Public Service of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-092

Date Request Received: 09/17/2020 **Date of Response: 10/01/2020**
Request No. STAFF 1-037 **Page 1 of 2**
Request from: New Hampshire Public Utilities Commission Staff

Witness: Katherine W. Peters, Mary Downes, Eric Stanley, Carol Woods

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Request:
Reference Bates page 14 regarding the impacts of the COVID-19 pandemic on program implementation in 2020 and the proposed plan for 2021-2023. Please provide a detailed description and any associated changes that were made to the proposed 2021-2023 plan to account for any COVID-19 pandemic impacts. Please provide a list and copies of any additional analyses that were conducted regarding pandemic impacts

Response:
The impacts of COVID-19 continue to evolve and develop. 2020 Impacts on program implementation include, but are not limited to, the following: a temporary shutdown of in-person and on-site work; furloughs or lay-offs of employees for contracted vendors; financial concerns for residential customers who have temporarily or permanently lost employment; financial concerns for commercial customers who have shut down; seen reduced business activity or otherwise had business operations negatively impacted; customers' need to focus more attention on health concerns, family concerns or other operational matters; a need for flexibility on incentives in order to help customers overcome barriers to moving forward with efficiency projects; and a need for flexibility to shift focus if and when the opportunities to achieve savings happen in different programs or offerings than originally planned. All of these implementation impacts will or may continue to be factors in the coming year(s) as it is not clear when the pandemic will subside.

Specific analysis done to review and quantify COVID-19 impacts include a COVID sensitivity analysis done by the Potential Study vendor, Dunsky. The key drivers of that analysis were modeling (1) reduced market size across various segments of the economy "to reflect fewer customers within a given segment due to temporary or permanent business closures" and (2) increased levels of barriers to EE, "to reflect increased competition for capital, decreased resources, and other impediments to energy efficiency upgrades." See section 2.5 of Attachment Staff 1-037 A.

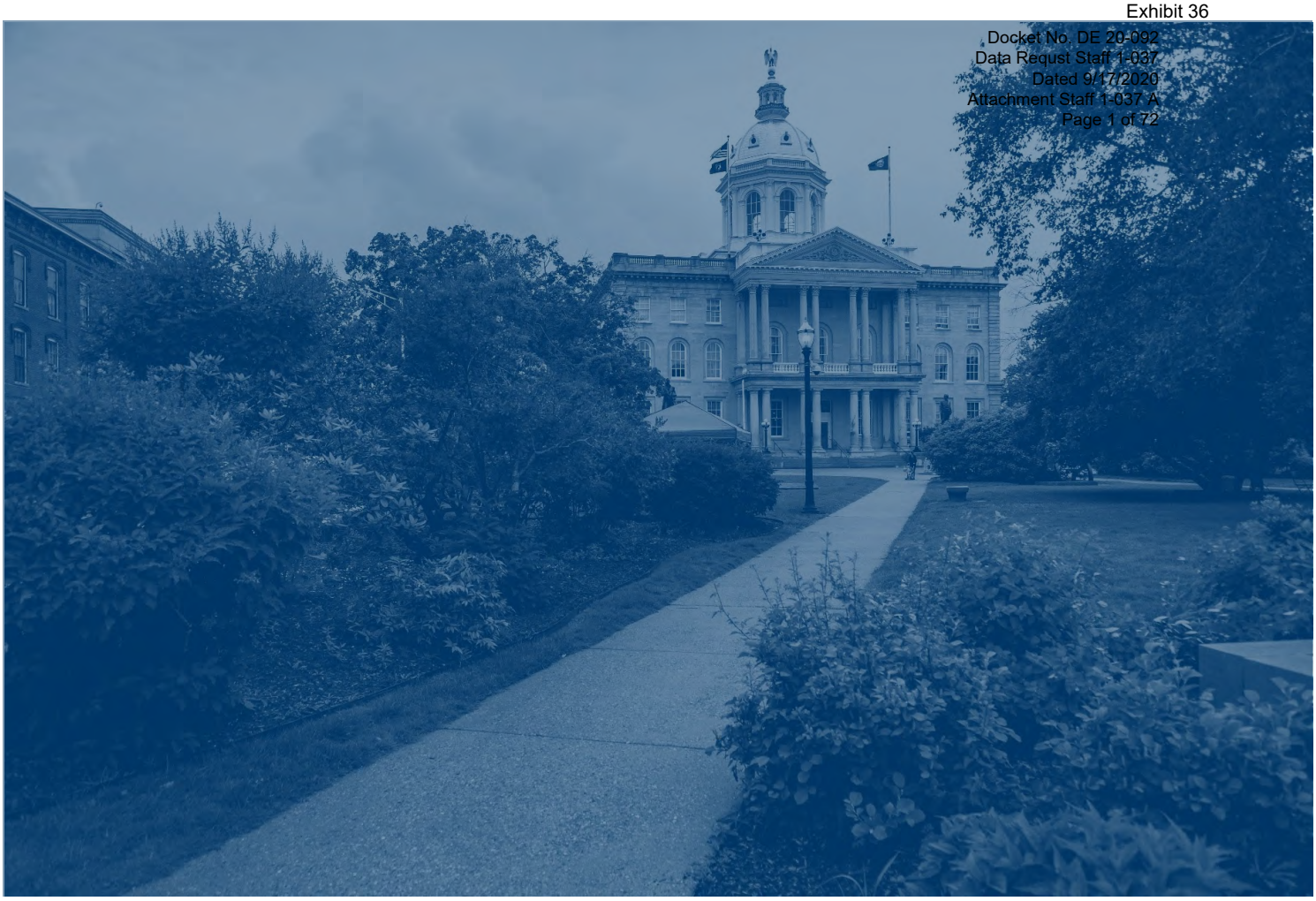
The NH Utilities contracted with Luth Research to survey customers for primary research data related to impacts of COVID-19 on customers and their resulting attitudes toward energy efficiency projects. See Attachment Staff 1-037 B.

Eversource conducted surveys of residential commercial customers on the impacts of COVID-19 and their resulting attitudes toward moving forward with energy efficiency projects in their homes. See Attachment Staff 1-037 C.

Additionally, the US Census Bureau has been conducting a series of pulse surveys with useful indicators for both small businesses and households regarding the impacts of COVID-19. The small business survey results can be found here: https://www.census.gov/data/experimental-data-products/small-business-pulse-survey.html and the household results here:https://www.census.gov/data/experimental-data-products/household-pulse-survey.html Both sets of data can be sorted for New Hampshire specific responses.

The NH Utilities worked to take all of this information into account when developing energy savings targets, projected cost to achieve, and a plan structure that includes both flexibility and accountability for achieving goals. Example elements that were applied to the plan to account for the effects of the pandemic include:

- Higher anticipated customer incentives for program offerings, such as Home Performance with ENERGY STAR, Large Business and Small Business programs, along with higher anticipated vendor costs due to required personal protective equipment.
- Greater investment in marketing and workforce development activities to support all programs.
- More dependency on energy savings achievements within the residential sector versus the commercial/industrial sector, based on the current observed impacts of the pandemic on the 2020 Energy Efficiency program portfolio and what the Joint Utilities are forecasting to achieve for program results.
- Continued deployment and expansion of virtual audit offerings for residential and non-residential customers.



New Hampshire Potential Study

Statewide Assessment of Energy Efficiency and Active Demand Opportunities, 2021-2023

Volume I: Results

Prepared for:

New Hampshire Evaluation, Measurement and Verification Working Group

dunsky

Submitted to:

New Hampshire Evaluation, Measurement and Verification Working Group

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With support from:
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Energy & Resource Solutions, Inc. (ERS)
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About Dunsky

Dunsky provides strategic analysis and counsel in the areas of energy efficiency, renewable energy and clean mobility. We support our clients – governments, utilities and others – through three key services: we **assess** opportunities (technical, economic, market); **design** strategies (programs, plans, policies); and **evaluate** performance (with a view to continuous improvement).

Dunsky's 30+ experts are wholly dedicated to helping our clients accelerate the clean energy transition, effectively and responsibly.

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Executive Summary

An executive summary will be included with the final report.

1 Introduction

1.1 Study Overview

This report presents the results of the New Hampshire Potential Study. The study provides a statewide overview of modelled potential for savings from energy efficiency and active demand programs over the 2021-2023 period.

1.1.1 Potential Study Context and Purpose

The project included primary data collection, described in the New Hampshire Market Baseline section below. The data collected was used as an input to the potential study modelling process, described in detail in Volume II of the report.

Eversource, Unitil, Liberty, and the New Hampshire Energy Cooperative ('the utilities') have been operating energy efficiency programs under the NHSaves brand since 2000. An Energy Efficiency Resource Standard was adopted in the state in 2016, requiring the utilities to file triennial plans, meet annual savings goals, and – as a long-term objective – capture all cost-effective energy efficiency in the state. The plans divide program design and funding by electric and gas utility (with electric utilities also pursuing delivered fuel savings in the residential sector), and the presentation of results in this study reflect this split.

The potential study is a high-level assessment of electric, natural gas, and delivered fuel savings opportunities in the State of New Hampshire over the next three years, in alignment with the 2021-2023 triennial plan. The main purpose of this study is to quantify the cost-effective savings opportunities for energy efficiency and electric active demand. In addition to this objective, the potential study can also support:

- Resource planning
- Program planning
- State policy and strategies

While the potential study provides granular information such as savings for specific measures in specific building segments, the study is not a program design document meant to accurately forecast and optimize savings and spending through utility programs in a given future year. The study is meant to quantify the total potential opportunities that exist under specific parameters as defined under each scenario.

1.1.1.1 COVID-19 Considerations

The study was initiated in September 2019, prior to the onset of the COVID-19 pandemic. The pandemic did not impact residential data collection activities but did interrupt data collection for the non-residential sector. This interruption is described in more detail in the Non-Residential Baseline Study section.

The lasting economic impacts of COVID-19 are still unclear but are likely to result in a significant economic slowdown. Both economic slowdowns and new social distancing practices can serve to increase barriers for efficiency programs. The results provided in this report are based on pre-COVID-19 market conditions. An analysis that assesses the sensitivity of achievable potential savings to the COVID-19 pandemic is included in the COVID-19 Sensitivity Analysis section of this report.

1.2 Data Sources and Uses

The study uses New Hampshire-specific data to populate the models used to estimate market potential. Where New Hampshire-specific data is not available or is insufficient, data from nearby jurisdictions was leveraged to fill gaps and produce a more robust representation of market parameters in the study.

Data source	Application in study
Utility customer data	Customer data is used to determine the number of customers in each market segment.
New Hampshire market baseline survey data	Recent baseline survey studies conducted in New Hampshire are used to establish equipment penetration and saturations in the model for select end-uses.
Utility Benefit Cost Ratio Models	The study uses measure-level benefit-cost ratio model workbooks provided by the utilities to derive avoided cost and other economic inputs, net-to-gross values and realization rates, as well as to benchmark results.
NHSaves program data	Historical program data is used to characterize programs for model input (e.g. incentive levels, administrative costs) and used to benchmark results.
Historical load	Historical hourly load data was used to assess peak demand and evaluate demand response potential.
U.S. DOE Building Archetypes	Buildings archetypes, adjusted for New Hampshire climate and consumption, were used to provide end-use breakdown and for quality control purposes.
Dunsky's Market Archetype	Where New Hampshire specific baseline data is not available (or was based on a low number of observations), baseline data from neighboring jurisdictions in the Northeast United States is leveraged and adjusted for New Hampshire specific attributes wherever possible.

1.3 New Hampshire Market Baseline

1.3.1 Residential Baseline Study

The residential baseline study was conducted by Itron and characterized energy-using equipment in New Hampshire homes. The study also assessed the extent to which these equipment baselines differ from those in neighbouring jurisdictions.

The study used a mobile-optimized web survey to collect data on building characteristics, equipment saturation, and photos of equipment nameplates. The equipment nameplate photographs were then compared to an in-house database to verify key metrics ((including vintage, capacity, and efficiency).

The survey segmentation was broken down by utility, housing type (single-family vs. multifamily), and climate zone, and low-income customers were flagged. Detailed saturation and efficiency results from the study were used as inputs to the potential study and are provided in the report, the *New Hampshire Residential Baseline Study*.

1.3.2 Non-Residential Baseline Study

For the non-residential baseline study, the team proposed an innovative approach which relied heavily on secondary sources from the numerous recent studies in neighboring jurisdictions. The Dunsky Energy Efficiency Potential model utilizes over 200 individual metrics for equipment saturation, penetration, and efficiency applied across each of the non-residential segments. For this study, the data sources vary by metric but generally fall into one of three categories:

- Value from a previous study in similar jurisdiction (Dunsky Market Archetype)
- Value derived directly from NH customers or data
- Value derived through engineering principles or professional judgment

The team initially populated each of the metrics with secondary research values from similar studies and then reviewed and adjusted these depending on the findings of additional primary data collected for the study. This primary data collection included computer-assisted telephone interviews (CATIs) with C&I facility personnel, interviews with representatives from industrial facilities, and interviews with distributors who have non-residential customers in both Massachusetts and New Hampshire who could speak about the sales activity and their perception of the evolution of the market/demand for efficient technologies in both markets.

The primary data collection for the non-residential sector was interrupted by the COVID-19 pandemic. As a result, the number of CATI survey completes were lower than originally planned and were focused on small non-residential customers. As a solution, the team compared these results to similar surveys that had recently been completed in Massachusetts to assess variation in customer responses based on size. The analysis found limited differences in responses due to customer size, and therefore concluded that the results collected for the small non-residential customers could be generalized to all sizes of non-residential customers.

In general, the team changed initial metrics only when there was a compelling case to do so based on direct data or market knowledge. A detailed description of research activities and adjustments made are provided in the *New Hampshire Non-Residential Baseline Memo*. The specific metrics used as the commercial baseline, including their sources, are identified in the *New Hampshire Non-Residential Baseline Metrics Workbook*.

1.3.2.1 Non-Residential Sector: Suggestions for Future Research

The primary research completed for this project focused on gathering data specific to measure classes with high savings potential and/or markets that are evolving quickly, namely lighting and HVAC. Future primary research specific to New Hampshire will be important to ensure that the assumptions informing program design strategies are accurate. In particular, the following areas are recommended for additional data collection activities:

- Linear LED saturation
- Primary water heating fuels
- Primary space heating fuels

1.4 Baseline Energy and Demand Forecasts

To understand the impact of the various measures analyzed in the potential study on overall energy consumption and demand in New Hampshire, the study establishes baseline energy and demand forecasts for the 2021-2023 period. The utilities provided electric and natural gas consumption and electric demand forecasts and delivered fuel forecasts were sourced from the Energy Information Agency. The study adjusted these forecasts to remove the projected impacts of existing and planned energy efficiency programs during the study period to avoid double-counting impacts estimated through the study.

Figure 1 below presents the adjusted baseline forecasts for each fuel type and electric peak demand. Electricity and natural gas consumption are expected to increase over the study period at annualized rates between 1% and 2%, while electric peak demand is only forecasted to increase approximately 0.2% per year. Delivered fuel consumption in the residential sector is expected to decline at an annualized rate of 1.3% - even in the absence of efficiency programming. These forecasts are used to illustrate the relative impacts of savings in each of the electric utility and gas utility-specific sections, as well as in the detailed data files.

Figure 1. Baseline Energy and Peak Demand Forecasts

*Forecasted peak demand provided by the utilities was not disaggregated by sector
**Delivered fuel forecasts were only developed for the residential sector as it is the only sector with delivered fuel-focused measures in the study

2 Energy Efficiency

2.1 Chapter Overview

This section presents the achievable energy efficiency potential for electric and natural gas utilities in New Hampshire over the 2021-2023 period. The results focus on estimated energy savings for electricity and natural gas. The study also quantified delivered fuel savings (including oil, propane, and kerosene) as well as peak demand savings (i.e. passive demand reductions) for electric measures, and these results are included in the detailed accompanying study data tables.

The first section of this chapter includes a description of the overall approach used to assess potential. The program-level results that follow are presented by utility type (electric and gas) and outline specific sector, segment, measure class, and measure opportunities available in New Hampshire over the 2021-2023 period.

The results provided in this report are based on pre-COVID-19 market conditions. An analysis that assesses the sensitivity of achievable potential savings to the COVID-19 pandemic is included in the COVID-19 Sensitivity Analysis section of this report.

2.1.1 Basis of Savings

Incremental annual program savings are the savings achieved in the first year of all measures incentivized through efficiency programs. Historically, utilities in New Hampshire have set efficiency targets and have developed efficiency plans in terms of incremental annual program savings. Incremental lifetime savings are expressed in terms of the savings expected over the entire useful lives of all measures incentivized through efficiency programs. The results in this chapter focus on savings on an incremental annual first-year basis. In some cases, the results also include incremental lifetime savings. These results do not include savings from interactive or secondary savings effects, although these savings are available in the detailed study data tables.

2.1.2 Approach

The study assesses energy efficiency potential using the Dunsky Energy Efficiency Potential (DEEP) model. DEEP employs a bottom-up modelling approach that evaluates thousands of measure-market combinations, applying program impacts (e.g. incentives and enabling activities that reduce customer barriers) to assess energy savings potentials across multiple scenarios. Rather than estimating potential based on the portion of each end-use that can be reduced by energy-saving measures and strategies (often referred to as a 'top-down' approach), DEEP applies a highly granular calculation methodology to assess the energy savings potential for each measure-market segment opportunity in each year.

DEEP assesses three levels of energy savings potential: technical, economic, and achievable.

- Technical potential is all theoretically possible energy savings resulting from measures included in the study. Technical potential is assessed by combining measure and market characterizations to

determine the maximum amount of savings possible in the absence of constraints such as cost-effectiveness screening, market barriers, or customer economics.

- **Economic potential** is a subset of the technical potential that only includes measures that pass cost-effectiveness screening. Economic screening is performed at the measure level and only includes costs related to the measure. Economic screening does not include general program costs.

- **Achievable potential** is the energy savings resulting from customer adoption of energy-savings measures. Rooted in the United States' Department of Energy (U.S. DOE) adoption curves[1], DEEP defines annual adoption rates based on a combination of customer cost-effectiveness and market barrier levels. Customer cost-effectiveness is calculated within the model based on inputs from measure and program characterization as well as economic and adoption parameters. The achievable potential scenarios included in this study are described in the following section.

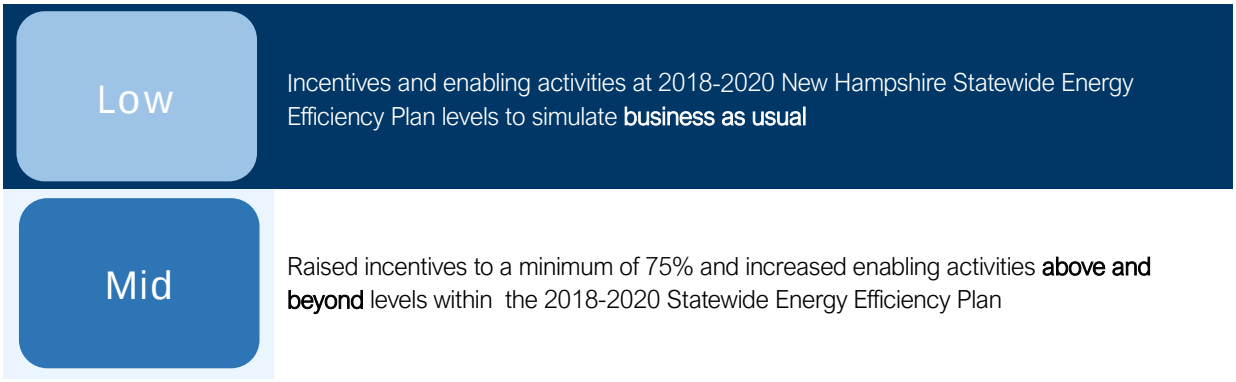
This report focuses on achievable potential savings as it is most relevant to program planning, however technical and economic savings are also included in the detailed study data tables.

Appendix A of Volume II of the report includes an in-depth overview of the energy efficiency potential study methodology.

2.1.2.1 Achievable Potential Scenarios

The potential study includes three achievable potential scenarios. Program settings – namely incentive levels and enabling activities (*see comment box below*) – define the achievable potential scenarios. The study structures the programs to closely align with existing NHSaves programs, but in some cases includes measures not currently offered through programs; this allows for the assessment of achievable savings in New Hampshire through novel measure offerings. Figure 2 below outlines the three achievable potential scenarios considered in this study. Appendix C of Volume II of the report includes the detailed program settings assumptions associated with each scenario.

Figure 2. Achievable Potential Scenarios



[1] The USDOE uses this model in several regulatory impact analyses. An example can be found in http://www.regulations.gov/contentStreamer?objectId=090000648106c003&disposition=attachment&contentType=pdf, section 17-A.4.

Max

Eliminates customer costs (100% incentive as portion of incremental costs) while maintaining same level of enabling strategies as Mid

Achievable Potential Scenario Settings

Incentive Levels: Program incentives address the barriers to measure adoption associated with upfront cost, covering part or all of the incremental cost associated with a high-efficiency measure. Incentive levels are characterized as a percentage and represent the portion of measure incremental costs that they cover.

Enabling Strategies: Non-financial barriers to measure uptake also exist and prevent consumers from adopting high-efficiency equipment. This means that programs must go beyond incentive strategies to address other non-economic barriers to customer participation. Barrier reductions can be achieved through enabling activities that streamline program participation including but not limited to:

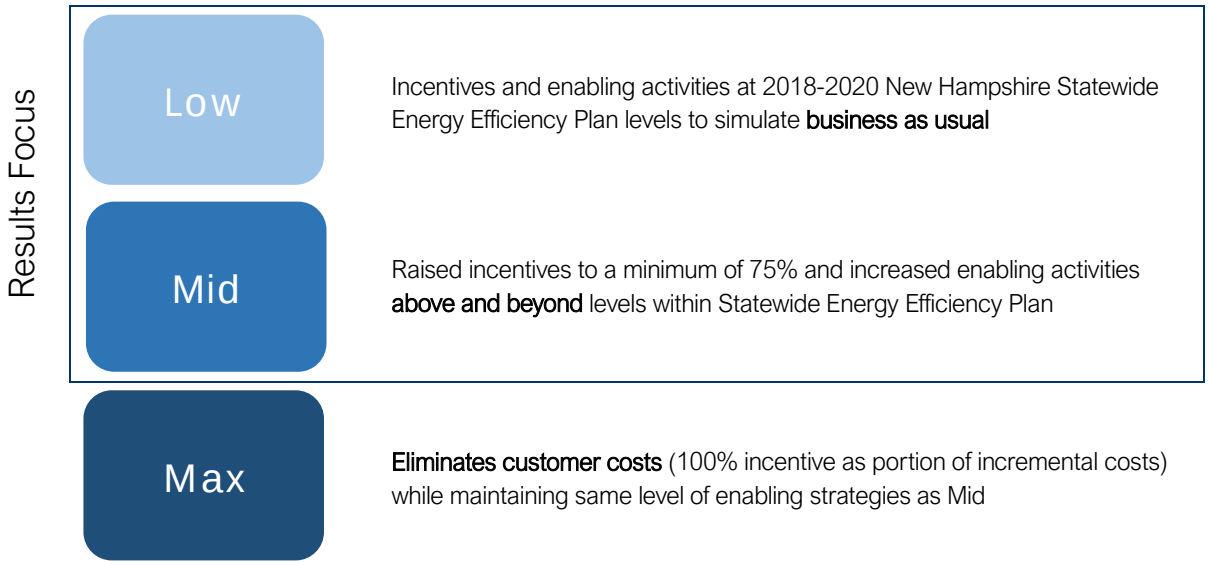
- Direct install programs
- Contractor training and support
- Upstream programs
- Targeted marketing
- Building and home energy labeling requirements
- Financing Programs

The program scenarios assessed in this study capture the impact of current enabling strategies included in NHSaves programs by calibrating the Low scenario achievable potentials to current portfolio savings. The potential impact of investing further in enabling strategies is assessed under the Mid program scenario, where additional barrier level reductions are applied over and above the Low scenario where possible. While the potential study does not identify the specific enabling strategies engaged or the associated barriers addressed, the results are intended to provide a quantitative assessment of additional savings that can be captured through enabling strategies.

2.2 Electric Utility Program-Level Savings: Achievable Potential

This section presents the achievable potential for electric savings from electric utility programs. It focuses primarily on the low and mid scenarios, given that these scenarios are most closely in-line with anticipated 2021-2023 NHSaves program budgets. Results for all three scenarios are included in the detailed study data tables.

Figure 3. Achievable Potential Scenarios: Results Focus



For brevity, the results focus on the first and final years of the study, 2021 and 2023. Results for all three years of the study are included in the detailed study data tables.

2.2.1 Basis of Savings

This section provides an overview of electric utility program savings potential. The electric savings presented here represent the savings achieved through electric and delivered fuel measures and *do not* account for electric savings achieved through natural gas measures due to interactive or secondary savings effects.

The savings are adjusted gross savings at the meter, with some exceptions for specific lighting measures in cases where the utilities provided approved net-to-gross values. The specific net-to-gross assumptions used in the study are provided in Appendix C of Volume II of the study.

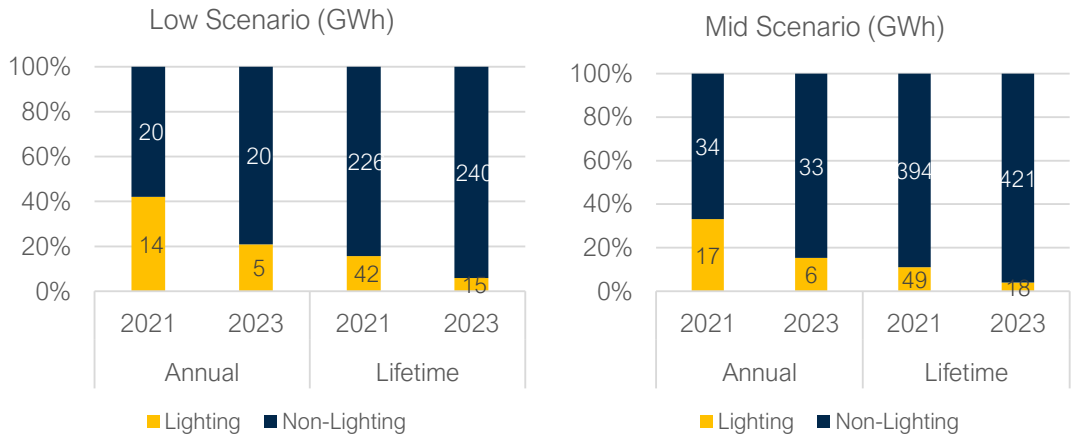
2.2.2 Summary of Lighting Savings

Given historical importance of lighting savings and the rapidly evolving lighting market, this section highlights key findings related to lighting, focusing on the years 2021 and 2023 and the low and mid scenarios.

2.2.2.1 Residential Savings

Below, the share of overall annual and lifetime residential savings represented by lighting are provided for the low and mid scenarios. Lighting remains an important source of savings for residential programs, although less so as the study progresses, less so under the mid scenario, and less so on a lifetime basis.

Figure 4. Lighting as a Share of Overall Residential Annual and Lifetime Savings for Low and Mid Scenario



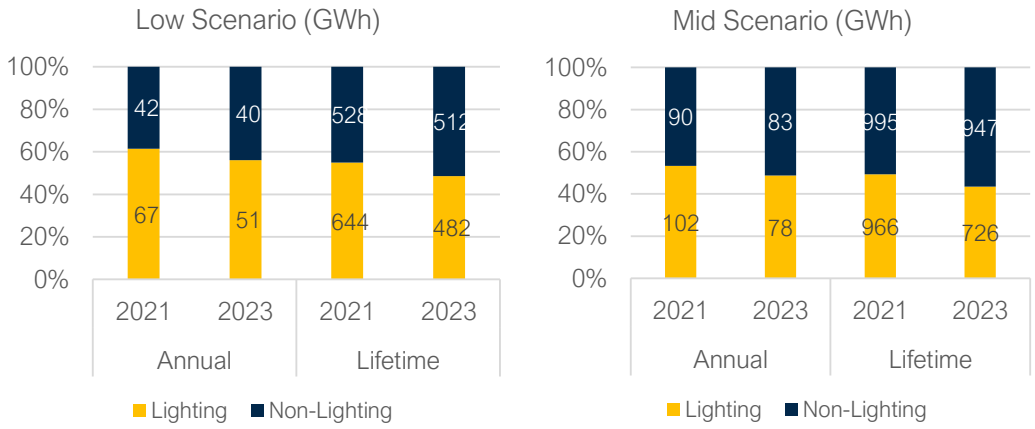
Under the low scenario, lighting accounts for 14 GWh of annual residential savings in 2021, slightly more than 40% of annual residential savings overall. Lighting makes up a smaller share of residential lifetime savings (16%). By 2023, lighting shrinks to 21% of annual Low scenario residential savings and 6% of lifetime savings.

Moving from the low to the mid scenario, annual lighting savings grow on absolute relative basis to 17 GWh but represent a smaller share of overall savings (33% of annual residential savings overall) as incentives and enabling strategies are increased, promoting the adoption of measures in other classes. By 2023, lighting represents 15% of annual savings and 4% of lifetime savings under the mid scenario.

2.2.2.2 Non-Residential Savings

Below, the share of overall annual and lifetime non-residential savings represented by lighting are provided for the low and mid scenarios. Although Tubular LEDs (TLEDs) are becoming more common, they have not seen the same level of market transformation as has occurred with A-Lamps and specialty bulbs. As a result, lighting is forecasted to continue to play an important role in non-residential programs over the study period.

Figure 5. Lighting as a Share of Overall Non-Residential Annual and Lifetime Savings for Low and Mid Scenario



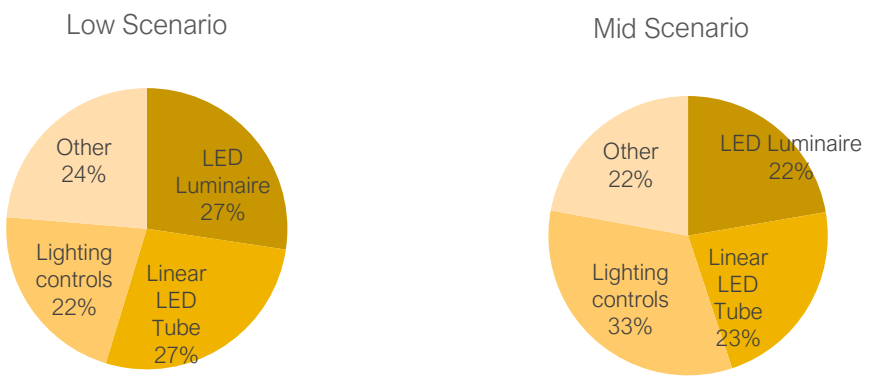
Under the low scenario, lighting accounts for 67 GWh of annual non-residential savings in 2021, approximately 60% of annual non-residential savings overall. At 644 GWh, lighting accounts for 55% of non-residential lifetime savings in 2021. By 2023, lighting remains an important, albeit slighting reduced, source of savings – 56% of total annual, and 49% of total lifetime.

Moving from the low to the mid scenario, annual lighting savings grow on an absolute basis to 102 GWh but decrease on a relative basis (53% of annual non-residential savings overall). By 2023, lighting represents 49% of annual savings and 43% of lifetime savings.

Although linear lighting remains an important opportunity, the lighting measure class also includes savings from lighting controls. Advanced lighting controls, including networked lighting, is a growing opportunity as new technologies and products integrate efficiency savings with increased functionality and non-energy benefits. These offer an emerging opportunity that also faces notable challenges including limited cross-compatibility among products from different manufacturers, limited customer awareness of the options and benefits, and timing re-lamping efforts with controls change-outs. Achieving the potential savings from advanced lighting controls will likely require investment to identify the most effective delivery strategies and tracking product development and roll-out.

Figure 6 provides an overview of the share of overall non-residential savings by lighting technology for the low and mid scenarios.

Figure 6. Non-Residential Annual Lighting Savings by Technology and Scenario, Average over 2021-2023



On average over the 2021 to 2023 period, lighting controls represent 22% of all lighting savings opportunities under the low scenario. This increases under the mid scenario where, on average, controls represent 33% of total annual lighting savings due to augmented incentives and implementation of enabling strategies.

2.2.2.3 Budget Implications

Under the mid scenario, lighting represents a smaller share of both residential and non-residential savings (on both an annual and a lifetime basis) in comparison to the low scenario. The mid scenario is associated with increased incentives (improving customer cost-effectiveness) and additional enabling strategies (reducing non-financial market barriers). This results in increased diversity of savings and a decreased dependence on lighting, but at an additional cost.

Table 1 below outlines the low and mid scenario electric utility budget and savings for years 2021 and 2023.

Table 1. Electric Utility Budget, Savings, and Levelized Cost by Scenario and Year

		2021	2023
Low Scenario	Electric Utility Budget (M$)	$62	$60
	Electric Utility Savings (GWh)	144	116
	$/kWh	$0.43	$0.52
Mid Scenario	Electric Utility Budget (M$)	$169	$159
	Electric Utility Savings (GWh)	242	200
	$/kWh	$0.70	$0.80

The per kilowatt-hour cost of savings increases within each scenario between years 2021 and 2023 and between the low and the mid scenarios. As lighting savings decrease over time, programs are expected to either see fewer savings for a constant budget or will be required to increase budgets to unlock additional

savings opportunities. These opportunities are explored in greater detail in the Savings by Measure Class and Top Measures sections that follow.

2.2.3 Savings as a Percent of Sales

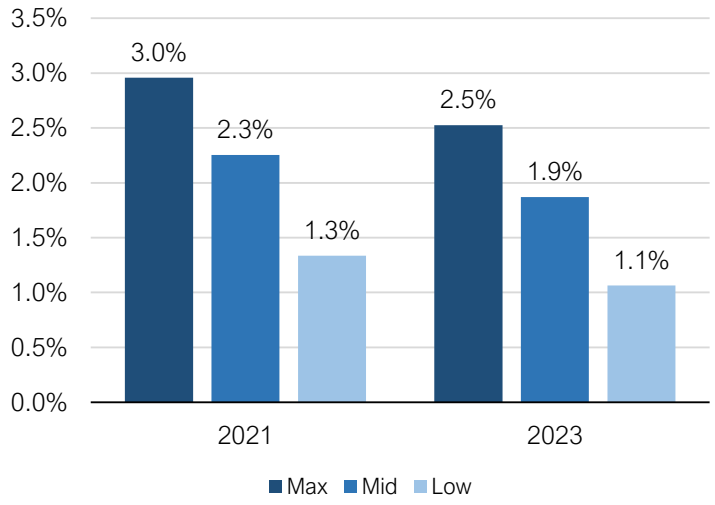
The study estimates that efficiency programs can procure between 143 GWh (low) and 315 GWh (max) of incremental annual savings in 2021, and between 115 GWh and 263 GWh of incremental annual savings in 2023, as outlined in Table 2 below. For context, NHSaves programs achieved portfolio-wide electric savings of 124 GWh in 2019.

Table 2. Annual Incremental Electric Program Savings by Scenario, Year

Scenario	2021 Electric Savings (GWh)	2023 Electric Savings (GWh)
Max	315	263
Mid	240	198
Low	143	115

Savings as a percent of sales is one of the target metrics included in the NHSaves three-year program plans. Below, Figure 7 presents the modeled potential electricity savings as a percent of electricity sales for the first and last years of the study.

Figure 7. Electricity Savings as a Percent of Sales[2]



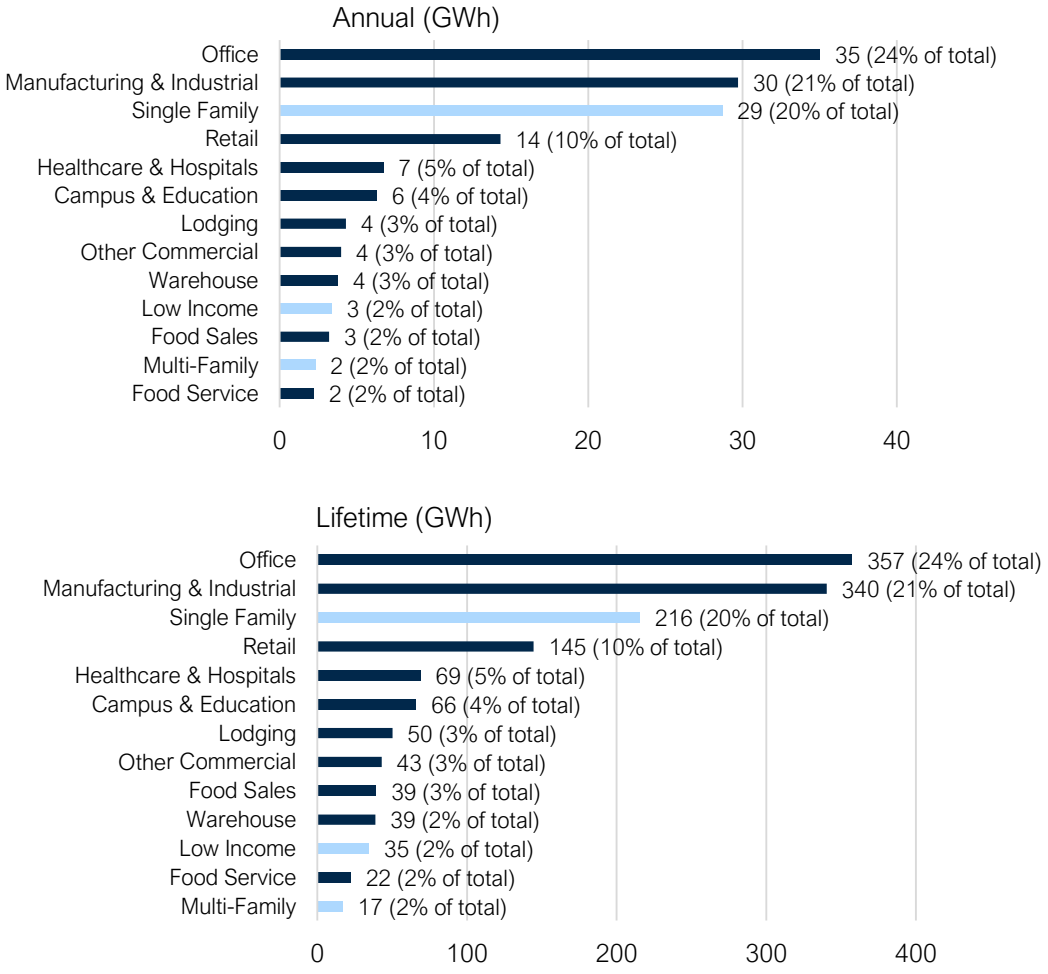
Savings range from 1.1% of sales to 3.0%, varying by scenario and year. The modeled savings as a percent of sales show a decrease across all scenarios in the final year of the study. This decrease is primarily a result of decreased savings from lighting measures in the residential sector, as outlined further in the sections that follow.

[2] Savings are shown as percent of forecasted sales in that year (e.g. 2021 savings are shown as a percent of 2021 sales, 2023 savings as a percent of 2023 sales).

2.2.4 Savings by Segment

The non-residential sector, which includes commercial, institutional, and industrial customers, is forecasted to account for approximately 60% of total electricity consumption throughout the study period (as seen in the Baseline Energy and Demand Forecasts section). Under the low scenario, the non-residential sector also represents the majority of both annual and lifetime electric savings (76% of annual savings and 81% of lifetime savings), as seen in Figure 8 below. The residential share of annual savings is larger than the residential share of lifetime savings (24% compared to 19%). This is due to a number of high-savings potential measures in the residential sector having short measure lifetimes, including – notably – home energy reports, which represent the sixth highest annual saving measure across all residential measures in 2021.

Figure 8. 2021 Annual and Lifetime Electricity Savings by Segment[3], Low Scenario



[3] As part of the study, customers were categorized into segments. Given the reliance on secondary data in the non-residential portion of the study, segment definitions were constrained, and segmentation in the study may differ from internal utility segmentation of customers. A full description of the segmentation process was provided in the *Commercial Segmentation Memo.*

At the segment level, the office and manufacturing/industrial segments represent the bulk of electric efficiency opportunities – collectively 45% of both annual and lifetime savings. Single family, retail, and healthcare & hospitals are within the top five segments on both an annual and lifetime basis.

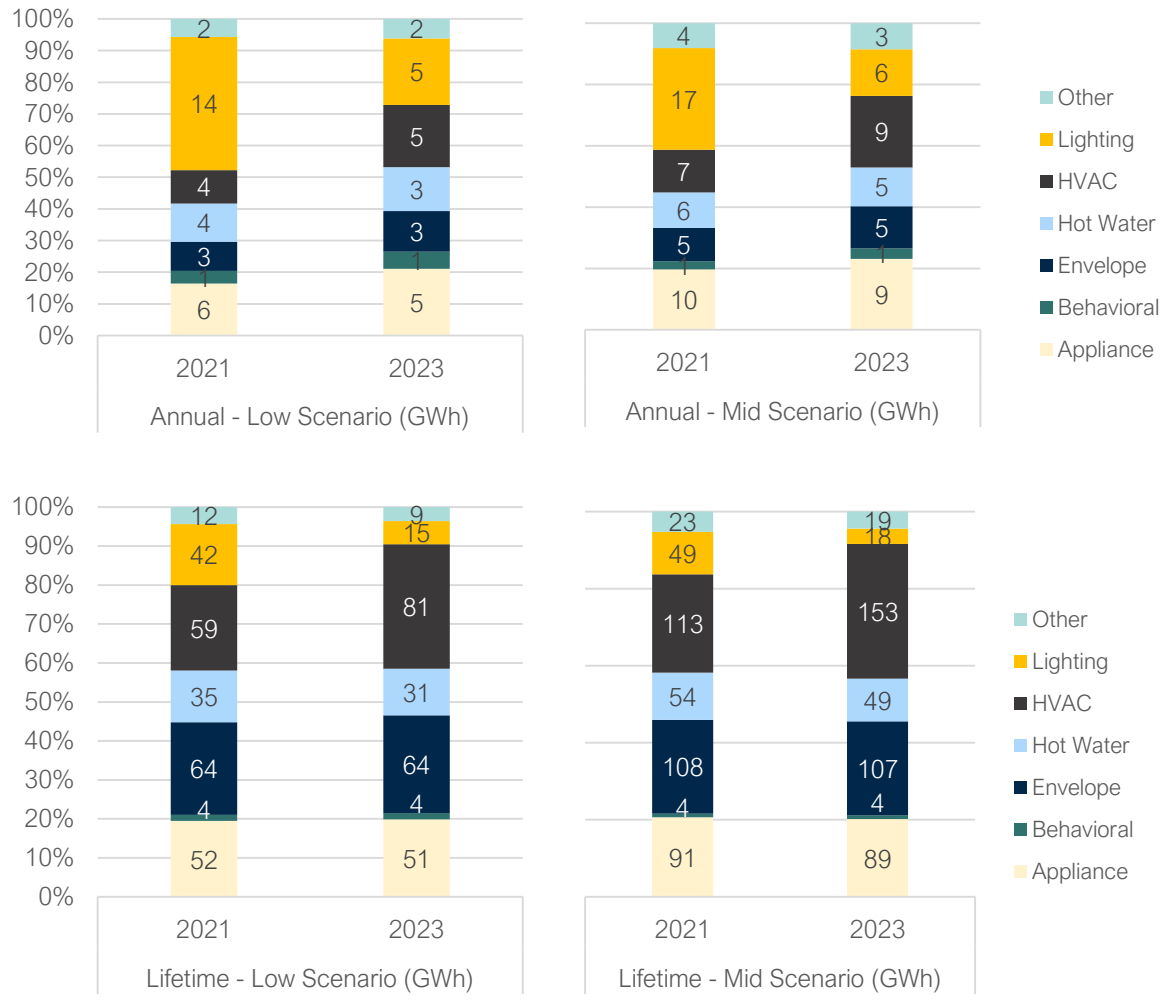
2.2.5 Residential

This section presents detailed results for the residential sector (including low income), outlining savings potential by measure class and highlighting top measures. Results are included for both the low and the mid scenarios.

2.2.5.1 Savings by Measure Class

For the residential sector, annual savings are distributed among multiple end-uses. Savings are increasingly diverse as the study progresses, and between the low and mid scenarios. Figure 9 below presents annual and lifetime residential savings by measure class and scenario for years 2021 and 2023.

Figure 9. Annual and Lifetime Residential Electricity Savings by Measure Class, Low and Mid Scenario



Note: The 'Other' category includes advanced power strips and pool pumps

Lighting remains an important measure class under both the low and mid scenarios in 2021. The study assumes declining NTG values for lighting in alignment with the utility benefit cost ratio models[4]. This results in fewer savings from lighting with each subsequent study year and decreased total savings over time as a result of reduced lighting savings under both scenarios.

Although absolute lighting savings increase under the mid scneario, the proportion of total savings represented by lighting decreases as incentives for measures increase and improve customer cost-effectiveness, and other market barriers are reduced through program design. Between the low and mid scenario, the HVAC, appliance, and other measure classes show the greatest relative growth. This indicates that adoption of these measures is more senstive to increased incentives and/or reduced market barriers.

The hot water measure class represents considerable savings under both scenarios on both an annual and a lifetime basis. Measures with long lifetimes, such as HVAC and envelope, also provide consistent lifetime savings under both scenarios.

2.2.5.2 Top Measures

Table 3 below outlines the top residential measures on an annual savings basis for the first and last years of the study. Results are shown for both the low and mid scenarios.

Table 3. Residential Top Measures by Annual Electricity Savings, Low and Mid Scenario (Lighting Measures Highlighted)

2021			
Low		Mid	
Measure	Savings (GWh)	Measure	Savings (GWh)
LED A-Lamp (Interior)	8.2	LED A-Lamp (Interior)	9.5
LED Bulbs (exterior)	2.4	Refrigerator Recycle	3.4
LED Specialty - Reflectors (Interior)	2.4	Advanced Power Strips	3.1
Refrigerator Recycle	1.9	LED Specialty - Reflectors (Interior)	2.8
LED Specialty - Candelabras, Globes (Interior)	1.4	LED Bulbs (exterior)	2.7
Home Energy Report	1.3	Refrigerator	1.8
Advanced Power Strips	1.2	Water Heater - Heat Pump Water Heater (HPWH)	1.8
Thermostatic Restrictor Shower Valve	1.2	LED Specialty - Candelabras, Globes (Interior)	1.6
Low Flow Shower Head	1.2	Thermostatic Restrictor Shower Valve	1.6
Refrigerator	1.1	Thermostat Wi-Fi	1.5
2023			
Low		Mid	
Measure	Savings (GWh)	Measure	Savings (GWh)

[4] The NTG value assumptions are included in Volume II.

LED A-Lamp (Interior)	3.0	LED A-Lamp (Interior)	3.4
Refrigerator Recycle	1.5	Mini-split Ductless Heat Pump (DMSHP)	3.1
Home Energy Report	1.4	Refrigerator Recycle	2.6
Refrigerator	1.1	Advanced Power Strips	2.4
Advanced Power Strips	0.9	Refrigerator	1.9
Thermostatic Restrictor Shower Valve	0.9	Water Heater - Heat Pump Water Heater (HPWH)	1.8
Low Flow Shower Head	0.9	Thermostat Wi-Fi	1.4
LED Bulbs (exterior)	0.9	Home Energy Report	1.4
LED Specialty - Reflectors (Interior)	0.9	Heat Pump Clothes Dryers	1.2
LED Specialty - Candelabras, Globes (Interior)	0.5	Thermostatic Restrictor Shower Valve	1.2

Although close to half the measures in the top ten measure list in 2021 are from the lighting class, increased program spending under the mid scenario results in greater savings from non-lighting measures. In 2021, program changes under the mid scenario result in greater savings from measures previously experiencing limited customer cost-effectiveness and/or barriers.

By 2023, lighting measures under the low scenario place lower on the top 10 list than in 2021 as their potential decreases. Savings from other measures on list remain relatively constant, leaving a gap in overall program savings.

Appliance, hot water, and other measures provide consistent savings**.** Refrigerators and refrigerator recycling, water restricting devices, and advanced power strips are high savings measures with consistent potential across all three study years.

The mid scenario includes several measures with higher upfront cost and/or barriers that do not show up under the low scenario**.** This includes heat pumps, heat pump water heaters, heat pump clothes dryers, and Wi-Fi thermostats.

2.2.6 Non-Residential

This section presents detailed results for the non-residential sector, outlining savings potential by measure class and highlighting top measures.

2.2.6.1 Savings by Measure Class

The non-residential sector continues to rely primarily on lighting savings on both an annual and lifetime savings basis. Figure 10 below presents annual and lifetime non-residential savings by measure class and scenario for years 2021 and 2023.

Figure 10. Non-Residential Annual and Lifetime Electricity Savings by Measure Class, Low Scenario

Although uptake of Tubular LEDs (TLEDs) is increasing, there has not yet been the same level of market transformation as has been seen with A-lamps and speciality bulbs. As a result, programs that incentivise efficient commercial lighting technologies are expected to continue to offer signfiicant potential over the study period.

Under the low scenario, non-lighting measure classes experience very little growth between 2021 and 2023. As lighting decreases, savings from other measure classes remain constant or - in the case of HVAC – actually decrease, reducing savings overall.

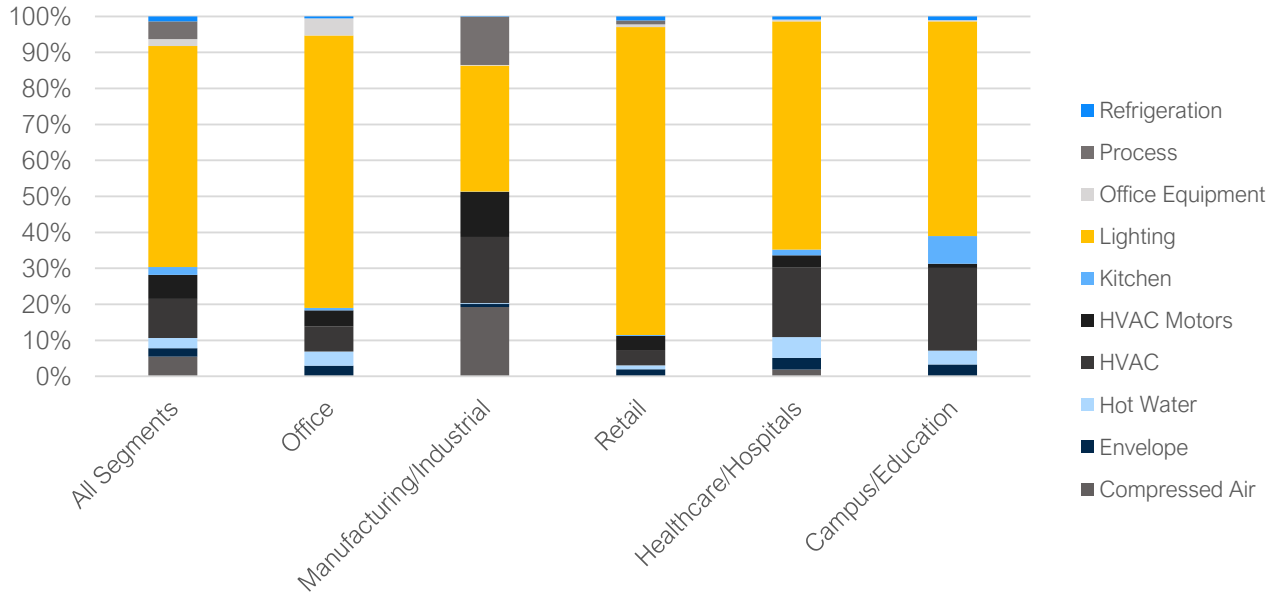
Savings are slightly more diverse under the mid scenario. Absolute growth is seen across all measure classes between the low and mid scenarios. This indicates there is room to grow savings through a mix of classes. HVAC shows the greatest relative growth, followed by compressed air and office equipment, indicating sensitivity to program design changes.

Although hot water is a smaller portion of savings, hot water measures have not featured prominently in past programs, and this class could be a promising source of savings moving forward. These findings are

strongly tied to the basic assumption regarding saturation of electric water heating equipment in the non-residential sector, however, which is an area where additional primary research in New Hampshire could be beneficial.

Given the large number of segments in the non-residential sector, Figure 11 below shows the measure class breakdown for the top five saving segments. Focusing on annual savings for the low scenario in 2021, we compare the measure class savings by segment to the sector overall.

Figure 11. 2021 Annual Electricity Savings by Measure Class for Top-Saving Non-Residential Segments, Low Scenario



Note: The mid scenario shows a very similar distribution of segment-specific measure class savings, so only the low scenario is included here

The manufacturing and industrial segment (the second highest saving segment overall) is considerably less dependent on lighting than the non-residential sector overall**.** Opportunities in this segment are focused on process savings, HVAC (which includes retro-commissioning, strategic energy management, and various HVAC equipment and controls), and compressed air. Across all top segments, HVAC opportunities are considerable - variable frequency drives and control devices represent strong HVAC and HVAC motor growth opportunities for NHSaves.

2.2.6.2 Top Measures

Table 4 below outlines the top non-residential measures on an annual savings basis for the first and last years of the study. Results are shown for the low and mid scenarios.

Table 4. Non-Residential Top Measures by Annual Electricity Savings, Low Scenario (Lighting Measures Highlighted)

2021			
Low		Mid	
Measure	Savings (GWh)	Measure	Savings (GWh)
LED Linear Tube	18.7	LED Linear Tube	23.8
LED Linear Luminaire	18.4	LED Linear Luminaire	22.9
Lighting Controls (Occupancy)	6.8	Retro-commissioning Strategic Energy Manager (RCx SEM)	19.0
LED High Bay	6.8	Lighting Controls (Occupancy)	12.7
Lighting Controls (Daylighting)	5.6	Lighting Controls (Daylighting)	8.6
HVAC VFD - Pump	4.2	LED High Bay	8.1
Retro-commissioning Strategic Energy Manager (RCx SEM)	3.6	Lighting Controls (Network)	8.0
LED Parking Garage (Exterior)	3.0	LED T12 Linear Tube	6.8
HVAC VFD - Fan	2.7	Advanced Power Strips	6.7
Air Receiver for Load/No Load Compressor	2.6	Air Receiver for Load/No Load Compressor	5.8
2023			
Low		Mid	
Measure	Savings (GWh)	Measure	Savings (GWh)
LED Linear Luminaire	18.7	LED Linear Tube	17.5
LED Linear Tube	18.4	LED Linear Luminaire	17.5
Lighting Controls (Occupancy)	6.8	Retro-commissioning Strategic Energy Manager (RCx SEM)	14.8
Lighting Controls (Daylighting)	6.8	Lighting Controls (Occupancy)	12.4
HVAC VFD - Pump	5.6	Lighting Controls (Daylighting)	8.4
LED High Bay	4.2	Lighting Controls (Network)	6.8
Retro-commissioning Strategic Energy Manager (RCx SEM)	3.6	Air Receiver for Load/No Load Compressor	5.9
HVAC VFD - Fan	3.0	HVAC VFD - Pump	5.4
Air Receiver for Load/No Load Compressor	2.7	Advanced Power Strips	5.2
LED Parking Garage (Exterior)	2.6	LED High Bay	4.8

While TLED adoption is becoming more common in the luminaire and tube markets, significant commercial lighting opportunities remain available to be captured by programs. Lighting controls also

feature prominently in the top measure list - Both occupancy and daylighting controls are in the top five measures across both scenarios and study years. Although lighting controls represent a growing opportunity, they also face notable challenges including limited cross-compatibility among products from different manufacturers, limited customer awareness of the options and benefits, and timing re-lamping efforts with controls change outs. It should be noted that achieving savings from these measures will likely required investment to identify the most effective delivery strategies and to track product roll-out and development.

Beyond lighting, manufacturing and industrial-focused opportunities feature prominently in the top measure lists. Notably, retro-commissioning and strategic energy management represent growing opportunities over time and between the low and mid scenarios.

2.3 Natural Gas Utility Program-Level Savings: Achievable Potential

2.3.1 Basis of Savings

This section provides an overview of natural gas utility program savings potential. The savings presented here represent the savings achieved through natural gas measures and do not account for natural gas savings achieved through electric measures due to interactive or secondary savings effects.

The savings are adjusted gross savings at the meter.

2.3.2 Savings as a Percent of Sales

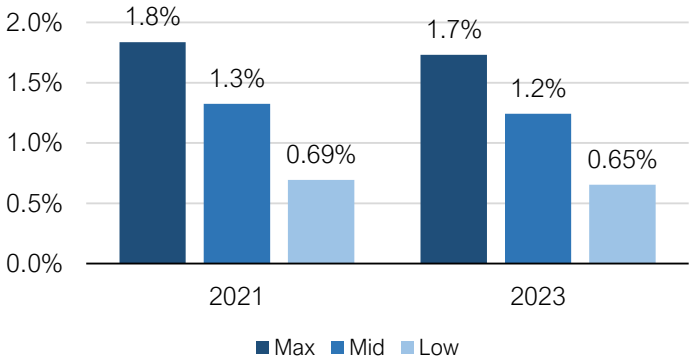
The study estimates that efficiency programs can procure between 206 thousand MMBtu (low) and 517 thousand MMBtu (max) of incremental annual savings in 2021, and between 197 thousand MMBtu and 493 thousand MMBtu of incremental annual savings in 2023, as outlined in Table 5 below. For context, the NHSaves programs achieved portfolio-wide natural gas savings of 209 Thousand MMBtu in 2019.

Table 5. Annual Incremental Natural Gas Program Savings by Scenario, Year

Scenario	2021 Natural Gas Savings (Thousand MMBtu)	2023 Natural Gas Savings (Thousand MMBtu)
Max	517	493
Mid	378	360
Low	206	197

Savings as a percent of sales is one of the target metrics included in the NHSaves three-year program plans. Below, Figure 12 presents the modeled potential natural gas savings as a percent of natural gas sales for the first and last years of the study.

Figure 12. Natural Gas Savings as a Percent of Sales[5]



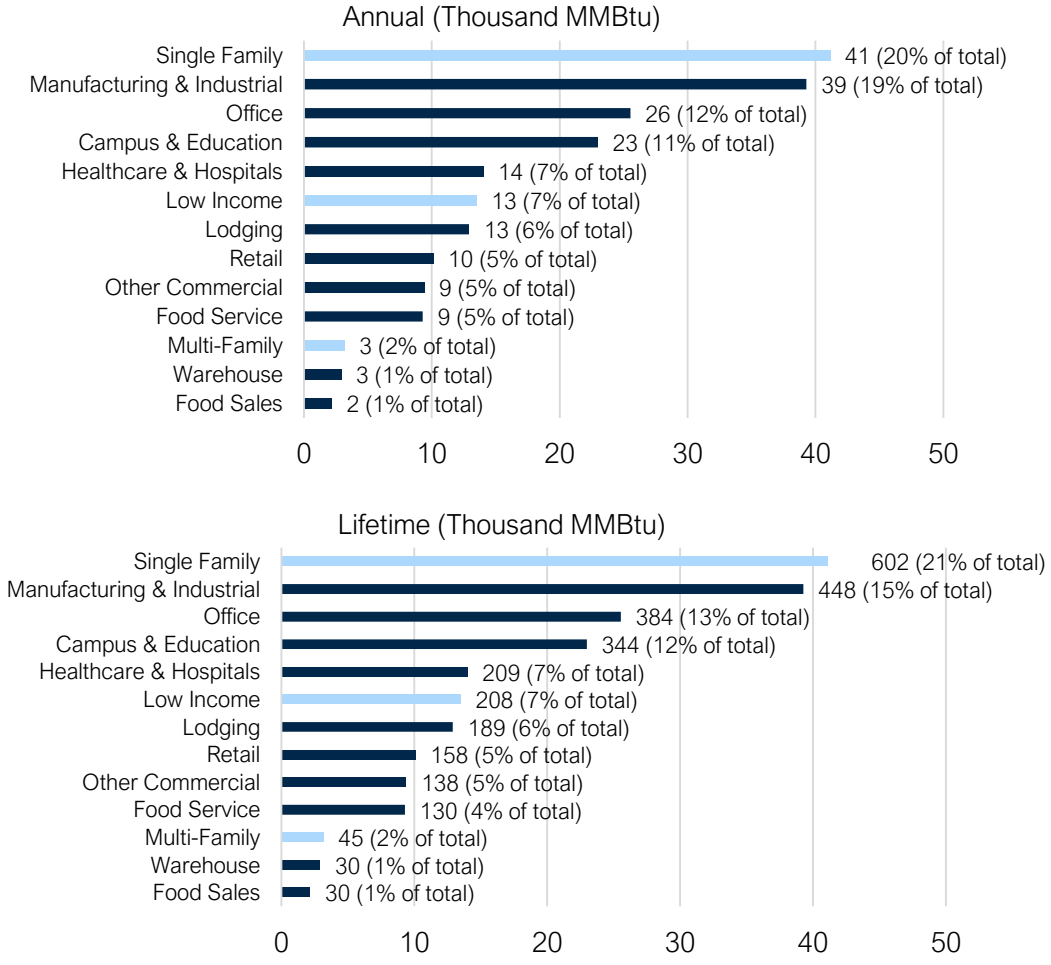
[5] Savings are shown as a percent of forecasted sales in that year (i.e. 2021 savings are shown as a percent of 2021 sales, 2023 savings as a percent of 2023 sales).

Savings range from 0.7% of sales to 1.8%, varying by scenario and year. The modeled savings as a percent of sales show a decrease across all scenarios in the final year of the study. This decrease is primarily a result of a new Federal standard for furnaces coming into effect in 2023, shifting the baseline and decreasing claimable savings.

2.3.3 Savings by Segment

The non-residential sector, which includes commercial, institutional, and industrial customers, is forecasted to account for approximately 68% of total natural gas consumption throughout the study period consumption (as seen in the Baseline Energy and Demand Forecasts section). Under the low scenario, the non-residential sector also represents the majority of both annual and lifetime natural gas savings (72% of annual savings, 71% of lifetime sales), as seen in Figure 13 below.

Figure 13. 2021 Annual and Lifetime Electricity Savings by Segment[6], Low Scenario



[6] As part of the study, customers were categorized into segments. Given the reliance on secondary data in the non-residential portion of the study, segment definitions were constrained, and segmentation in the study may differ from internal utility segmentation of customers. A full description of the segmentation process was provided in the *Commercial Segmentation Memo.*

Single family is the top-saving segment on both an annual and lifetime basis, followed by manufacturing and industrial. The top five segments – also including office, campus and education, and healthcare and hospitals - collectively account for close to 70% of both annual and lifetime savings.

2.3.4 Residential

This section presents detailed results for the residential sector (including low income), outlining savings potential by measure class and highlighting top measures. Results are included for both the low and the mid scenarios.

2.3.4.1 Savings by Measure Class

Within the residential sector, the majority of natural gas savings result from a reduction in energy associated with space heating – either through HVAC equipment or envelope improvements. Figure 14 below presents annual and lifetime residential savings by measure class and scenario for years 2021 and 2023.

Figure 14. Residential Annual and Lifetime Natural Gas Savings by Measure Class, Low and Mid Scenarios

The HVAC measure class represents a larger share of overall savings in the mid scenario as compared to the low scenario. The mid scenario shows considerable absolute and relative growth for this measure class on both an annual and lifetime basis. Specific measures with high potential include furnaces and Wi-Fi thermostats.

The envelope measure class grows more slowly between low and mid scenarios but maintains a large share of annual and lifetime savings under both scenarios. This relatively slower growth indicates less sensitivity of envelope measures to cost-effectiveness improvements and/or barrier reductions than HVAC. Key envelope measures include insulation and incentives for new construction[7], although savings also arise from air sealing and efficient windows.

Beyond HVAC and envelope, opportunities are found in the hot water and behavioural classes. Hot water measures represent a high savings end-use that is currently largely untapped by programs. Measures include low flow fixtures, including faucets and showerheads, along with efficient water heaters. Behavioural measures (i.e. home energy reports) show considerable incremental annual savings but have a limited influence on lifetime savings due to their relatively short lifetimes.

2.3.4.2 Top Measures

Table 6 below outlines the top residential measures on an annual savings basis for the first and last years of the study. Results are shown for both the low and mid scenarios.

Table 6. Residential Top Measures by Annual Natural Gas Savings, Low and Mid Scenario

2021			
Low		Mid	
Measure	Savings (Thousand MMBtu)	Measure	Savings (Thousand MMBtu)
Home Energy Report	9.3	Furnace	20.5
Furnace	8.8	Water Heater - Tankless	13.8
Water Heater - Tankless	4.3	Thermostat (Wi-Fi)	11.6
Duct Insulation	3.9	Home Energy Report	9.3
Water Heater - Storage	3.6	Boiler	7.6
Thermostatic Restrictor Shower Valve	3.1	Water Heater - Storage	7.1
Insulation - Attic	2.9	Duct Insulation	5.6
Low Flow Shower Head	2.9	Thermostatic Restrictor Shower Valve	4.4
Thermostat (Wi-Fi)	2.9	New Home Construction	4.1
New Home Construction	2.8	Air Sealing	4.0

[7] The residential new construction measure incentivizes participants to build to the ENERGY STAR for homes building standard, assuming a baseline of 2018 International Energy Conservation Code (IECC).

2023			
Low		Mid	
Measure	Savings (Thousand MMBtu)	Measure	Savings (Thousand MMBtu)
Home Energy Report	9.4	Furnace	20.5
Furnace	8.8	Water Heater - Tankless	14.0
Water Heater - Tankless	4.4	Thermostat (Wi-Fi)	11.3
Duct Insulation	3.8	Home Energy Report	9.4
Water Heater - Storage	3.7	Boiler	7.6
New Home Construction	2.9	Water Heater - Storage	7.2
Thermostat (Wi-Fi)	2.8	Duct Insulation	5.4
Insulation - Attic	2.8	New Home Construction	4.1
Boiler	2.8	Air Sealing	3.9
Thermostatic Restrictor Shower Valve	2.4	Thermostatic Restrictor Shower Valve	3.4

Moving from the low to the mid scenario, the largest changes in savings result from those measures with relatively low cost-effectiveness. This is due to measures that are less cost-effective being more sensitive to changes in barrier levels[8]. Examples of such measures include furnaces, boilers, water heaters, and Wi-Fi Thermostats.

Top measures are highly consistent between study years for both scenarios. No standards changes come into effect that would impact residential natural gas savings over the study period, so savings sources remain relatively constant over the study period within a given scenario.

Home energy reports provide high annual savings across all years and scenarios. As noted with previously, however, the short lifetime of this measure limits their lifetime savings.

2.3.5 Non-Residential

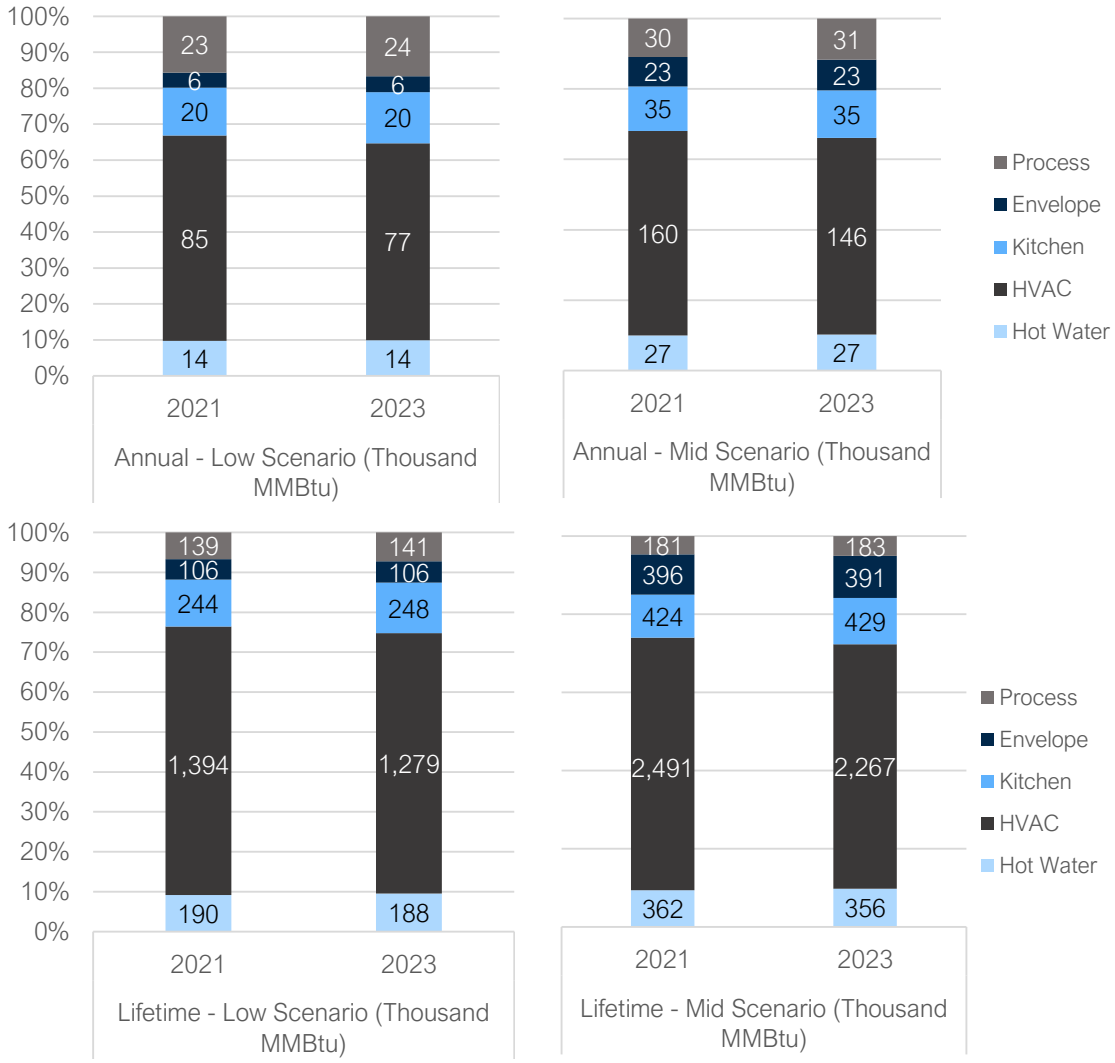
This section presents detailed results for the non-residential sector, outlining potential by measure class and highlighting top measures.

2.3.5.1 Savings by Measure Class

The HVAC measure class represents the majority of non-residential natural gas savings on both an annual and lifetime basis. Figure 15 below presents annual and lifetime non-residential savings by measure class and scenario for years 2021 and 2023.

[8] For additional details on this, see call-out box 'DEEP's Adoption Methodology and Optimizing Program Savings' in the Portfolio Costs and Benefits section.

Figure 15. Non-Residential Annual and Lifetime Natural Gas Savings by Measure Class, Low and Mid Scenarios



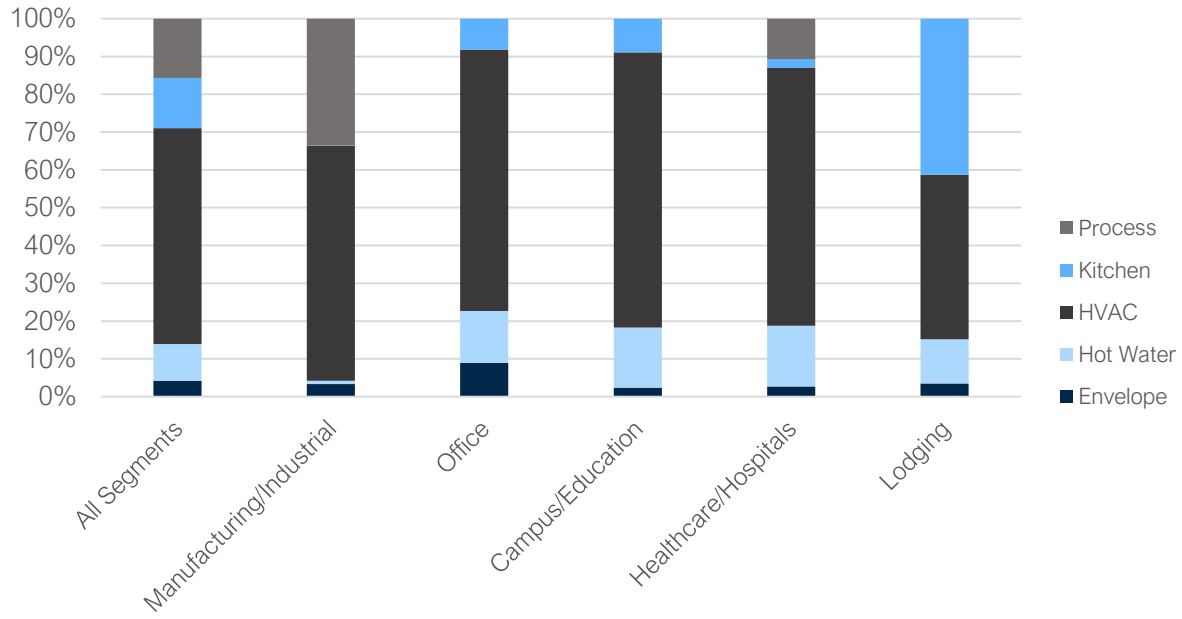
As with the residential sector, non-residential gas savings are dominated by HVAC measures both on an annual basis and on a lifetime basis. Savings are dominated by various heating equipment measures (including condensing make-up air units, waste heat recovery, and rooftop units). A drop in annual HVAC savings can be seen in 2023 when the Federal standard for furnaces comes into effect, shifting the baseline and decreasing claimable savings.

Envelope savings show the highest relative change between low and mid scenario, while process savings grow at a slower rate between the low and mid scenarios than the other measure classes but remain a considerable opportunity (particularly on an annual savings basis). Process measures include steam traps, controls, and assorted custom measures.

The kitchen measure class also shows high potential. Key measures include fryers, convection ovens, and dishwashers. As would be expected, kitchen opportunities are focused in specific segments, as seen below.

Given the large number of segments in the non-residential sector, Figure 16 below shows the measure class breakdown for the top five saving segments. Focusing on annual savings for the low scenario in 2021, we compare the measure class savings by segment to the sector overall.

Figure 16. 2021 Annual Electricity Savings by Measure Class for Top-Saving Non-Residential, Low Scenario



HVAC opportunities are considerable across all segments. Although slightly smaller in lodging, they remain close to half of the overall natural gas savings opportunities for this segment, and – at the high end – up to 73% of the opportunities associated with Campus/Education.

Targeted campaigns would be beneficial for some measure classes. In particular, campaigns could focus on process savings in the Manufacturing/Industrial and Healthcare/Hospital segments and on kitchen savings in the Lodging, Office, and Campus/Education segments.

2.3.5.2 Top Measures

Table 7 below outlines the top non-residential measures on an annual savings basis for the first and last years of the study. Results are shown for both the low and mid scenarios.

Table 7. Non-Residential Top Measures by Annual Natural Gas Savings, Low and Mid Scenario

2021			
Low		Mid	
Measure	Savings (Thousand MMBtu)	Measure	Savings (Thousand MMBtu)
Steam Trap	23.2	Steam Trap	30.2
Boiler	18.3	Boiler	30.0

Waste Heat Recovery	11.9	Waste Heat Recovery	28.2
Boiler Reset Control	10.2	Fresh Air controlled by CO_2 monitors	16.6
Condensing Make Up Air Unit	9.5	Fryer	16.3
Fresh Air controlled by CO2 monitors	8.8	Building Shell Air Sealing	15.1
Fryer	8.7	Furnace	14.2
Volume Water Heater	7.9	Volume Water Heater	13.0
Furnace	6.8	Condensing Make Up Air Unit	12.7
Kitchen Demand Control Ventilation	6.1	Boiler Reset Control	11.8
2023			
Low		Mid	
Measure	Savings (Thousand MMBtu)	Measure	Savings (Thousand MMBtu)
Steam Trap	23.5	Steam Trap	30.5
Boiler	18.6	Boiler	30.3
Waste Heat Recovery	11.7	Waste Heat Recovery	27.5
Boiler Reset Control	9.9	Fryer	16.5
Condensing Make Up Air Unit	9.7	Fresh Air controlled by CO_2 monitors	14.8
Fryer	8.9	Building Shell Air Sealing	14.8
Fresh Air controlled by CO_2 monitors	7.9	Volume Water Heater	13.0
Volume Water Heater	7.9	Condensing Make Up Air Unit	12.8
Kitchen Demand Control Ventilation	6.0	Boiler Reset Control	11.5
Oven	5.8	Oven	10.0

Top measures are highly consistent between study years for both scenarios with the exception of furnaces. In 2023, a new Federal furnace standard comes into effect, adjusting baseline efficiency levels and reducing claimable savings available for programs to capture.

In 2021, the highest growth measures between low and mid scenarios are those with lower cost-effectiveness. Notable measures include building shell air sealing, waste heat recovery, and furnaces.

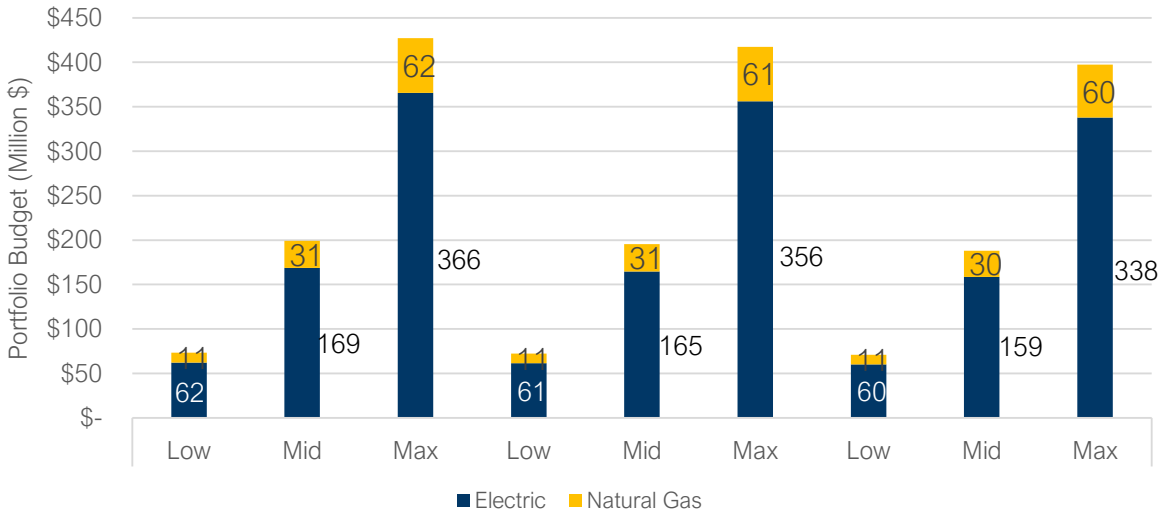
2.4 Portfolio Costs and Benefits

Overall, there is significant potential for energy efficiency in New Hampshire, although programs will be required to adjust in the face of transforming A-lamp and speciality lighting markets – program delivery, costs, and impacts will be impacted. This section provides high-level cost and benefit projections for the achievable potential scenarios. While these projections may offer a valuable directional assessment of program opportunities and the associated costs over the study period, these are largely informed by past program designs and performance in New Hampshire. As the efficiency technology mix evolves, and new delivery approaches and targeted measures are required, the actual costs and program balances could vary significantly from these projections.

2.4.1 Program Costs

The study estimates that efficiency program costs will range between $73 and $428 million in 2021, and $71 and $398 million in 2023. Similar to current efficiency spending, the majority of this directed toward the electric efficiency programs (which also includes delivered fuel measures) as seen in Figure 17.

Figure 17. Estimated Program Costs by Year, Scenario



Note: electric program costs include incentive and implementation costs for delivered fuel measures

Relative to 2019 NHSaves programs, which had a total budget of $57 million, the study estimates a considerable increase in spending across all scenarios, as outlined in Table 8 below.

Table 8. Estimated Program Costs by Year, Scenario

Portfolio	Scenario	2021	2022	2023	Average	2019 Results
Electric	Low	$62M	$61M	$60M	$61M	$47M
	Mid	$169M	$165M	$159M	$164M	
	Max	$366	$356M	$338M	$353M	
Gas	Low	$11M	$11M	$11M	$11M	$10M
	Mid	$31M	$31M	$30M	$31M	

	Max	$62M	$61M	$60M	$61M	
Total	Low	$73M	$72M	$71M	$72M	$57M
	Mid	$200M	$196M	$189M	$195M	
	Max	$428M	$417M	$398M	$414M	

In addition to larger budgets, the average cost of savings increases under all scenarios for both electric and natural gas, as seen in Table 9 below.

Table 9. Average Estimated Savings Unit Cost by Year, Scenario

Portfolio	Scenario	2021	2022	2023	Average	2019 Results
$ per Incremental Annual kWh	Low	$0.43	$0.47	$0.52	$0.47	$0.38
	Mid	$0.70	$0.74	$0.79	$0.74	
	Max	$1.15	$1.21	$1.27	$1.21	
$ per Incremental Annual MMBtu	Low	$54	$54	$56	$55	$21
	Mid	$81	$82	$85	$83	
	Max	$119	$120	$125	$121	

These increased costs can primarily be explained by the reduction in A-Lamp savings, which generally have low per unit savings costs (all scenarios) and due to increased incentives and participation in programs under the mid and max scenarios. The unit cost of savings will also increase for two additional reasons. First, raising incentives increases the cost not just for newly acquired savings, but also for savings that would have been obtained under lower incentive levels and thus at a lower per unit cost. Second, the higher incentives and investments in enabling strategies may drive more uptake of measures with higher unit savings costs due to their lower savings to incremental cost ratios. However, the precise magnitude of cost increases under these scenarios should be interpreted with the following caveats:

- **Cost estimates are based on historical cost data.** Fixed and variable cost inputs were developed based on historical spending data for NHSaves programs. These inputs do not vary over the study period to account for factors that may increase costs (e.g. higher labour or technology costs as programs increase demand for specific services and/or equipment drives up prices) or decrease costs (e.g. lower program implementation costs as programs mature and become more efficient or employ new delivery strategies). For example, utilities have historically placed emphasis on creating cost-effective lighting programs as this is where the majority of savings were found. However, as lighting savings decrease, utilities will likely begin focusing more on programs offering non-lighting savings, which will impact program implementation effectiveness and costs relative to current implementation practices today.

- **The program scenarios are not optimized for program spending.** For each achievable scenario in the DEEP model, incentive levels are set at the program level as a portion of the incremental costs for each eligible measure in the program. However, a real-world program design would likely set unique incentive levels for each measure, applying higher incentive levels for measures that may have had limited uptake in the past, and maintaining or lowering incentive levels for measures that meet their expected adoption. The text box below describes how a more granular approach to

incentive setting could lead to significantly lower program spending at minimal expense of reducing savings.

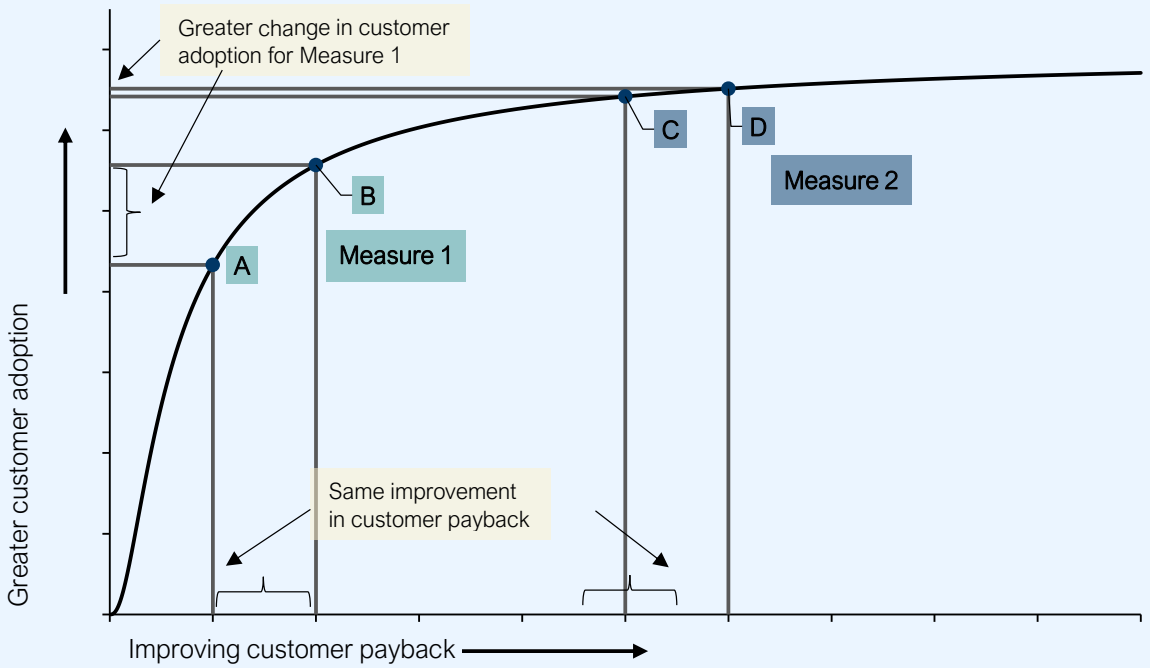
DEEP's Adoption Methodology and Optimizing Program Savings

The DEEP model calculates market adoption as a function of customer payback and a technology's underlying market barrier level. Increasing incentives will improve the customer payback, pushing a measure further to the right along the adoption curve. However, because the adoption curve is not linear, the degree of market reaction will depend on where the measure sits on its allocated adoption curve. This means increasing incentives for measures on the lower end of the adoption curve will result in much greater proportional increase in adoption compared to measures at the higher end of the adoption curve.

Figure 18 illustrates this effect. In this example, consider two theoretical measures, Measure 1 and Measure 2. Both are offered within the same program and share the same barrier level assignment, meaning they follow the same adoption curve. Due to differences in the relationship between the incremental costs and the energy savings of the two measures, each sits at a different point on the adoption curve. Measure 1 starts at point A, indicating that the customer payback is not sufficient to drive the majority of potential customers to adopt this technology. Measure 2 has a much higher ratio of energy savings to incremental costs, and thus it sits at point C, wherein most customers will likely adopt the efficient option.

As incentives are increased for both measures, the customer payback is increased, and moving both measures up and to the right along the adoption curve (to Points B and D for Measures 1 and 2, respectively). As can be seen from the figure, this results in a significant increase in adoption for measure 1, which is in the steep part of the adoption curve. However, for Measure 2 the incremental change in adoption is minimal, despite the increased incentives. Ideally, an optimized program design would target Measure 1 for an increased incentive but may not change incentive levels for Measure 2 and would prioritize driving incremental savings from Measure 2 through enabling strategies, marketing, and/or novel delivery pathways rather than through additional incentives.

Figure 18. Schematic Example of Adoption Theory

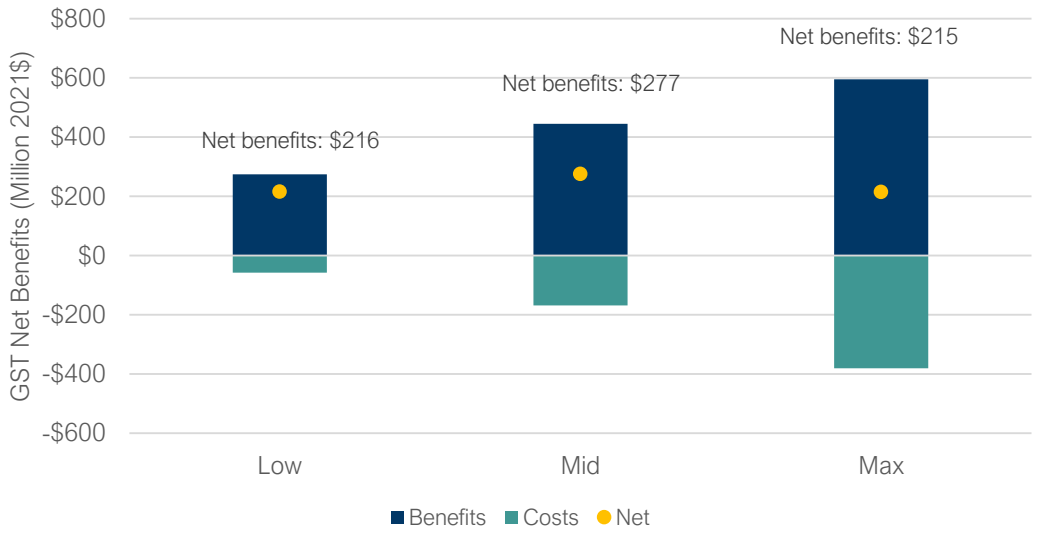


In this study, the impact of this non-linear relationship between incentive costs and savings achievement described above will be particularly pronounced under the Max scenario. Since all measures receive a 100% incentive under the Max scenario, every measure will traverse the higher-end of the adoption curve where incremental increases in incentive payments will induce progressively smaller incremental increases in customer adoption and savings. For this reason, cost estimates under the Max scenario in particular likely significant overstate the cost per unit of savings that could be achieved under an optimized portfolio approach.

2.4.2 Program Benefits

In all scenarios, efficiency savings create significant benefits. Based on the Granite State Test, the average benefits generated each program year range from $216 (low) to $642 (max) million as shown in Figure 19.

Figure 19. 2021-2023 Average Lifetime Granite State Test Benefits Generated Each Year by Scenario



The mid scenario shows the highest net benefits. This points to diminishing returns from increased spending on incentives under the Max scenario, where participant costs are completely eliminated.

2.5 COVID-19 Sensitivity Analysis

2.5.1 Context

COVID-19 was declared a global pandemic mid-way through the study. There is a high degree of uncertainty surrounding the short and long-term impacts of the pandemic, and the degree to which energy efficiency programs will be impacted remains uncertain. The COVID-19 sensitivity analysis was completed in order to provide insights regarding the sensitivity of achievable potential savings to changes in market conditions that may plausibly be expected as a direct result of the pandemic – decreased market sizes and increased barriers to efficiency activities.

As more is understood regarding the impact of the pandemic on both the residential and non-residential sectors, gauging this sensitivity is expected to help the utilities refine their understanding of how the study findings can be interpreted in the context of shifting market conditions.

2.5.2 Methodology

Within the potential model, the following parameters can be adjusted to assess the sensitivity of savings potential to predicted impacts from COVID-19:

- **Market Size:** The market size can be reduced to reflect fewer customers within a given segment due to temporary or permanent business closures.
- **Barrier Levels:** Barrier levels can be increased to reflect increased competition for capital, decreased resources, and other impediments to energy efficiency upgrades. [9]

These parameters were adjusted on a segment-by-segment basis using following steps:

1. **Categorize each non-residential segment into one of three impact categories:**
    a. Low: No anticipated business closures, increased barriers to efficiency
    b. Moderate: Anticipated short-term closures, increased barriers to efficiency
    c. High: Anticipated long-term closures, increased barriers to efficiency

    To categorize the segments, the Dunsky team reviewed available data regarding anticipated segment-specific impacts of the pandemic[10].

2. **Define high and low bounds for each of the three non-residential segment categories and for the residential sector**

[9] The Barrier Levels refer to the Barrier Level selected on the adoption curves described in greater detail in Appendix A.
[10] The data used to complete the categorization included the US census small business pulse survey along with a research effort that was initiated by the utilities and led by Luth Research which contacted customers about their experiences with COVID-19.

Next, the Dunsky team defined 'greater impact on savings' and 'lesser impact on savings' impact scenarios for each of the non-residential segment categories and for the residential sector as a whole. The settings are defined in Table 10 below.

Table 10. Segment Categorization and Scenario Settings by Impact Category

Sector	Impact Category	Segments	Lesser Impact on Savings Scenario	Greater Impact on Savings Scenario
Non-Residential	Low	Food sales Warehouse	**Market size:** No change **Barriers:** Increase by 0.2 for all study years	**Market size:** No change **Barriers:** Increased by 0.5 for all study years
	Moderate	Campus/Education Healthcare/Hospitals Lodging Manufacturing/Industrial Office Retail Other	**Market size:** Reduce 1st year market size by 10%, return 2nd and 3rd year markets to baseline size **Barriers:** Increase by 0.5 for all study years	**Market size:** Reduce 1st year market size by 25%, return 2nd and 3rd year markets to baseline size **Barriers:** Increase by 0.7 for all study years
	High	Food Service	**Market size:** Reduce market size by 10% for all study years **Barriers**: Increase by 0.7 for all study years	**Market size:** Reduce market size by 25% for all study years **Barriers**: Increase by 1 for all study years
Residential	N/A	N/A	**Market size:** No change **Barriers:** Increase by 0.2 for all study years	**Market size:** No change **Barriers:** Increased by 0.5 for all study years

The analysis assumes COVID-19 will result in a reduction in adoption of efficiency measures through programs. The high and low impact scenarios provide gradations in the level of severity of savings reductions as a result of varying market conditions.

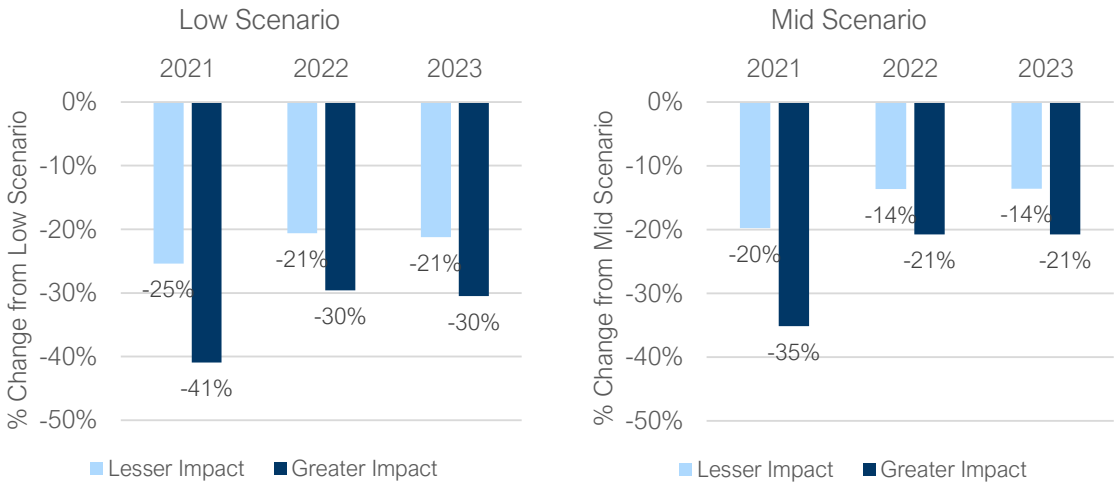
2.5.3 Results

In the sections that follow, the low and mid achievable potential scenarios are treated as baselines. The impacts under the 'lesser impact on savings' and 'greater impact on savings' scenarios are then compared to these baselines to understand the impact of changes to market sizes and barrier levels on achievable savings potential. It should be noted that this sensitivity analysis focuses on changes to the adoption of measures. Consideration of how changes to the per unit savings of measures may change as a result of COVID (through differing hours of use, for example) were considered out of scope for this assessment.

2.5.3.1 Electric Savings

The relative change in annual incremental electric savings from baseline (low and mid achievable potential scenarios) are included in Figure 20 below.

Figure 20. Reduction in Savings from Low Achievable Potential Scenario (Left) and Mid Achievable Scenario (Right) by Year

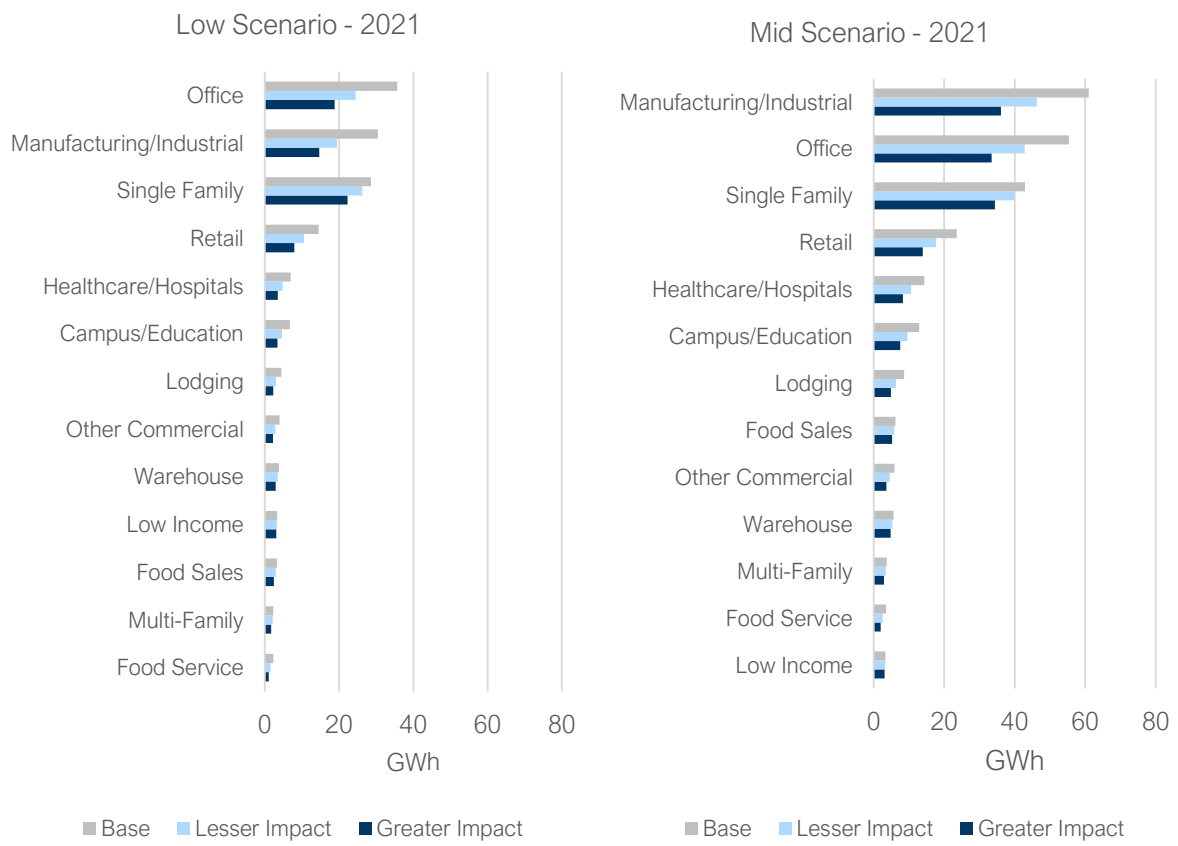


At the scenario settings outlined in Table 10, electric savings are forecasted to decrease from 20% to 41% in 2021 depending on the achievable potential and impact on savings scenarios, and from 14% to 30% by 2023.

Relative decreases in savings are greater under the low scenario. The mid scenario is characterized by higher incentive levels, and consequently higher participant cost-effectiveness. As a result of the non-linear shape of the adoption curves used in the model[11], higher participant cost-effectiveness is associated with lessened impact from changing barriers, resulting in decreased sensitivity under the mid scenario. This points to programs designed more closely in alignment with mid scenario incentive levels and barrier reductions being more resilient with respect to the adoption of measures in the face of COVID-19 impacts.

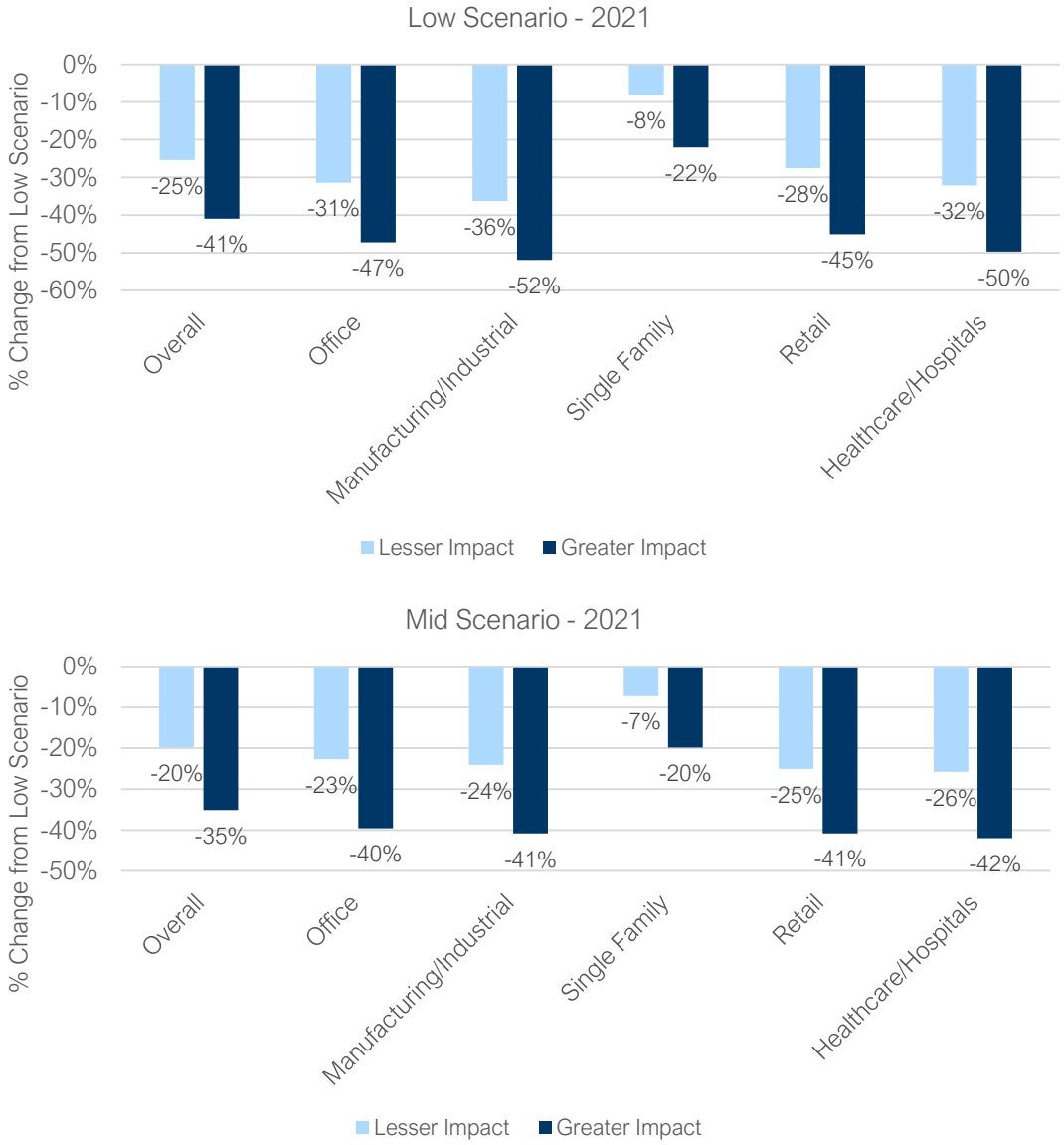
[11] For additional details on this, see call-out box 'DEEP's Adoption Methodology and Optimizing Program Savings' in the Portfolio Costs and Benefits section.

Figure 21. Achievable Potential by Segment and Impact Scenario Compared to Base for Low and Mid achievable potential scenario



Smaller relative impacts are noted for residential segments, as there are no 'closures' associated with this sector, unlike non-residential segments. The largest absolute decreases are noted in those segments associated with the most baseline achievable potential - Manufacturing/Industrial, Office, Retail, Single Family, and Healthcare/Hospitals. The relative change from baseline for each of these segments is in Figure 22 below.

Figure 22. Relative Change from Baseline for Top Segments, 2021



As previously noted in the electric non-residential savings by measure class section, savings by measure class vary between segments. As a result, changes in savings will not be decreased uniformly among classes – instead, those classes which feature more prominently in the top saving segments will be most impacted. The manufacturing and industrial segment sees the largest relative change in savings and shows a relatively different breakdown of measure class savings than the other segments, with greater opportunities in process savings, HVAC and HVAC motors, and compressed air than the non-residential sector overall. The office and retails segments depend more heavily on lighting savings than the sector overall, while healthcare and hospitals are associated with greater HVAC opportunities. Each of these measure classes, and others with high potential in the most impacted segments, are expected to see larger savings reductions than would be expected based on the overall sector-level breakdown of opportunities.

COVID-19: Shifting Usage and Opportunities

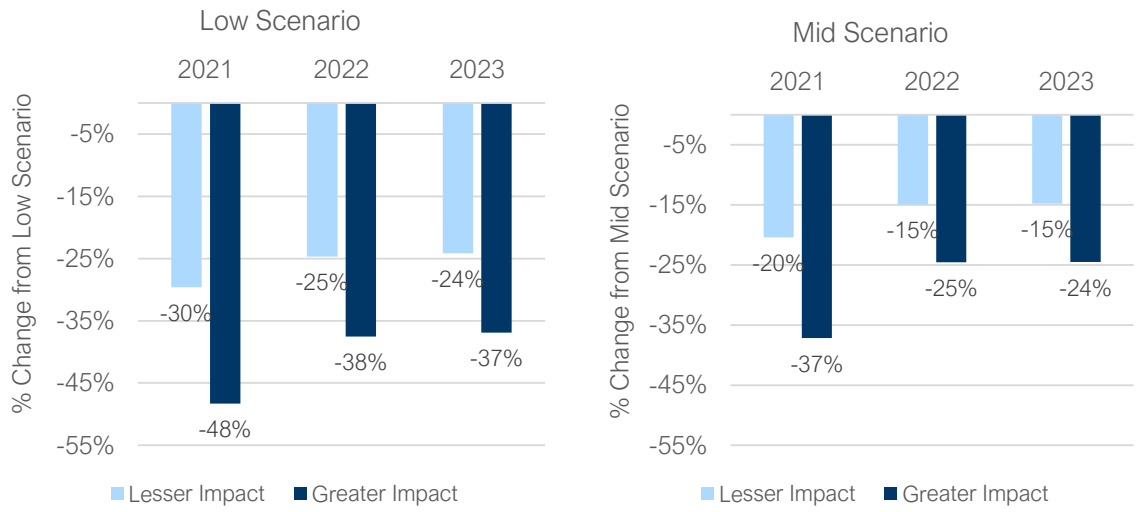
The COVID-19 pandemic has resulted in unprecedented changes in how and where we use energy. As more people work and attend school from their homes, occupancy in office buildings and schools remains low, for example. Program administrators and regulators are currently assessing how these changes will impact claimable savings, and the extent to which shifted usage characteristics should be considered in program evaluation.

These changes are also associated with potential opportunities for efficiency programs. Now may actually be a beneficial time for retrofits, given that there would be little-to-no disturbance to workers and students.

2.5.3.2 Natural Gas Savings

The relative change in annual incremental natural gas savings from baseline (low and mid achievable potential scenarios) are included in Figure 23 below.

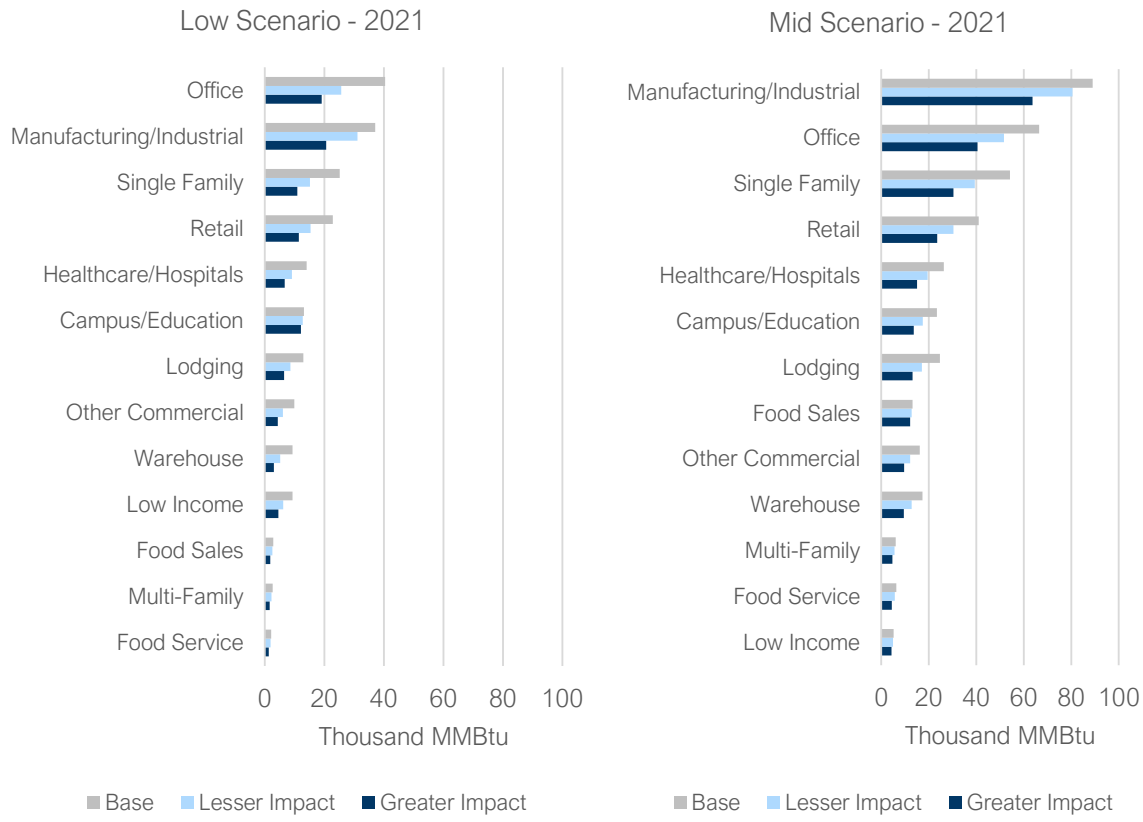
Figure 23. Reduction in Savings from Low Achievable Potential Scenario (Left) and Mid Achievable Scenario (Right) by Year



At the scenario settings outlined in Table 10, natural gas savings are forecasted to decrease from 20% to 48% in 2021 depending on the achievable potential and impact on savings scenarios, and from 15% to 37% by 2023.

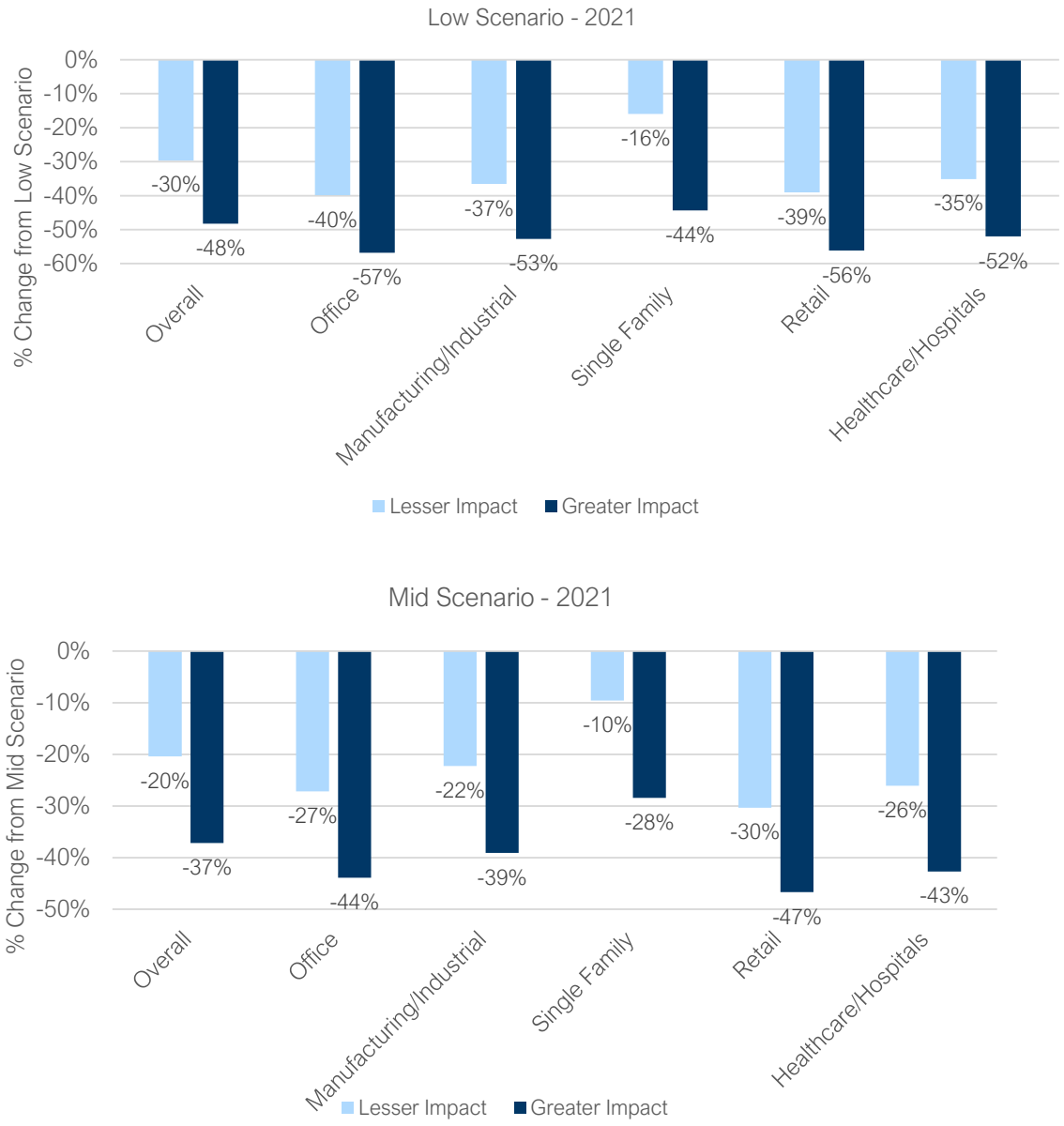
As with the electric savings potential, relative decreases in savings are greater under the low scenario in comparison to the mid scenario due to the non-linear relationship between cost-effectiveness and adoption in the adoption curves used in the model. This supports the conclusion that program design that is more in alignment with the mid scenario will see less impacts from increased barriers than programs at low scenario levels.

Figure 24. Achievable Potential by Segment and Impact Scenario Compared to Base (Low Achievable Potential Scenario)



Mirroring the electric results, the largest absolute decreases in savings are seen in the manufacturing/industrial, office, campus/education, single family, and healthcare/hospitals given high potential in these segments.

Figure 25. Relative Change from Baseline for Top Segments, 2021



As with electric savings, measure classes with high potential in the most impacted segments are likely to see greater reductions in savings than would be expected based on the sector-level savings opportunity breakdown. Notably, larger than average impacts in the manufacturing/industrial and healthcare/hospital segments are expected to decrease process savings more than would be expected from the sector-level measure class breakdown. HVAC savings also feature prominently among top saving segments and may be affected by COVID to a larger degree than would be expected from the sector-level breakdown.

3 Active Demand

3.1 Chapter Overview

The following chapter presents results for the active demand module of the potential study. The active peak demand reduction potential is assessed by analyzing the ability for behavioral measures, equipment controls, and industrial and commercial curtailment to reduce the ISO North England (ISO-NE) system-wide annual peak demand[12].

The active demand potential is assessed against the ISO NE system hourly load curve and annual peak demand. A standard peak day 24-hour load curve is identified and adjusted to account for projected load growth and efficiency program impacts over the study period. The active demand potential is assessed against nine years of historical annual hourly load data to simulate year-long measure deployment.

Technical potential is estimated as the total possible coincident peak load reduction for each individual measure multiplied by the saturation of the measure or opportunity in each market segment.

Economic potential is the amount of coincident peak load reduction for each individual measure that passes the Granite State Test. Only those that pass the threshold are included in the achievable potential scenarios.

Achievable potential is assessed under three cost scenarios by applying mixes of all cost-effective measures and programs, giving priority to the most cost-effective measures first. For each year, the active demand potential is assessed, accounting for existing programs from previous years as well as new measures or programs starting in that year. Unlike many efficiency measures, active demand peak savings only persist as long as the program is active. For new and expanded programs, ramp-up factors were applied to account for the time required to recruit participants[13].

Because active demand measures interact via their effects on the statewide load curve, technical and economic active demand potentials are not considered to be additive and are therefore not presented in aggregate in this report. To ensure that the combined achievable potential results were truly additive in their ability to reduce annual peak loads, combinations of programs were assessed against the ISO-NE hourly load curve to capture inter-program interactions that could affect the net impact of each program. Further details of this approach are provided in Appendix B.

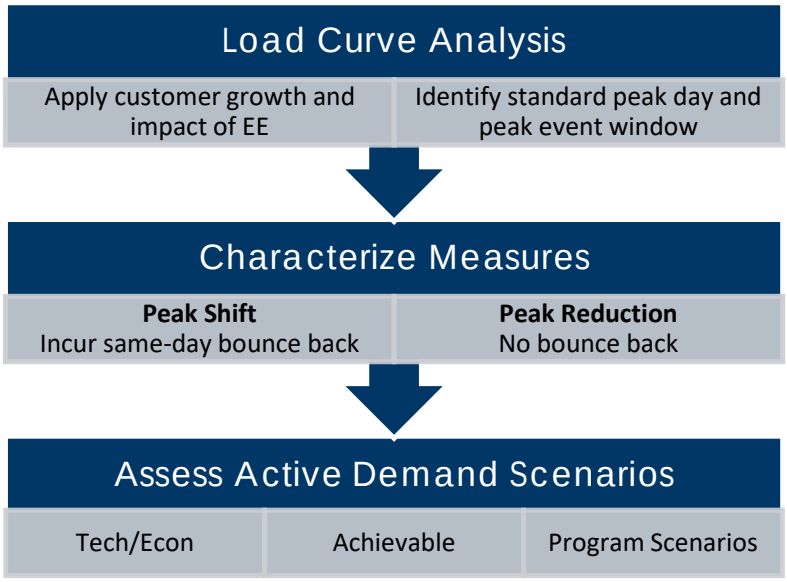
[12] The system-wide annual peak demand refers to the hour in the year that exhibits the highest system peak demand in MW. It is assessed on a system-wide basis, not accounting for local constraints across the transmission and distribution system.
[13] A summary of active demand program assumptions, including ramp up rates, is included in Appendix C

3.1.1 Approach

The figure below presents an overview of the steps applied to assess the active demand potential in this study.

This assessment considered the statewide and ISO-NE system peak-day hourly load curve to identify a standard peak day for both the statewide demand and ISO-NE. The model then assesses each measure's interaction with the ISO-NE standard peak day, taking into account any measure bounce back or shift to an earlier or later hour.

Figure 26. Demand Response Potential Assessment Approach

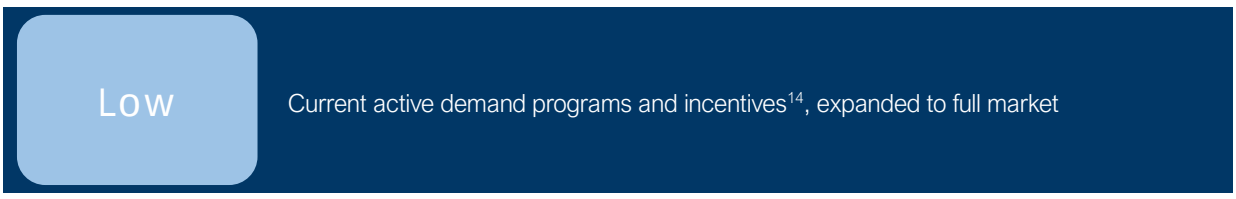


A more detailed description of the active demand modeling approach applied in this study can be found in Appendix B.

3.1.2 Achievable Potential Scenarios

The achievable potential is assessed under three scenarios, corresponding to varied active demand program approaches. These scenarios deliver varying benefits covering a range of peak demand impacts. Further details on the specific programs and their related inputs are presented in Appendix C.

Figure 27. Active Demand Program Scenario Descriptions



[14] Incentives were based on 2020 incentive levels from Eversource

Expanded active demand programs with mid-point incentives (relative to maximum and benchmarked to other jurisdictions)

Expanded DR programs with maximum cost-effective incentives

3.1.3 Summary of Results

Under the Low scenario, which represents NHSaves' current programs expanded to full market, the potential is estimated to grow from 13MW in 2021 to 23MW in 2023, which represents 1.0% of the statewide peak in 2023. Under the Mid and Max scenarios, the achievable potential estimates achieve 54MW and 61MW by 2023, respectively, translating into 2.2% and 2.6% of the statewide peak.

Program spending is projected to range between $1 to $2 million per year under the Low Scenario and as high as $16 million in the Max scenario. In the Mid and Max scenarios, the results show high up-front costs in the initial years as new programs are developed, or new customers are enrolled in the programs, and new controls systems are put in place. In later years, a greater emphasis on incentives is expected to maintain participation in the programs while up-front costs decrease. While the Max scenario provides the most peak reduction potential, the Mid scenario is more cost-effective.

3.2 Load Curve Analysis

The first step in the active demand potential analysis is to define the standard peak day load curve and apply the impacts of load growth projections and efficiency measure adoption. The standard peak day utility load curve is then used to characterize measures and assess the measure-specific peak demand reduction potentials at the technical and economic levels. Achievable peak demand reduction potentials are further verified against ISO-NE annual historical hourly load data to assess DR measure deployment constraints and intra-day shifts in the ISO-NE annual peak.

The standard peak day load curve for the statewide electric system is defined by taking an average of the load shape from the top ten peak days in each of the nine years of historical hourly load data provided. The standard peak is then forecasted in the future, considering efficiency measures and load growth forecasts from NH utilities' projections. Since the study is only for three years (2021-2023), no impact on the load shape is notable.

Figure 28. NH Standard Peak Day Based on Historical Data from ISO-NE

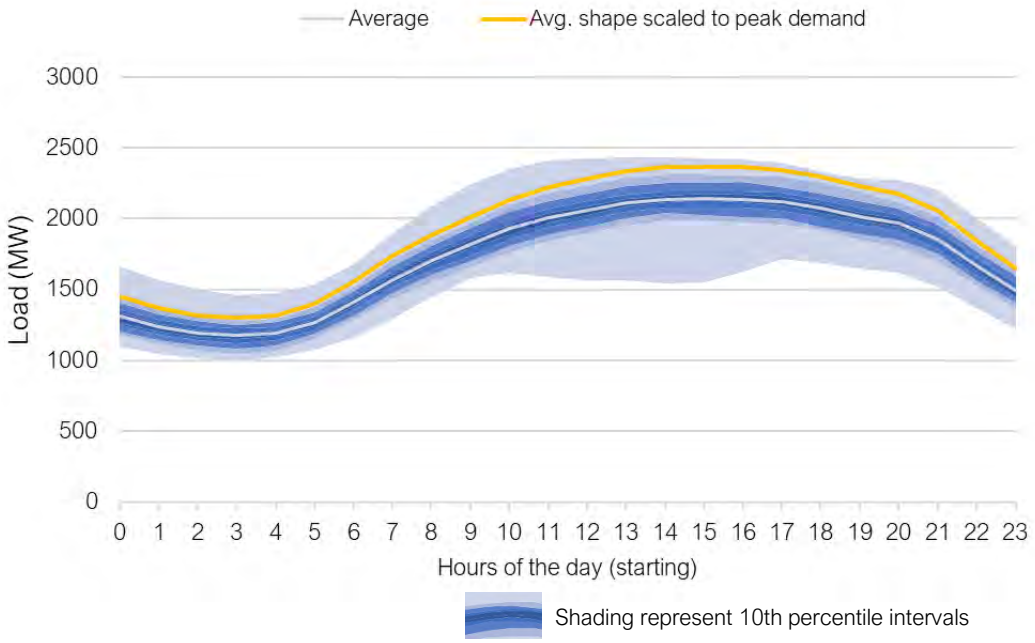
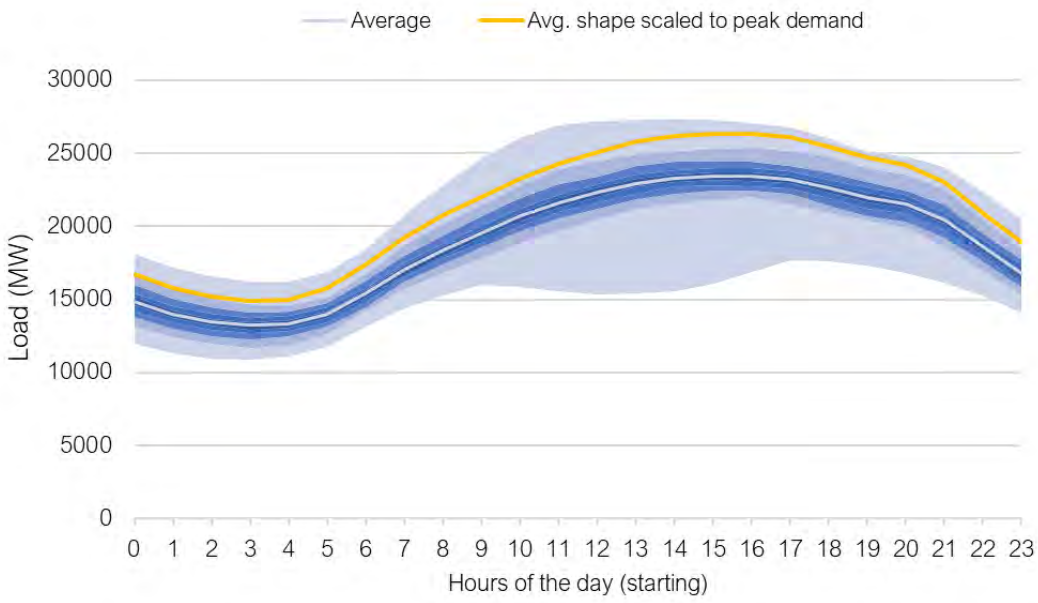


Figure 29. ISO-NE Standard Peak Day Based on Historical Data



This analysis finds that NH's statewide system has an extended late afternoon peak, which is driven predominantly by residential and commercial space cooling. ISO-NE peak load has a similar shape compared to NH, allowing both systems to benefit from a similar DR window. NH peak demand is responsible for slightly under 10% of the ISO-NE peak demand. Therefore, fluctuation in New Hampshire's demand has little impact on the overall ISO-NE demand curve shape (this means that concerns of

bounce-back/shifting of ISO-NE peak period due to NH DR programs are limited). Table 11. Standard Peak Day Key MetricsTable 11 provides key metrics to describe the peak day shape from a DR potential perspective.

Table 11. Standard Peak Day Key Metrics[15]

Year	NH Peak Demand (MW)	Peak hours[16]	ISO-NE Peak Demand (MW)	Peak hours
2011	2,433	12:00 – 16:59	27,333	12:00 – 16:59
2012	2,292	14:00 – 18:59	25,553	13:00 – 17:59
2013	2,421	13:00 – 17:59	26,919	13:00 – 17:59
2014	2,288	11:00 – 15:59	24,089	12:00 – 16:59
2015	2,219	14:00 – 18:59	24,074	13:00 – 17:59
2016	2,367	13:00 – 17:59	25,192	12:00 – 16:59
2017	2,165	14:00 – 18:59	23,519	13:00 – 17:59
2018	2,379	13:00 – 17:59	25,612	13:00 – 17:59
2019	2,299	14:00 – 18:59	23,988	14:00 – 18:59
2021	2,370	13:00 – 17:59	26,351	13:00 – 17:59
2022	2,372	13:00 – 17:59	26,670	13:00 – 17:59
2023	2,385	13:00 – 17:59	26,988	13:00 – 17:59

Following our analysis, the reduction potential for all measures was assessed based on a DR window from 13:00 to 17:59, as presented in the table above. For ISO-NE, the system peak hour is from 16:00 to 16:59. It is important to note that ISO-NE peak forecast shows that the peak hour could be shifting by one hour in later years. The impact of a one-hour peak shift later in the afternoon is not expected to alter the results of this study significantly. A peak shift to later in the afternoon would tend to generate a slightly higher potential from residential measures and a somewhat lower potential from the C&I sector.

3.3 Achievable Potential

The overall achievable potential in each year for each scenario is presented below. These results represent the overall peak load reduction potential when all constituent programs are assessed together against the ISO-NE load curve, accounting for combined interactions among programs and reasonable roll-out schedules.

[15] Historical hourly load data for the years 2011-2019 (shaded rows) were extracted from ISO-NE's website. 2020 values were not available at the time this study was produced.
[16] Top 5 hours during the peak day for historical peaks.

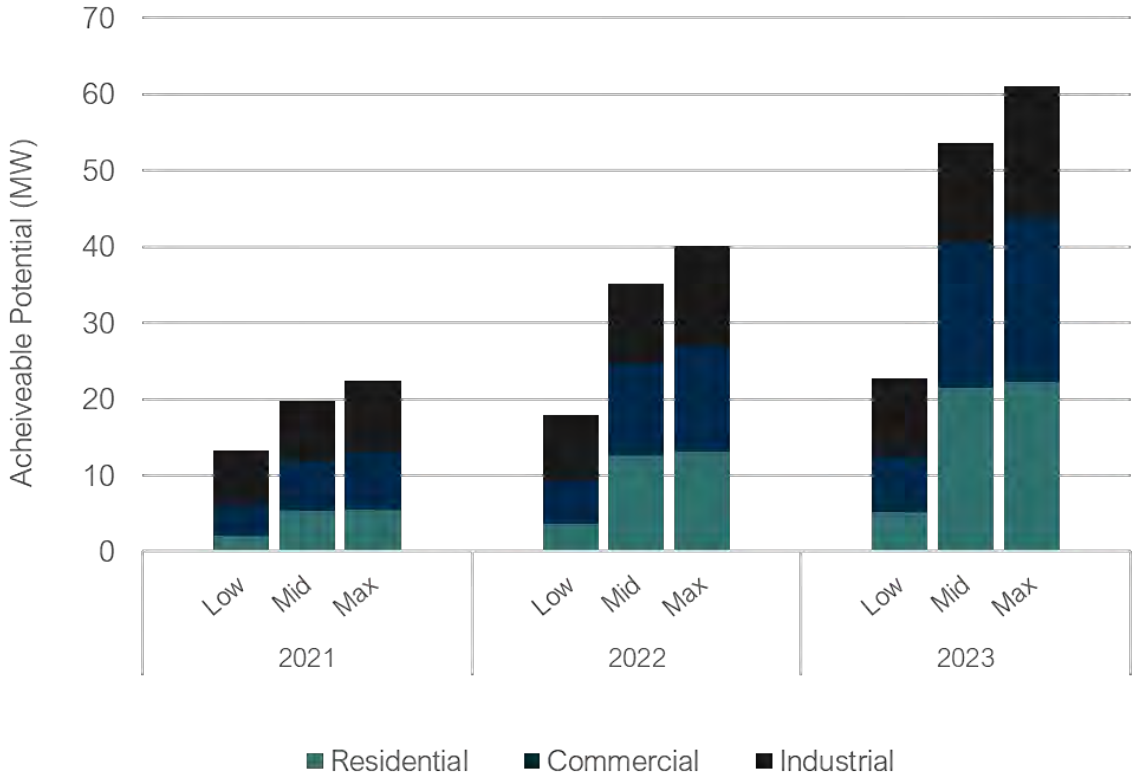
The analysis applies a range of new and existing DR programs, assessing the ability of each to address the ISO-NE annual peak. Technical and economic potentials are assessed for each measure individually, and no interactions among the measures are considered. A description of each individual program and all technical and economic detailed results for individual measures in each market segment are provided in Appendix C.

Measures that cost-effectively deliver sufficient peak load reductions individually are retained and applied in the achievable potential scenario analysis to determine their achievable potential, the results of which are presented in the following chapter. Consistent with the other savings modules in this study, only cases where the measure yields a Granite State Test value in excess of 1.0 are retained in the economic potential. In all cases, Granite State test values presented here are those associated with the specific installation year indicated, covering just the market segments that yield Granite State Test values that exceed the threshold.

Under the Low scenario, which represents New Hampshire's current programs[17] expanded to their full extent, the potential is estimated to grow from 14MW in 2021 to 23MW in 2023, which represents 1.0% of New Hampshire's peak in 2023. Under the Mid and Max scenarios, the achievable potential estimates respectively achieve 54MW and 61MW in 2023, translating into 2.2% and 2.6% of New Hampshire's peak. Based on these results, the scenario analysis indicates that expanding the number and types of DR programs and measures can provide more DR potential than simply expanding current programs.

Figure 30. Achievable Potential by Sector, Scenario, and Year

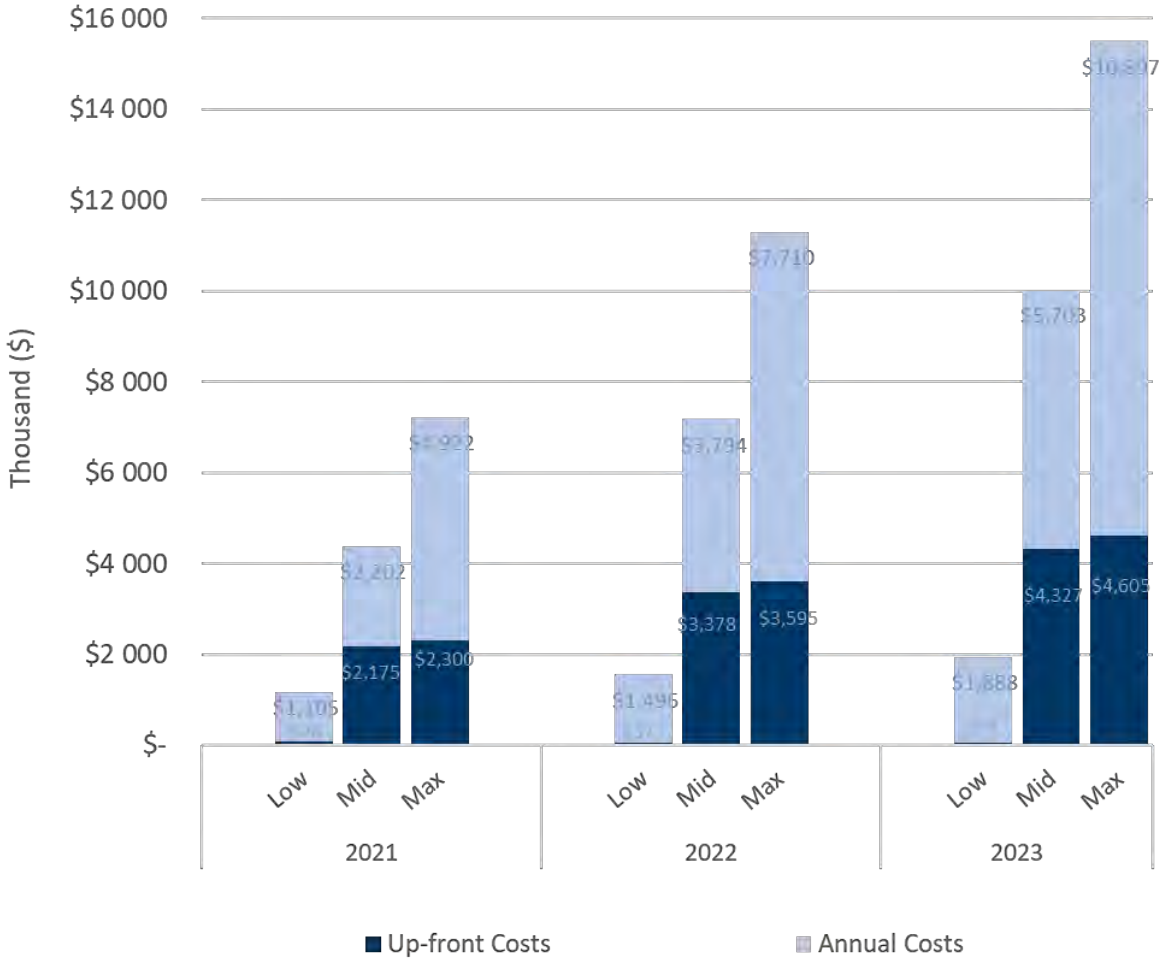
[17] 2019 active demand programs



Error! Reference source not found. below provides the program costs for each scenario, broken down by upfront measure costs[18], and program administration costs and customer incentives. In the Mid and Max scenarios, the results show high up-front costs in the initial years as new programs are developed, new customers are enrolled in the programs, and new controls systems are put in place. In later years, the upfront costs are reduced as incentives maintain program participation among customers with installed DR devices.

Figure 31. Demand Response Program Costs

[18] Upfront measure costs include sign-up (enrollment) incentive costs, as well as controls and equipment installation costs.



The Granite State Test results include all DR measures that are cost-effective, using a 1.0 benefit-cost ratio threshold, assuming a 9-year measure/program life with a 3-year contract cycle (participant attrition and new recruitment)[19]. Table 12 provides cost-effectiveness results for each of the three scenarios based on a program lifetime basis.

Table 12. Demand Response Granite State Test Results[20]

Scenario	Benefit-Cost Ratio
Low	1.7
Mid	1.5
Max	1.1

[19] It is assumed that after each contract cycle, some participant will drop out from the program (5% for C&I customers, 15% for BYOD programs and 10% for DLC programs)
[20] Based on a 2023 installation year.

Table 13 shows annualized, cost-effectiveness results for each study year. These results take into consideration the benefits for the measures installed before and account for all costs incurred that year.

Table 13. Annualized Demand Response Granite State Test Results

Scenario	2021	2022	2023
Low	2.2	2.3	2.3
Mid	1.0	1.0	1.1
Max	0.7	0.8	0.9

The Granite State Test results show that while the Max scenario provides the most peak reduction potential, the Mid and Low scenarios are more cost-effective. A few key observations to note are:

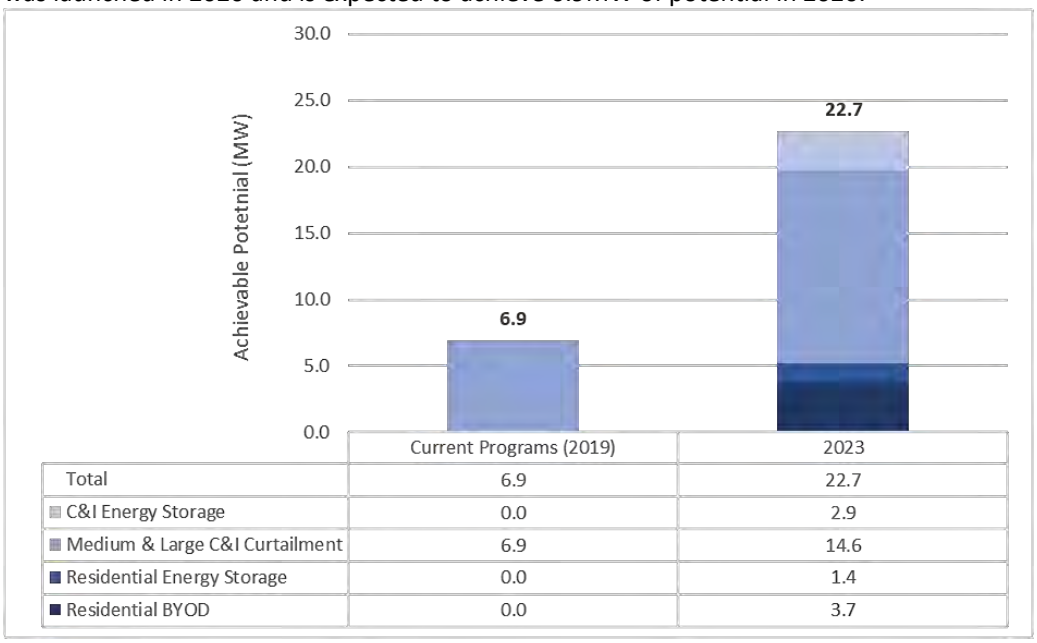
- **The Low scenario is cost-effective throughout the study period.** The Granite State Test values increase in later years as more participants enroll in the program, and as enrollment costs diminish.
- **The Mid scenario shows increasing cost-effectiveness.** This is because the expanded programs benefit from the upfront cost investments made in the initial years, and simply require customer incentives to maintain participation after that.
- **The Max scenario is cost-effective over the program lifetime.** More substantial upfront costs and higher annual incentives result in a program that would not be cost-effective before four years into the program life.

Overall, these results show that there is a cost-effective DR potential in NH, which could deliver up to 61MW of annual peak reduction, which is a 54MW increase from the 2019 achieved reduction through current DR programs.

3.3.1 Low Scenario

The Low scenario captures the DR potential from expanding current existing programs to their fullest extent under the current incentive levels and delivery approach, thereby assessing the uncaptured DR potential still available to these programs. The BYOD residential program was included in the existing programs as it

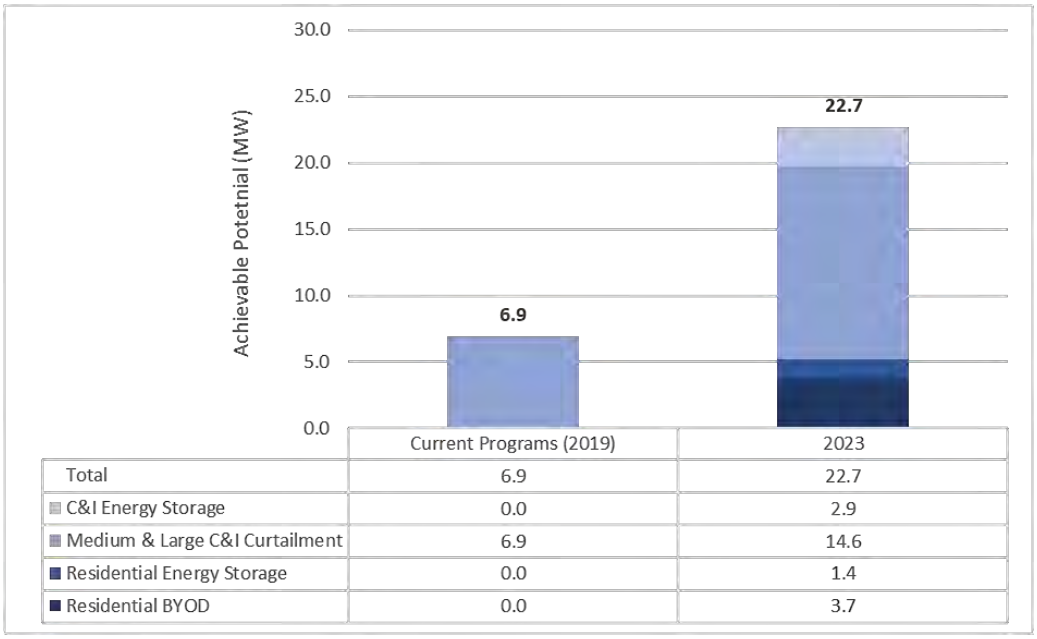
was launched in 2020 and is expected to achieve 0.9MW of potential in 2020.



	Current Programs (2019)	2023
Total	6.9	22.7
C&I Energy Storage	0.0	2.9
Medium & Large C&I Curtailment	6.9	14.6
Residential Energy Storage	0.0	1.4
Residential BYOD	0.0	3.7

shows that utilities can achieve three times the 2019 peak demand reductions by 2023 by expanding their existing programs. This comes from an expansion of the commercial and industrial curtailment programs, growing from 6.9 MW to 22.7 MW in 2023 and from the full deployment of the BYOD residential program.

Figure 32. Low Scenario Achievable Potential by Program



	Current Programs (2019)	2023
Total	6.9	22.7
C&I Energy Storage	0.0	2.9
Medium & Large C&I Curtailment	6.9	14.6
Residential Energy Storage	0.0	1.4
Residential BYOD	0.0	3.7

At the program level, residential WiFi thermostats only reach a cost-effectiveness of 1.0 in the first year, but by 2023 it increases up to 1.4 as enrollment incentives are only offered to new participants and as some program costs can be shared by a larger number of participants. More details are provided in the accompanying DR detailed data files.

Table 14 below provides the measure-level savings for the current programs, and the 2023 DR potentials. The commercial and industrial curtailment measures show potential for growth from their current levels. These programs tend to be very cost-effective, and the cost of expanding these existing programs is much less than the costs of expanding to new measures and programs under the Mid and Max scenarios, which supports higher Granite State Test values under the Low scenario.

The Residential BYOD program also shows potential. Residential WiFi thermostats have potential for growth, but this is somewhat constrained by the limited penetration of central AC systems paired with existing WiFi thermostats in NH homes. At the program level, residential WiFi thermostats only reach a cost-effectiveness of 1.0 in the first year, but by 2023 it increases up to 1.4 as enrollment incentives are only offered to new participants and as some program costs can be shared by a larger number of participants. More details are provided in the accompanying DR detailed data files.

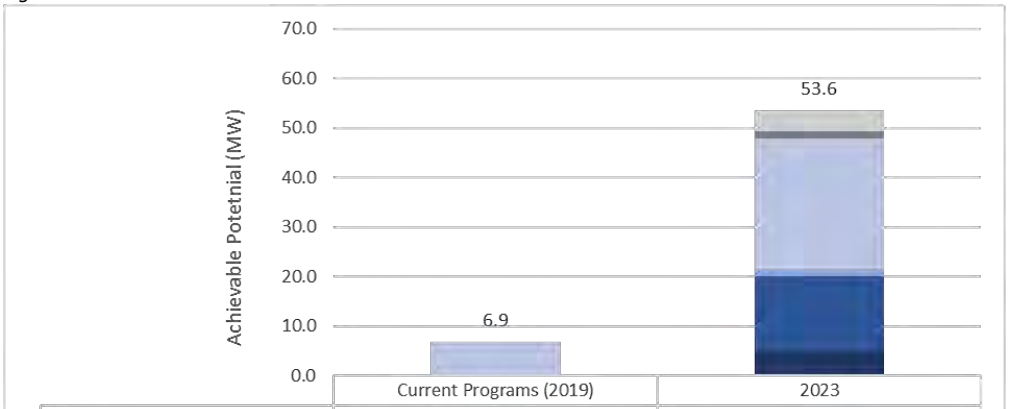
Table 14. Low Scenario - Top Measures

Measures	DR Potential 2019 Enrolment (MW)	Achievable Potential 2023 (MW)
Large Commercial Curtailment	6.9	3.8
Large Industrial Curtailment		5.1
Medium Commercial Curtailment	0	2.5
Medium Industrial Curtailment	0	3.2
C&I Battery Storage	0	3.0
Residential WiFi Thermostats - BYOD	0	3.8
Residential Battery Energy Storage - BYOD	0	1.4
Total	6.9	22.7

3.3.2 Mid Scenario

Under the Mid scenario, DR programs are expanded to apply new measures and strategies, such as smart pool pumps and EV chargers, capital incentives for energy storage (thermal energy storage), and WiFi thermostats for small businesses. As detailed in

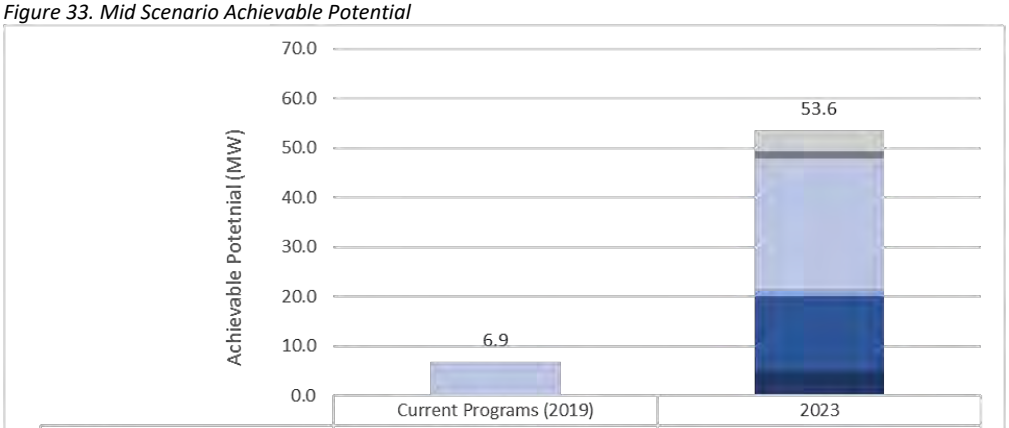
Figure 33. Mid Scenario Achievable Potential



	Current Programs (2019)	2023
Total	6.9	53.6
C&I Energy Storage	0.0	4.3
Small Commercial BYOD/DLC	0.0	1.4
Medium & Large C&I Curtailment	6.9	26.4
Residential Energy Storage	0.0	1.4
Residential DLC	0.0	15.2
Residential BYOD	0.0	4.9

below, the achievable potential increases in nearly all sectors, with commercial curtailment and residential programs, significantly driving expanded DR potentials. In this scenario, incentives were increased to match typical values from other jurisdictions for new measures. Where no information was available, the incentives were set to an intermediate level between Low and Max Scenario incentive levels. Details on program settings for each scenario are provided in the accompanying DR detailed data files.

Figure 33. Mid Scenario Achievable Potential



	Current Programs (2019)	2023
Total	6.9	53.6
C&I Energy Storage	0.0	4.3
Small Commercial BYOD/DLC	0.0	1.4
Medium & Large C&I Curtailment	6.9	26.4
Residential Energy Storage	0.0	1.4
Residential DLC	0.0	15.2
Residential BYOD	0.0	4.9

The top measures under the Mid scenario are provided in Table 15 below. The added programs and measures in the Mid scenario generate additional potential, with a few measures offering notable opportunities such as:

- **Residential Pool Pumps and WiFi Thermostats** generate most of the new savings, with 5.8 MW (pool pumps) and 12.9 MW (WiFi thermostats) by 2023. These two measures represent 87% of the total residential potential, with most of this potential (77%) coming from a DLC type of program.
- **Battery Energy Storage** in commercial buildings yields 3.0 MW of new achievable potential by 2023, which is focused on leveraging customer-owned batteries.
- **Medium and Large Commercial Curtailment** offers increased potential by raising incentive levels to attract more participation, resulting in an overall increase of 6 MW compared to the Low scenario.
- **Emergency Generators (gas)** in the Medium and Large C&I program (6 MW in 2023) offer an opportunity for achieving additional potential. This measure includes an annual performance incentive as well as an up-front incentive to cover costs for achieving emissions compliance in a non-emergency application

Table 15. Mid Scenario – Top Measures

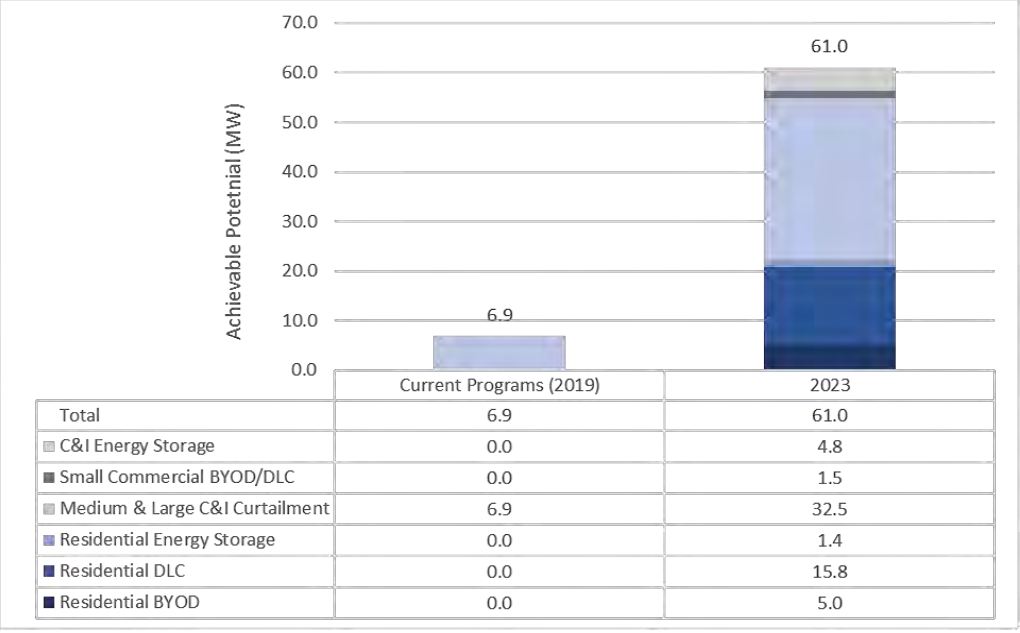
Measures	DR Potential 2019 Enrolment (MW)	Achievable Potential 2023 (MW)
Large Commercial Curtailment	6.9	7.6
Large Industrial Curtailment		6.6
Medium Commercial Curtailment	0.0	2.9
Medium Industrial Curtailment	0.0	3.3
C&I Battery Storage	0.0	3.0
Gas Emergency Generator (New)	0.0	6.0
Small Business Thermal Energy Storage (New)	0.0	1.3
Residential WiFi Thermostats (Expanded to DLC)	0.0	12.9
Residential Pool Pumps (New)	0.0	5.8
Residential Battery Energy Storage - BYOD	0.0	1.4
Small Business Water Heater (New)	0.0	1.1

3.3.3 Max Scenario

In the Max scenario incentives were increased further, while maintaining individual measure Granite State Test values of at least 1.0[21], and portfolio-wide Granite State Test values over 1.0 on a lifetime basis. This leads to more savings in all programs, as shown

[21] Measure screening considers all measure costs but excludes program costs.

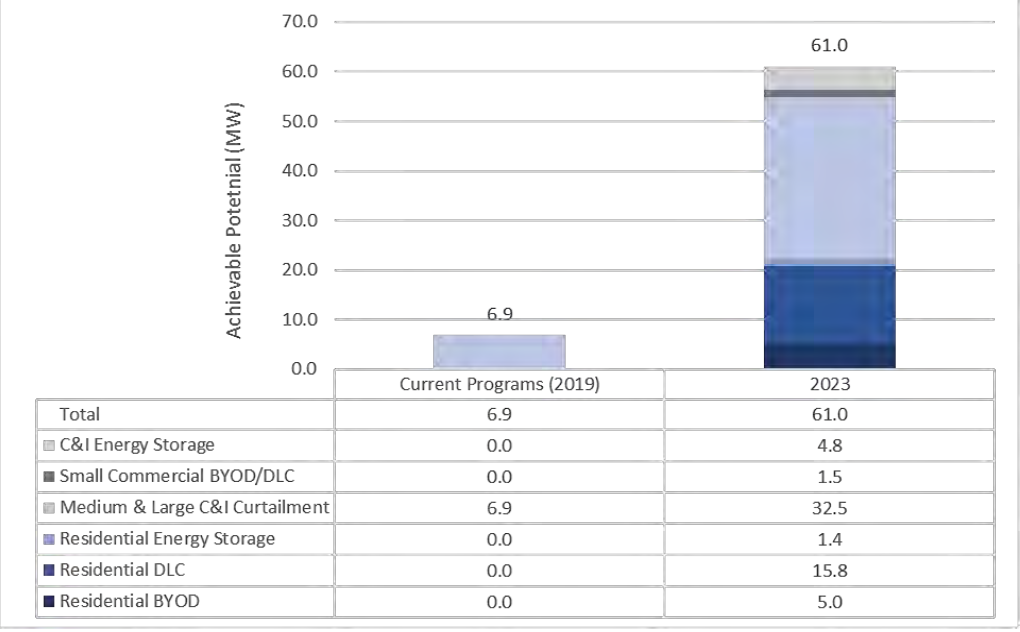
in Figure 34. Max Scenario Achievable Potential



	Current Programs (2019)	2023
Total	6.9	61.0
C&I Energy Storage	0.0	4.8
Small Commercial BYOD/DLC	0.0	1.5
Medium & Large C&I Curtailment	6.9	32.5
Residential Energy Storage	0.0	1.4
Residential DLC	0.0	15.8
Residential BYOD	0.0	5.0

Error! Not a valid bookmark self-reference.Error! Reference source not found. When compared to the Mid scenario, the Max scenario offers an additional 7.3MW of potential by 2023. The majority of the gains in achievable potential comes from the medium and large commercial curtailment programs (5.7 MW of additional potential). However, as was noted earlier, this increase in potential comes with significantly higher incentive costs that reduce the overall cost-effectiveness of the Max scenario relative to other scenarios.

Figure 34. Max Scenario Achievable Potential



	Current Programs (2019)	2023
Total	6.9	61.0
C&I Energy Storage	0.0	4.8
Small Commercial BYOD/DLC	0.0	1.5
Medium & Large C&I Curtailment	6.9	32.5
Residential Energy Storage	0.0	1.4
Residential DLC	0.0	15.8
Residential BYOD	0.0	5.0

The resulting top measure mix under the Max scenario is similar to the Mid scenario. However, all measures now have increased potential from increased adoption, resulting from the attractiveness of higher customer incentives. Since industrial and large commercial measures are the most cost-effective, there is more room to increase incentives compared to the other measures. Thus industrial measures show the largest increase in potential over the Mid scenario results. On the residential side, the potential increase was limited by the overall residential program cost-effectiveness. Therefore, a significant increase in the incentive level between the Mid and Max scenario was not observed.

Table 16. Max Scenario - Top 10 Measures

Measures	DR Potential 2019 Enrolment (MW)	Achievable Potential 2023 (MW)
Large Commercial Curtailment	6.9	10.0
Large Industrial Curtailment		9.9
Medium Commercial Curtailment	0.0	2.6
Medium Industrial Curtailment	0.0	3.5
C&I Battery Storage	0.0	3.3
Gas Emergency Generator (New)	0.0	6.4
Small Business Thermal Energy Storage (New)	0.0	1.5
Residential WiFi Thermostats (Expanded to DLC)	0.0	13.4
Residential Pool Pumps (New)	0.0	6.5
Residential Battery Energy Storage - BYOD	0.0	1.4
Small Business Water Heater (New)	0.0	1.1

3.4 Monthly Peak Analysis

Active demand program measures have seasonal patterns in their potential for capacity reductions. As part of this study, an assessment of the potential for reducing monthly peaks during the ISO-NE monthly peak hour was performed. The evaluation consists of assessing the ability for the achievable potential to reduce the monthly peaks and providing some key guidance towards which measures would provide the most benefits.

3.4.1 Approach

This assessment is divided into two parts: initially, the total potential for capacity savings by month from all assessed measures included is identified. For each measure included in the annual peak reduction potential assessment, the monthly capacity reduction is estimated by prorating the impacts to the monthly peaks. Then, additional measures that can reduce heating season monthly peaks are identified based on measure-level results in jurisdictions with annual winter peaks.

Two main steps were undertaken to evaluate the monthly capacity reduction.

1. Monthly Load Curve Analysis: A standard day peak load shape for each month of the year is developed using the historical hourly load data for the ISO-NE system.

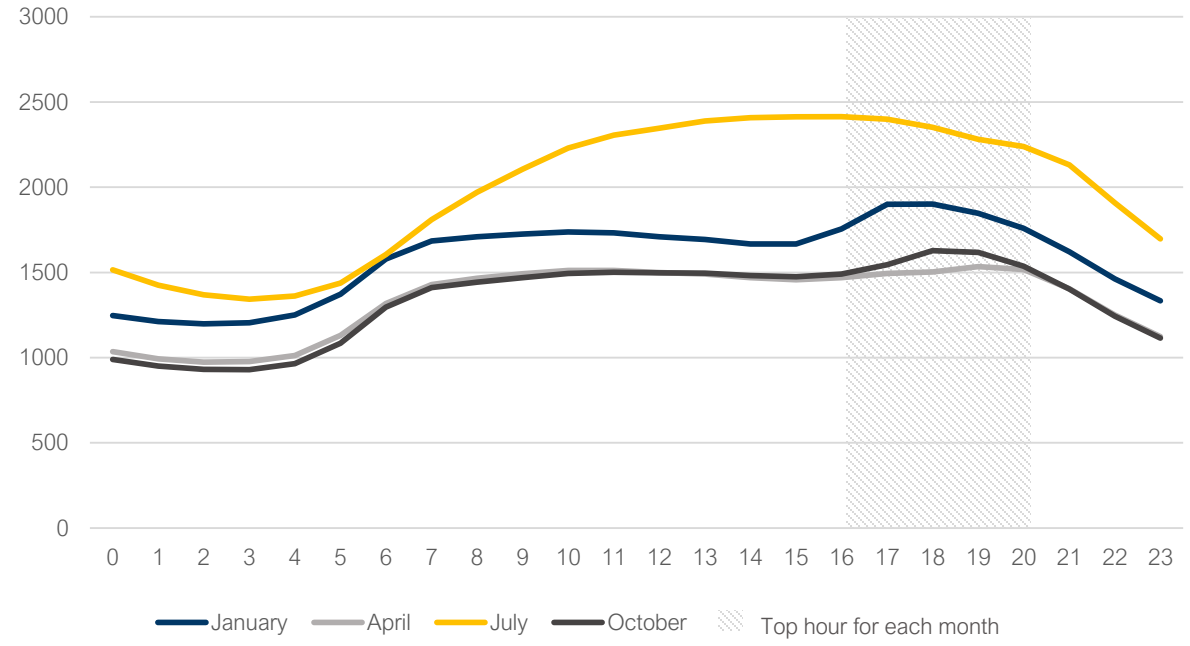
2. **Monthly DR impacts Assessment:** Using the monthly load curves, it is assumed that the modeled measures can exert a proportional impact on the monthly peak as they do on the summer peak. Depending on the measure, this can be either as an equivalent portion of the segment's contribution to the overall peak or as an equivalent portion of the end-use contribution to the monthly peak

3.4.2 Load Curve Analysis

The first step in the analysis is to define the standard peak day load curve for each month of the year. The standard peak day utility load curve is then used to determine expected monthly peaks in MW and the peak time of day and derive contribution to the monthly peak hour demands for each market segment, as well as the end-use breakdown of the peak demand by sector.

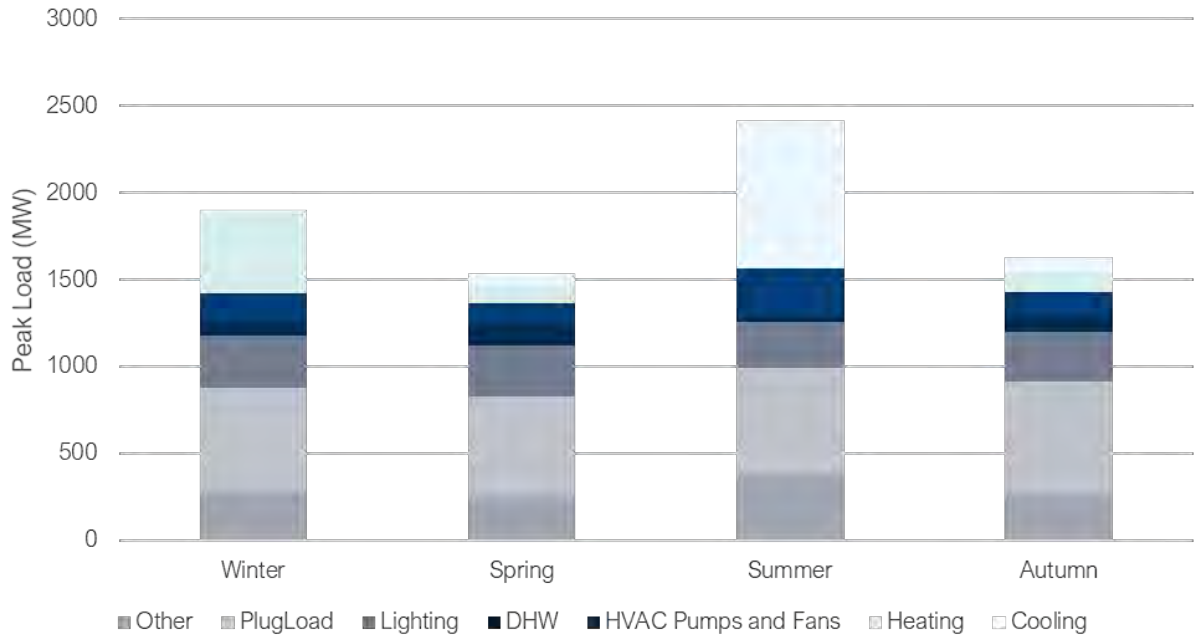
The standard peak day load curve for the statewide electric system is defined by taking an average of the load shape from each of the top ten peak days in each of nine years of historical hourly load data provided. **Error! Reference source not found.** displays the peak day load shape for four key months of the year. It shows that the top hour for each of the four months is occurring in late afternoons as early as 16:00 (hour starting) in summer and up to 19:00 (hour starting) in shoulder seasons. Note as well how the spring (April) and summer (July) peaks are more extended.

Figure 35. Monthly NH Standard Peak Day Based on Historical Data



The end-use analysis reveals that a large portion of the total load does not vary seasonally (1,235MW). The cooling represents up to 35% in summer and up to 47% when including other HVAC loads such as pumps and ventilation. **Error! Reference source not found.** below shows the end-use breakdown per season at peak hour.

Figure 36: Peak Load Hour by End-Use



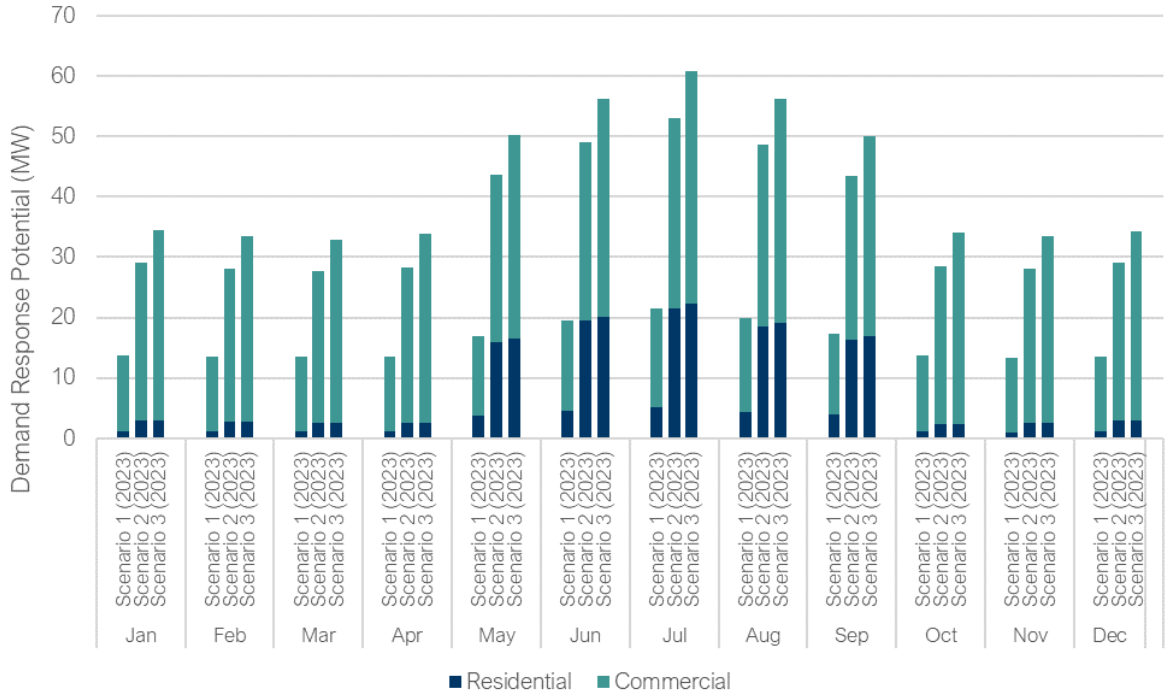
3.4.3 Achievable Potential

The overall achievable potential that could be used to reduce the load during ISO-NE monthly peak hours is presented in the section below[22]. It is important to note that the results presented do not include the impact of DR measures that specifically address the winter peak.

Under the Low Scenario, at least 13MW of the 23MW is achievable monthly by 2023. Under the Mid and Max scenarios, the monthly achievable potential respectively provides at least 28MW of the 54MW and 33MW of the 61MW achievable by 2023.

[22] The goal of the assessment is to identify measures that can be leveraged for a monthly use; however, the impact on the opt-out rates related to the number of DR calls is not evaluated. To apply the measure all year-long, a specific DR program will have to be developed.

Figure 37: Monthly Achievable Potential (MW) by Scenario



An important part of the DR potential can be achieved on a monthly basis. A few measures are offering notable opportunities, while others are not transferable. A few key observations to note are:

- **For the Low scenario, 50% of the potential comes from controlling loads that are not seasonally impacted**, mainly provided from energy storage or C&I loads such as processes and some lighting.
- **For the Mid and Max scenarios, 27% stems from energy storage systems and 17% from all year long C&I curtailable load**
- **The residential potential is the most impacted**: most of the residential achievable potential is targeting summer loads (cooling, pool pump). Therefore, it is not applicable for non-summer months.

In summary, current and expanded C&I curtailment programs are the ones best suited to capture some of the monthly peaks, while energy storage programs offer greater flexibility and the advantage to be less disruptive for customers.

3.4.4 Additional Measures

The analysis brings to light the need to develop programs specifically targeting the residential sector to address winter loads. While our assessment does not quantify measure potential for heating loads reduction, an overview of potential measures, successfully implemented in some jurisdictions, are presented below.

- **WiFi Thermostats Program**

WiFi thermostat is a key measure to reduce space heating loads through control of the temperature setpoint. When winter peaks are targeted, the WiFi thermostat needs to be connected to a central electric heating system instead of a central AC system. Some jurisdictions also target electric baseboards, although this measure is not often cost-effective with a DLC type of program. While this program would target a different segment of the population, some customers enrolled under the BYOD summer program might have a WiFi thermostat connected to both their electric cooling and heating systems. In those cases, the program could benefit from targeting both the summer and winter peaks.

Peak loads savings usually range between 0.5kW to 2kW reduction per home in winter applications.

- Electric Water Heaters & Other Appliances Programs

The achievable DR potential excludes most of smart appliances (or smart switches) due to cost-effectiveness screening. While these measures were not cost-effective when solely considering summer loads, leveraging these devices or appliances for the winter peak loads as well could increase cost-effectiveness, especially for appliances that are used more intensely in winter, such as clothes dryers.

Residential water heater programs are common in winter peaking jurisdiction and can offer great benefits if their use is coincident with the peak hour. For example, Burlington Electric Department has piloted ten devices that control electric domestic hot water heaters, and it was designed to provide both capacity and regulation service to the New England System Operator. The controls are based on the temperature of the tank so that the lowest-temperature tanks stay on, at least partially, during the event. This maximizes customer satisfaction and convenience by eliminating the possibility of a cold-water draw.

Peak savings for electric water heaters in winter is approximately 0.3kW per home.

- Dual fuel heating systems

Dual-heat programs could be explored to further reduce the heating load. In Quebec, the program provides a lower electricity rate that encourages the use of electric space heat during non-peak times, and a high rate that discourages the use of electricity during peak times. This is different from time-of-use rates, which encourage the shifting of electricity use to off-peak periods, because the intent is to shift to a non-electric fuel, which avoids potential rebound effects of simply shifting the load to a different time. The ratio of non-peak rates to peak rates in the dual-heat programs is a factor of four or five, which has been shown empirically to be sufficient to change customer behavior.

3.5 Key Takeaways

Based on the results of the active demand potential assessment, there is an apparent 61 MW (Max Scenario) of demand response potential in 2023, representing about 2.6% of the system peak. 6.9 MW of this potential is being captured by current DR program enrollment, which indicates that a further 54 MW of potential is achievable by expanding the program offer and increasing incentives. Alternatively, the Low scenario suggests that a further 16 MW of potential is achievable by solely expanding participation in existing programs.

As shown in **Error! Reference source not found.**, the active demand achievable potential can be increased further by providing more incentives to drive program adoption and by expanding programs.

Table 17. Active Demand Potential, by Scenario

Scenarios	Low Scenario	Mid Scenario	Max Scenario
Achievable Potential (MW)	23	54	61

Error! Reference source not found. below benchmarks the achievable active demand potential from the Mid and Max scenarios to DR potential study findings in other jurisdictions. Overall, these show that the NH active demand potential is similar to other summer peaking jurisdictions, where the industrial portion of the utility peak load is moderate, as is the case in New Hampshire.

Table 18. Benchmarking of the Achievable Active Demand Potential (Mid-Max Scenarios) to Other Summer Peaking Jurisdictions

	New Hampshire (2020)	Massachusetts (2018)	Michigan (2017)	Northwest Power (2014)
Portion of Peak Load	2.0% - 2.6% (2023)	3.5% - 4.0% (10-year outlook)	2.3%-5.3% (3-year outlook)	8.2% (15-year outlook)
Avoided Costs	$205 / kW	$290 / kW	$140 / kW	n/a

Based on the findings in this report, three key takeaways emerge:

- **Expanding industrial and commercial curtailment offers the most active demand potential.** The C&I sector offers the most potential, while being the most cost-effective. Expanding the offer within the sector is a low-hanging fruit. Finally, incentives for backup generators should be considered to help better realize their potential within the active demand program.
- **There is room for growth in the residential sector.** WiFi thermostats remain a significant contributor to the residential achievable potential. This potential can be realized by leveraging existing thermostats with the BYOD program and by reaching out to customers that have not adopted the technology. Residential pool pumps can also greatly enhance the residential reduction potential (with smart pool pump, simple timer, and smart switch).
- **An important part of the active demand potential can be achieved on a monthly basis with an appropriate program design.** 50% of the low scenario potential comes from controlling loads that are not impacted seasonally. For the Mid and Max scenarios, 27% of the potential is in energy storage systems, and 17% in all-year C&I curtailable loads.
- **Measures that can persist later in the afternoon should be prioritized.** With the advent of new loads such as EVs or solar PVs, the New Hampshire and ISO-NE peak hour might shift towards a later peak time. When developing a new program, close attention should be paid to ensure minimal impacts on the achievable savings.

Overall, it appears that both expanding to new programs and increasing incentives have an important role in increasing active demand potential in New Hampshire.

This report was prepared by Dunsky Energy Consulting. It represents our professional judgment based on data and information available at the time the work was conducted. Dunsky makes no warranties or representations, expressed or implied, in relation to the data, information, findings and recommendations from this report or related work products.

NHsaves
Your Source for Energy Efficiency

COVID-19 Impact on Energy Efficiency Study

LUTH research

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LUTH research

Background and Objectives

Background and Objectives

The NHSaves electric and natural gas utilities are seeking statistically significant quantitative and qualitative data on the current impacts of COVID-19 on NH utility customer attitudes, interests and planned activities related to energy efficiency actions and investments. The results would inform EE program goal setting and program design elements.

Screen & Evaluative Criteria

- Person in household who would contact local utility company or deal with bill
- Age 18 or older
- Aware Eversource, Liberty Utilities, the New Hampshire Electric Co-Op or Unitil is one of their local utilities

Method

- Web survey
- Qualification screener
- Impact of COVID-19 virus on respondent's household / company
- When impact of virus in New Hampshire is expected to start declining
- Importance of energy efficiency compared with a year ago and in next 2-3 years
- Awareness and participation in energy efficiency programs
- Participation in energy audit and impact of virus on potential participation
- Potential participation in virtual energy audit
- Demographics

Survey Specs

- Interview length 5 minutes on average
- Survey fielding: June 24-July 2, 2020
- Sample sources: Eversource, Liberty Utilities, the New Hampshire Electric Co-Op and Unitil customer lists
- 2,024 residential and 442 commercial customers participated
- The margin of error is plus or minus 2.2% at the 95% level for results based on all residential customers and 4.7% for results based on all commercial customers

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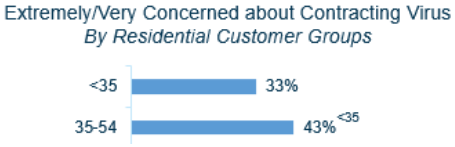
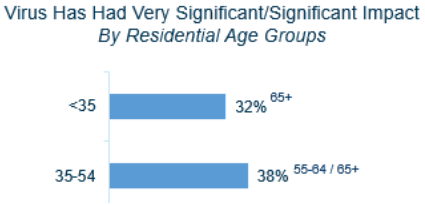
Stat Testing

- Stat testing on individual slides is indicated at the 95% level with small letters, like below; in this example, the 43% result for 35-54 year olds was statistically higher than the 33% result for the same response for respondents younger than 35.



- If a result is statistically higher than several other subgroups, the different subgroups are separated with a slash mark; in the example below, the result is statistically higher for 35-54 year olds compared 55-64 year olds and those 65+. The result for respondents younger than 35 is also statistically higher than those 65+.



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Summary and Implications

Summary and Implications

Implications

While the COVID-19 outbreak has had widespread impact on New Hampshire customers, particularly the financial health of commercial customers, most see the return to a new 'normal' in the near future, although there is still a potential for considerable opinion volatility due to confusion and uncertainty.

The effect of the virus on energy efficiency efforts, particularly in the next 2-3 years, is likely to be small, especially since its importance is expected to continue increasing. Large majorities of both residential and commercial customers say the virus has made no difference in the likelihood they will participate in an audit or have EE updates installed. However, there is a core of about 20% of residential and 10% of commercial customers who aren't comfortable with in-home visits prior the virus being widely seen to be under control or the development of a vaccine; a virtual audit could be an alternative among this group and more widely as well.

Impact of COVID-19

- More than one-third of residential and commercial customers (36%) know someone who has contracted COVID-19.
- Nearly half of residential customers (46%) are extremely or very concerned about contracting COVID-19 and 40% of commercial customers are similarly concerned that someone in their workplace will contract the virus.
- About half of customers think the outbreak in NH will be declining by the end of 2020, while about one-quarter believe this won't happen until 2021. However, 30% of residential customers and 21% of commercial ones aren't sure when this will happen.

Summary and Implications

- The financial impact of the virus has hit businesses much harder than residential customers and the consensus is that businesses won't fully recover financially until 2021, while residential customers will recover financially by the end of this year.

- Despite the financial hit taken by business, however, only 26% are concerned about paying their bills in general and 21% are concerned about their utility bills. Worry among residential customers is even lower.

Energy Efficiency Programs

- Far more customers say that energy efficiency has increased rather than decreased in importance to them over the past year and even more believe it will increase in importance over the next 2-3 years.

- Almost three-quarters of both residential (73%) and business customers (71%) say they are aware that utility companies offer EE programs to help reduce electric and/or gas bills.

- Residential customers are about three times as likely as commercial ones to have taken advantage of an EE program.

- Despite lower participation, commercial customers are significantly more likely than residential customers to say the EE programs they participated in were useful to them (76% vs. 57%).

- Expected participation in EE programs during the next 12 months mirrors previous results, with residential customers three times as likely as commercial ones to be likely to participate (33% vs. 11%).

Summary and Implications

Energy Audits

- About one in ten residential customers and one in five commercial customers have participated in an energy audit or had energy efficiency upgrades installed.
- Large majorities of both residential (68%) and commercial customers (85%) say the COVID-19 outbreak has not made them less likely to participate in an energy audit or have EE upgrades installed.
- There is a core of about one in five residential and one in ten commercial customers who's concerns won't be allayed even by proposed safety protocols to be employed by EE professionals; this group won't be comfortable until the virus is widely seen to be under control or a vaccine is available.
- Between one in three and one in four residential customers who are uneasy with an in-person audit would be likely to participate in a virtual one; the most-affluent customers are more likely than others to be likely to participate.

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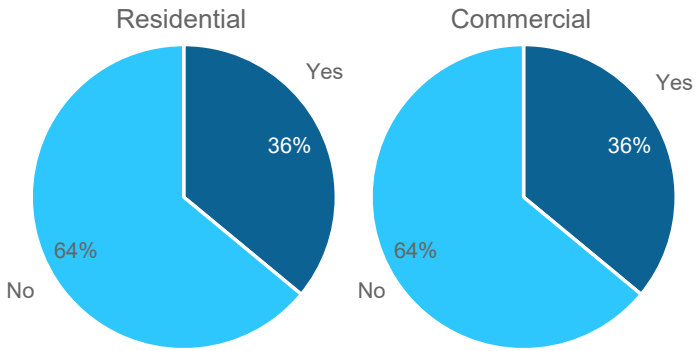
Impact of COVID-19

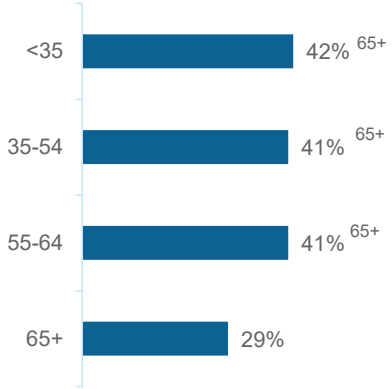
Knowing Anyone Who Contracted COVID-19

Just over one in three residential and commercial customers know someone who has contracted the COVID-19 virus. The percentage of residential customers who are aware of a victim is consistent except among those 65 and older, who are less likely to know someone who contracted the virus.

Know Someone Who Contracted the Virus



Know Someone Who Contracted Virus
By Residential Age Groups

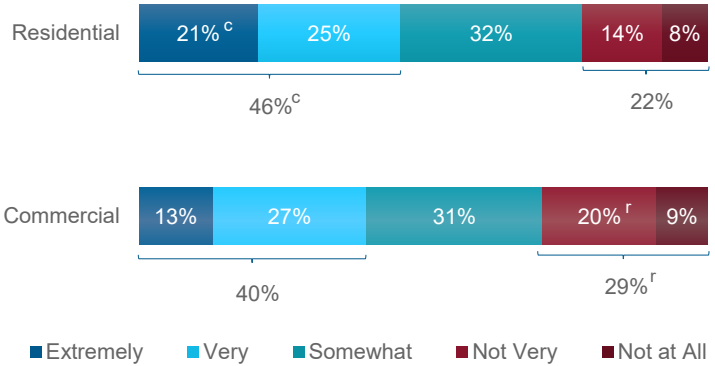


Q1. Do you know anyone who has contracted the COVID-19 virus?
Bases: Residential (n=2,024), Commercial (n=442); Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

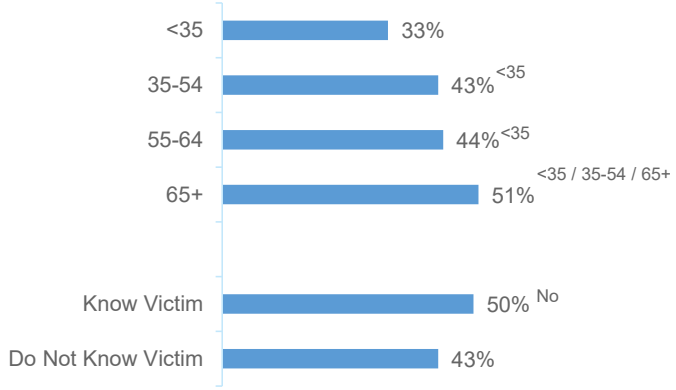
Concern about Contracting COVID-19

Residential customers are slightly more concerned that someone in their household will contract the virus than commercial customers are that one of their employees will; in both cases, less than half are extremely or very concerned. Among residential customer groups, concern increases with age. Concern with contracting the virus is only slightly higher among those who know a victim than among those who don't.

Concern about Contracting Virus
By Customer Type



Extremely/Very Concerned about Contracting Virus
By Residential Customer Groups

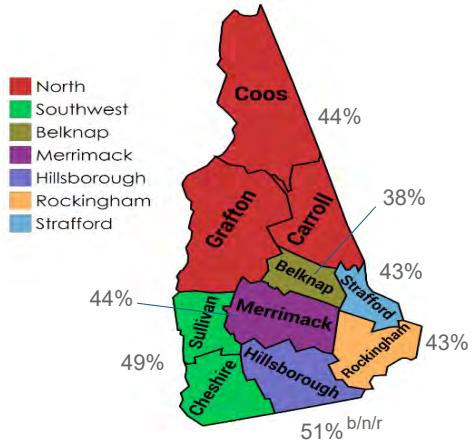


Q2. How concerned are you about you or someone living in your household contracting the COVID-19 virus? / How concerned are you about you or someone in your workplace contracting the COVID-19 virus?
Bases: Residential (n=2,024), Commercial (n=442); Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915); Residential – Know victim (n=719), Do not know victim (n=1,305)

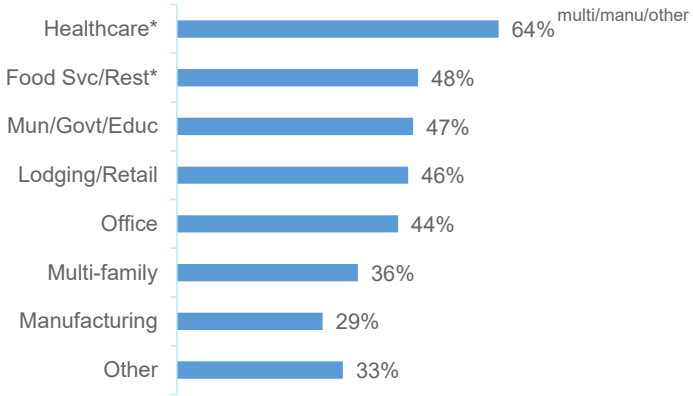
Concern about Contracting COVID-19

Concern with contracting the virus is slightly higher among residential customers in Hillsborough County than in the rest of the state. Not surprisingly, concern is also much higher among commercial customers in the healthcare field than in other industries.

Extremely/Very Concerned about Contracting Virus
By Residential Region



Extremely/Very Concerned about Someone in Workplace Contracting Virus
By Commercial Groups



*Small base

Q2. How concerned are you about you or someone living in your household contracting the COVID-19 virus? / How concerned are you about you or someone in your workplace contracting the COVID-19 virus?

Bases: Residential – North (n=332), Southwest (n=152), Belknap (n=119), Hillsborough (n=554), Merrimack (n=239), Rockingham (n=458), Strafford (n=170); Commercial – Manufacturing (n=58), Office (n=66), Lodging/Retail (n=79), Healthcare (n=22), Food service/Restaurants (n=25), Multi-family (n=59), Municipal/Government/Education (n=36), Other (n=97)

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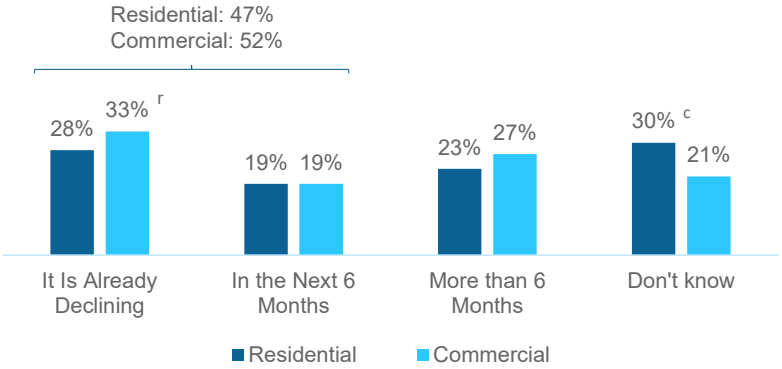
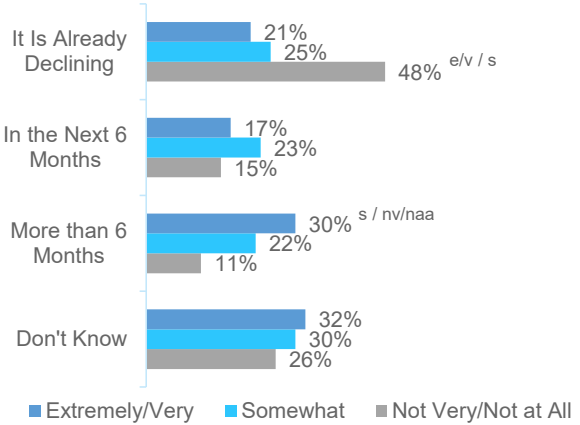
When Outbreak Will Start Declining

About half of both residential and commercial customers think the COVID-19 outbreak in New Hampshire will start declining before the end of the year; about three in ten think it is already declining. About one quarter don't think it will start declining until next year and 30% of residential and 21% of commercial customers don't know. Among the residential group most concerned about contracting the virus, 38% think it will start declining by the end of the year, while 30% think it won't until 2021.

When Outbreak Will Start Declining
By Customer Type



When Outbreak Will Start Declining
By Residential Customer Concern about Virus

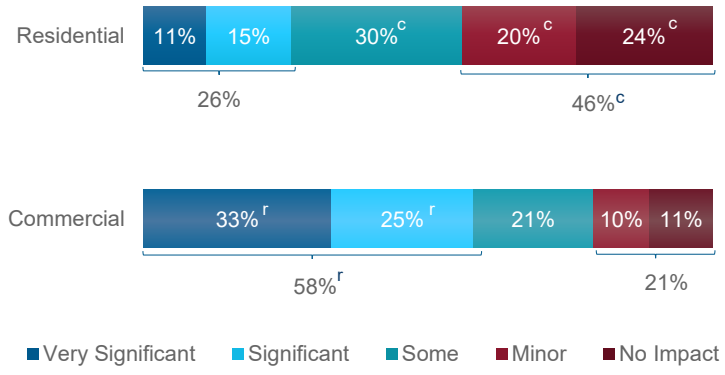


Q3. How long do you think it will take for the COVID-19 outbreak in New Hampshire to start declining?
Bases: Residential (n=2,024), Commercial (n=442); Residential – Extremely/Very concerned (n=927), Somewhat concerned (n=648), Not very/Not at all concerned (n=449)

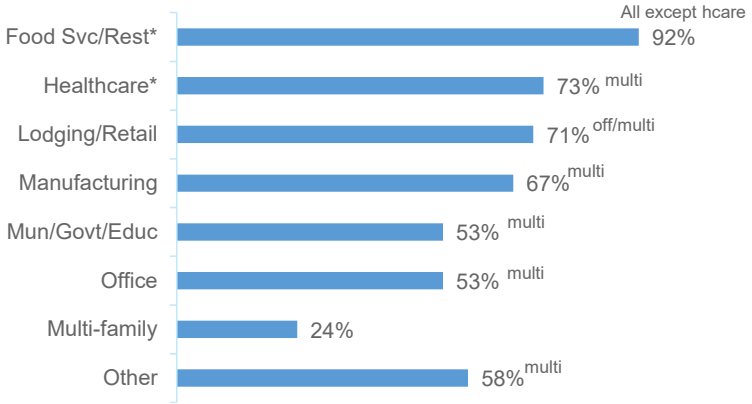
Impact of COVID-19 on Finances

While a majority of commercial customers say the COVID-19 pandemic and efforts to combat it have had a significant impact on their organization's financial situation, only one-quarter of residential customers say it has similarly affected their household's finances. Food service and restaurants have been particularly hard hit, while multi-family businesses have been the least impacted.

Impact of Virus on Finances
By Customer Type



Virus Has Had Very Significant/Significant Impact
By Commercial Groups



*Small base

Q4. How big an impact has the COVID-19 pandemic and efforts to combat it had on your household's finances? / How big an impact has the COVID-19 pandemic and efforts to combat it had on your company's/organization's financial situation?
Bases: Residential (n=2,024), Commercial (n=442); Commercial – Manufacturing (n=58), Office (n=66), Lodging/Retail (n=79), Healthcare (n=22), Food service/Restaurants (n=25), Multi-family (n=59), Municipal/Government/Education (n=36), Other (n=97)

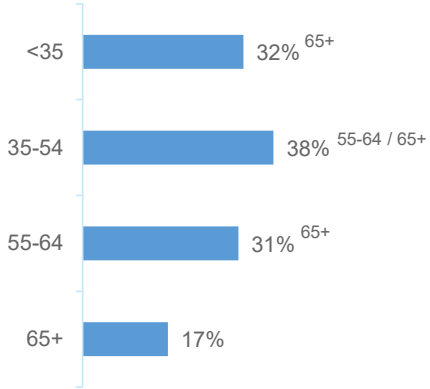
NHsaves Your Source for Energy Efficiency

LUTH research

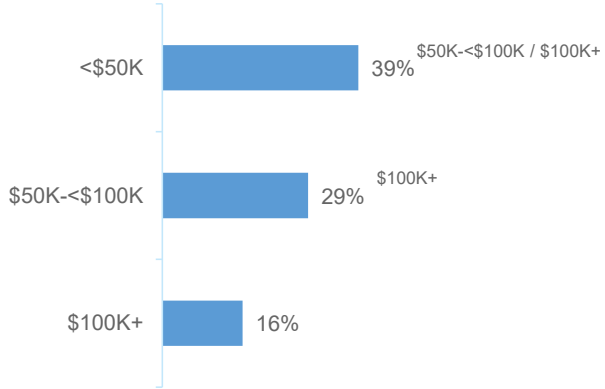
Impact of COVID-19 on Finances

Among residential groups, 35-54 year olds and those with household incomes below $50,000 annually have been most affected. The impact has been much less among seniors and the most-affluent households.

Virus Has Had Very Significant/Significant Impact
By Residential Age Groups



Virus Has Had Very Significant/Significant Impact
By Residential Income Groups

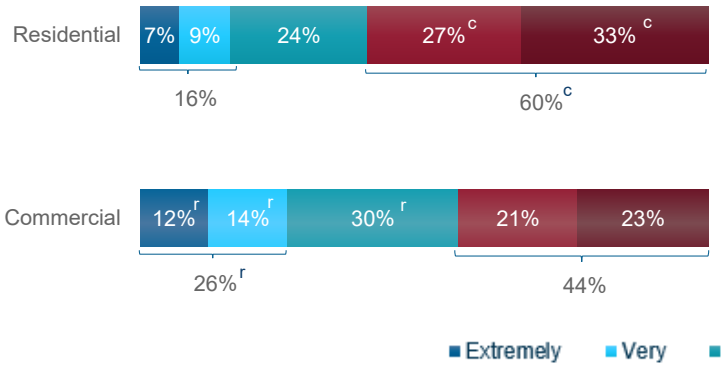


Q4. How big an impact has the COVID-19 pandemic and efforts to combat it had on your household's finances? / How big an impact has the COVID-19 pandemic and efforts to combat it had on your company's/organization's financial situation?
Bases: Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915);

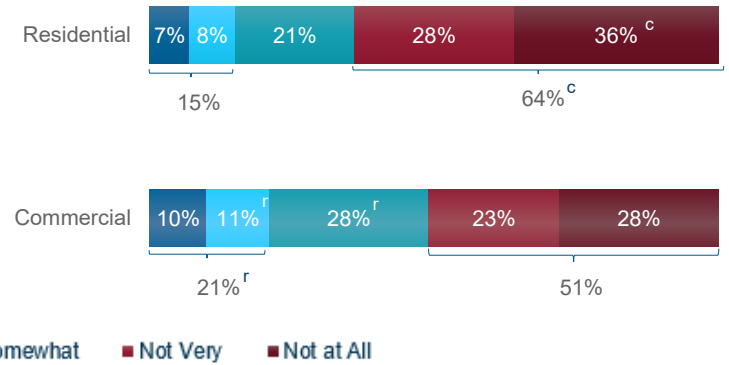
Concern about Paying Bills

Despite financial problems caused by efforts to combat the pandemic, only 16% of residential customers are extremely or very concerned about paying their bills in general and 15% are similarly concerned about paying their utility bills in particular. Concern among commercial customers is higher, although even among this group only one-quarter are concerned about paying their bills in general and one in five are concerned about paying their utility bills.

Concern about Paying Bills in General
By Customer Type



Concern about Paying Utility Bills
By Customer Type



■ Extremely ■ Very ■ Somewhat ■ Not Very ■ Not at All

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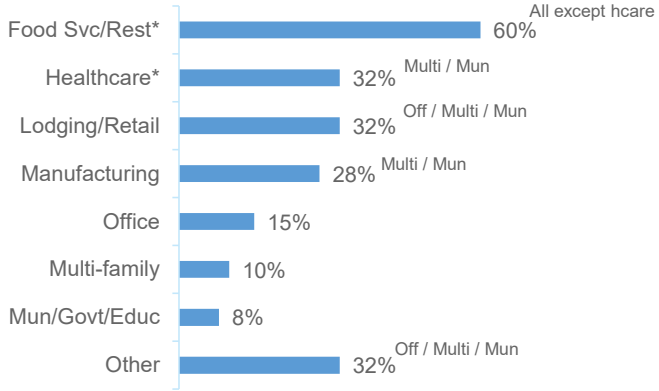
Q5A. How concerned are you currently about paying your bills in general? / How concerned are you currently about your company/organization being able to pay its bills?
Q5B. How concerned are you about paying your **[INSERT FROM SERVICE VARIABLE]** bills? / How concerned are you about your company/organization being able to pay its **[INSERT FROM SERVICE VARIABLE]** bills?
Bases: Residential (n=2,024), Commercial (n=442)

LUTH research

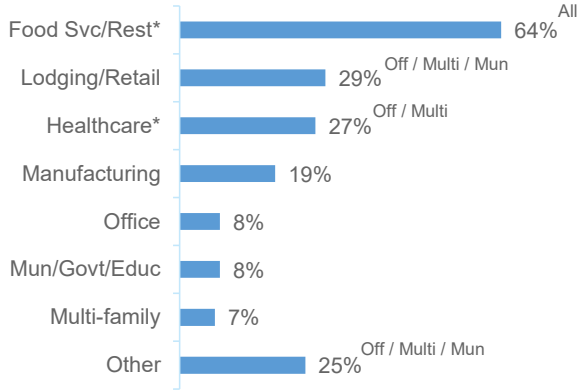
Concern about Paying Bills

In the short term, food service and restaurants are being hit very hard, with well over half being concerned about paying their bills, while office, multi-family and municipal/government/education organizations are having much less difficulty.

Extremely/Very Concerned about Bills in General
By Commercial Groups



Extremely/Very Concerned about Utility Bills
By Commercial Groups



Q5A. How concerned are you currently about paying your bills in general? / How concerned are you currently about your company/organization being able to pay its bills?
Q5B. How concerned are you about paying your **[INSERT FROM SERVICE VARIABLE]** bills? / How concerned are you about your company/organization being able to pay its **[INSERT FROM SERVICE VARIABLE]** bills?
Bases: Commercial – Manufacturing (n=58), Office (n=66), Lodging/Retail (n=79), Healthcare (n=22), Food service/Restaurants (n=25), Multi-family (n=59), Municipal/Government/Education (n=36), Other (n=97)

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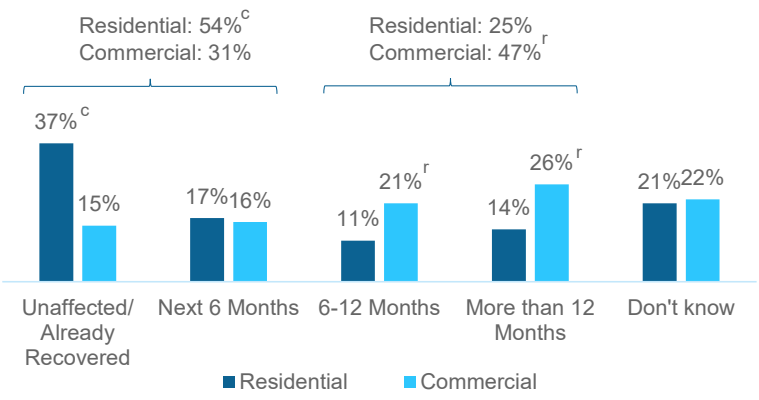
LUTH research

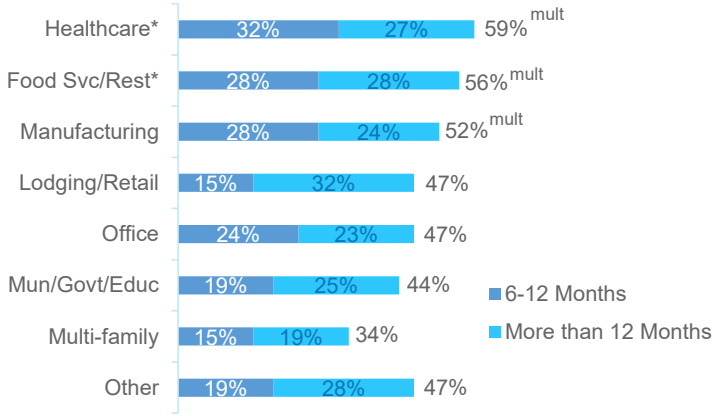
How Long to Recover Financially

While a majority of residential customers think they will have recovered financially by the end of the year, almost half of commercial customers think it will take at least 6 months to a year to recover and one in four believe it will take more than a year. Healthcare and food service/restaurant businesses are the most convinced it will be well into 2021 before they recover.

When Will Recover Financially
By Customer Type



Will Take at Least 6 Months to Recover Financially
By Commercial Groups



*Small Base
Q6. How long do you think it will take for your household to return to where it was financially before the COVID-19 outbreak? / How long do you think it will take for your company/organization to return to where it was financially before the COVID-19 outbreak?
Bases: Residential (n=2,024), Commercial (n=442); Commercial – Manufacturing (n=58), Office (n=66), Lodging/Retail (n=79), Healthcare (n=22), Food service/Restaurants (n=25), Multi-family (n=59), Municipal/Government/Education (n=36), Other (n=97)

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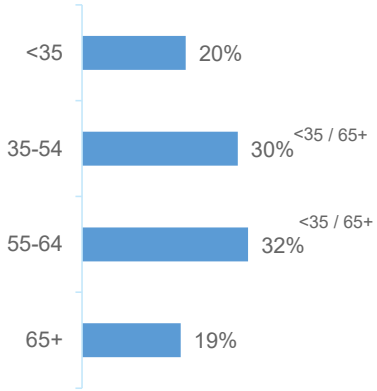
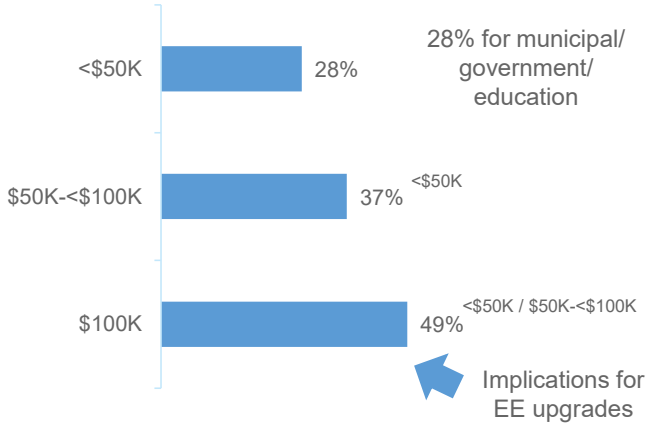
How Long to Recover Financially

Residential customers 35-64 are the most likely to think it won't be until 2021 before their households have recovered financially from the damage caused by COVID-19. About half of customers in the most-affluent households think they have already recovered financially.

Will Take at Least 6 Months to Recover Financially
By Residential Age Groups



Unaffected/Already Recovered Financially
By Residential Income Groups



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Q6. How long do you think it will take for your household to return to where it was financially before the COVID-19 outbreak? / How long do you think it will take for your company/organization to return to where it was financially before the COVID-19 outbreak?
Bases: Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915); Residential - <$50,000 (n=432), $50,000-<$100,000 (n=585), $100,000+ (n=453)

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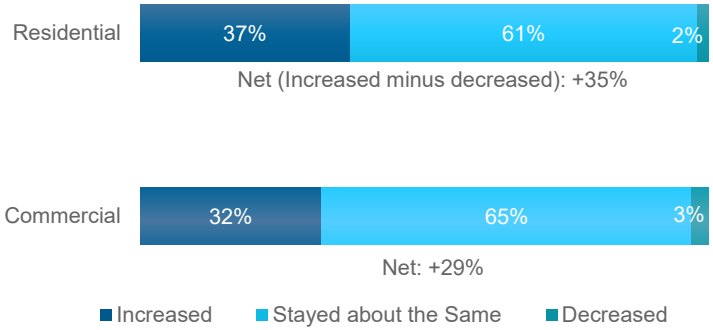
Energy Efficiency Programs

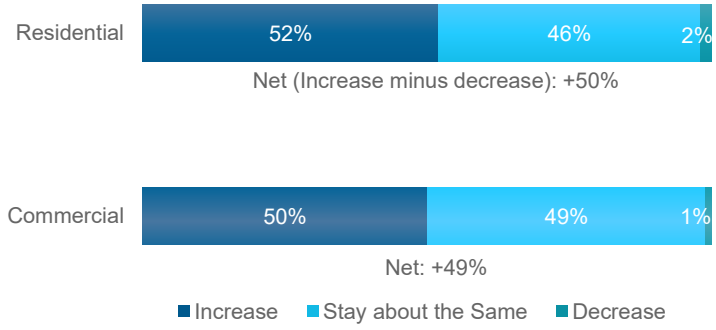
Importance of Energy Efficiency

Both residential and commercial customers are much more likely to say that the importance of energy efficiency to their household or business has increased rather than decreased compared with a year ago and even more think it will increase over the next 2-3 years.

Importance of EE Compared with Year Ago
By Customer Type



Importance of EE in Next 2-3 Years
By Customer Type

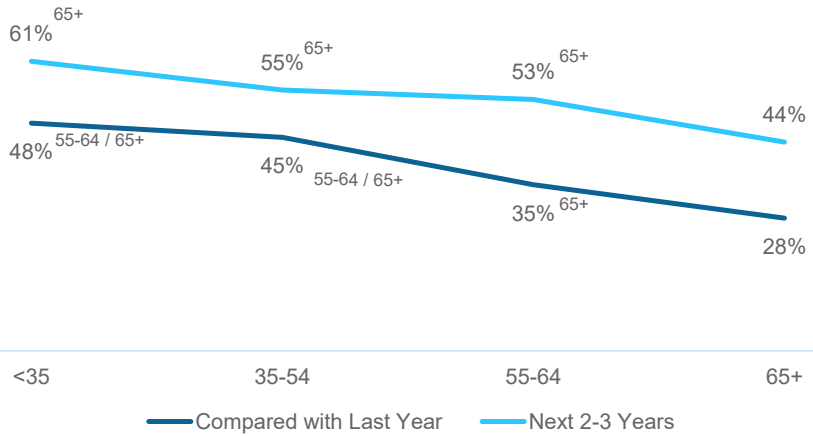


Q7. Compared with a year ago, has the importance of energy efficiency for your household increased, decreased or stayed the same? / Compared with a year ago, has the importance of energy efficiency for your company/ organization increased, decreased or stayed the same?
Q8. Thinking about the next 2-3 years, do you think the importance of energy efficiency for your household will increase, decrease or stay about the same? / Thinking about the next 2-3 years, do you think the importance of energy efficiency for your company/organization will increase, decrease or stay about the same?
Bases: Residential (n=2,024), Commercial (n=442)

Importance of Energy Efficiency

While the net importance of energy efficiency has increased and is expected to increase across all age groups, the gap narrows as age increases; however, even among seniors, nearly half expect the importance of energy efficiency will increase over the next 2-3 years.

Net Increase in Importance of Energy Efficiency
By Residential Age Groups



Q7. Compared with a year ago, has the importance of energy efficiency for your household increased, decreased or stayed the same? / Compared with a year ago, has the importance of energy efficiency for your company/ organization increased, decreased or stayed the same?
Q8. Thinking about the next 2-3 years, do you think the importance of energy efficiency for your household will increase, decrease or stay about the same? / Thinking about the next 2-3 years, do you think the importance of energy efficiency for your company/organization will increase, decrease or stay about the same?
Bases: Bases: Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

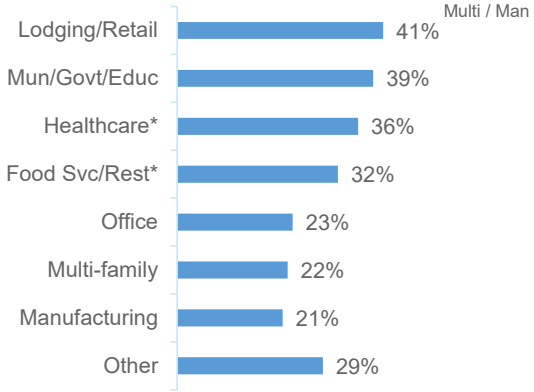
NHsaves Your Source for Energy Efficiency

LUTH research

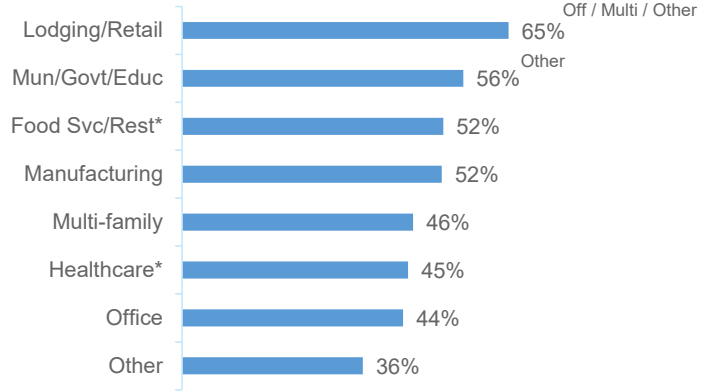
Importance of Energy Efficiency

Among commercial segments, the greatest increases in the importance of energy efficiency are in the lodging and retail sectors, although there are healthy increases in the importance of energy efficiency across groups. However, lodging and retail is one of the businesses most financially impacted by COVID-19.

Net Increase in Importance of Energy Efficiency Compared with Last Year
By Commercial Groups



Net Increase in Importance of Energy Efficiency Next 2-3 Years
By Commercial Groups



Q7. Compared with a year ago, has the importance of energy efficiency for your household increased, decreased or stayed the same? / Compared with a year ago, has the importance of energy efficiency for your company/ organization increased, decreased or stayed the same?
Q8. Thinking about the next 2-3 years, do you think the importance of energy efficiency for your household will increase, decrease or stay about the same? / Thinking about the next 2-3 years, do you think the importance of energy efficiency for your company/organization will increase, decrease or stay about the same?
Bases: Bases: Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

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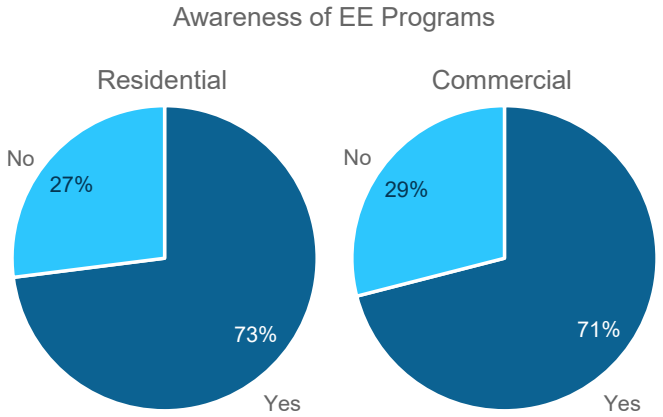
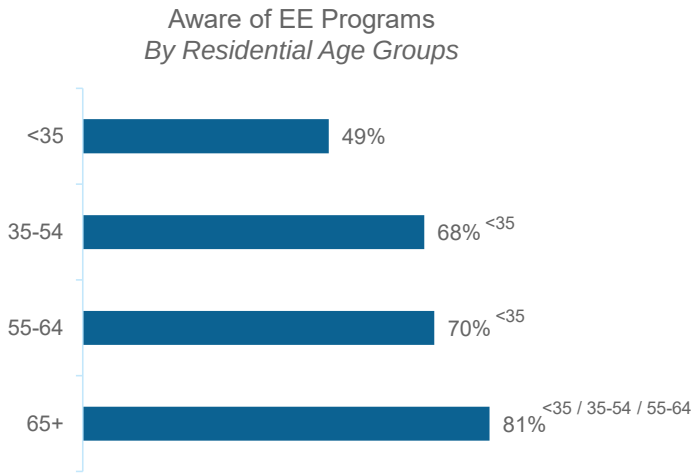
Awareness of Energy Efficiency Programs

Almost three-quarters of both residential and commercial customers are aware that electric and natural gas customers offer energy efficiency programs to help reduce energy costs. Awareness increases sharply among residential age groups. Considering the importance of energy efficiency to younger customers in particular, it would be fruitful to increase awareness among those customers.

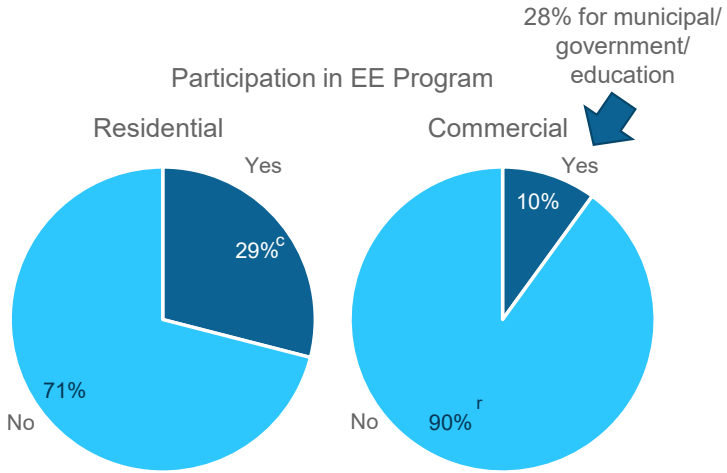


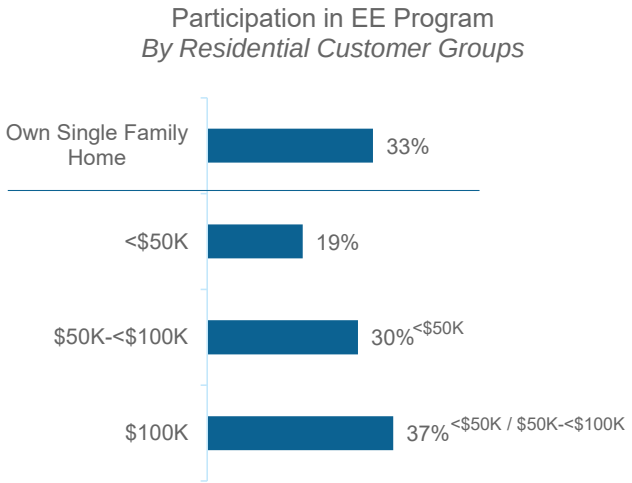


Q9. Are you aware that electric and natural gas companies offer energy efficiency programs to help you reduce your energy costs? / Are you aware that electric and natural gas companies offer energy efficiency programs to help you reduce your company's/organization's energy costs?
Bases: Residential (n=2,024), Commercial (n=442); Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

Participation in Energy Efficiency Programs

Residential customers are three times as likely as commercial customers to have participated in EE programs. One in three single family homeowners have participated in an EE program and participation rises with income.

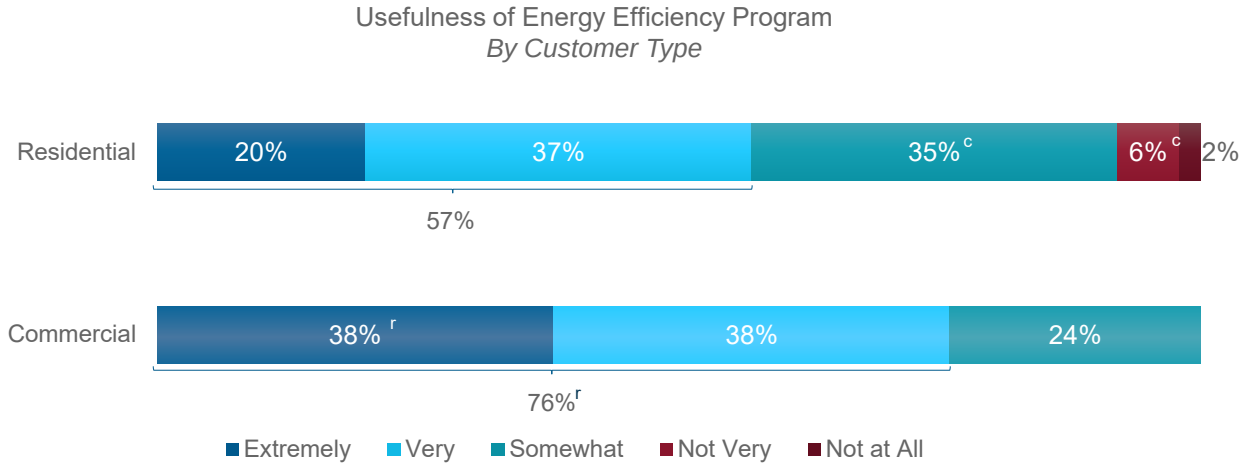




Q10. Have you received a rebate or financial support from your electric or natural gas company for any of the following energy efficiency equipment or offerings? / Have you received a rebate or financial support from your electric or natural gas company for any of the following energy efficiency offerings?
Bases: Residential (n=2,024), Commercial (n=442); Residential – Own single-family home (n=1,516), <$50,000 (n=432), $50,000-<$100,000 (n=585), $100,000+ (n=453)

Usefulness of Energy Efficiency Program

Although participation in EE programs is significantly lower among commercial customers, commercial customers are significantly more likely to say the programs they participated in were useful to them.

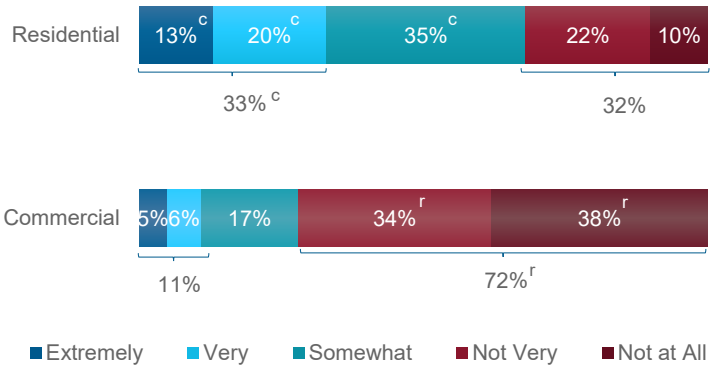


Q11. And how useful to you were the energy efficiency programs you participated in? Were they…? / And how useful to you were the energy efficiency programs your company/organization participated in? Were they…?
Bases: Participated in energy efficiency program – Residential (n=595), Commercial (n=45)

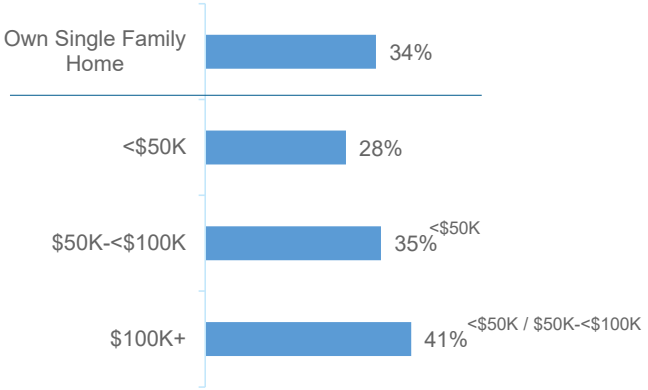
Participation in Efficiency Program in Next 12 Months

Residential customers are about three times as likely as commercial ones to be likely to participate in an EE program in the next 12 months. Likely participation rises with household income.

Likely Participation in EE Program
By Customer Type



Extremely/Very Likely to Participate
By Residential Customer Groups



Q12. Are you likely to participate in any of the following energy efficiency programs during the next 12 months? / Is your company/organization likely to participate in any of the following energy efficiency programs during the next 12 months?
Bases: Residential (n=2,024), Commercial (n=442); Residential – Own single-family home (n=1,516), <$50,000 (n=432), $50,000-<$100,000 (n=585), $100,000+ (n=453)

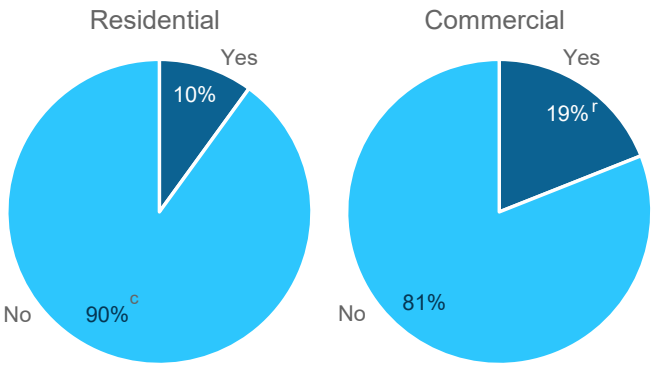
LUTH research

Energy Audits

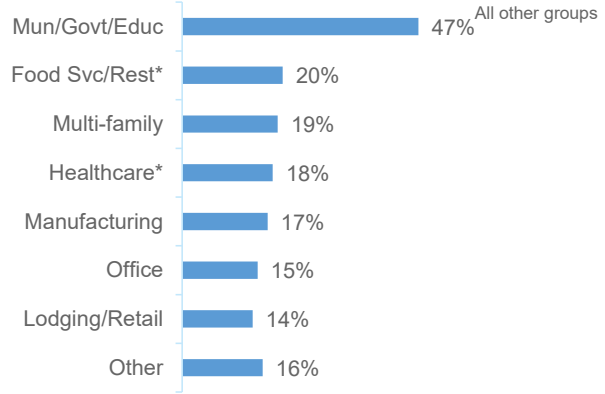
Participation in Energy Audit

Commercial customers are about twice as likely as residential ones to have had on-site energy evaluation/audit and/or installation of energy efficiency upgrades. Municipal, government and education organizations are far more likely than other types of commercial entities to have participated in an audit and/or installed upgrades.

Participation in Energy Audit



Participated in Energy Audit
By Commercial Groups



*Small base
Q13. Have you ever had an in-home visit from an electricity or natural gas company representative to conduct an energy evaluation or audit of your home's energy efficiency or to install energy efficiency upgrades? This would be separate from a regular service call. / Has your company/organization ever had an on-site visit from an electricity or natural gas company representative to conduct an energy evaluation or audit of your location's energy efficiency or to install energy efficiency upgrades? This would be separate from a regular service call.
Bases: Residential (n=2,024), Commercial (n=442); Commercial – Manufacturing (n=58), Office (n=66), Lodging/Retail (n=79), Healthcare (n=22), Food service/Restaurants (n=25), Multi-family (n=59), Municipal/Government/Education (n=36), Other (n=97)

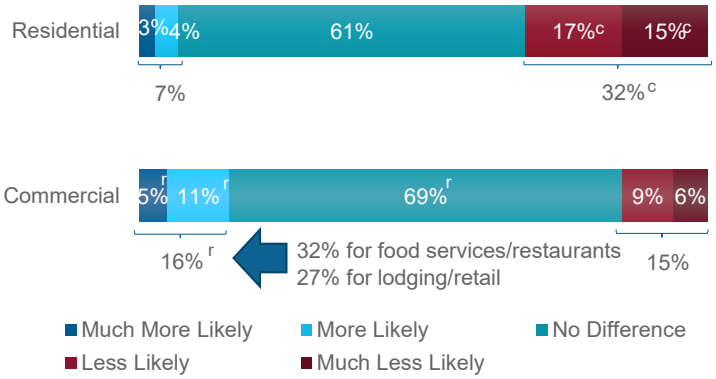
NHsaves Your Source for Energy Efficiency

LUTH research

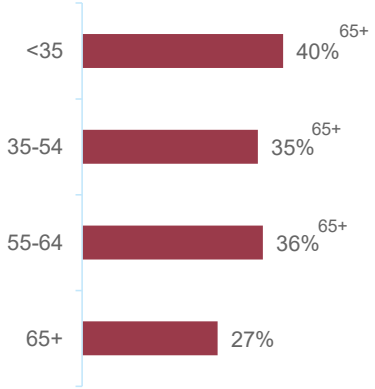
Impact of COVID-19 on Participation in Energy Audit

The COVID-19 outbreak has made one in three residential customers and 15% of commercial customers less likely to participate in an energy evaluation/audit and/or install energy efficiency upgrades. The negative impact of the virus on potential participation gradually declines as age increases.

Likely Participation in EE Program
By Customer Type



Less Likely to Participate
By Residential Age Groups



Q14. Thinking about an in-home visit from an electricity or natural gas company representative to conduct an energy evaluation or audit of your home's energy efficiency or to install energy efficiency upgrades, has the COVID-19 outbreak changed how likely you are to take part in such a program? / Thinking about an on-site visit from an electricity or natural gas company representative to conduct an energy evaluation or audit of your location's energy efficiency or to install energy efficiency upgrades, has the COVID-19 outbreak changed how likely you are to take part in such a program?
Bases: Residential (n=2,024), Commercial (n=442); Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

NHsaves Your Source for Energy Efficiency

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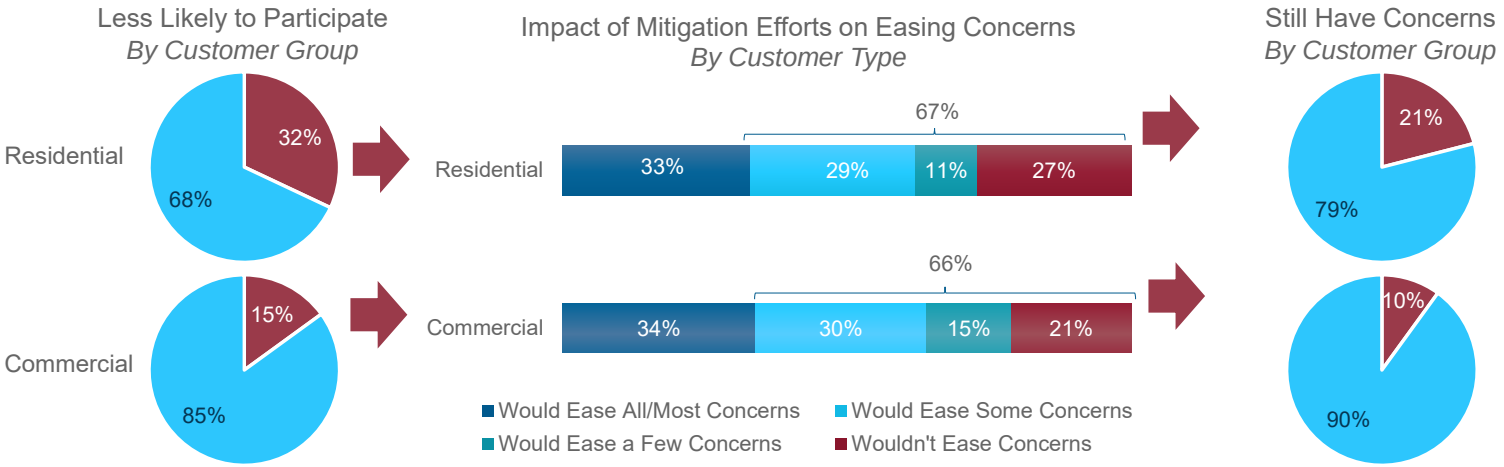
Impact of Mitigation Efforts

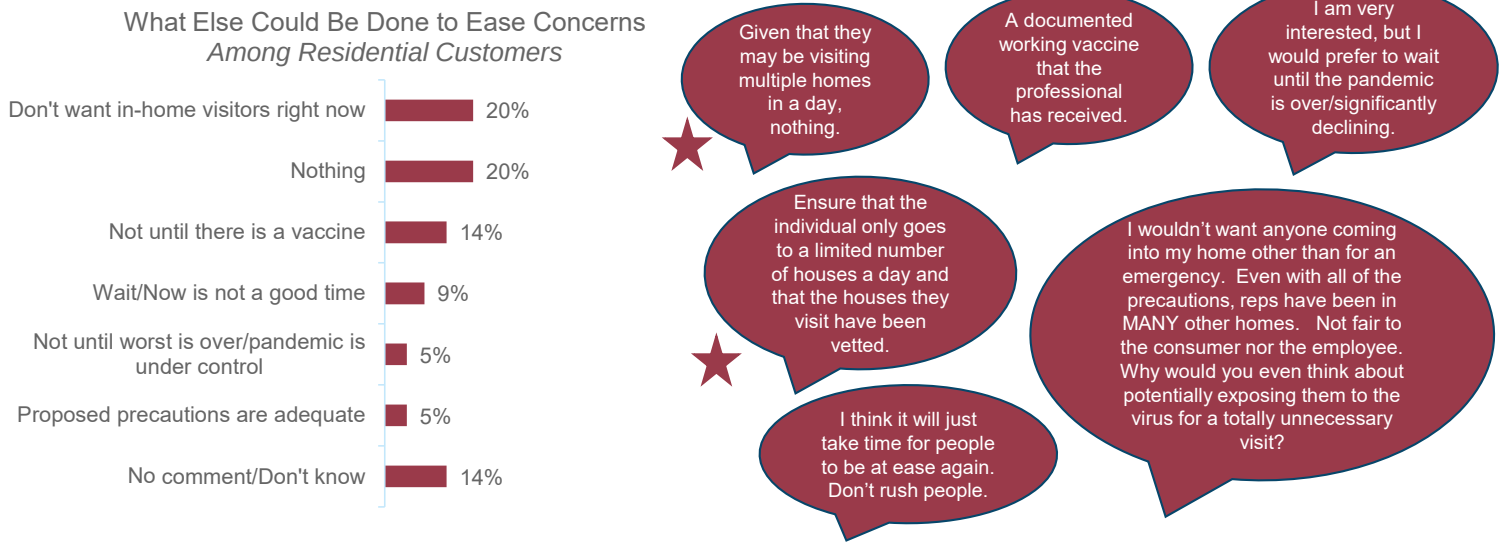
Customers who said they were less likely to participate in an energy evaluation/audit and/or have energy efficiency upgrades installed were asked if their concerns would be eased if energy efficiency professionals took special precautions with protective clothing and equipment and received special training. One in three of this group said these precautions would ease all or most of their concerns, while two-thirds would still have at least some concerns. The group still having concerns equals 21% of all residential and 10% of all commercial customers.



Q15. By how much, if at all, would your concerns about in-home visits be eased if energy efficiency professionals wore protective clothing/equipment and received training relating to safe practices? Would these precautions…? / By how much, if at all, would your concerns about on-site visits be eased if energy efficiency professionals wore protective clothing/equipment and received training relating to safe practices? Would these precautions…?
Bases: Residential (n=2,024), Commercial (n=442); Less likely to participate – Residential (n=642), Commercial (n=66)

What Additionally Could Be Done to Ease Concerns?

Residential customers who said the potential mitigation efforts would only ease some or fewer of their concerns were asked what additional steps could be taken by utility company energy efficiency professionals to ease their concerns. Generally, respondents said that nothing specifically could be done, that they were too worried about visitors due to COVID-19.

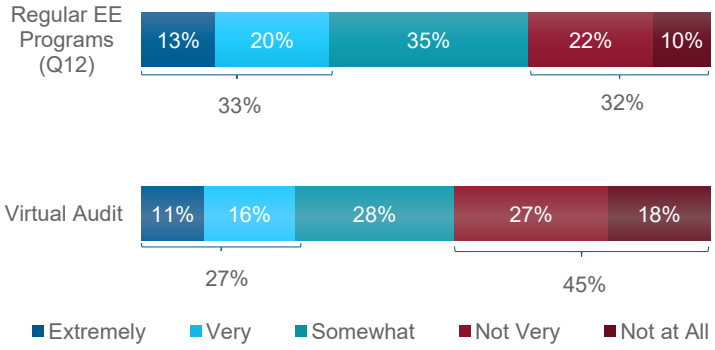


Q16. What in addition could be done to ease your concerns about in-home visits from energy efficiency professionals? / What in addition could be done to ease your concerns about on-site visits from energy efficiency professionals?
Bases: Residential – Mitigation efforts would ease a few or no concerns (n=425)

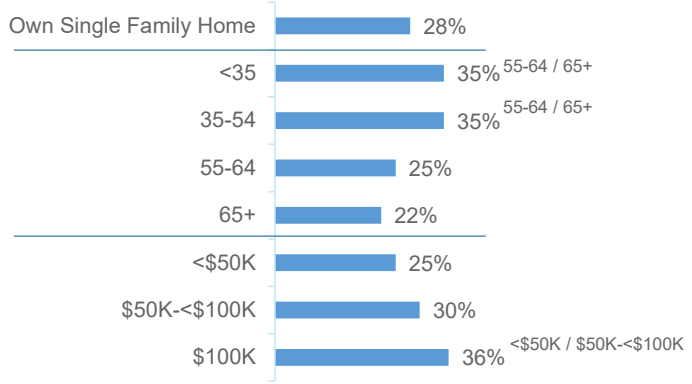
Participation in Virtual Energy Audit

Residential customers were asked how likely they would be to participate in a virtual no-cost home energy assessment, which was explained in detail. Overall, 27% said they were very or extremely interested in participating in one, slightly below the 33% which say they are likely to participate in a regular energy efficiency program in the next 12 months, but well above the percentage who have participated in an audit to date (10%).

Likely Participation in Regular or Virtual Audit
Among Residential Customers



Extremely/Very Likely to Participate
By Residential Customer Groups



Q17. An alternative to an in-home energy evaluation or audit of your home's energy efficiency would be a virtual no-cost home energy assessment. This would mean talking with an energy specialist over the phone and using video chat and/or sending photos of your home via email. After the audit is completed, you would receive a customized energy report tailored specifically to your home, as well as recommended energy-saving products delivered to your door at no cost, such as LED light blubs, advanced power strips, low-flow shower heads, faucet aerators and programmable thermostats. If this program were offered and you qualified to participate, how likely would you be to participate in a Virtual Home Energy Assessment? Would you be…?
Bases: Residential (n=2,024); Residential – Own single-family home (n=1,516), Residential - <35 (n=150), 35-54 (n=499), 55-64 (n-460), 65+ (n=915)

NHsaves Your Source for Energy Efficiency

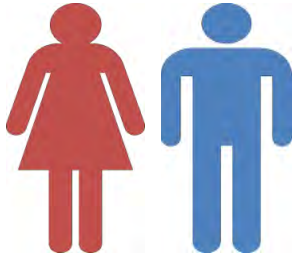
LUTH research

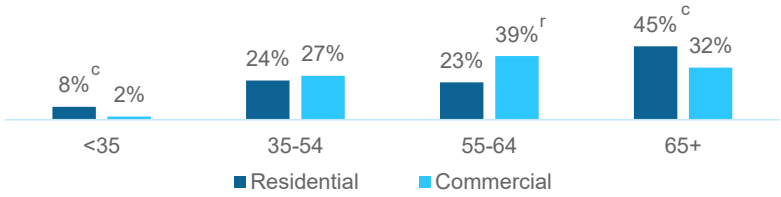
LUTH research

Demographics

Demographics

Residential Only





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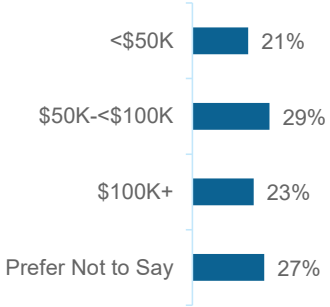

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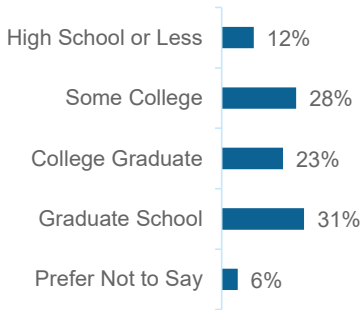
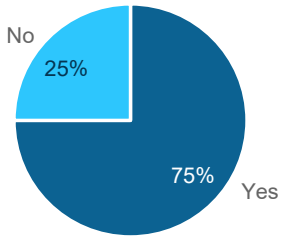


Owners of Single-Family Home
Residential Only



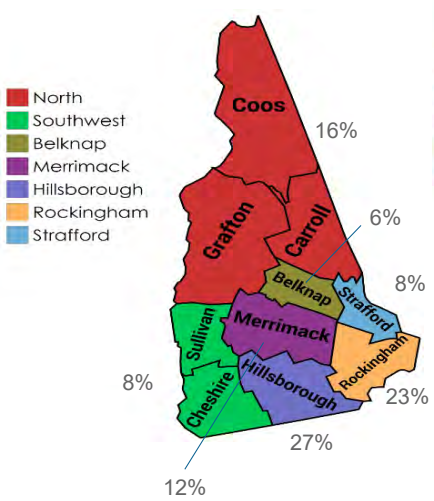
NHsaves
Your Source for Energy Efficiency

Bases: Residential (n=2,024), Commercial (n=442)

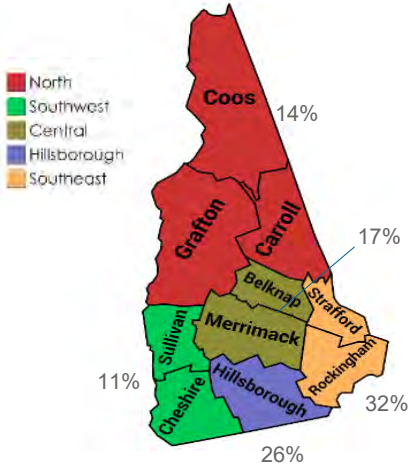
LUTH research

Demographics

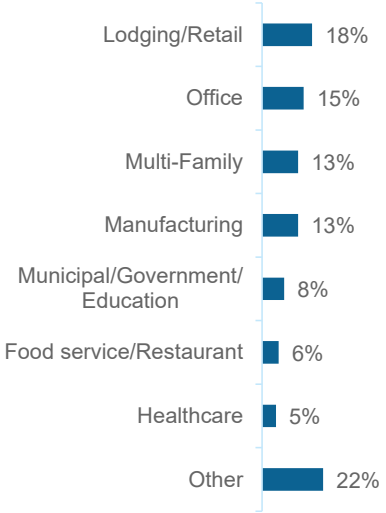
Residential



Commercial



Commercial Only

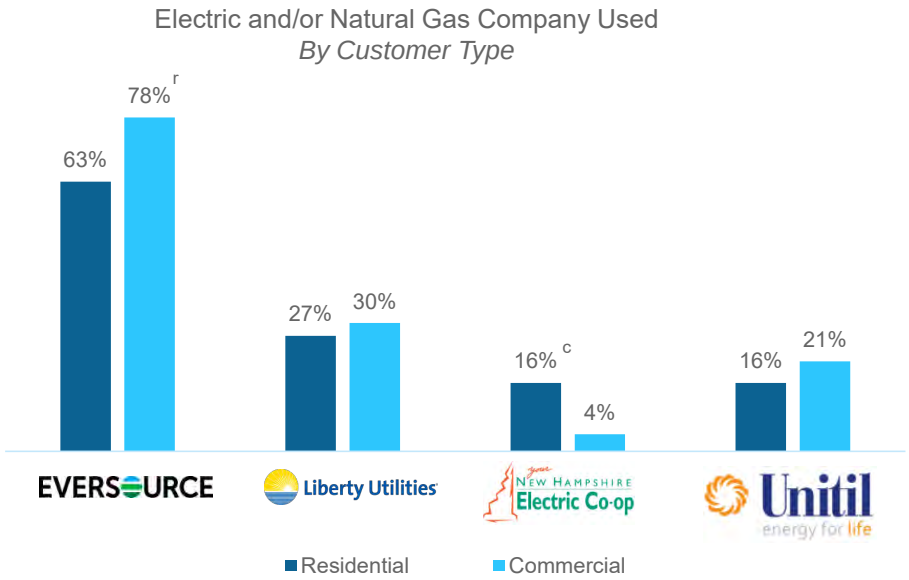


NHsaves Your Source for Energy Efficiency

Bases: Residential (n=2,024), Commercial (n=442)

LUTH research

Demographics



NHsaves Your Source for Energy Efficiency

Bases: Residential (n=2,024), Commercial (n=442)

LUTH research

In Home EE Work Safety
June 2020

EVERSOURCE ADVISORY GROUP

Problem Statement & Methodology

Eversource is interested in understanding how customers feel about in-home energy efficiency work in light of the current pandemic (COVID-19), and when, if at all, they would feel comfortable scheduling a contractor.

- Results from this survey may influence Eversource's communications and actions regarding safety protocols during home energy assessments.

Audience	Eversource Advisory Group Residential Customers
# of participants	300 Customers
Testing period	7 day run from 6/4/2020 to 6/11/2020
Method	Survey with closed and open ended questions

Take Aways and Action Items

Comfort in Contractor Work

- Majority of customers would be more comfortable with EE contractors performing work in their homes with knowledge of health and safety protocols that will be followed.

- Include health and safety protocols along with virtual assessment information, as customers prefer to know the protocols prior to scheduling an assessment and will be more comfortable doing so.

Safety Protocols in Homes

- In addition to protocols provided, customers are willing to wear masks while contractors are working, and would be more likely to schedule work knowing sanitization would occur after the work is complete.

- Enforce additional protocols, such as mask-wearing and sanitization to increase likelihood of scheduling contractor work.

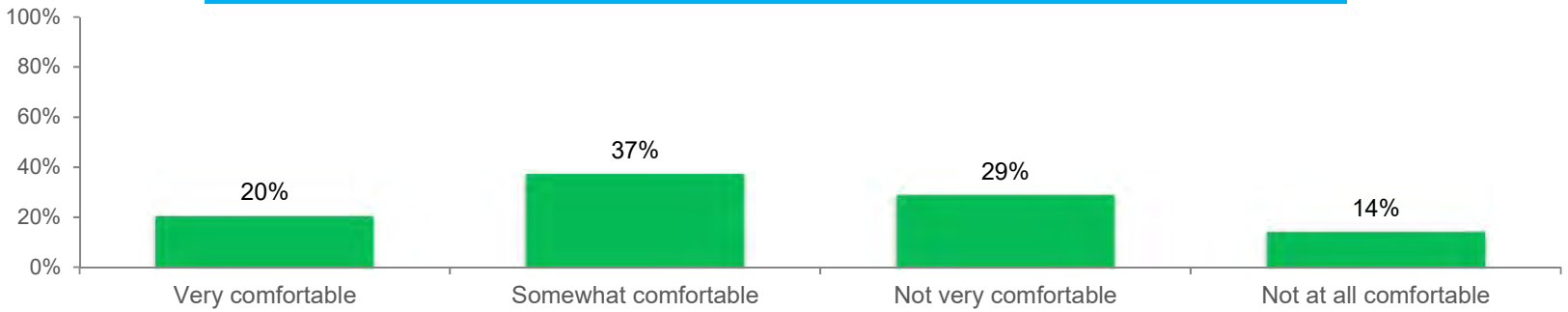
Timeframe for Scheduling Work

- With implementation of sanitizing post-work and/or details of where in the home the contractor will go, more than half are comfortable with work in their home in the next few months.

- Share as many details with customers as possible, including where and for how long the contractor will be in the home, to increase comfort for in-home work.

Comfort with in-home contractor work improves when customers are informed of health and safety protocols

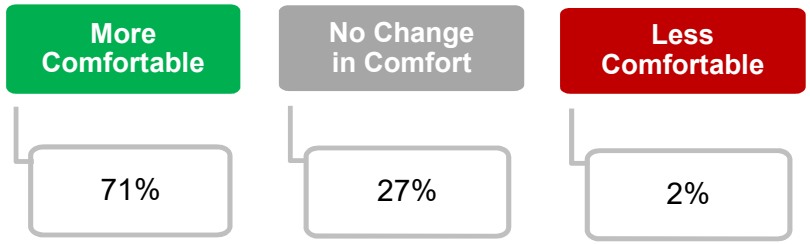
Comfort in Contractor Work In-Home (Pre-exposure to health and safety protocols)



Comfort in Contractor Work In-Home (Post-exposure to health and safety protocols)

Health and Safety Protocols

- Proper use of personal protective equipment (PPE) - mask, gloves, etc.
- Use of EPA-registered disinfectants on surfaces and equipment
- Personal hygiene to minimize infection risk
- Physical distancing based on different levels of PPE
- Workers ineligibility based on health conditions



Q1 - Without knowing what health and safety protocols will be followed, how comfortable would you be with an energy efficiency contractor entering your home to complete the project within the next month? (n=300)

Q4 - After reviewing the information about health and safety protocols, how comfortable would you be with an energy efficiency contractor entering your home to complete the project within the next month? (n=300

Reassurance that health and safety protocols will be followed will increase customer comfort

Suggested Steps to Increase Comfort

- Contractor tested for COVID-19 / temperature checked
- Clear explanation of safety protocols that will be taken:
  - Contractor wears a mask / gloves / shoe covers
  - Tools are sanitized
  - Keep 6 ft distance

"As long as they and I are wearing a mask, and we can accomplish what needs to be done at a safe distance, I would be fine." (**Somewhat comfortable**, Residential, Western MA Electric)

"I would be more comfortable after hearing an explanation of the safety protocols that will be used, including masks, gloves, and sanitizing of any tools used." **(Somewhat comfortable,** Residential, NH Electric)

"Clear communication about contractor's management of workers during the pandemic. Reassure me that workers are having temps checked regularly, are wearing masks when possible, are social distancing when possible. Reassure me that you care about my health & safety as well as that of the workers. Offer a link to established guidelines that are in concert with CDC & local government guidelines..." (**Not very comfortable**, Residential, CT Electric)

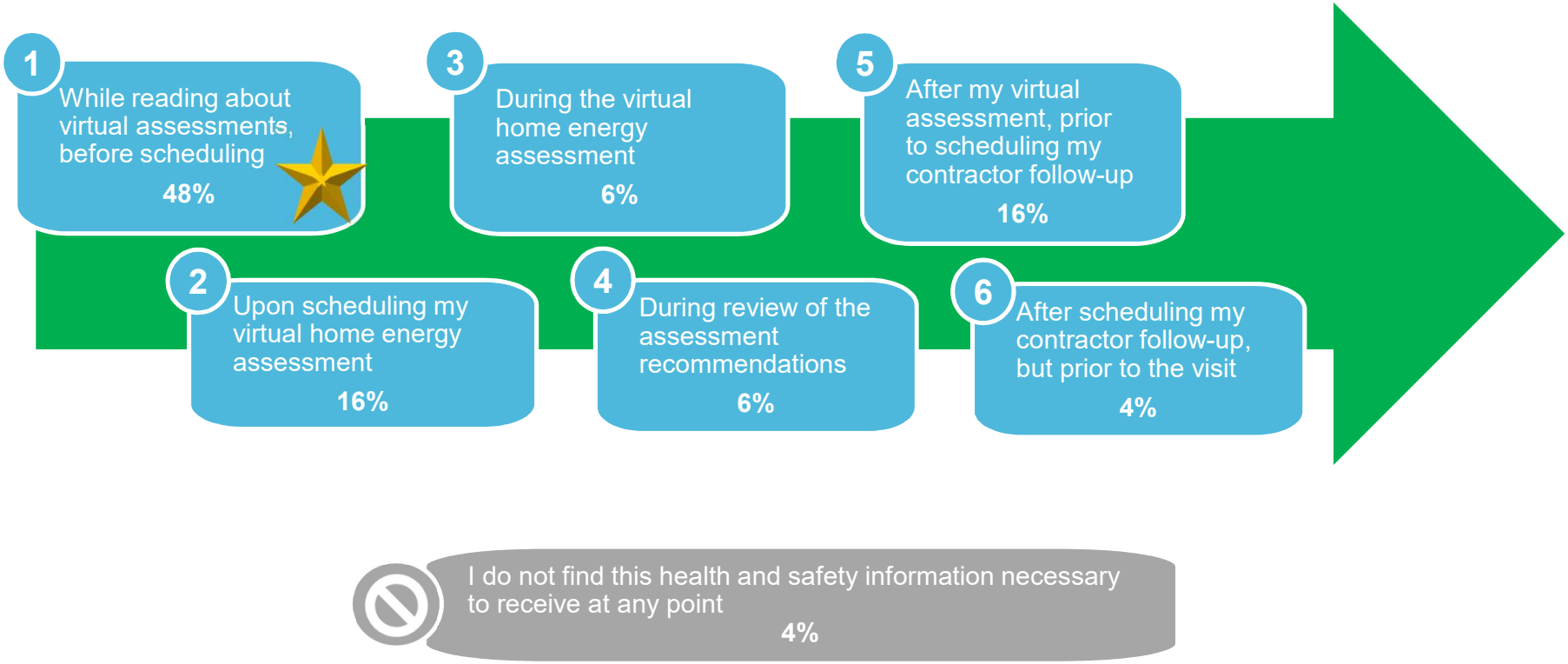
"I have COPD and I have an Autoimmune disorder, so it makes me very weary to let any stranger into my home. I'm not sure that there's anything that can be done except seeing everything open back up. And even then, I'm still pretty nervous." **(Not very comfortable,** Residential, Western MA Electric)

Q2 - Please explain what could be done to make you more comfortable? (n=239)

Many prefer to receive health and safety protocols *before* scheduling a home energy assessment

Preference Regarding Timing of Receiving Health and Safety Protocols

***Click here** to view the Health and Safety protocols.*



Q3 - Continue to imagine you've received a virtual home energy assessment and have agreed to install new insulation or replace your central air conditioner. When would you prefer to initially receive this information regarding the contractor's health and safety protocols? (n=300)

Majority would feel comfortable scheduling energy efficiency work over the next few months; more than one quarter are unsure

Time When Comfortable with Contractor Work In-Home

June	30%
July	15%
August	11%
September	10%
October	4%
November	<1%
December	1%
Not sure when I would be comfortable	29%

Q6 - When, if at all, would you feel comfortable having an energy efficiency contractor in your home to complete your insulation or A/C installation? (n=300)

Adherence to state guidelines, health and safety protocols, and the state of the virus affect customers' feelings towards when contractors can work in their homes

Timing and Factors Contributing to Contractor Work In-home

June

- Safety precautions / protocols
- Social distancing
- Masks, gloves, shoe covers
- Want A/C before summer

July

- Further into re-opening phases
- Want COVID-19 cases to decrease
- Better understanding of where virus stands
- Allows time to get familiar with protocols

September / October / November / December

- Expect less spread of virus
- See where the state and virus stand in a few months

Not sure

- At risk / health concerns
- State of virus, want a vaccine
- Not essential work / can wait

Q6 - When, if at all, would you feel comfortable having an energy efficiency contractor in your home to complete your insulation or A/C installation? (n=300)
Q7 - Please explain all the factors that affect your feelings on having an energy efficiency contractor in your home to complete your insulation or A/C installation. (n=300)

Customers share quotes to justify their feelings on energy efficiency contractor work in their home

Factors Contributing to Contractor Work In-home

"I am comfortable with contractors in my home when social distancing is possible. I do not believe that I would have to be within 6 feet of the contractor, if I did I would wear a mask and I would be sure to clean the area that the contractor worked after the person left (if it wasn't done by the company). I believe with precautions that jobs like these would be safe for everyone involved." (**June,** Residential, NH Electric)

"By July we should know how well the gradual reopening is going. Assuming infection rates continue to decline into July, I would feel at that time we had enough data to believe it would be low risk." (**July,** Residential, CT Electric)

"The major issues with Covid-19 should be gone by then and if it restarts people believe that will be in November." (**September**, Residential, Eastern MA Electric)

"As businesses are just beginning to open, there's likely to be a surge in more COVID 19 cases, I'm not comfortable until the first wave FINISHES, and the second wave passes as well." (**Not sure when I would be comfortable**, Residential, CT Gas)

Q7 - Please explain all the factors that affect your feelings on having an energy efficiency contractor in your home to complete your insulation or A/C installation. (n=300)

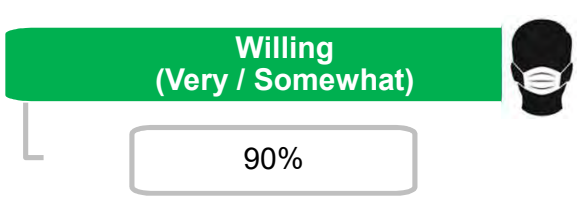
Sanitization post-service would increase likelihood of contractor work; willingness to wear masks is high

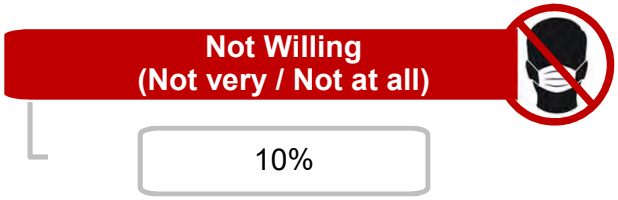
Additional Precautions to Increase Likelihood of Contractor Work In-home

Contractors sanitizing your home after the work is complete (included with service)	58%
Detailed sketch showing exactly where contractors will pass through while inside your home	22%
Being outside while the contractors perform work	21%
Having a video stream set up in the work area to view from another location	11%
Other	6%
None, it's all unnecessary	20%
None, I'm just too nervous	10%

Other mentions include COVID-19 testing on the contractor and knowing the amount of time the contractor will be in the home.

Willingness to Wear Mask during Contractor Work In-Home





Q5 - How willing would you be to wear a mask while a contractor is working in your home? (n=300)

Q8 - Which of the following would make you more likely to allow an energy efficiency contractor in your home to perform the installation of your new insulation or central air conditioner sooner? Please select all that apply. (n=300)

Customers are more comfortable scheduling contractor work *sooner* with additional precautions, such as sanitation, implemented

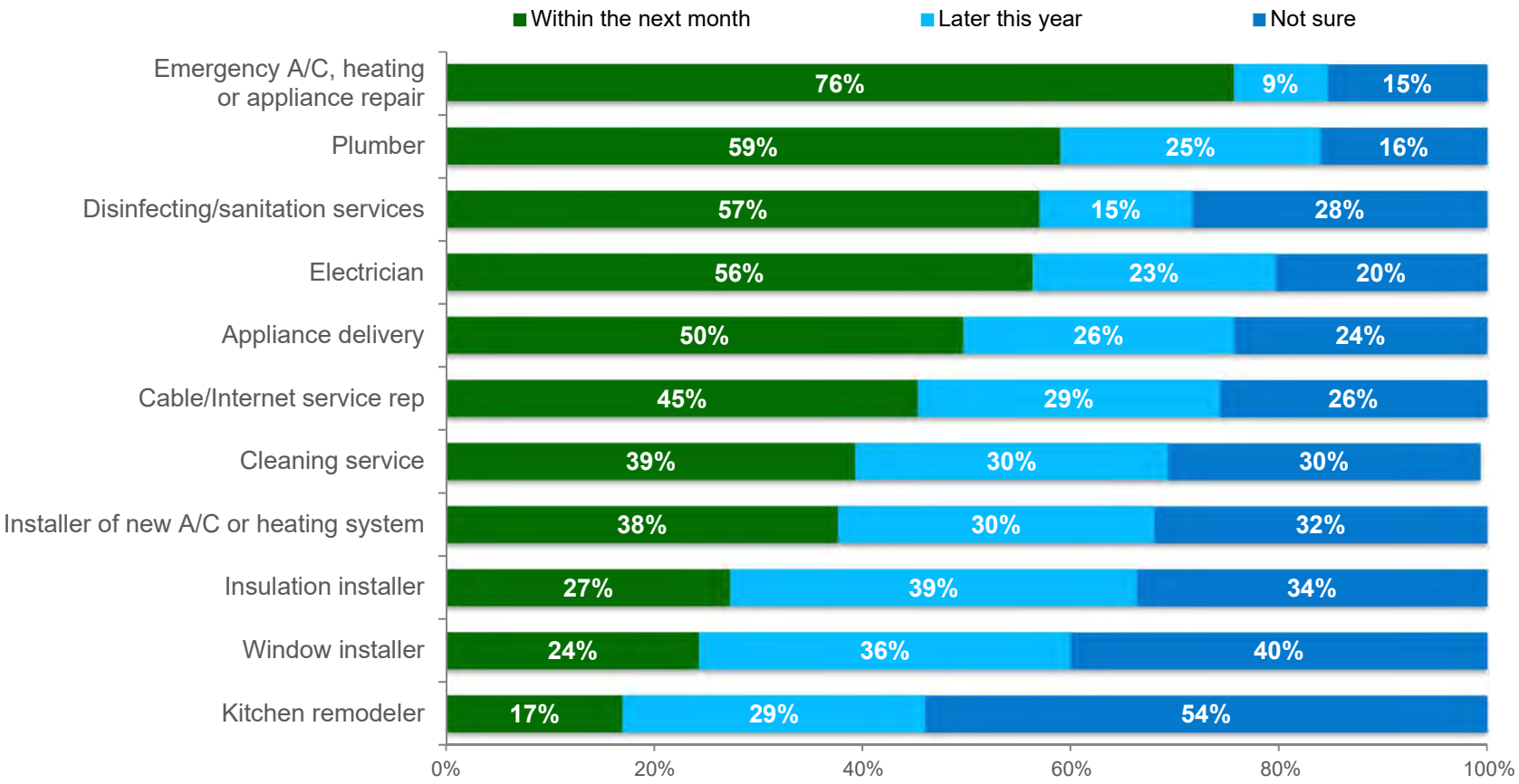
	Time When Comfortable with Contractor Work In-Home (Pre-Exposure to Additional Precautions)	Time When Comfortable with Contractor Work In-Home (With Additional Precautions Implemented)
June	30%	35%
July	15%	22%
August	11%	15%
September	10%	11%
October	4%	2%
November	<1%	0%
December	1%	2%
Not sure when I would be comfortable	29%	13%

I am not comfortable scheduling this year

Q6 - When, if at all, would you feel comfortable having an energy efficiency contractor in your home to complete your insulation or A/C installation? (n=300)
Q9 - With these steps implemented, when would you feel comfortable having a contractor in your home to complete you insulation or A/C installation? (n=300)

Many are comfortable scheduling urgent home services within the next month; kitchen remodelers and window installers could be pushed to another time

Scheduling Home Services



Q10 - Thinking of possible vendors that could enter your home over the coming months, how do you feel about the following services? (n=300)

Appendix

1. To start, imagine you have had the initial assessment and decided that you would like to move forward with installation of one of the recommended improvements, such as new insulation or installing more efficient central air conditioning. Without knowing what health and safety protocols will be followed, how comfortable would you be with an energy efficiency contractor entering your home to complete the project within the next month?

2. Please explain what could be done to make you more comfortable with allowing an energy efficiency contractor into your home to install your new insulation or central air conditioner.

3. Continue to imagine you've received a virtual home energy assessment and have agreed to install new insulation or replace your central air conditioner. When would you prefer to initially receive this information regarding the contractor's health and safety protocols?

4. After receiving the information about health and safety protocols, how comfortable would you be with an energy efficiency contractor entering your home to complete the project within the next month?

5. How willing would you be to wear a mask while a contractor is working in your home?

6. When, if at all, would you feel comfortable having an energy efficiency contractor in your home to complete your insulation or A/C installation?

7. Please explain all the factors that affect your feelings on having an energy efficiency contractor in your home to complete your insulation or A/C installation.

8. Which of the following would make you more likely to allow an energy efficiency contractor in your home to perform the installation of your new insulation or central air conditioner sooner? Please select all that apply.

9. With these steps implemented, when would you feel comfortable having a contractor in your home to complete your insulation or A/C installation?

10. Thinking of possible service providers that could enter your home over the coming months, how do you feel about the following services?

Appendix – Health and Safety Protocols shown to customers

- Proper use of personal protective equipment (PPE) - mask, gloves, etc.
- Use of EPA-registered disinfectants on surfaces and equipment
- Personal hygiene to minimize infection risk
- Physical distancing based on different levels of PPE
- Workers ineligibility based on health conditions

***Click here** to return to the Health and Safety protocols results.*