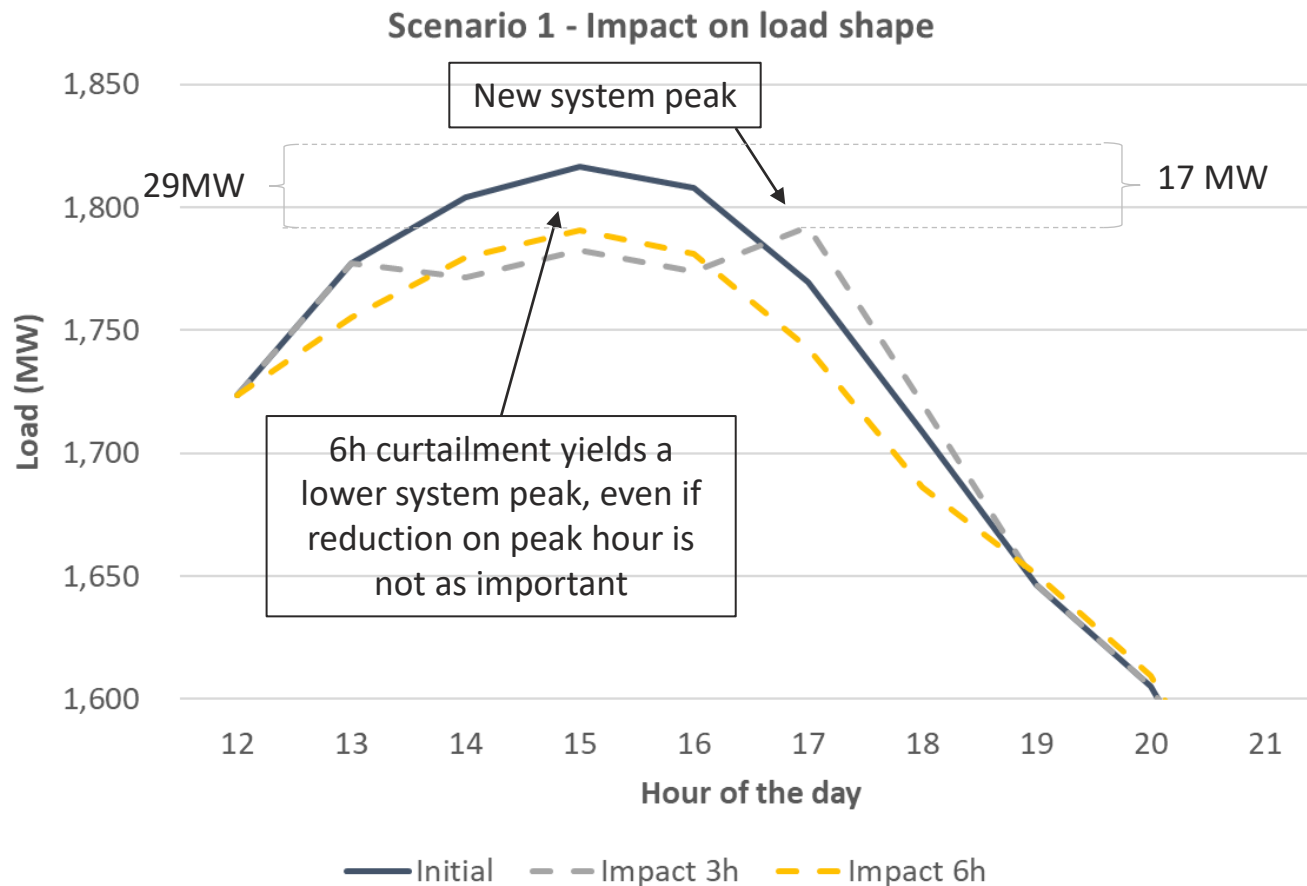


- Economic potential assessed at: 125 MW*
- Residential DR has lots of room to grow
- Expanding programs has bigger effect than simply raising incentives
- Budgets range from \$2M to \$33M per year. Mid scenario appears to offer best savings/cost balance.

DR Portfolio Costs (\$1000) by scenario



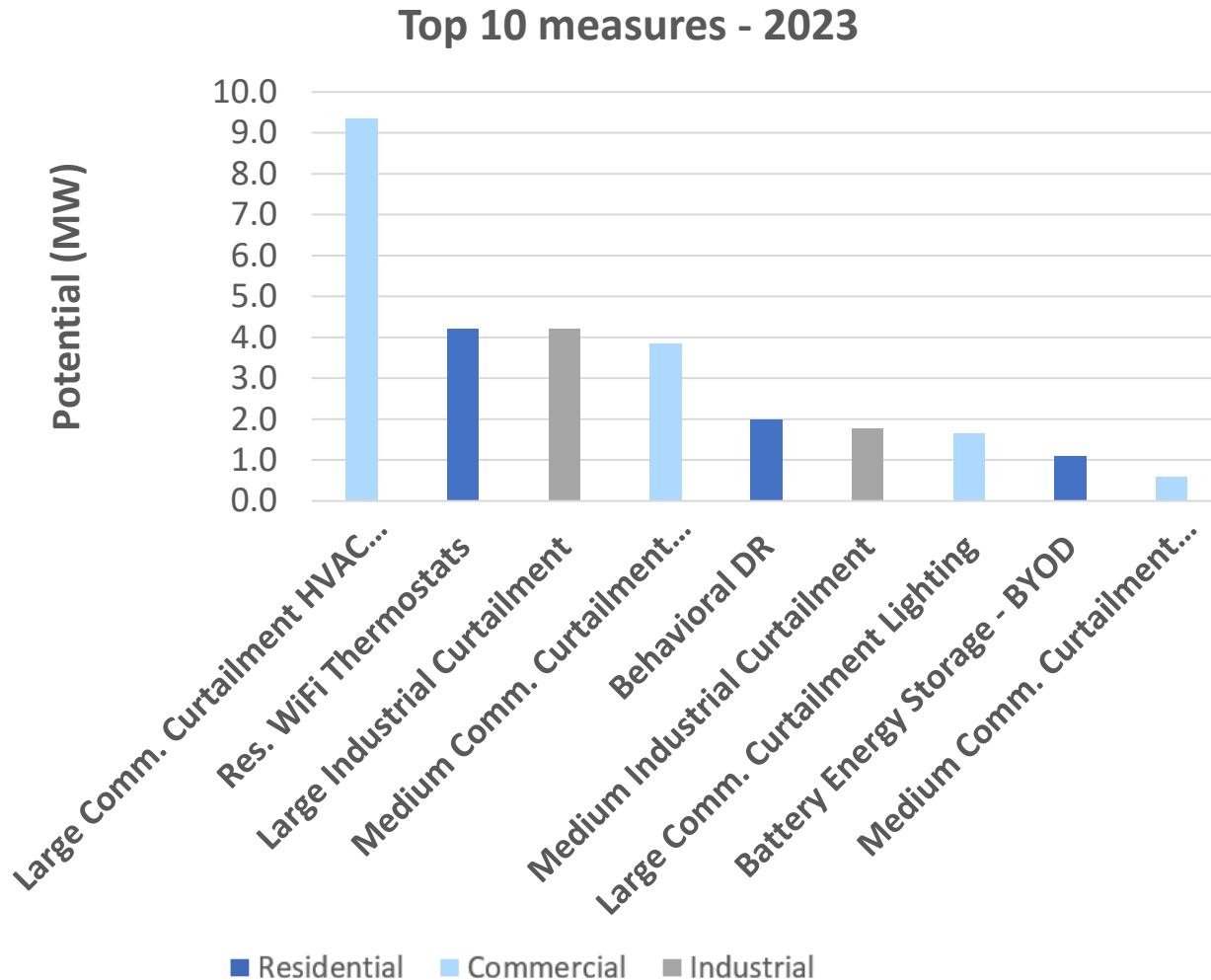
- Increasing impact come at significantly increased cost
- Mid and Max scenarios involve notable investment in early years to install equipment (controls, battery storage, etc)
- The Max scenario is more focused on high curtailment incentives, which need to be paid each year to drive peak reductions.
- 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)



- 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

Top 10 Measures: 2023 Achievable Potential (MW)

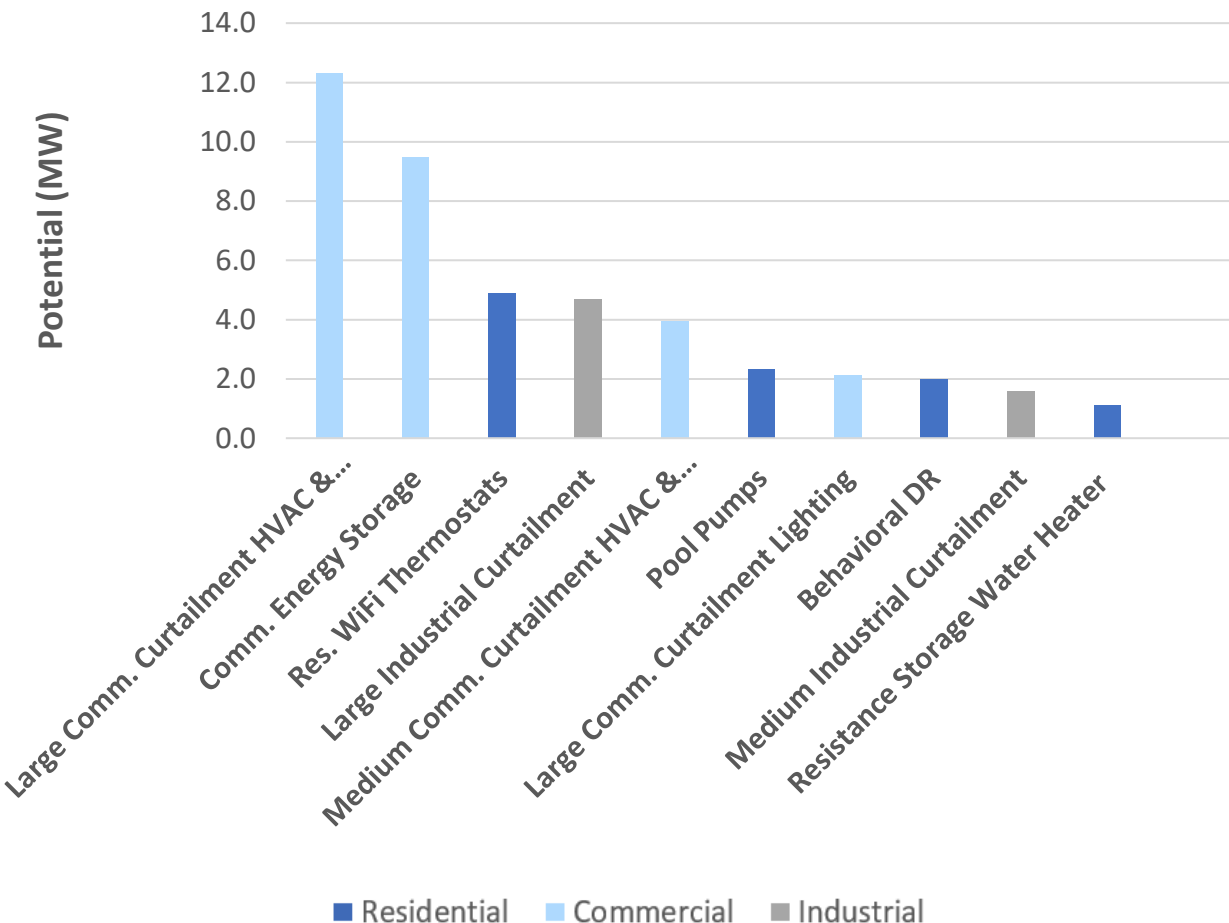


- Central AC shows notable potential for current program expansion, could integrate with efficient AC incentives
- Did not apply any growth to Behavioral DR

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

Top 10 Measures: 2023 Achievable Potential (MW)

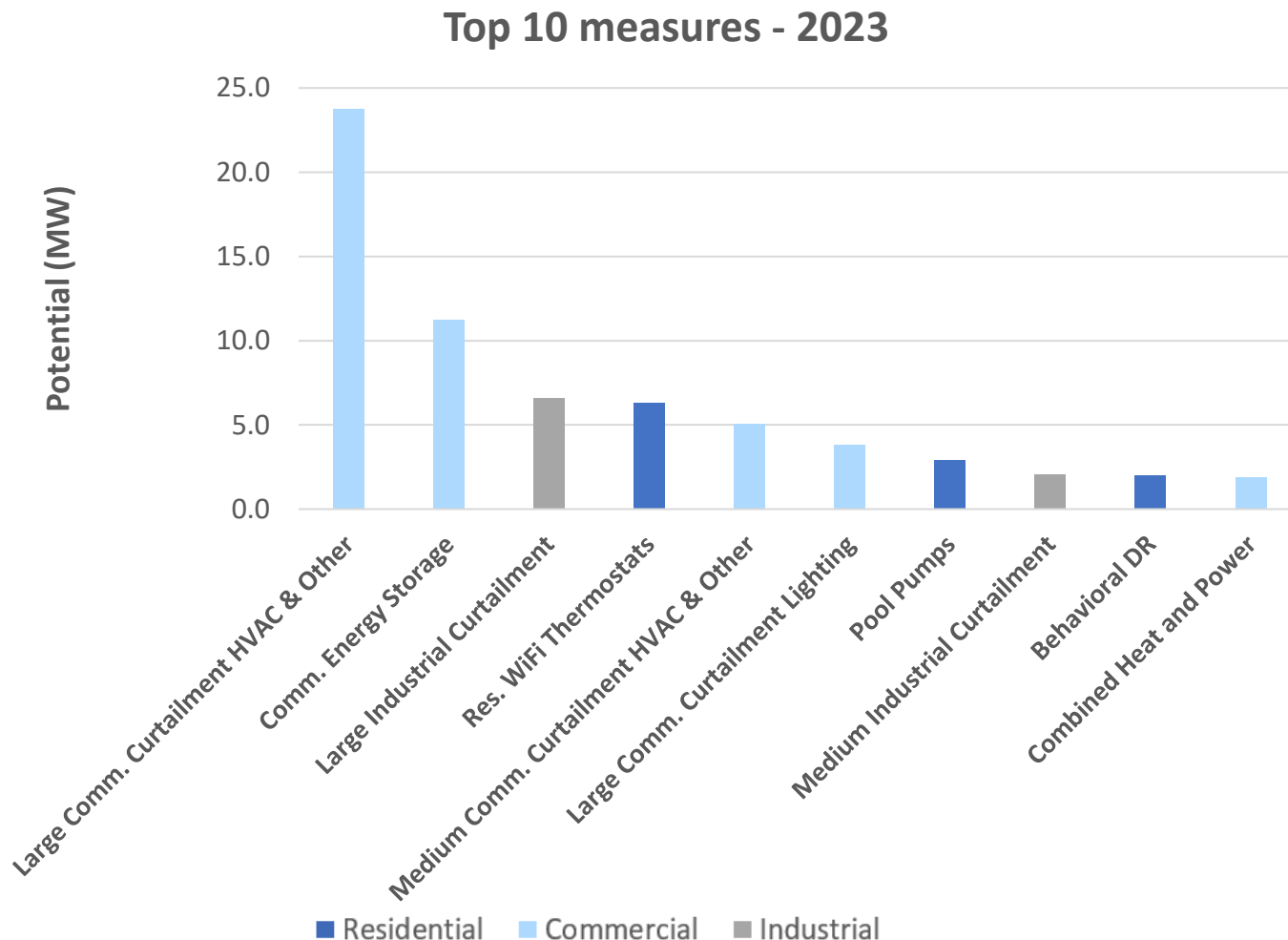
Top 10 measures - 2023



- 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

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

- 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)

Three program scenarios are explored in this study:

Low

Incentive levels set at **maximum allowable incentive (70%)**

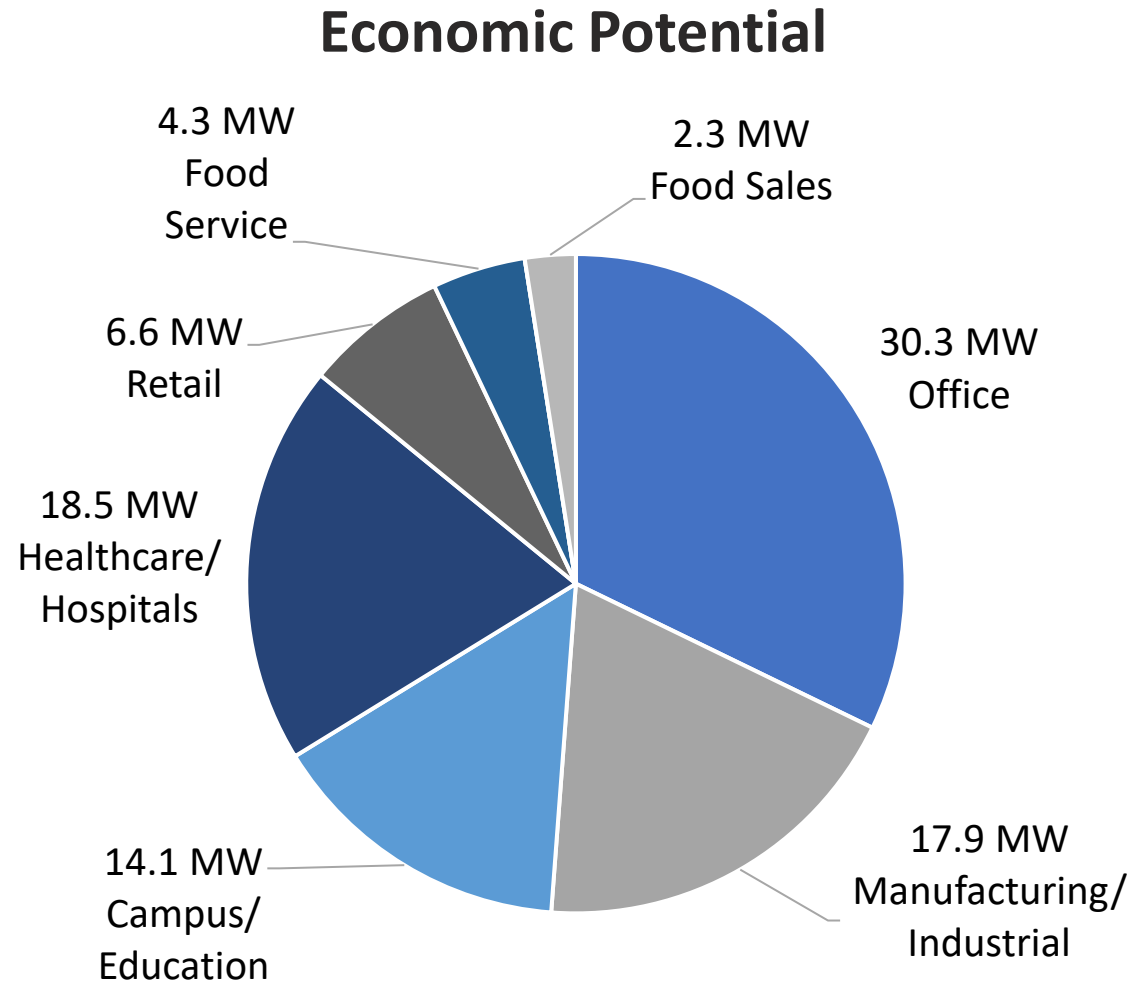
Mid

Incentive levels set at maximum allowable incentive (70%)
with **additional barrier level decrease**

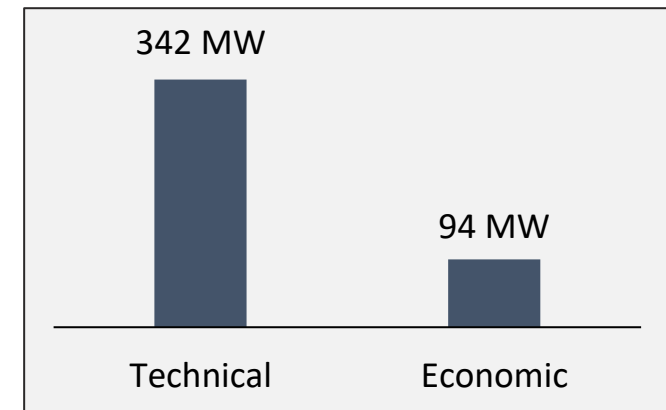
Max

Incentive levels set at **100%** with same barrier level
decrease as mid scenario

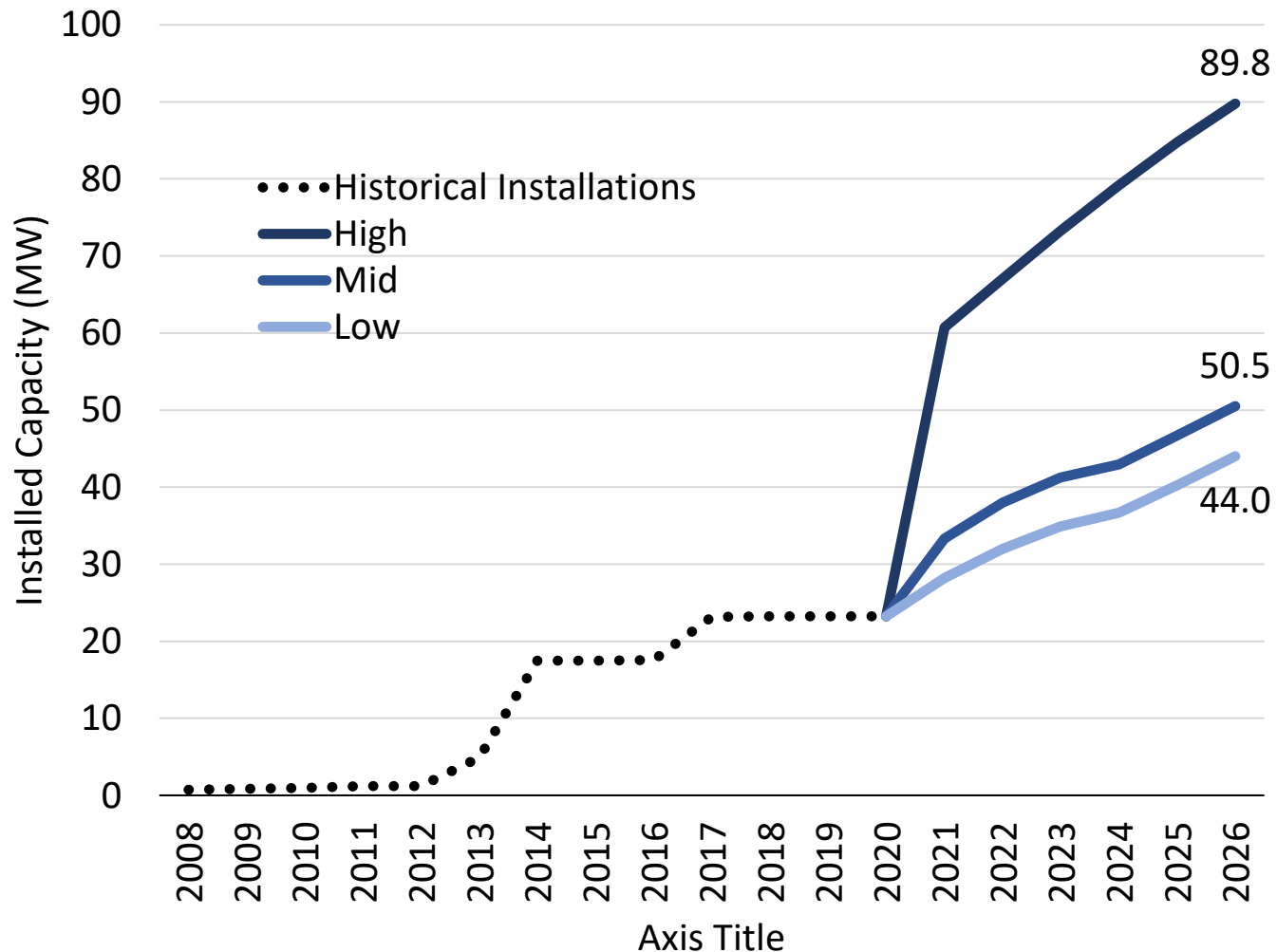
CHP Economic Potential Installed Capacity Potential by Segment (MW)



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



Historical Installed Capacity and Achievable Adoption Projections

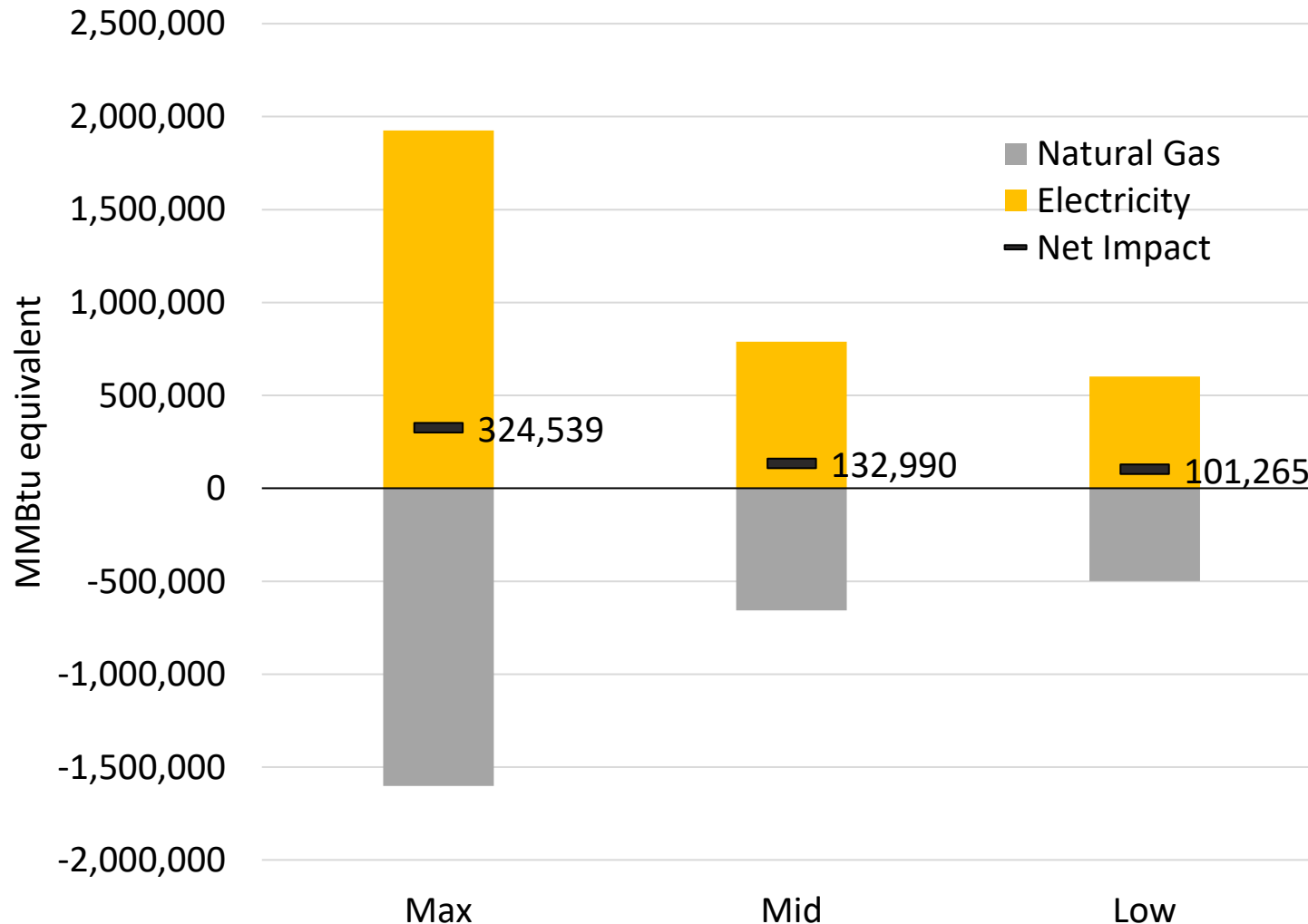


Average impacts (2021-2026)

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

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)

- 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)

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

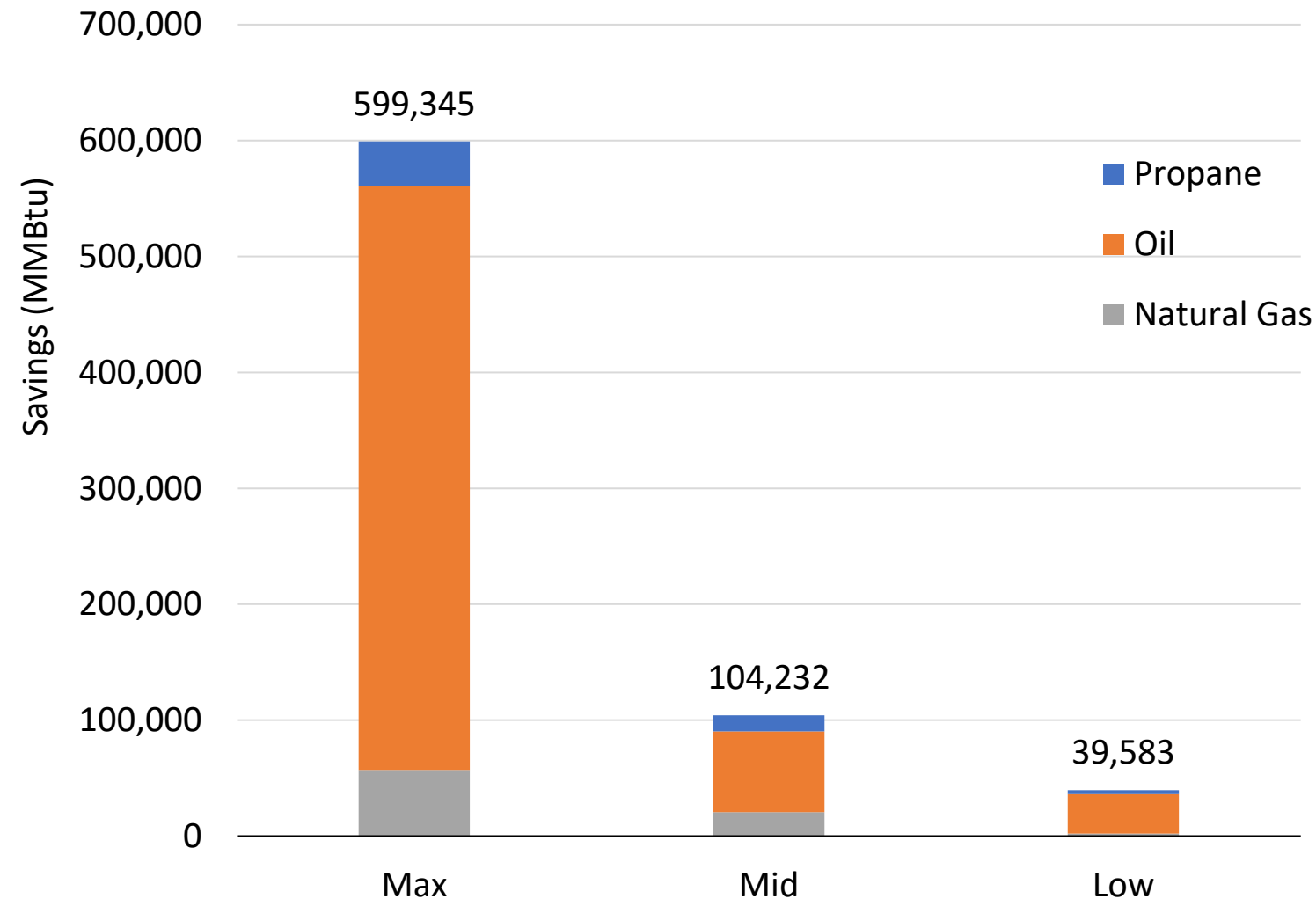
Mid

Applies **50%** incentives and additional enabling strategies (full-step barrier reduction)

Max

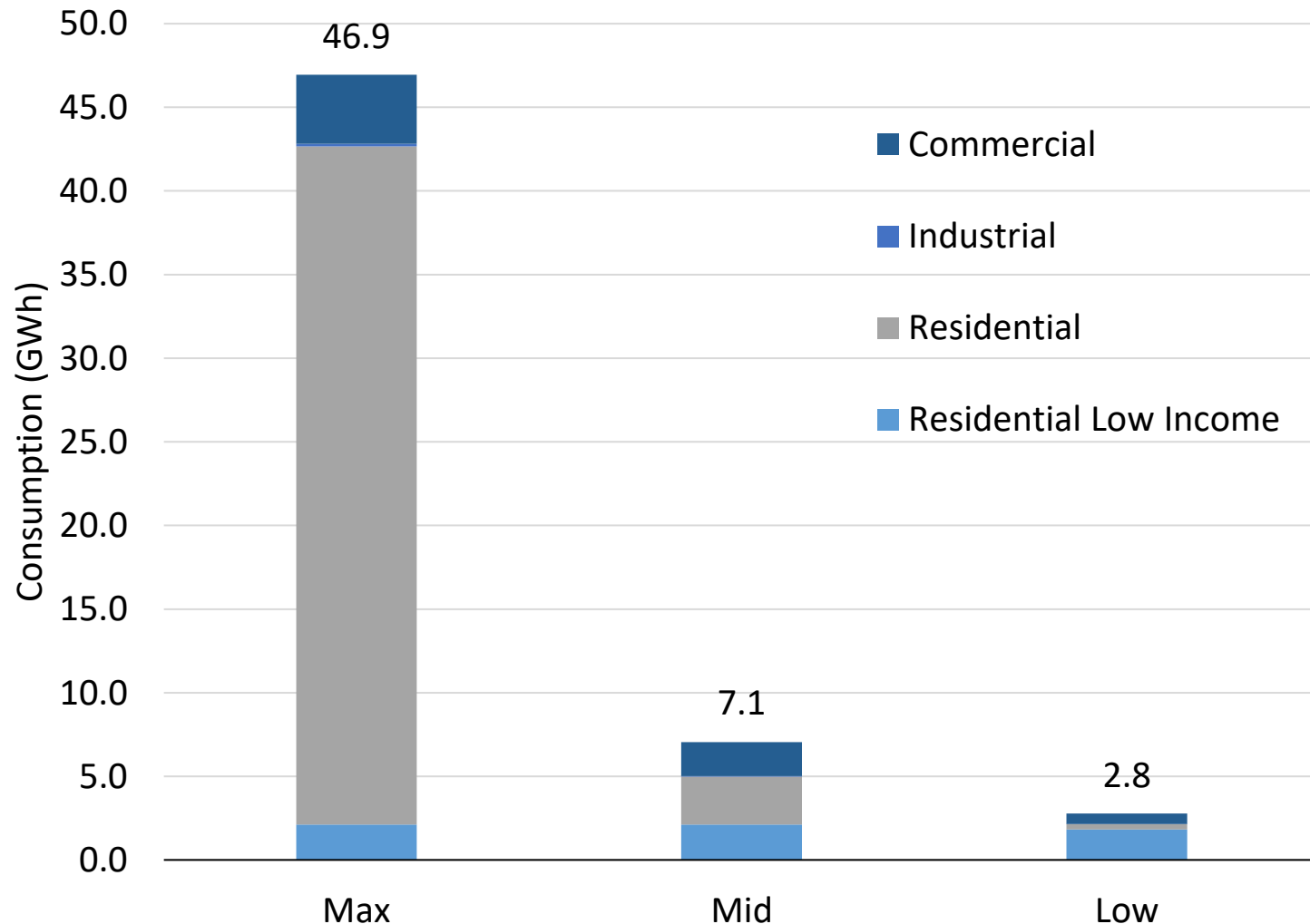
Incentives set at **100%** to completely eliminates customer costs and applies enabling strategies (full-step barrier reduction)

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



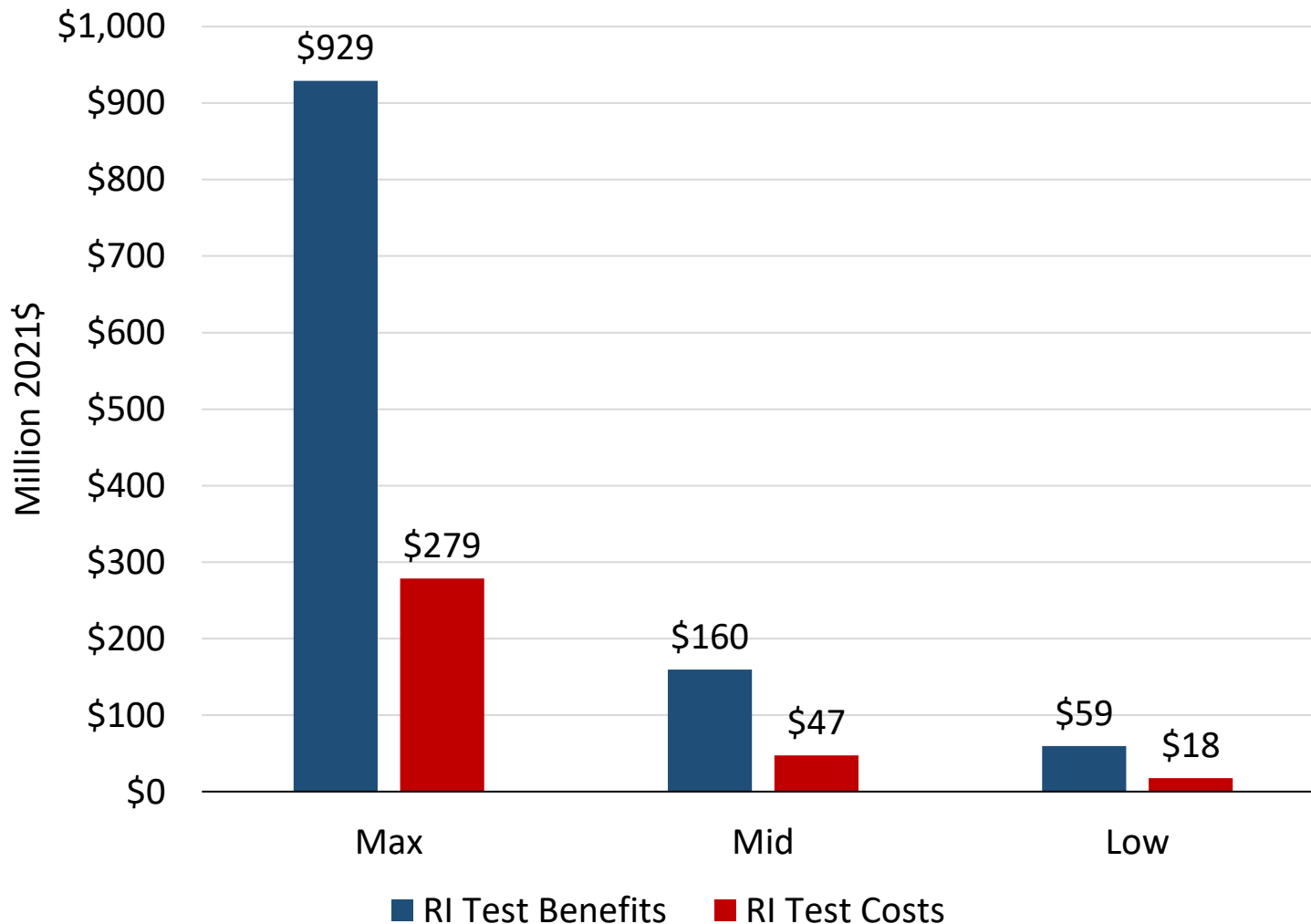
- There is significant technical potential for heating electrification in Rhode Island – particularly when natural gas is included.
- Propane and oil fuel switching are largely cost-effective, but most natural gas electrification does not pass the RI Test
- Increasing incentives and reducing barriers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

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

Total Rhode Island Test Benefits and Costs by 2023



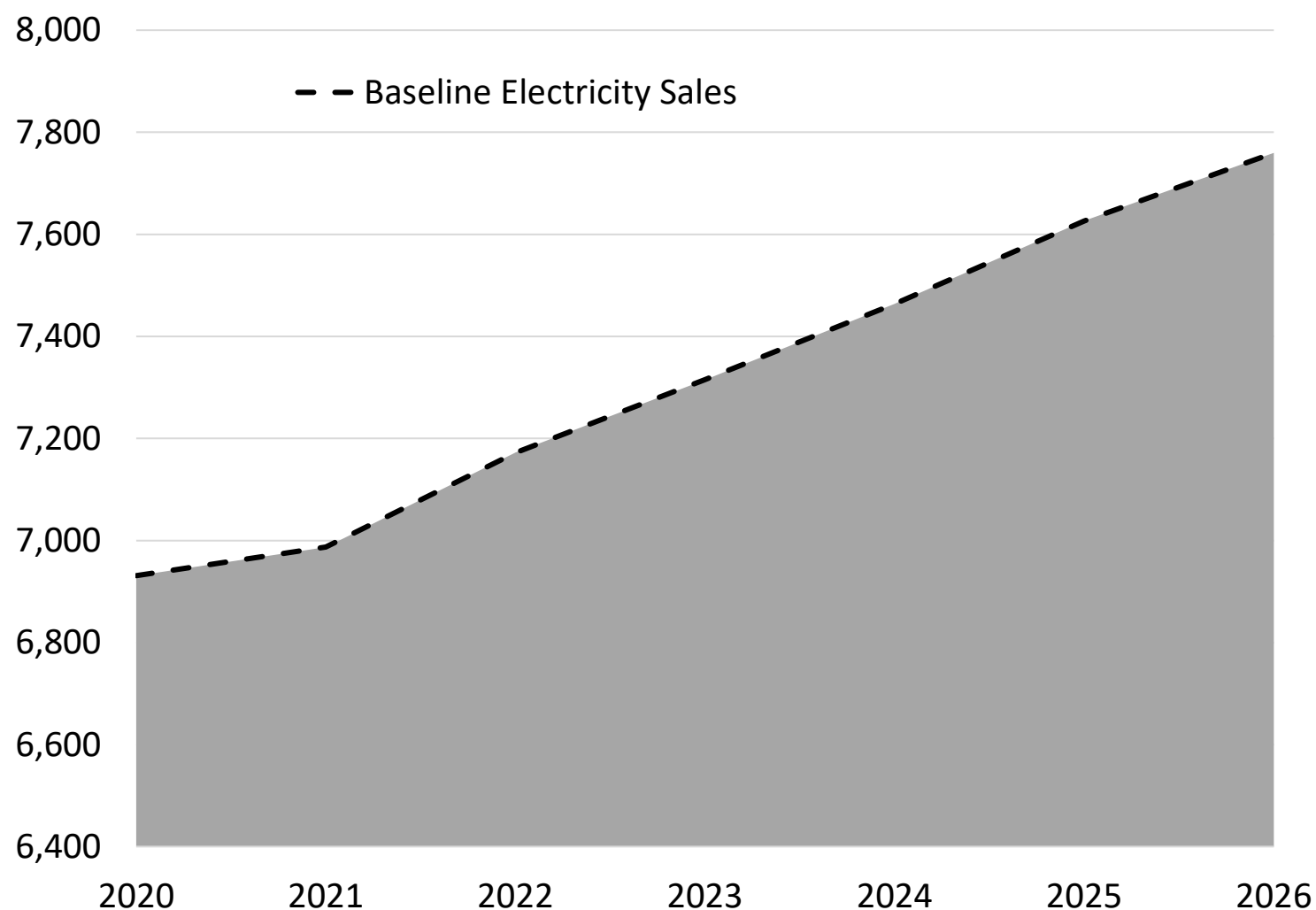
- Annual estimated costs range from \$6.4M (Low) to \$115M (Max) per year
 - National Grid’s 2019 HE spending totaled \$1.8M
- Lifetime customer net benefits are significant.
 - \$35.2M customer lifetime benefits by 2023 under Low Scenario over a third accruing to the residential low income sector.

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

- 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.

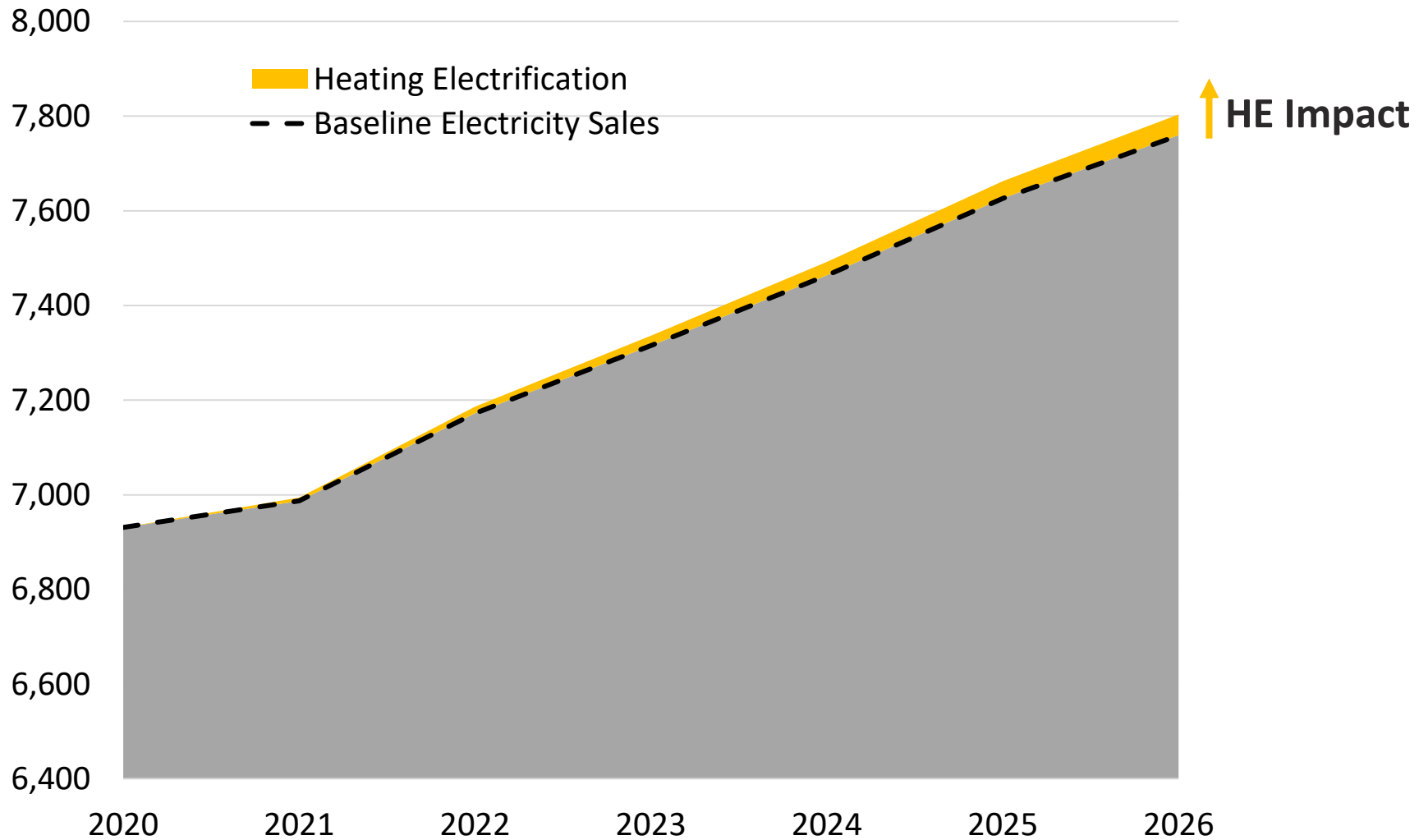
Impacts on Sales

Baseline Electricity Sales (GWh)



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

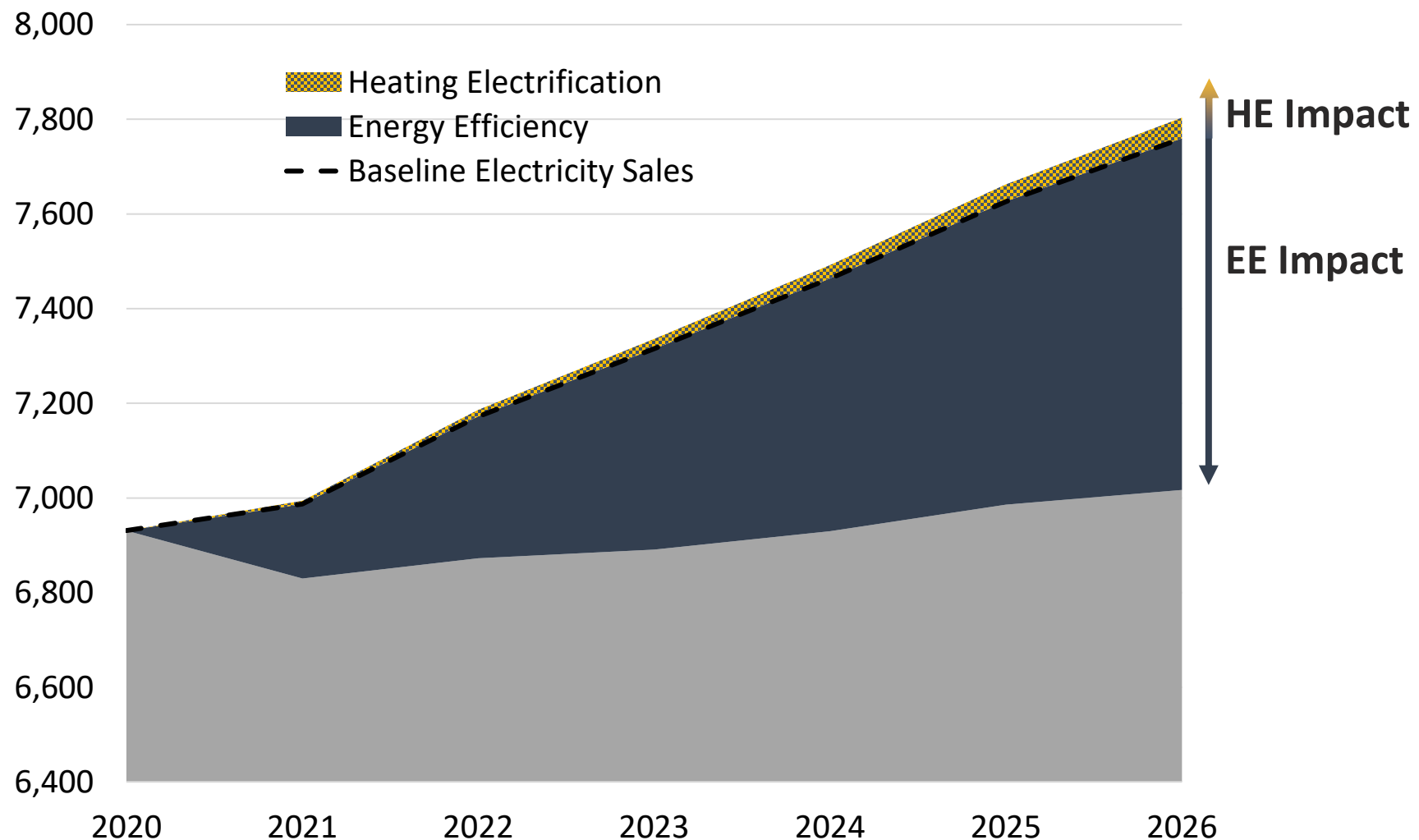
Mid Scenario: Electricity Sales + HE (GWh)



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

Cumulative Impact on 2026 Baseline	
HE	+0.6%

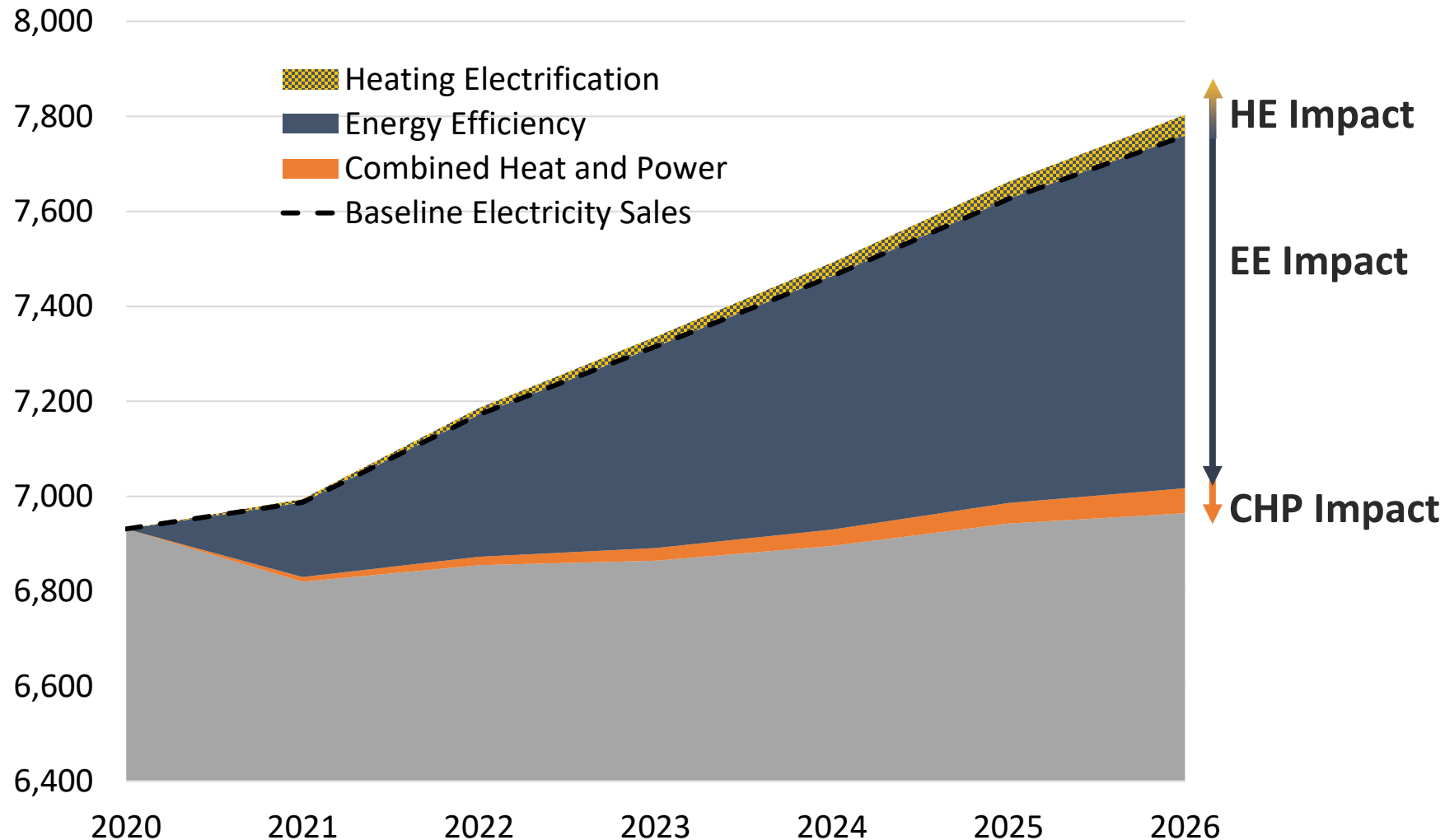
Mid Scenario: Electricity Sales + HE + EE (GWh)



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

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

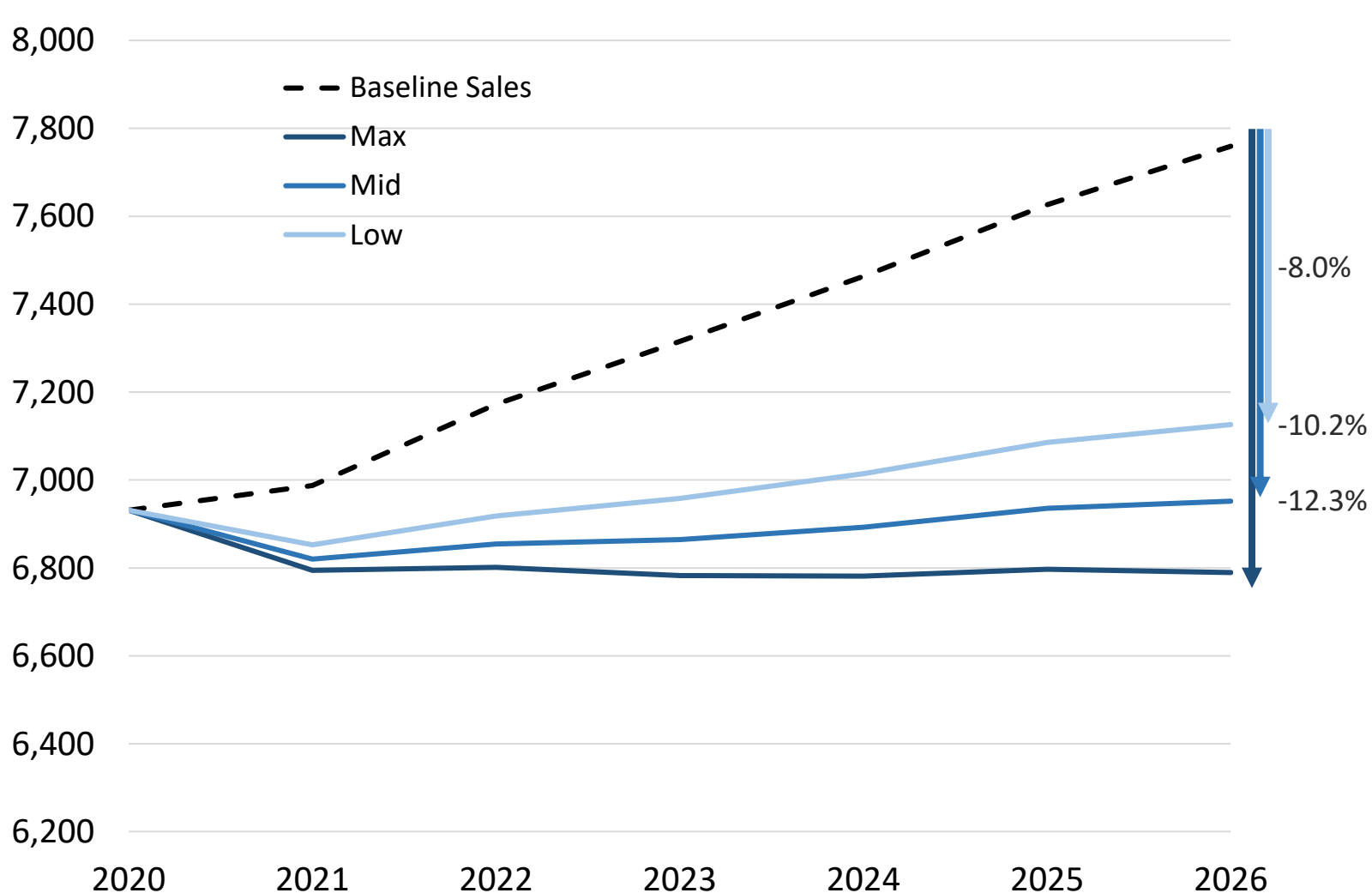
Mid Scenario: Electricity Sales + HE + EE + CHP (GWh)



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

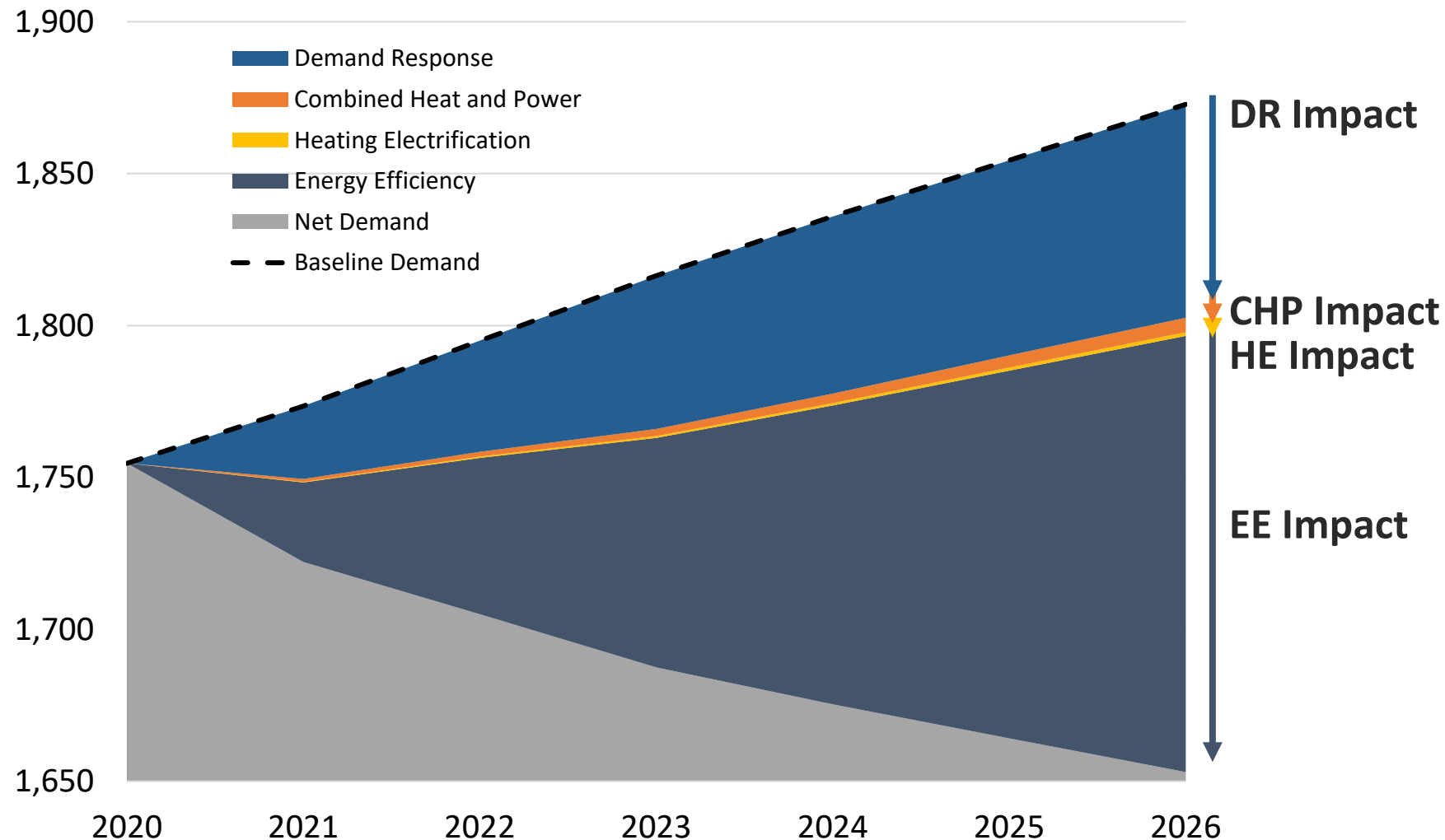
Cumulative Impact on 2026 Baseline	
HE	+0.6%
EE	-10.1%
CHP	-0.7%

Cumulative 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

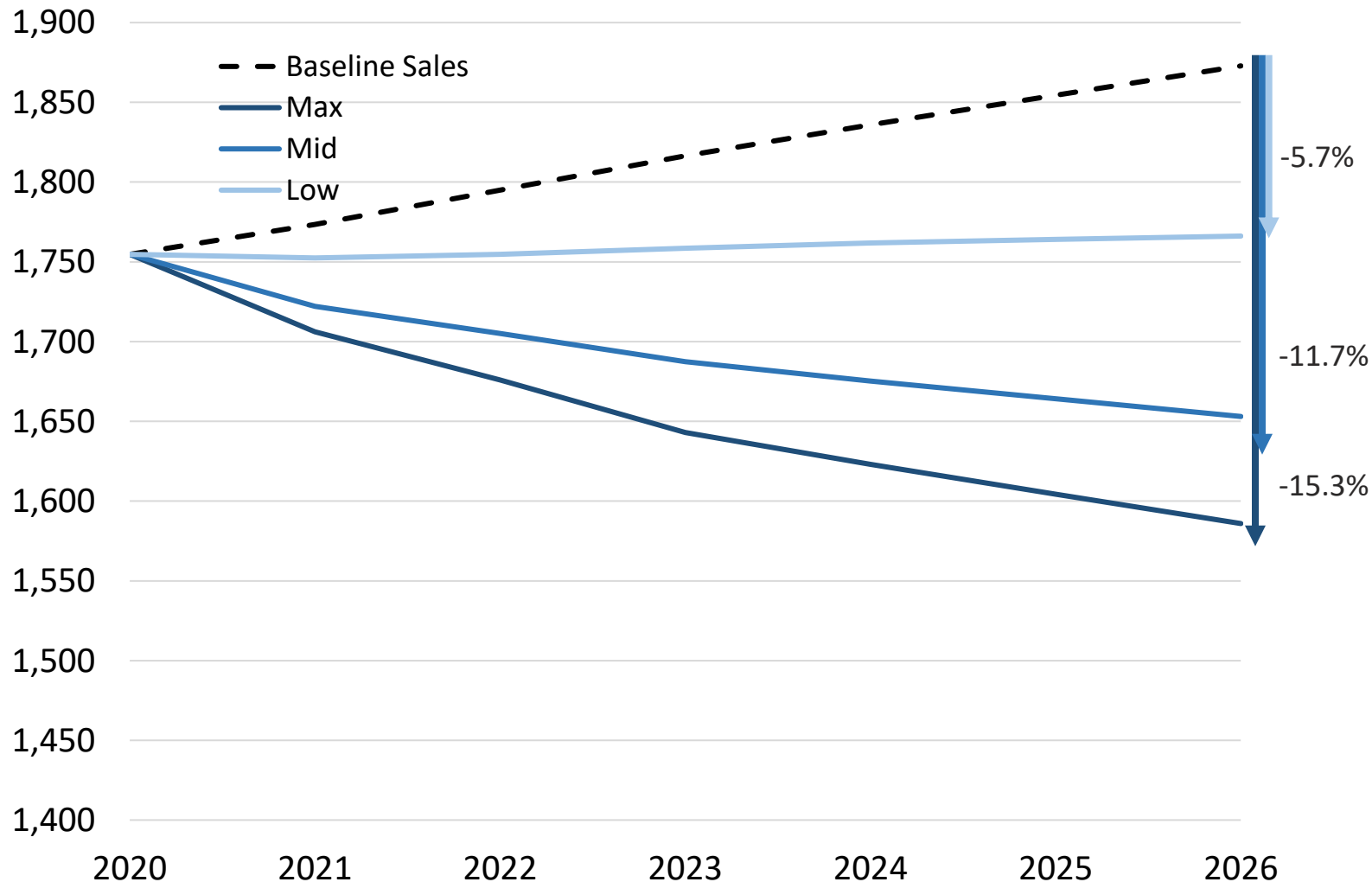
Mid Scenario: Electric Demand (MW)



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

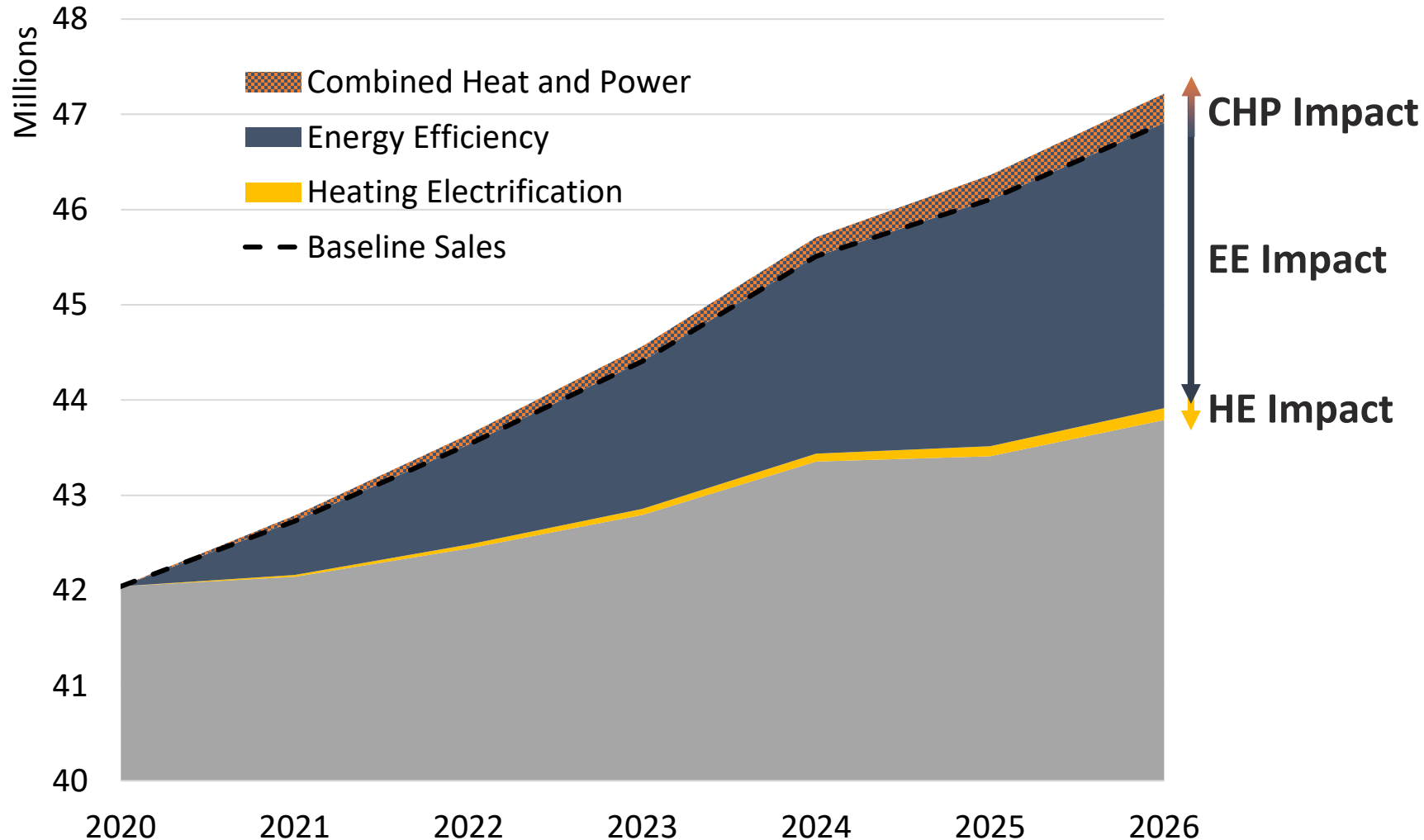
Cumulative Impact on 2026 Baseline	
DR	-3.7%
CHP	-0.3%
HE	-0.1%
EE	-7.8%

Cumulative 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.

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

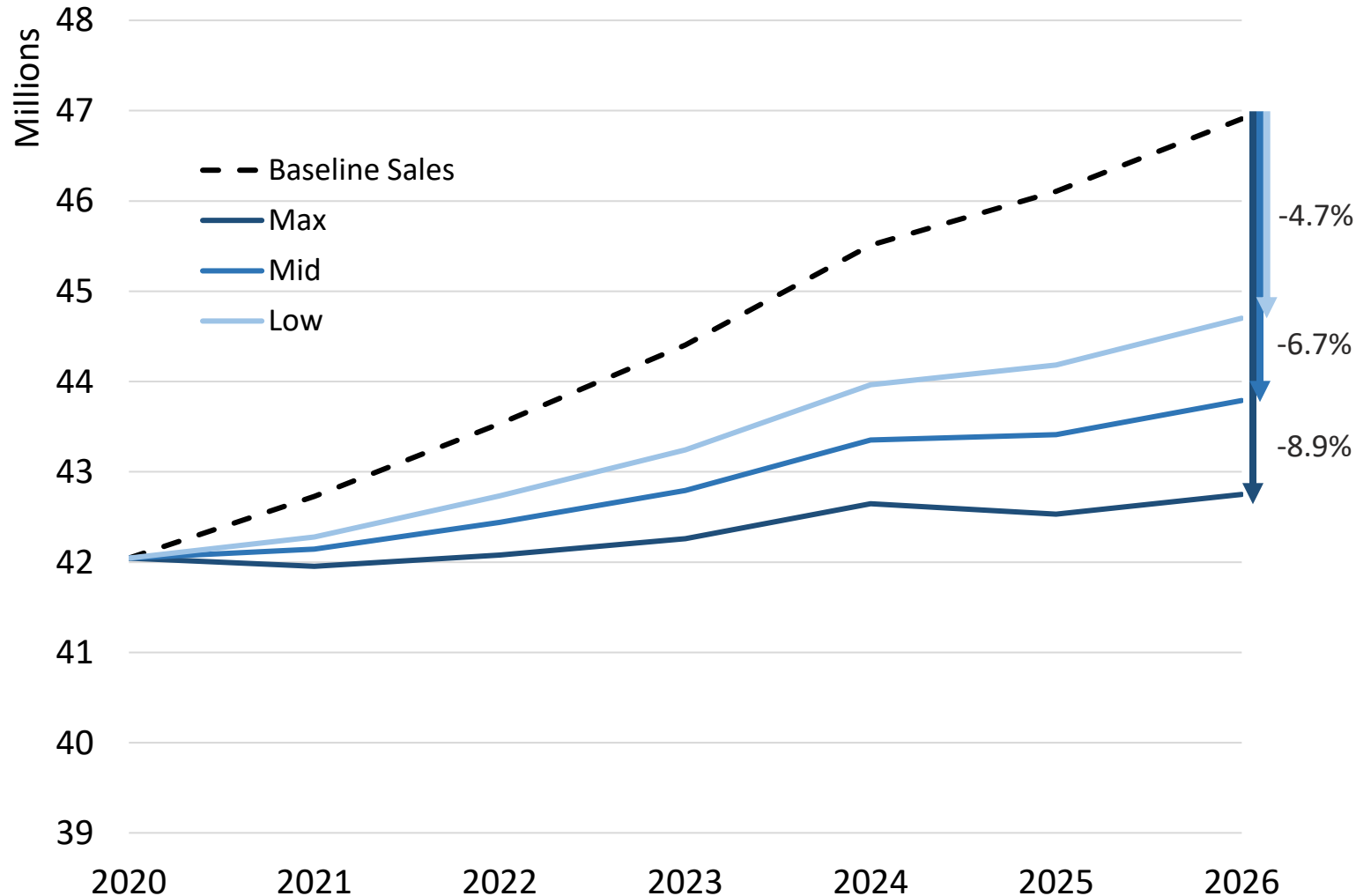


- CHP will increase on-site consumption of natural gas
- EE offers greatest opportunity to reduce natural gas sales

Cumulative Impact on 2026 Baseline

CHP	+0.7%
EE	-7.0%
HE	-0.3%

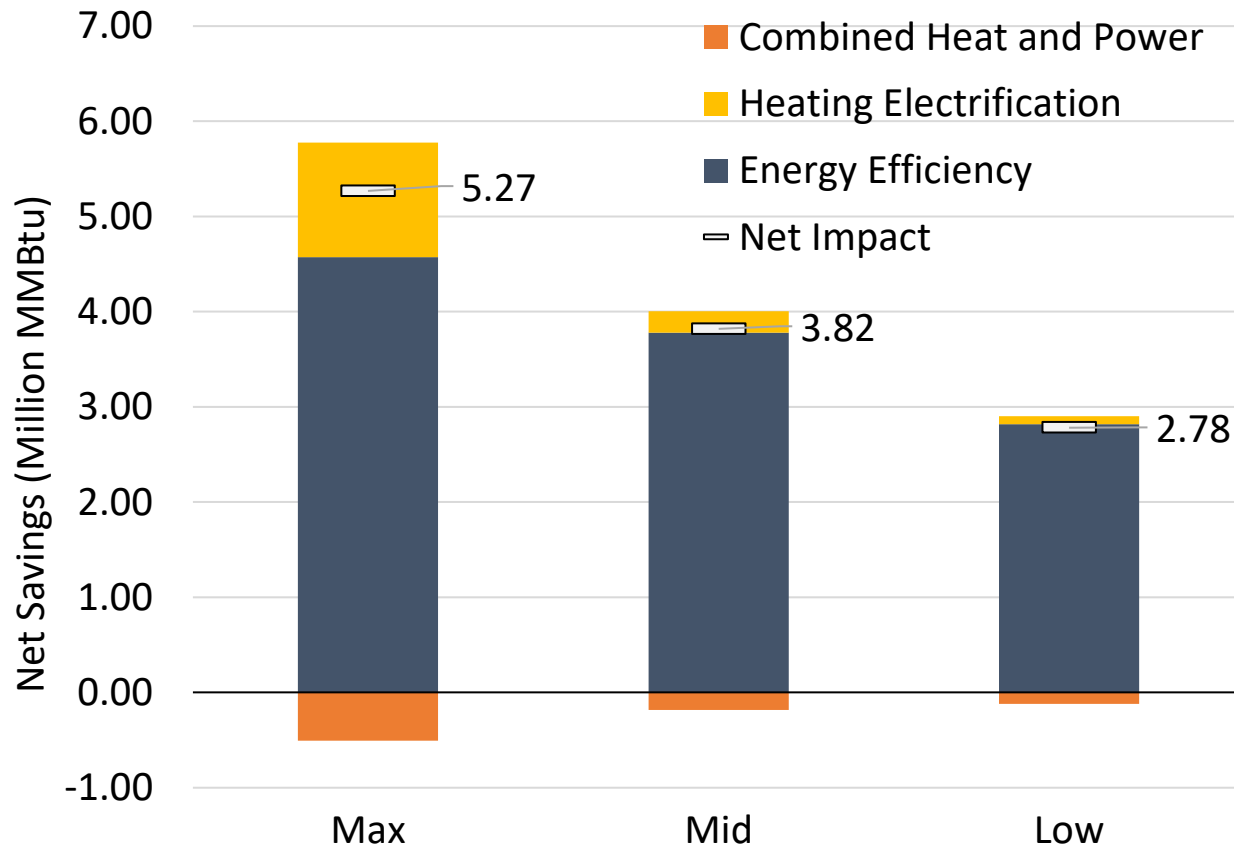
Cumulative Impact on Natural Gas Sales (MMBtu)



- 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

Total Net Customer Energy Savings by 2023

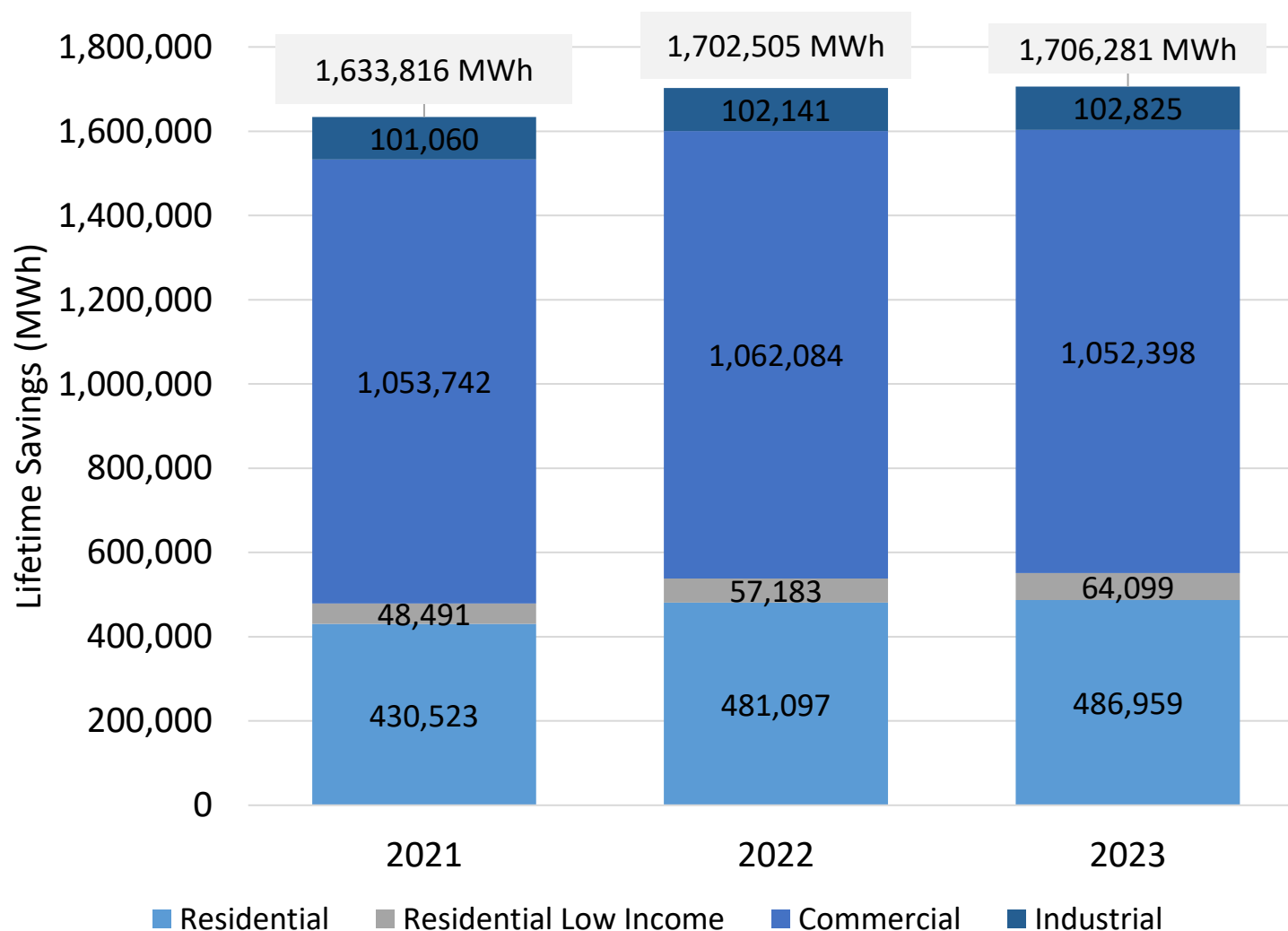


Note: This graph does not consider savings at the generator, which would show CHP as a net positive energy savings.

- 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.

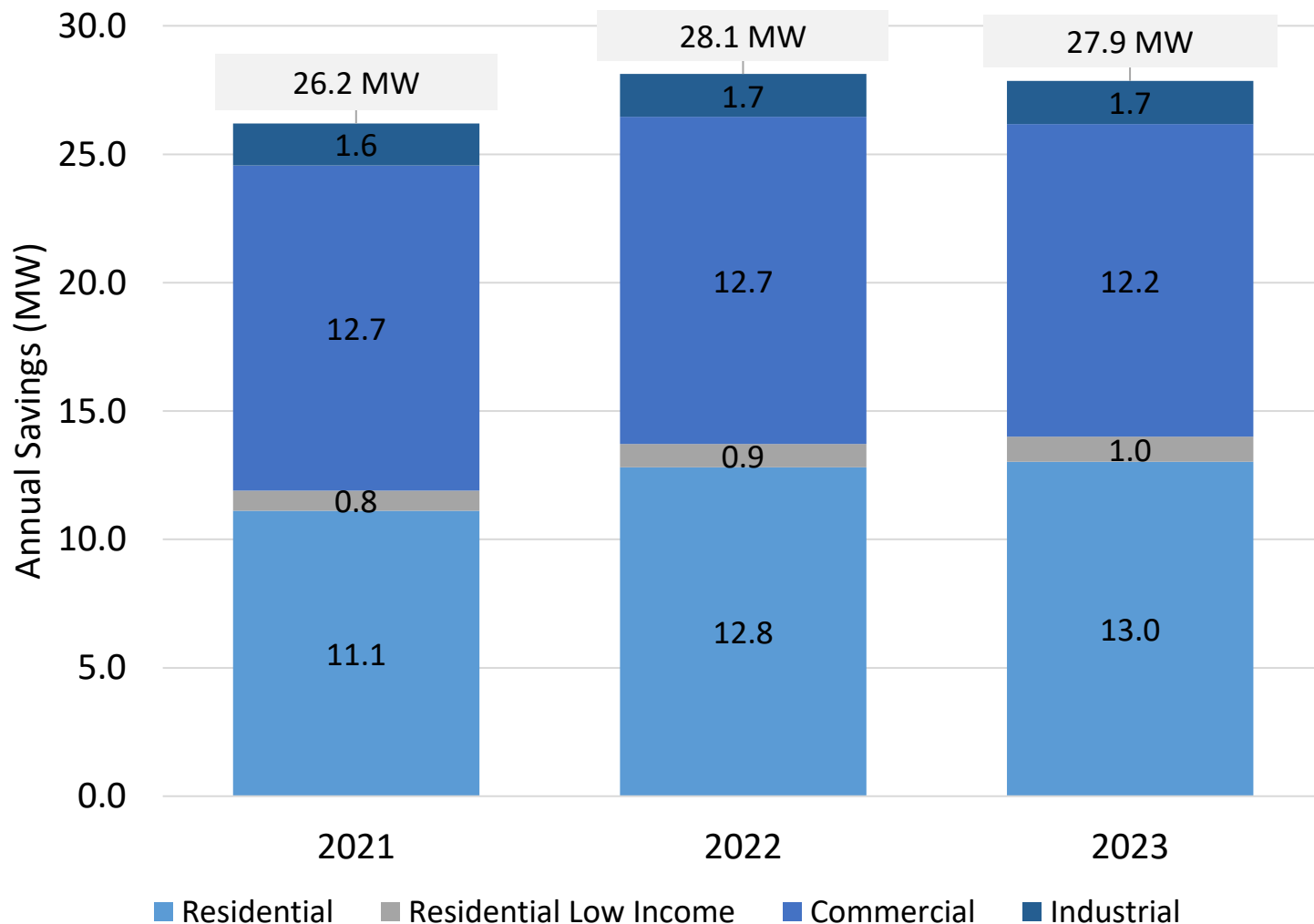
Appendix

Lifetime Electric Savings by Sector (Mid)



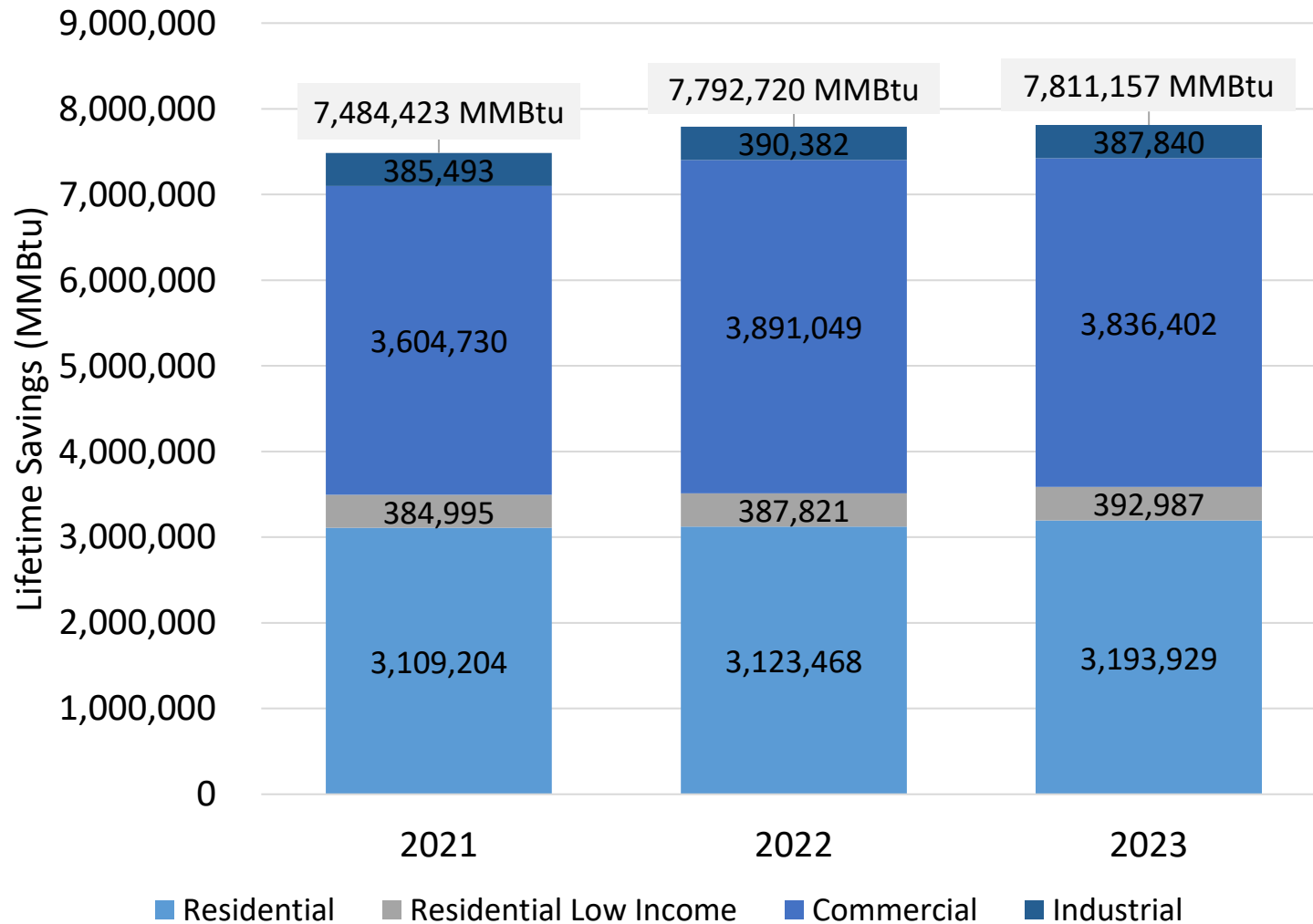
- Bulk of electric savings come from residential and commercial sectors
 - Within residential sector, savings are driven by the single family segment
 - Within commercial sector, savings are driven by office, retail, and education/campus segments.

Annual Passive Peak Demand Reduction by Sector (Mid)



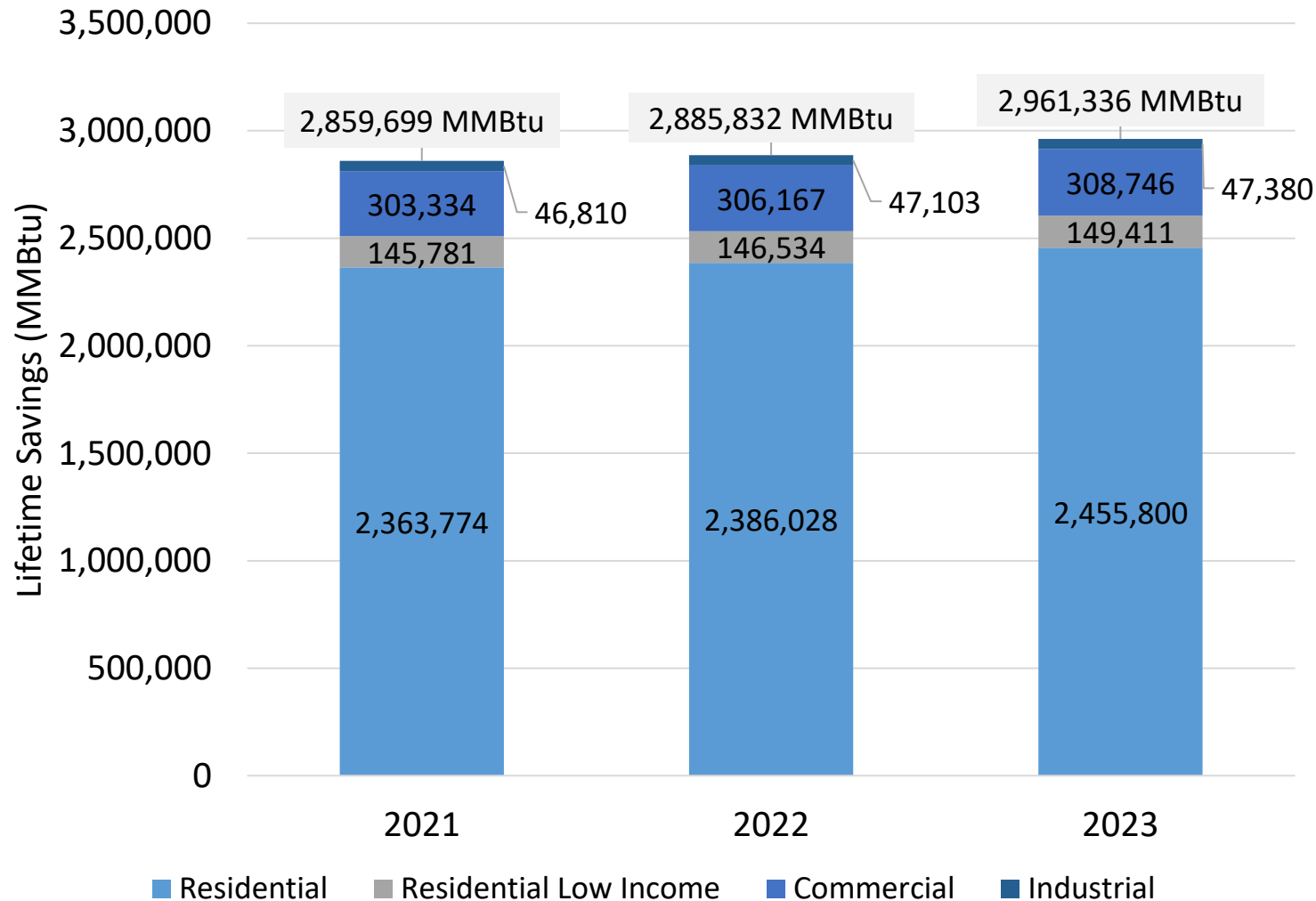
- Similar to energy savings, bulk of passive demand savings come from residential and commercial sectors

Lifetime Gas Savings by Sector (Mid)



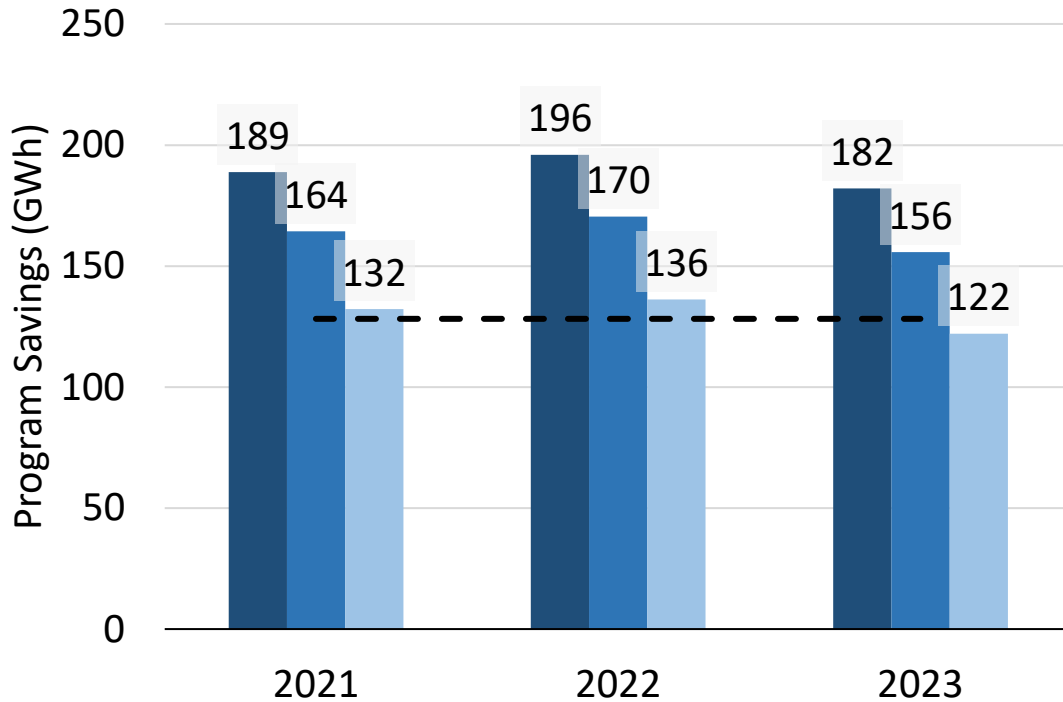
- Commercial sector is the slight majority of EE gas savings under mid scenario
 - Residential sector savings driven by single family segment.
 - Commercial sector savings driven office, retail, education/campus and lodging segments.
- Residential sector shows significant upside between Low and Mid scenarios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

Lifetime Delivered Fuel Savings by Sector (Mid)



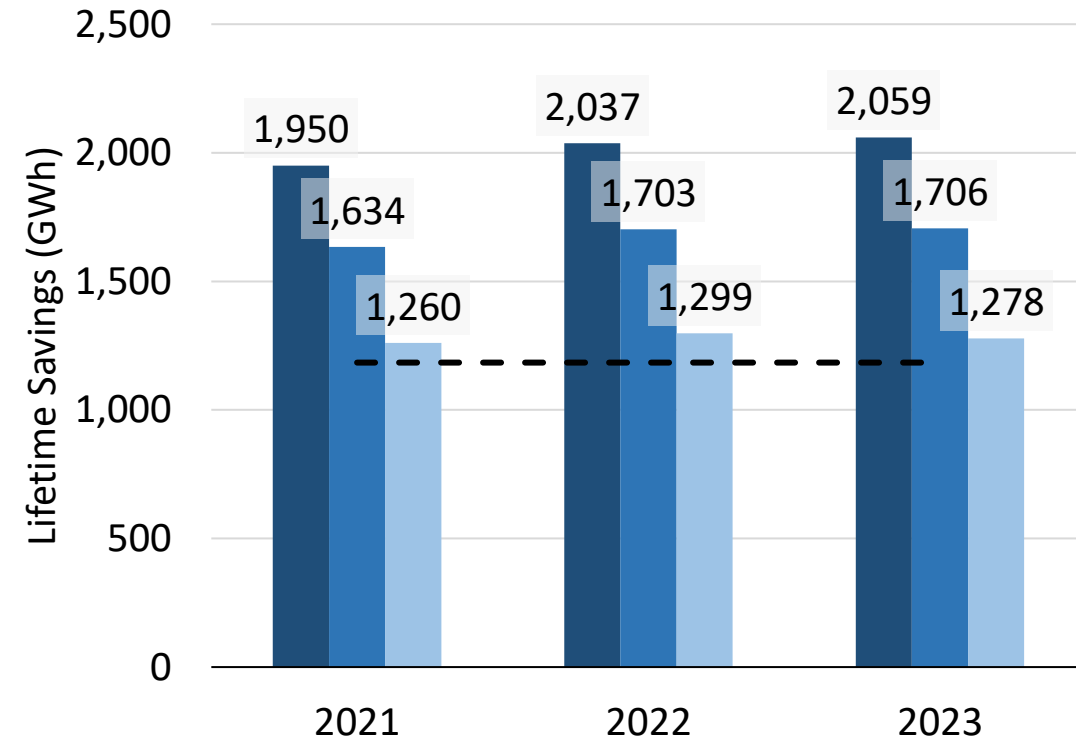
- The bulk of delivered fuel savings come from the single-family residential customers
- Oil measures account for approximately 94% of delivered fuel savings

Annual Electric Program Savings



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

Lifetime Electric Program Savings

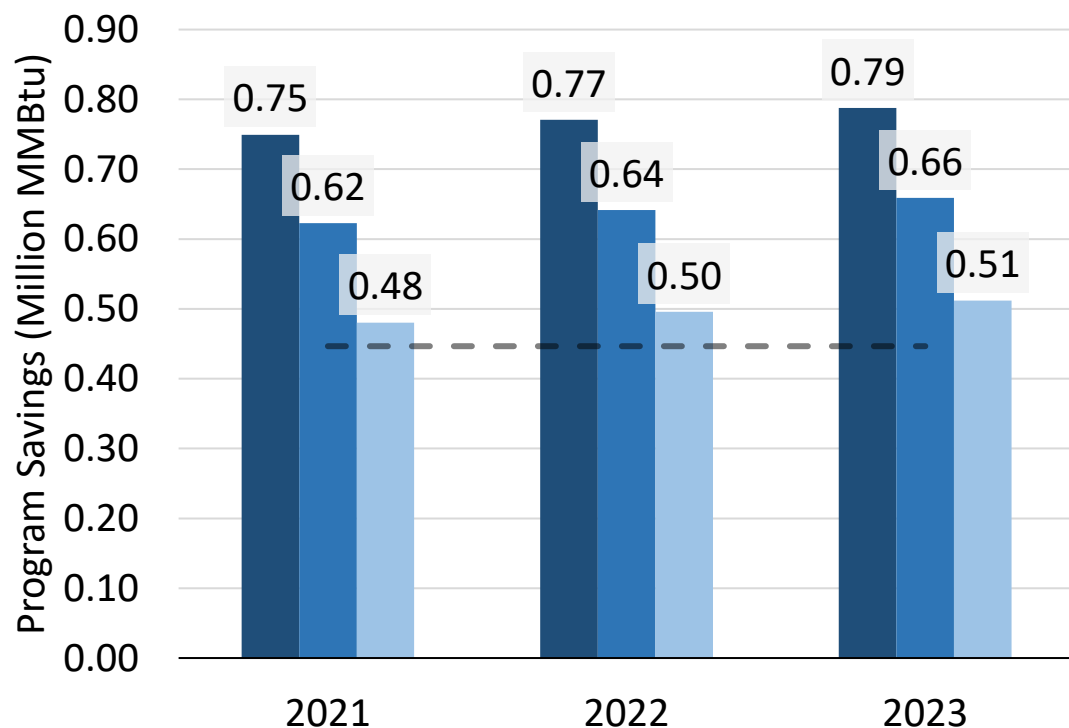


■ Max
 ■ Mid
 ■ Low
 - - Benchmark: 2020 Plan

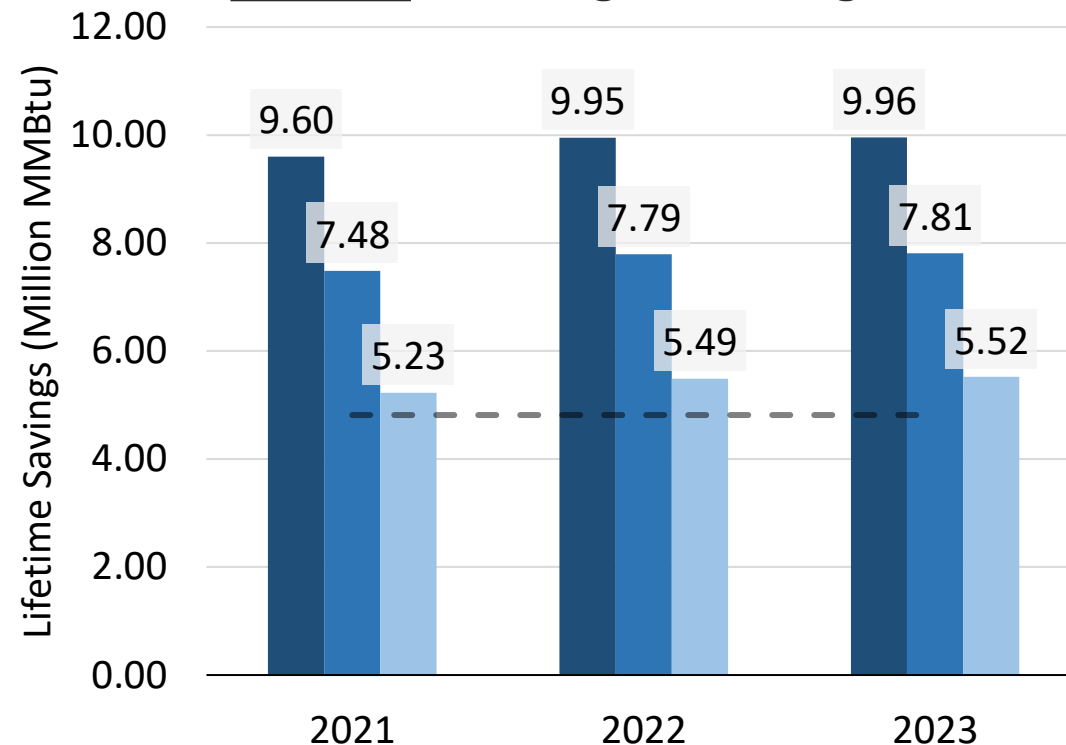
Annual Savings: The amount of energy savings achieved in the first-year of the measure’s installation.

Lifetime Savings: The amount of energy savings achieved over the entire measure’s lifetime.

Annual Gas Program Savings



Lifetime Gas Program Savings



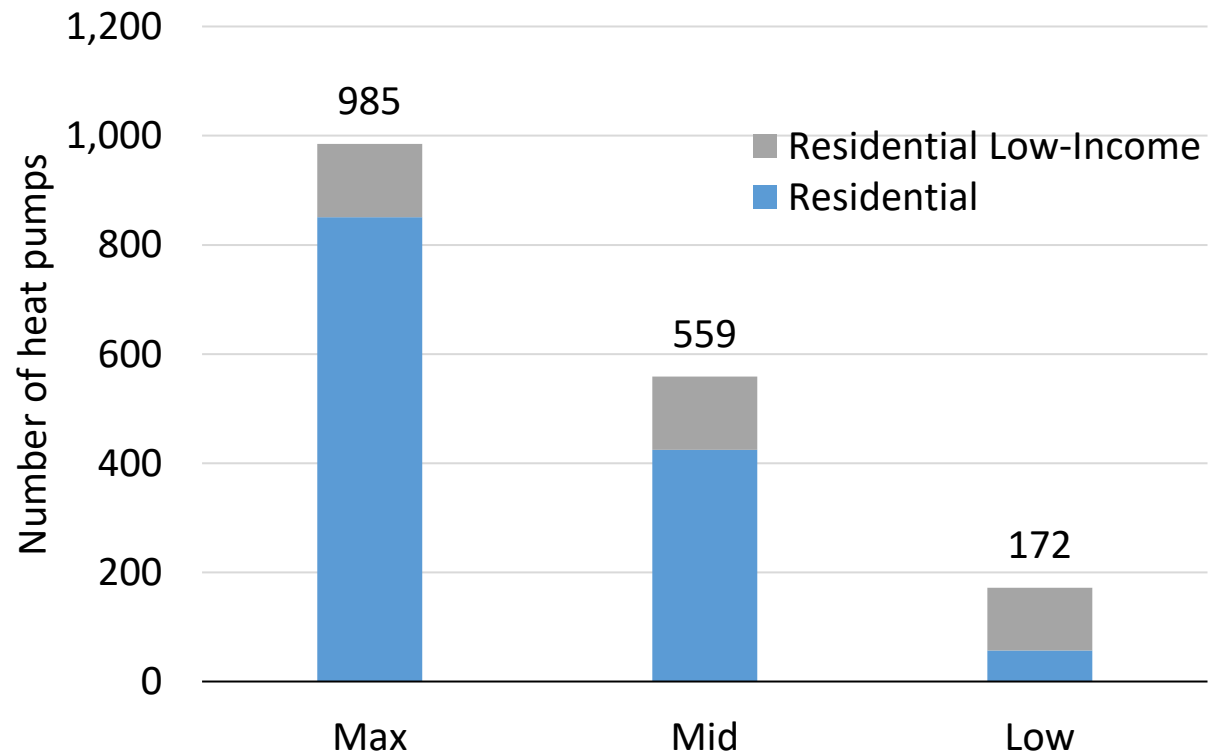
■ Max
 ■ Mid
 ■ Low
 - - Benchmark: 2020 Plan

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.

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

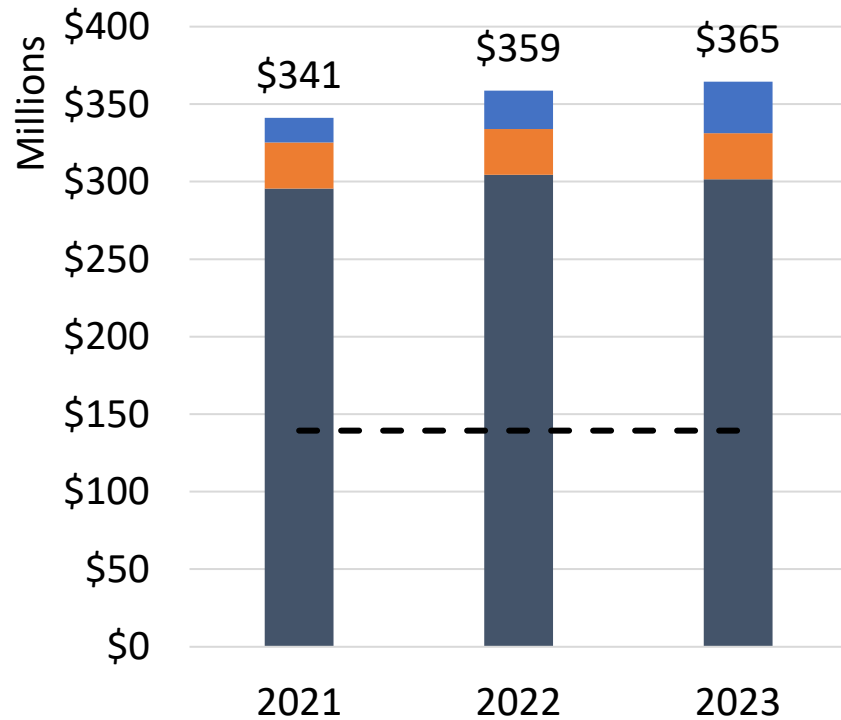
All Saving Streams: Estimated Combined Costs



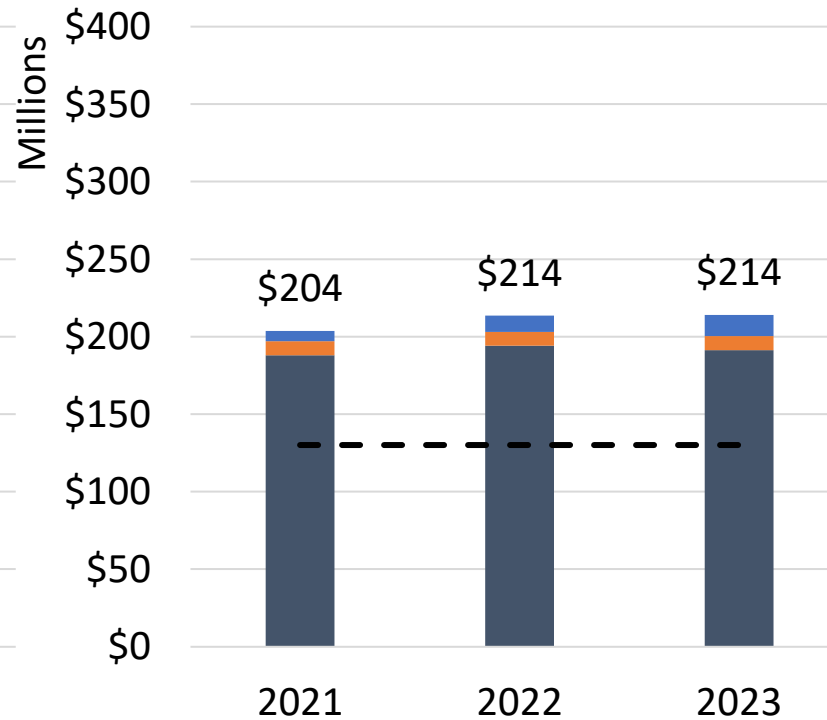
Estimated Combined Costs (EE, CHP, and DR only)

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

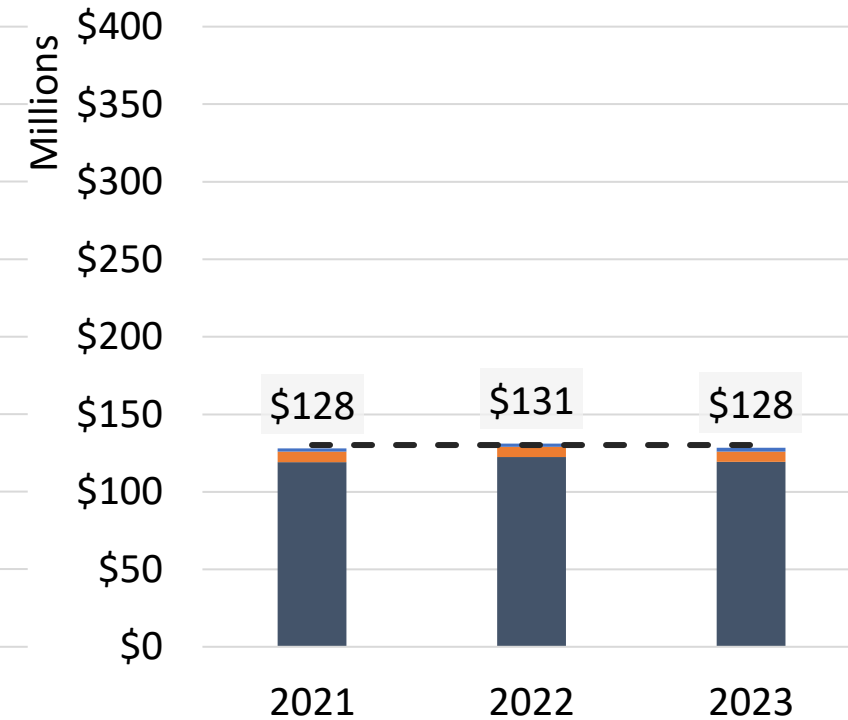
Max Scenario



Mid Scenario

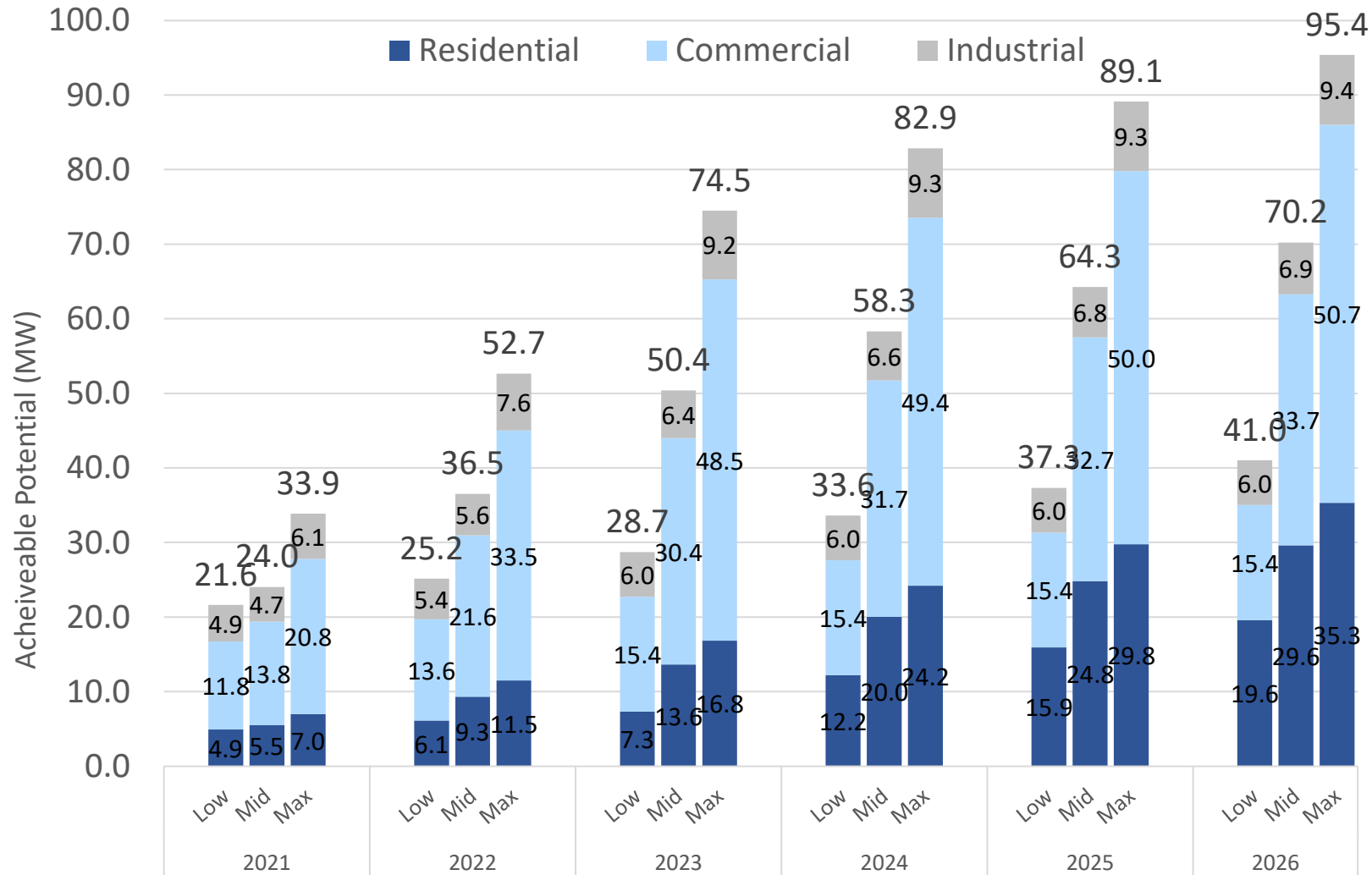


Low Scenario



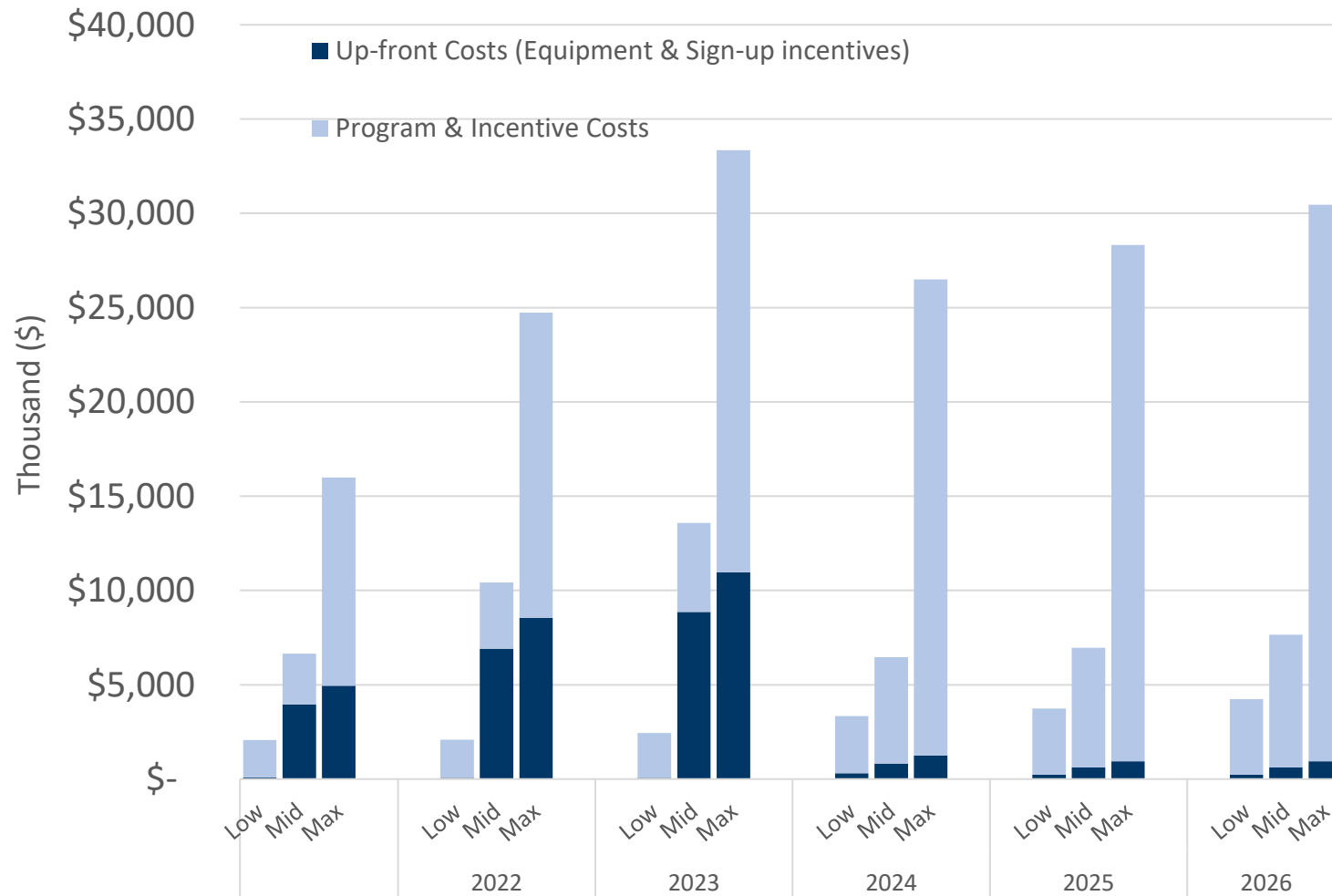
■ Demand Response ■ Combined Heat and Power ■ Energy Efficiency - -2019 Benchmark

Achievable Potential (MW) by scenario

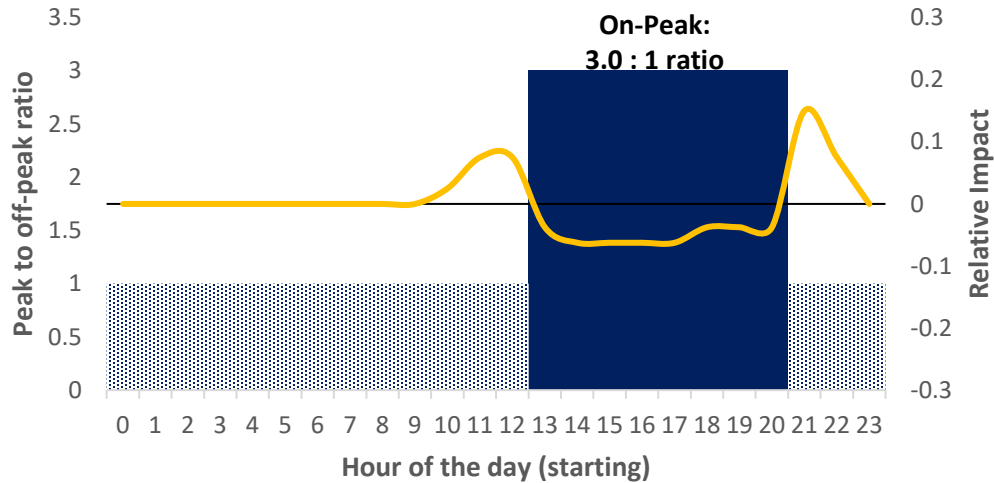


- Economic potential assessed at: 125 MW*
- Residential DR has lots of room to grow
- Expanding programs has bigger effect than simply raising incentives
- Budgets range from \$2M to \$33M per year. Mid scenario appears to offer best savings/cost balance.

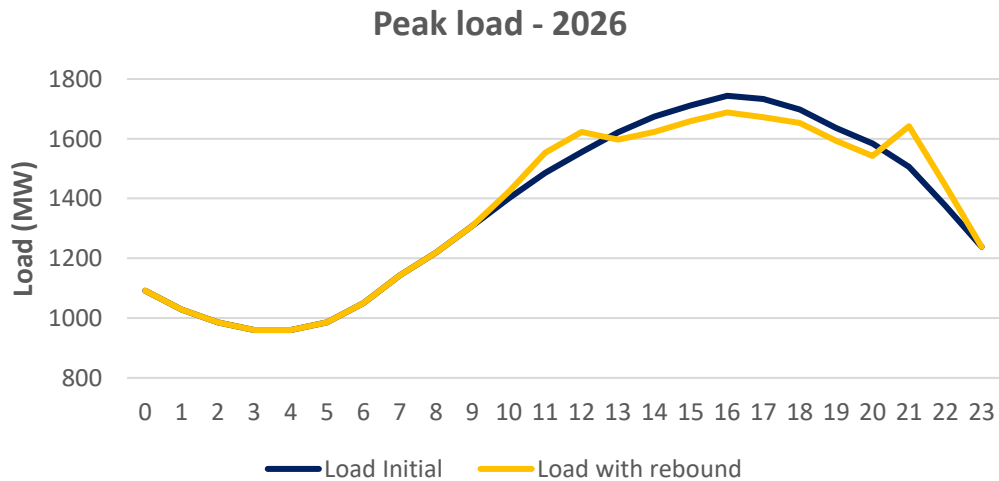
DR Portfolio Costs (\$1000) by scenario



- 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.
- Keep in mind: DR savings on persist for as long as the programs are active (study assumed that measures deliver savings for a 10 year program life)

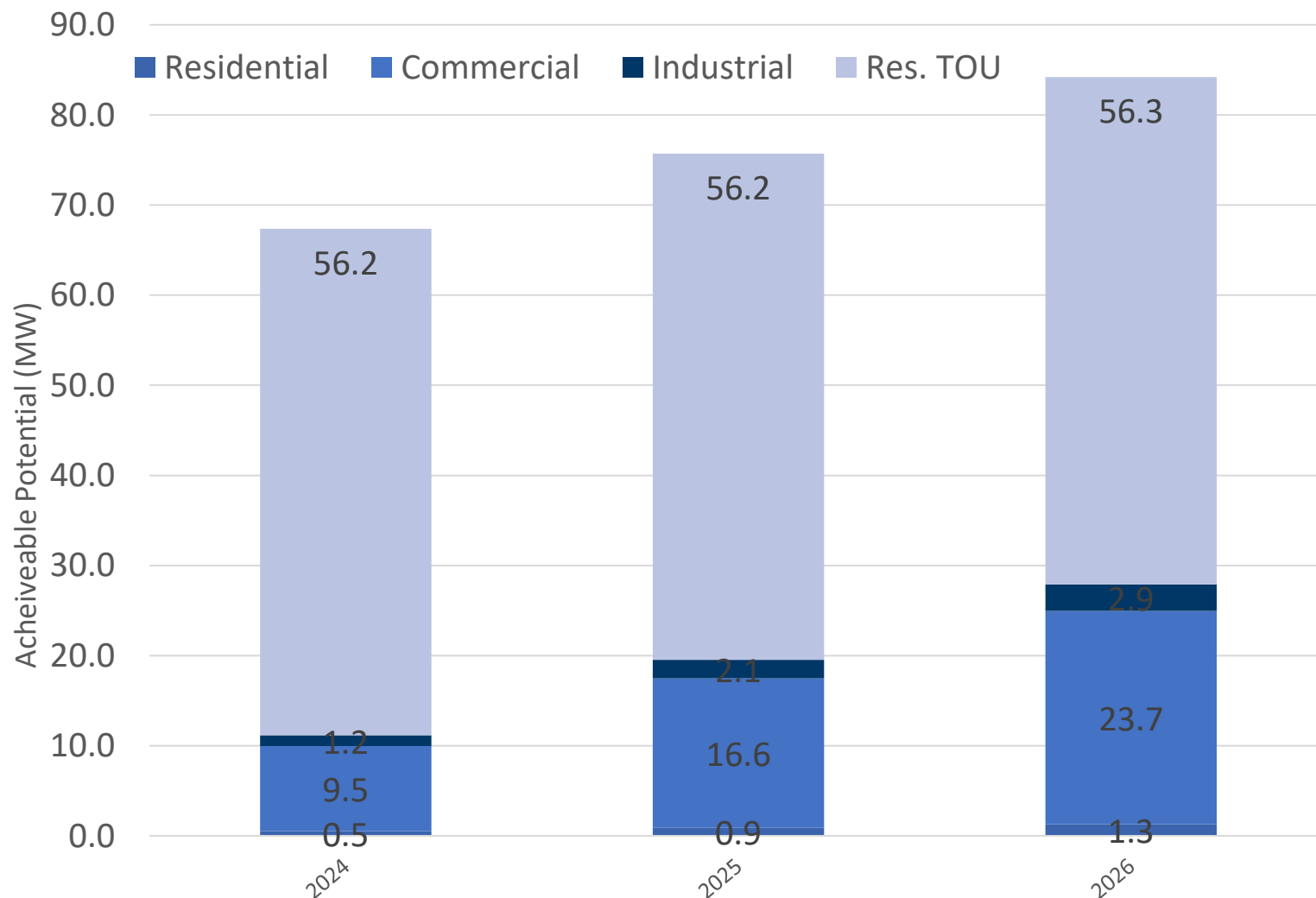


- TOU was selected:
 - Stable load shape means TOU will provide benefits even in days with lower peak demand
 - Historical heat waves comes in multiple day events, diminishing CPP effects
- Residential sector only
 - With the integration of solar, peak is shifting towards the evening. Residential is 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

Achievable Potential with Residential TOU Rates (Mid)



- 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