

NEW HAMPSHIRE
TECHNICAL REFERENCE MANUAL

for Estimating Savings from Energy Efficiency Measures, 2027 Program Year

Introduction

This *New Hampshire Technical Reference Manual for Estimating Savings from Energy Efficiency Measures* ("TRM") documents for regulatory agencies, customers, and other stakeholders how the New Hampshire Utilities consistently, reliably, and transparently calculate savings from the installation of efficient equipment, collectively called "measures." This reference manual provides methods, formulas and default assumptions for estimating energy, peak demand and other resource impacts from efficiency measures.

Within this document, efficiency measures are organized by the sector for which the measure is eligible and by the primary energy source associated with the measure. The three sectors are Residential, Income Eligible, and Commercial & Industrial ("C&I"). The primary energy sources addressed in this technical reference document are electricity and natural gas, and savings from delivered fuels such as oil and propane are also addressed where appropriate.

Measures are presented in their own chapters as a measure characterization. Measure characterizations provide mathematical equations for determining savings (algorithms), as well as default assumptions and sources, where applicable. In addition, any descriptions of calculation methods or baselines are provided as appropriate. The baseline efficiency case, high efficiency case and the method for calculating savings are listed in the same order within. The measure calculations and assumptions provided in the TRM will match those found in the Benefit Cost Models ("BC Models") created by utilities. There are some measures in the BC models that we do not currently anticipate incentivizing and therefore have not been reflected in the TRM. If the opportunity arises to offer them in a cost-effective way, we will update the TRM with entries for these measures at that time.

Algorithms are provided for estimating annual energy and peak demand impacts for primary and secondary energy sources if appropriate. In addition, algorithms or calculated results may be provided for other nonenergy impacts (such as water savings or operation and maintenance cost savings). Inputs and assumptions are based on New Hampshire-specific evaluations or data where available Other factors being equal, New Hampshire jurisdiction-specific results will be favored over results from other jurisdictions in order to account for differences in climate, hours of use, program design and delivery, market conditions, and evaluation frameworks. However, when relevant results exist both from New Hampshire and from other states, it may be necessary to balance the desirable attributes of state-specificity and data reliability. When considering whether to apply results from a study originating in another jurisdiction to New Hampshire programs, the EM&V Working Group (with support from independent evaluation firms as needed), will make the determination based on (1) the similarity of evaluated program/measures to those offered in NH; (2) the similarity of relevant markets and customers base; (3) the recency of the study relative to the recency of any applicable NH results; and (4) the quality of the study's methodology and sample size. In addition to third-party evaluations, inputs may also be based on sources including manufacturer and industry data, data from government agencies such as the U.S. Department of Energy or Environmental Protection Agency, or credible and realistic factors developed using engineering judgment.

This document will be reviewed and updated annually to reflect changes in technology, baselines and evaluation results.

Reference Tables

PROGRAM ABBREVIATIONS

Commercial	Program	Sub Programs
Energy Rewards RFP Program	RFP	
Large Business Energy Solutions	LBES	Midstream (Mid) New Equipment (New) Direct Install (DI) New Construction (NC)
Municipal Energy Solutions	Muni	Midstream (Mid) New Equipment (New) Direct Install (DI) New Construction (NC)
Small Business Energy Solutions	SBES	Midstream (Mid) New Equipment (New) Direct Install (DI) New Construction (NC)
Residential		
ENERGY STAR Homes	ES Homes	
ENERGY STAR Products	ES Products	
Home Energy Assistance	HEA	
Home Energy Reports	HER	
Home Performance	HEP	
Residential Active Demand Response	Res ADR	

CATEGORIES

Active Demand Response
Appliances
Building Shell
Compressed Air
Custom
Food Service
Heating Ventilation and Air Conditioning (HVAC)
Hot Water
Lighting
Motors and Drives
Whole Home

Measure Characterization, or Chapter, Structure

This section describes the common entries or inputs that make up each measure characterization, or chapter, within the TRM. A formatted template follows the descriptions of each section of the measure characterization. A single device or behavior is defined as a measure within each program and fuel. The source of each assumption or default parameter value will be referenced in the endnotes section of each measure chapter

The New Hampshire Utilities use the algorithms in the Measure Characterization sections to calculate the gross savings for energy efficiency measures. Impact factors are then applied to make various adjustments to the gross savings estimates to account for the performance of individual measures or energy efficiency programs as a whole in achieving energy reductions as assessed through evaluation studies. Impact factors address both the technical performance of energy efficiency measures and programs, accounting for the measured energy and demand reductions realized compared to the gross estimated reductions, as well as in certain cases the programs' effect on the market for energy efficient products and services.

Measure Code	**A unique way to identify a measure where the first set of characters indicates the market, the second set of characters indicates the category, and the third set is an abbreviated code for the measure name.**
Market	This is the sector for which the measure is applicable and can be Residential, Income Eligible or C&I.
Program Type	The type of baseline used (i.e., retrofit, lost opportunity).
Category	The category of measure type, based on list above.

Measure Description:

This section includes a plain text description of the energy efficiency measure, including the benefit(s) of its installation.

Baseline Efficiency:

This section includes a statement of the assumed equipment/operation efficiency in the absence of program intervention. Multiple baselines are provided as needed, e.g., for different markets. Baselines may refer to reference tables or may be presented as a table for more complex measures.

High Efficiency:

This section describes the high efficiency case from which the energy and demand savings are determined. The high efficiency case may be based on specific details of the measure installation, minimum requirements for inclusion in the program, or an energy efficiency case based on historical participation. It may refer to tables within the measure characterization or in the appendices or efficiency standards set by organizations such as ENERGY STAR® and the Consortium for Energy Efficiency.

Algorithms for Calculating Primary Energy Impact:

This section describes the method for calculating gross electric savings and electric demand savings in appropriate units. It includes a table at the beginning of the section notating if the savings for each measure ID are deemed, calculated using an algorithm, or modeled. If savings are deemed, the table includes the savings values for the measure.

The savings algorithm will be provided in a form similar to the following:

$$\Delta kWh = \Delta kW \times Hours$$

Similarly, the method for calculating electric demand savings will be provided in a form similar to the following:

$$\Delta kW = \left(Watts_{BASE} - Watts_{EE}\right)/1000$$

This section also describes any non-electric (gas, propane, oil) savings in appropriate units, i.e., MMBtu associated with the energy efficiency measure, including all assumptions and the method of calculation.

Measure Life:

This section provides the measure life for each measure.

BC ID	Measure Name	Program	**Measure Life**
[Unique ID for measures in the utilities' Benefit-Cost model]	[Measure Name]	[Program Abbreviation from list above]	XX

Other Resource Impacts:

If applicable, this section describes any water or ancillary savings associated with the energy efficiency measure, including all assumptions.

Impact Factors for Calculating Adjusted Gross Savings:

The section includes a table of impact factor values for calculating adjusted gross savings. These include in-service rates, realization rates, and coincidence factors. Definitions of each impact factor and the sources on which they are based are described below.

Measure Name	Program	ISR	RRE	RRNE	RRSP	RRWP	CFSP	CFWP
[Measure Name]	[Program abbreviation]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates (ISR):

Actual portion of efficient units that are installed. For example, efficient lamps may have an in-service rate less than 1.00 since some lamps are purchased as replacement units and are not immediately installed. The ISR is 1.00 for most measures.

Realization Rates (RR_E, RR_{NE}, RR_{SP}, RR_{WP}):

Used to adjust the gross savings (as calculated by the savings algorithms) based on impact evaluation studies. The realization rate is equal to the ratio of measure savings developed from an impact evaluation to the estimated measure savings derived from the savings algorithms. The realization rate does not include the effects of any other impact factors, unless explicitly noted. Depending on the impact evaluation study, there may be separate Realization Rates for electric energy (RR_E), peak demand ($RR_{SP,\ WP}O$), or non-electric energy ($RR_{NE)}$).

Coincidence Factors (CF_{SP}, CF_{WP}):

Used to adjust the connected load kW savings derived from the savings algorithm. A coincidence factor represents the fraction of the connected load reduction expected to occur at the same time as a particular system peak period. The coincidence factor includes both coincidence and diversity factors combined into one number, thus there is no need for a separate diversity factor in this TRM. Coincidence Factors are provided for the on-peak period as defined by the ISO New England for the Forward Capacity Market ("FCM"), and are calculated consistently with the FCM methodology. Electric demand reduction during the ISO New England peak periods is defined as follows:

On-Peak Definition (applicable definition for NH):

- Summer On-Peak: average demand reduction from 1:00-5:00 PM on non-holiday weekdays in June, July, and August
- Winter On-Peak: average demand reduction from 5:00-7:00 PM on non-holiday weekdays in December and January

Seasonal Peak Definition (not applied in NH):

- Summer Seasonal Peak: demand reduction when the real-time system hourly load is equal to or greater than 90% of the most recent "50/50" system peak forecast for June-August
- Winter Seasonal Peak: demand reduction when the real-time system hourly load is equal to or greater than 90% of the most recent "50/50" system peak load forecast for December-January

The values described as Coincidence Factors in the TRM are not always consistent with the strict definition of a Coincidence Factor (CF). It would be more accurate to define the Coincidence Factor as "the value that is multiplied by the Gross kW value to calculate the average kW reduction coincident with the peak periods." For example, a coincidence factor of 1.00 may be used because the coincidence is already included in the estimate of Gross kW; this is often the case when the "Max kW Reduction" is not calculated and instead the "Gross kW" is estimated using the annual kWh reduction estimate and a load shape model.

Energy Load Shape:

The section includes a table or reference with the time-of-use pattern of a typical customer's electrical energy consumption for each segment and end use. Because the value of avoided energy varies throughout the year, load shapes are used to allocate energy savings into specific time periods in order to better reflect its time-dependent value. Load shapes are defined as follows based on ISO-NE definitions:

- Summer On-Peak: 7 am to 11 pm, weekdays, during the months of June through September, except ISO-NE holidays;
- Summer Off-Peak: All other hours during the months of June through September (includes weekends and holidays);

- Winter On-Peak: 7 am to 11 pm, weekdays, during the months of October through May, except ISO-NE holidays; and
- Winter Off-Peak: All other hours during the months of October through May (includes weekends and holidays).

Impact Factors for Calculating Net Savings:

This section includes net-to-gross factors to calculate the amount of savings attributable to a program or measure. The net-to-gross ratio **is** the ratio of net savings to the gross savings adjusted by any impact factors (i.e., the "adjusted" gross savings). Depending on the evaluation study, the NTG ratio may be determined from the free-ridership and spillover rates, if available, or it may be a distinct value with no separate specification of FR and SO values.

A free-rider is a customer who participates in an energy efficiency program (and gets an incentive) but who would have installed some or all of the same measure(s) on their own, with no change in timing of the installation, if the program had not been available. The free-ridership rate is the percentage of savings attributable to participants who would have installed the measures in the absence of program intervention.

The spillover rate is the percentage of savings attributable to a measure or program, but additional to the gross (tracked) savings of a program. Spillover includes the effects of 1) participants in the program who install additional energy efficient measures outside of the program as a result of participating in the program, and 2) non-participants who install or influence the installation of energy efficient measures as a result of being aware of the program. These two components are the participant spillover (SOP) and nonparticipant spillover (SONP).

This section would only apply to midstream offerings and other measures which are known to have greater levels of free-ridership than others either due to an inherent part of their program design or market evolution. For all other offerings, the utilities prioritize designing programs and putting mechanisms in place to minimize free-riders.

Non-Energy Impacts:

As discussed with the NH Benefit/Cost Working Group, and per Commission Order,[1] the NH Utilities are applying non-energy impacts (NEIs) in cost-effectiveness screening as follows:

The **Primary Granite State Test** reflects low-income participant NEIs, based on New Hampshire-specific primary research on the Home Energy Assistance program. Specifically, based on the HEA evaluation,[2] a per-project value of $438.72 reflecting participant NEIs—including increased comfort, decreased noise, and health-related NEIs—will be applied annually to each weatherization project for 21 years, the weighted average measure life of air sealing and insulation, pipe insulation. These NEIs are reflected in the measure chapters for insulation and air sealing.

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[1] Docket No. DE 17-136, Order Approving Benefit Cost Working Group Recommendations, No. 26,322, December 30, 2019; Order Approving 2020 Update Plan, No. 26,323, December 31, 2019.
[2]Opinion Dynamics. Home Energy Assistance Program Evaluation Report 2016-2017, Final, July 29, 2020. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200729-NHSaves-HEA-Evaluation-Report-FINAL.pdf

The **Secondary Granite State Test** reflects sector-level percentage adders for participant NEIs for the residential (non-low-income) and C&I sectors, based on a review of secondary NEI research from similar jurisdictions, adjusted for New Hampshire-specific economic and other factors and matched to New Hampshire's programs and measures.[3] The test also reflects environmental externality NEIs, based on non-embedded avoided cost values from the AESC. These NEI values are not reflected in the TRM measure chapters. For HEA, the same primary research NEI value is applied in the Secondary Granite State Test as in the Primary Granite State Test.

Both the **Primary and Secondary Granite State Tests** reflect other resource impacts for water and delivered fuels, as reflected in the TRM measure chapters.

[3] DNV-GL. New Hampshire Non-Energy Impacts Database Methodology Memo, April 2020. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/Final-NH-NEI-Methodology-Memo-20200409.pdf; New Hampshire Non-Energy Impacts Database, July 2020. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200722-NH-NEI-Draft-Database-NHML-core.xlsm

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1. Residential

Active Demand Response

Measure Code	RES-BE-ADR
Markets	Residential
ProgramTypes	Custom
Categories	Active Demand Response

Measure Description:

Residential Direct Load Control is focused on reducing electrical demand during summer peak load periods by controlling equipment inside a building, such as via wi-fi connected thermostats, communicating domestic hot water heaters and pool pumps, and other controlled energy-using devices.

Residential Storage Daily Dispatch involves customers receiving incentives to decrease demand by discharging energy from storage in response to a signal or communication from the Program Administrators. Residential Storage Daily Dispatch demand response periods may occur during peak hours in summer months.

Summer peak load control periods for both Residential Direct Load Control and Residential Storage Daily Dispatch are three-hour events that may occur between 2:00 p.m. and 7:00 p.m. on non-holiday weekdays between June 1 and September 30.

Baseline Efficiency:

For Direct Load Control, evaluators determined baseline conditions using an experimental design methodology (randomly assigned treatment and control groups), or a within-subject methodology or savings adjustment factor for demand reduction events where experimental design was not possible.

For thermostat controls in the Residential Direct Load Control program, vendor-supplied baselines may use one of several baseline methodologies to determine savings. The assumption in this document is that either the ISO-NE[1] or PJM[2] demand response customer baseline operation models are used by the vendor.

The baseline case for Residential Storage Daily Dispatch is an equivalent residential home with onsite energy storage, including any onsite solar PV production, but without peak demand response control.[3]

High Efficiency:

The high-efficiency case is a residential building with devices that are equipped to communicate with the utility to reduce demand during curtailment periods. This could include communicating thermostats, residential storage equipment, or other types of residential demand response equipment.

Note that active demand response is not intended to reduce energy use, but rather to reduce power consumption during demand response periods. As a result, little energy savings are available for Residential Direct Load Control. A small amount of energy savings per demand response event is provided in the section below.

For Residential Storage Daily Dispatch, a negative net kWh impact should be assessed to account for round-trip efficiency losses during the charging and discharging periods.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkW
EA5a001	Residential Direct Load Control	Res ADR	Calculated
EA5a002	Residential Storage Daily Dispatch P4P (savings) Summer	Res ADR	Calculated
EA5a003	Residential Storage Daily Dispatch P4P (consumption) Summer	Res ADR	Calculated

Thermostat control programs are the most widely implemented and therefore have the most well-supported savings findings.

For vendors that use ISO-NE or PJM baselines to calculate demand savings for central air conditioners controlled by wi-fi connected thermostats, an adjustment to vendor-claimed demand savings based on evaluation results[4] is applied:

$$\Delta kW_{Pre-event} = (\Delta kW_{Pre-event,vendor}) \times (F_{pre-event})$$

$$\Delta kW_{Post-event} = (\Delta kW_{Post-event,vendor}) \times (F_{post-event})$$

$$\Delta kW_{Event} = (\Delta kW_{vendor}) \times (F_{event})$$

$$F_{event} = -3.06 + (0.05 \times Temp_{avg})$$

Where:

Unit = one dispatched thermostat

$\Delta kW_{Pre-event}$ = demand adjustment for pre-cooling before event

$\Delta kW_{post-event}$ = demand adjustment for recovery cooling after event

$\Delta kW_{pre/post/event,vendor}$ = vendor demand savings in the period of interest (i.e. pre-event, during event, or post-event), typically calculated relative to ISO-NE or PJM baseline

$F_{pre-event}$ = savings adjustment factor in the pre-event period = 0.72

$F_{post-event}$ = savings adjustment factor in the post-event period = 0.68

$F_{event} = -3.06 + (0.05 \times Temp_{avg})$

$Temp_{avg}$ = average outdoor air temperature during the event period

For demand response events that affect central air conditioners controlled by a wi-fi connected thermostat: a deemed energy savings of 0.60 kWh[4.] per event.

For Residential Storage Daily Dispatch, energy savings are measured directly at the device, on a site-by-site basis, as reported by the vendor:

$$\Delta kW_{Event} = \Delta kW_{vendor}$$

More detailed savings algorithms for Residential Storage Daily Dispatch and other types of residential active demand response measures, with pre-, during-, and post-event savings adjustments, may be developed as additional program evaluations are conducted.

Measure Life:

As all residential active demand response measures are based on Program Administrators calling demand reduction events each year, the deemed measure life is 1 year.[5]

BC ID	Measure Name	Program	Measure Life
EA5a001	Residential Direct Load Control	Res ADR	1
EA5a002	Residential Storage Daily Dispatch P4P (savings) Summer	Res ADR	1
EA5a003	Residential Storage Daily Dispatch P4P (consumption) Summer	Res ADR	1

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA5a001	Residential Direct Load Control	Res ADR	1.00	1.00	1.00	1.00	1.00	1.00	0.00
EA5a002	Residential Storage Daily Dispatch P4P (savings) Summer	Res ADR	1.00	1.00	1.00	1.00	1.00	1.00	0.00
EA5a003	Residential Storage Daily Dispatch P4P (consumption) Summer	Res ADR	1.00	1.00	1.00	1.00	1.00	1.00	0.00

In-Service Rates:

All installations are assumed to have 100% in-service rates pending program evaluation. Event opt-outs and attrition during events are captured in the gross impact algorithm above.

Realization Rates:

Savings adjustment factors and deemed energy savings provided in the Algorithms section above represent an evaluation adjustment to vendor-reported reported gross savings.

Coincidence Factors:

Summer coincidence factors are assumed to be 100% reflecting the timing of demand response events.

Winter coincidence factors are assumed to be 0%.

Scaling Factors:

A scaling factor is used to account for the fact that the benefits of an active demand response resource depend on how often it performs. The greater the frequency of demand response events, the more that the active demand resource reduces the installed capacity requirement, and therefore the greater its value. For planning the utilities use a scaling factor of 10% for direct load control and 100% for storage, reflecting the AESC 2018 review of sensitivity analyses run by PJM load forecasters. For reporting utilities will use scaling factor values based on the most recent evaluation timing of events that are called in 2021.

Energy Load Shape:

All savings for Active Demand Response take place in the summer on-peak period.

Revision History:

Revision Number	Date	Description
7	1/14/2022	The deemed savings number for thermostat ADRs was updated to 0.60 kwh from 0.67 kwh.
8	1/14/2022	Fixed broken links in references

Endnotes:

1: ISO New England (2014). ISO New England Manual for Measurement and Verification of Demand Reduction Value from Demand Resources (Manual M-MVDR). Revision 6, June 1, 2014 https://www.iso-ne.com/static-assets/documents/2017/02/mmvdr_measurement-and-verification-demand-reduction_rev6_20140601.pdf

2: Day-Ahead and Real-Time Market Operations (2019). PJM Manual 11: Energy & Ancillary Services Market Operations, Revision 108. Effective Date: December 3, 2019. https://www.pjm.com/~/media/documents/manuals/m11.ashx

3: Navigant Consulting (2020). 2019 Residential Energy Storage Demand Response Demonstration Evaluation, Summer Season. Prepared for National Grid and Unitil. MA.

http://ma-eeac.org/ wp-content/uploads/MA19DR02-E-Storage_Res-Storage-Summer-Eval_wInfographic_2020-02-10-final.pdf

4: Navigant Consulting (2020). 2019 Residential Wi-Fi Thermostat Direct Load Control Offering Evaluation. Prepared for Eversource, National Grid, and Unitil. MA and CT. https://ma-eeac.org/wp-content/uploads/2019-Residential-Wi-Fi-Thermostat-DLC-Evaluation-Report-2020-04-01-with-Infographic.pdf

5: The PA program evaluation plan and the measure life for behavioral measures are as published in the 2019-2021 Massachusetts Three-Year Energy Efficiency Plan. https://ma-eeac.org/wp-content/uploads/2019-2021-Three-Year-Energy-Efficiency-Plans-DPU-Order_01.29.19.pdf

Appliances Advanced Power Strip

Measure Code	RES-APP-APS
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Appliances

Measure Description:

Advanced power strips can automatically eliminate standby power loads of electronic peripheral devices that are not needed (DVD player, computer printer, scanner, etc.) either automatically or when an electronic control device (typically a television or personal computer) is in standby or off mode.

Baseline Efficiency:

The baseline efficiency case is the customers' electronic peripheral devices as they are currently operating.

High Efficiency:

The high efficiency case is the installation of an Advanced Power Strip.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on referenced study results.[1]

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EA3b001	Advanced Power Strip, Tier I	ES Products	105.00	0.010
EA3b002	Advanced Power Strip, Tier II	ES Products	207.00	0.024
EB1a035	Advanced Power Strip, Tier I	HEA	105.00	0.010
EB1a036	Advanced Power Strip, Tier II	HEA	207.00	0.024

BC ID	Measure Name	Program	ΔkWh	ΔkW
EA2a035	Advanced Power Strip, Tier I	HEP	105.00	0.010
EA2a036	Advanced Power Strip, Tier II	HEP	207.00	0.024

Measure Life:

The measure life is 5 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3b001	Advanced Power Strip, Tier I	ES Products	0.83	0.92	n/a	0.92	0.92	0.58	0.86
EA3b002	Advanced Power Strip, Tier II	ES Products	0.83	0.92	n/a	0.92	0.92	0.58	0.86
EB1a035	Advanced Power Strip, Tier I	HEA	1.00	0.91	0.91	0.91	0.91	58.2	86.3
EB1a036	Advanced Power Strip, Tier II	HEA	1.00	0.91	0.91	0.91	0.91	58.2	86.3
EA2a035	Advanced Power Strip, Tier I	HEP	.99	0.96	0.96	0.96	0.96	58.2	86.3
EA2a036	Advanced Power Strip, Tier II	HEP	.99	0.96	0.96	0.96	0.96	58.2	86.3

In-Service Rates:

In-service rates for ES products are based on a 2021 MA ISR study[3]. HEP in-service rates are based on a 2020 NH HEP impact and process study.[4]

Realization Rates:

Realization rates for Energy Star Products program account for the savings lost due to improper customer set-up/use of devices, as found in the referenced study[1.] Realization rates are 91% for HEA, and 96% for Home Performance.

Coincidence Factors:

Programs use a summer coincidence factor of 58% and a winter coincidence factor of 86%[2.]

Energy Load Shape:

See Appendix 1 – "Primary TV and Peripherals"[2.]

Revision History:

Revision Number	Date	Description
9	5/3/2021	Fixed broken links in references

Revision Number	Date	Description
131	12/1/2022	Updated kWh, kW savings for Tiers 1 and 2 to match referenced study. Updated ISR based on recent MA study.
316	8/29/2025	Added APS measures for HEA and HEP programs

Endnotes:

1: NMR Group, Inc. (2018). Advanced Power Strip Metering Study. Prepared for Massachusetts Program Administrators and EEAC.

2: Based on the 2025-2027 MA TRM. Navigant Consulting, 2018. RES1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

3: NMR Group Inc. (2021). Residential Products In Service Rates Memo. 2021_NMR_Products_ISR

4: Opinion Dynamics, 2020. New Hampshire Utilities Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

Energy Kits

Measure Code	RES-APP-APS
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Appliances

Measure Description:

Energy kits are packages of easily self-installed energy savings devices. Measures included in kits typically include faucet aerators, door sweeps, advanced power strips, and/or similar devices. Kits include instructional materials and other educational content, such as instructional videos, to help customers identify other ways to save energy.

Baseline Efficiency:

See relevant TRM chapters of measures included in kit.

High Efficiency:

See relevant TRM chapters of measures included in kit.

Algorithms for Calculating Primary Energy Impact:

Savings are deemed based on the combination of measures included in the kit.

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔmmBTU
GB1A025	Energy Kit	HEA	Deemed based on relevant measures	Deemed based on relevant measures	Deemed based on relevant measures
EB1A122	Energy Kit	HEA	Deemed based on relevant measures	Deemed based on relevant measures	Deemed based on relevant measures

Measure Life:

See relevant TRM chapters of measures included in kit.

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
GB1A025	Energy Kit	HEA	0.62	n/a	1.00	1.00	1.00	n/a	n/a	1,2
EB1A122	Energy Kit	HEA	0.84	1.00	n/a	1.00	1.00	Based on relevant measures	Based on relevant measures	3

Energy Load Shape:

See relevant TRM chapters.

Revision History:

Revision Number	Date	Description
318	1/1/2027	Added chapter to reflect kit-specific ISR.

Endnotes:

1: ISR is applied per NMR Group, Inc. (2026) New Hampshire Home Energy Assistance Impact and Process Evaluation.

2: Realization rates are assumed to be 100% until evaluated.

3: See TRM chapters of included measures for coincidence factors.

Appliances Clothes Dryer

Measure Code	RES-APP-CD
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Appliances

Measure Description:

Clothes dryers exceeding minimum qualifying efficiency standards established as ENERGY STAR® or most efficient.

Baseline Efficiency:

For lost opportunity applications, the baseline efficiency case is a new electric resistance dryer that meets the federal standard as of January 1, 2015, which is a Combined Energy Factor (EF) of 3.73 for a vented standard dryer[1]. Different testing procedures were used in setting the federal standard (DOE Test Procedure Appendix D1) and the Energy Star standard (DOE Test Procedure Appendix D2). To enable comparison a baseline CEF of 3.11 is used. This was derived from ENERGY STAR Version 1.0 Estimated Baseline which multiplies the 2015 federal standard by the average change in electric dryers' assessed CEF between Appendix D1 and Appendix D2: 3.73-(3.73*0.166).

For retrofit applications, the baseline efficiency case is the existing electric resistance dryer.

High Efficiency:

The high efficiency case is a clothes dryer that meets the ENERGY STAR standard as of May 19, 2014. For a new standard vented or ventless electric resistance dryer the minimum CEF is 3.93[2].

For Heat Pump and Hybrid technology clothes dryers, CEFs are based on an average of Northwest Energy Efficiency Alliance qualified product testing as of October 2019. For Heat Pump technology dyers, the average CEF is 6.83. For Hybrid technology clothes dryers, the average CEF is 4.30.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Id	Measure Name	Program	ΔkWh	ΔkW
EB1a052	Clothes Dryer (Retrofit)	HEA	Modeled	Modeled
EA2a055	Clothes Dryer (Retrofit)	HEP	Modeled	Modeled
EA1a027	Clothes Dryer (New Construction)	ES Homes	160.4	0.047
EA3b010	Clothes Dryer (ENERGY STAR)	ES Products	160.4	0.047
EA3b012	Clothes Dryer (ENERGY STAR + Hybrid technology)	ES Products	213.3	0.063
EA3b011	Clothes Dryer (ENERGY STAR + Heat Pump technology)	ES Products	421.1	0.124

HEA and HEP savings are deemed using whole home modeling software.

Unit Savings for ES Homes and Energy Star Products are deemed based on EPA ENERGY STAR list and Northwest Energy Efficiency Alliance lab testing results. Demand savings are derived from the Navigant Demand Impact Model.[3, 4,5,6, 9]

Source Algorithms for Deemed Savings:

ΔkWh =(lbs/YEAR÷CEF_{Base})−(lbs/YEAR÷CEF_{EFF})

Where:

Lbs/YEAR = Typical pounds of clothing dried per year (based on 8.45 lbs/load and 283 loads/yr)

CEF_{BASE} = Baseline Combined Energy Factor (lbs/kWh)

CEF_{EFF} = Efficient Combined Energy Factor (lbs/kWh)

Measure Life:

The measure life is 12 years.[6]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a052	Clothes Dryer (Retrofit)	HEA	1	0.91	n/a	0.91	0.91	0.45	0.58
EA2a055	Clothes Dryer (Retrofit)	HEP	0.99	0.96	n/a	0.96	1	0.45	0.58
EA1a027	Clothes Dryer (New Construction)	ES Homes	1	1	n/a	1	1	0.45	0.58
EA3b010	Clothes Dryer (ENERGY STAR)	ES Products	1	1	n/a	1	1	0.45	0.58
EA3b012	Clothes Dryer (ENERGY STAR + Hybrid technology)	ES Products	1	1	n/a	1	1	0.45	0.58
EA3b011	Clothes Dryer (ENERGY STAR + Heat Pump technology)	ES Products	1	1	n/a	1	1	0.45	0.58

In-Service Rates:

Installations have 100% in-service rate for ES Products unless an evaluation finds otherwise, 100% for HEA[7], and 99% for HPwES[8].

Realization Rates:

Realization rates are 100% for ES Products unless an evaluation finds otherwise, 91% for HEA[7], and 96% for HPwES[8].

Coincidence Factors:

Programs a summer coincidence factor of 45% and a winter coincidence factor of 58%.[9]

Energy Load Shape:

See Appendix 1 – "Clothes Dryer – Electric".

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
Clothes Dryer - Electric	16.90%	14.20%	38.90%	30.00%

Revision History:

Revision Number	Date	Description
10	1/14/22	Added savings values for retrofit clothes dryers. Previously were vendor calculated.
113	12/1/2022	Updated to vendor calculated for HEA and HPwES and now includes information on software used for the vendor calculated savings
124	12/1/22	Corrected HPwES Realization Rate verbiage to 96% from 100% to align with table, study and model.

Endnotes:

1: DOE (accessed July 2020). Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers. https://www.energy.gov/sites/prod/files/2015/03/f20/Clothes%20Dryer%20Standards_RFI.pdf

2: EnergyStar Energy Efficient Products (accessed July 2020): https://www.energystar.gov/products/appliances/clothes_dryers/key_product_criteria

3: Environmental Protection Agency (2018). Savings Calculator for ENERGY STAR Qualified Appliances. Energy_Star_2018_Consumer_Appliance_Calculator

4: Northwest Energy Efficiency Alliance (2019). Dryers - QPL October 2019.

5: Department of Energy (2015). 10 CFR Part 431 March 27, 2015. Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers. Table II.7.

6: Department of Energy (2013). 10 CFR Parts 429 and 430 August 14, 2013. Energy Conservation Program: Test Procedures for Residential Clothes Dryers; Final Rule. Table 11.1.

7: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

8: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL, https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

9: Navigant Consulting, 2018. RES1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Appliances Clothes Washer

Measure Code	RES-APP-CW
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Appliances

Measure Description:

Clothes washers exceeding minimum qualifying efficiency standards established as ENERGY STAR® or Most Efficient. The measure saves electric energy used by the washer itself, as well as heating energy (in the form of electricity or fossil fuel) associated with the heating of the domestic hot water (DHW) consumed during the wash cycles. DHW heating efficiency is assumed to be code-compliant.

Baseline Efficiency:

For lost opportunity baseline, the base efficiency case is a residential clothes washer that meets the federal standard for front-loading washers effective 3/7/2015 which requires an IMEF (Integrated Modified Energy Factor) no less than 1.84 and an IWF (Integrated Water Factor) no greater than 4.7, and for top-loading washers effective 1/1/18 which requires an IMEF no less than 1.57 and an IWF no greater than 6.5. For retrofit baseline, the base efficiency case is the existing residential clothes washer.

High Efficiency:

The high efficiency case is a residential clothes washer that meets the ENERGY STAR standard as of February 5, 2018. For a new front-loading clothes washer the minimum IMEF is 2.76 and the maximum IWF is 3.2. For a new top-loading clothes washer the minimum IMEF is 2.06 and the maximum IWF is 4.3.

Algorithms for Calculating Primary Energy Impact:

Savings Table

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu

EB1a051	Clothes Washer (Retrofit)	HEA	Modelled	Modelled	Modelled	Modelled	Modelled
EA2a054	Clothes Washer (Retrofit)	HEP	Modelled	Modelled	Modelled	Modelled	Modelled
EA1a026	Clothes Washer (New Construction)	ES Homes	89.9	0.279	0	0	0.05
GA1a009	Clothes Washer (New Construction) – Gas	ES Homes	24.1	0.075	0.29	0	0
EA3b017	Clothes Washer (ENERGY STAR)	ES Products	88.1	0.274	0.024	0.042	0.003
EA3b018	Clothes Washer (ENERGY STAR Most Efficient)	ES Products	137.6	0.427	0.166	0.291	0.023

HEA and HEP savings are modelled using whole home energy simulation modelling.

All other unit electric savings are based on weighted averages by efficiency class presented in the 2018 Efficiency Vermont TRM[1]. Demand savings are derived from the Navigant Demand Impact Model[2]. Fossil fuel DHW savings are based on NH-specific water heating fuel types.

Measure Life:

The measure life is 11 years.[1,3]

Other Resource Impacts:

Annual water savings are deemed.

BC ID	Measure Name	Program	Annual Water Savings (gallons)
EB1a051	Clothes Washer (Retrofit)	HEA	Modeled
EA2a054	Clothes Washer (Retrofit)	HEP	Modeled
EA1a026	Clothes Washer (New Construction)	ES Homes	823
GA1a009	Clothes Washer (New Construction) – Gas	ES Homes	823
EA3b017	Clothes Washer (ENERGY STAR)	ES Products	823
EA3b018	Clothes Washer (ENERGY STAR Most Efficient)	ES Products	2020

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a051	Clothes Washer (Retrofit)	HEA	1	0.91	0.91	0.91	0.91	0.49	0.52
EA2a054	Clothes Washer (Retrofit)	HEP	0.99	0.96	0.96	0.96	0.96	0.49	0.52
EA1a026	Clothes Washer (New Construction)	ES Homes	1	1	1	1	1	0.49	0.52

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GA1a009	Clothes Washer (New Construction) – Gas	ES Homes	1	1	1	1	1	0.49	0.52
EA3b017	Clothes Washer (ENERGY STAR)	ES Products	1	1	1	1	1	0.49	0.52
EA3b018	Clothes Washer (ENERGY STAR Most Efficient)	ES Products	1	1	1	1	1	0.49	0.52

In-Service Rates:

Installations have 100% in service rate for ES Products unless an evaluation finds otherwise, 100% for HEA[4], and 99% for HPwES[5].

Realization Rates:

Realization rates are 100% for ES Products unless an evaluation finds otherwise, 91% for HEA[4,] and 96% for HPwES[5.]

Coincidence Factors:

All electric programs use a summer coincidence factor of 49% and a winter coincidence factor of 52%[2.]

Energy Load Shape:

See Appendix 1 – "Clothes Washer"[2.]

Revision History:

Revision Number	Date	Description
11	1/14/2022	Added option to use EPA calculator for retrofit savings values
112	12/1/2022	Included additional information on software used for the vendor calculated savings
125	12/1/2022	Corrected HPwES Realization Rate verbiage to 96% from 100% to align with table, study and model. Corrected kWh, kW and water savings to align referenced TRM.

Endnotes:

1: Energy Efficiency Vermont (2018) Technical Reference User Manual. Efficient Clothes Washers.

2: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

3: Appliance Magazine. U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels. Jan. 2010. p. 10

4: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

5: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

Appliances Dehumidifier

Measure Code	RES-APP-DEH
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Appliances

Measure Description:

Dehumidifiers exceeding minimum qualifying efficiency standards established as ENERGY STAR.

Baseline Efficiency:

The lost opportunity baseline efficiency case is a dehumidifier that meets the federal standard effective June 13, 2019. Specific baseline Energy Factors (EFs) by product capacity found in the Code of Federal Regulations, 10 CFR 430.32(v)(2). The retrofit baseline efficiency case is the existing dehumidifier.

High Efficiency:

The high efficiency case is a dehumidifier that meets the ENERGY STAR standard as of October 31, 2019[1]. For a new dehumidifier with a capacity less than 25 pints/day the minimum EF is 1.57 liters/kWh. For a new dehumidifier with a capacity between 25.01 and 50 pints/day the minimum EF is 1.8 liters/kWh. For a new dehumidifier with a capacity greater than or equal to 50 pints/day the minimum EF is 3.3 liters/kWh.

Capacity (pints)	Energy Factor (2019 Federal Standard)	Energy Factor (ENERGY STAR)
≤ 25	1.30	1.57
25.01-50	1.60	1.80
≥ 50	2.80	3.30

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EB1a053	Dehumidifier (Retrofit)	HEA	407.1	0.10
EA2a056	Dehumidifier (Retrofit)	HEP	407.1	0.10
EA3b019	Dehumidifier (ENERGY STAR)	Products	82.3	0.02

Unit savings are deemed based on the calculations below. Demand savings are derived from the Navigant Demand Impact Model[1].

Source Algorithm for calculating Deemed Savings:

$$\Delta kWh = Load \times [(1 \div Eff_{BASE}) - (1 \div Eff_{ES})] \times Hours$$

Where:

Load = Typical dehumidification load, 1520 Liters/year[1].

Eff_{BASE} = Average efficiency of model meeting the federal standard, in Liters/kWh

Eff_{ES} = Efficiency of ENERGY STAR® model, in Liters/kWh

Hours = Dehumidifier annual operating hours, site-specific if available, or deemed 2,851 hour/year[2]

Measure Life:

The measure life is 12 years[3].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a053	Dehumidifier (Retrofit)	HEA	1	0.91	n/a	0.91	0.91	0.82	0.17
EA2a056	Dehumidifier (Retrofit)	HEP	0.99	0.96	n/a	0.96	0.96	0.82	0.17
EA3b019	Dehumidifier (ENERGY STAR)	ES Products	1	1	n/a	1	1	0.82	0.17

In-Service Rates:

Installations have 100% in service rate for ES Products unless an evaluation finds otherwise, 100% for HEA[4], and 99% for HPwES[5].

Realization Rates:

Realization rates are 100% for ES Products unless an evaluation finds otherwise, 91% for HEA[4], and 96% for HPwES[5].

Coincidence Factors:

All programs use a summer coincidence factor of 82% and a winter coincidence factor of 17%[1].

Energy Load Shape:

See Appendix 1 – "Dehumidifier"[1].

Revision History:

Revision Number	Date	Description
126	12/1/2022	Corrected HPwES Realization Rate verbiage to 96% from 100% to align with table, study and model.

Endnotes:

1: Navigant Consulting, 2018. RES1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

2: Environmental Protection Agency (2019). Dehumidifier Key Efficiency Criteria. https://www.energystar.gov/products/appliances/dehumidifiers/key_efficiency_criteria

3: Environmental Protection Agency (2014). Savings Calculator for Energy Star Qualified Appliances. ENERGY_STAR_2015_Appliance_Calculator

4: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

5: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

Appliances Freezer

Measure Code	RES-APP-FZR
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Appliances

Measure Description:

Freezers exceeding minimum qualifying efficiency standards established as ENERGY STAR®.

Baseline Efficiency:

For lost opportunity, the baseline efficiency case is a freezer that meets the Federal standard effective September 15, 2014. Specific baseline coefficients and constants by product class found in the Code of Federal Regulations, 10 CFR 430.32(a).

For retrofit, the baseline efficiency case is the existing freezer.

High Efficiency:

The high efficiency case is a freezer that meets the ENERGY STAR standard as of September 15, 2014. For a new freezer the measured energy use must be 10% less than the minimum federal efficiency standards.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
EB1a050	Freezer (Retrofit)	HEA	Modeled	Modeled
EA2a053	Freezer (Retrofit)	HEP	Modeled	Modeled
EA3b021	Freezer (ENERGY STAR®)	ES Products	31.2	0.004

Retrofit unit energy and demand savings are based on project-specific calculations. Lost-opportunity unit energy and demand savings are based on calculations from the 2018 Vermont TRM[1].

$\Delta kWh = kWh_{BASE} - kWh_{ES}$

Where:

kWh_{BASE} = Average usage of a baseline freezer

kWh_{ES} = Average usage of a new freezer meeting ENERGY STAR® standards

Measure Life:

The measure life is 12 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a050	Freezer (Retrofit)	HEA	1	0.91	n/a	0.91	0.91	0.91	0.68
EA2a053	Freezer (Retrofit)	HEP	0.99	0.96	n/a	0.96	0.96	0.91	0.68
EA3b021	Freezer (ENERGY STAR®)	ES Products	1	1	n/a	1	1	0.91	0.68

In-Service Rates:

Installations have 100% in service rate for ES Products unless an evaluation finds otherwise, 100% for HEA[3], and 99% for HPwES[4].

Realization Rates:

Realization rates are 100% for ES Products unless an evaluation finds otherwise, 91% for HEA[3], and 96% for HPwES[4].

Coincidence Factors:

Summer and winter coincidence factors are estimated using the demand allocation methodology described in the referenced study.[5]

Energy Load Shape:

See Appendix 1 – "Freezer"[5].

Revision History:

Revision Number	Date	Description
127	12/1/2022	Corrected HPwES Realization Rate verbiage to 96% from 100% to align with table, study and model.

Endnotes:

1: Vermont TRM (2018): ENERGY STAR Retail Products Platform, page 178 of 313.

2: Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances.

3: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

4: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

5: Navigant Consulting,2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Appliances Recycling

Measure Code	RES-APP-RCL
Markets	Residential
Program Types	Retrofit
Categories	Appliances

Measure Description:

The retirement of old, inefficient refrigerators, freezers, dehumidifiers, and room air conditioners. In cases when these appliances are replaced by a homeowner, the existing unit is retained, sold or donated for use elsewhere, representing additional load on the grid. This measure covers recycling of the existing, functional equipment, thereby eliminating the consumption associated with that equipment. Appliance recycling programs receive energy savings credit for permanently removing inefficient, functional equipment from the electric grid.

Baseline Efficiency:

The baseline efficiency case is an old, inefficient working refrigerator, freezer, dehumidifier or room air conditioner.

High Efficiency:

The high efficiency case assumes no replacement of the recycled unit.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW	REF
EA3b027	Refrigerator Recycling	ES Products	868	0.15	1,2
EA3b028	Secondary Refrigerator Recycling	ES Products	868	0.16	1,2
EA3b029	Freezer Recycling	ES Products	628	0.09	1,2
EA3b030	Room Air Conditioner Recycling	ES Products	245	0.39	1,2
EA3b037	Dehumidifier Recycling	ES Products	1020	0.24	1,2

Measure Life:

BC ID	Measure Name	Measure Life	REF
EA3b027	Refrigerator Recycling	5	3
EA3b028	Secondary Refrigerator Recycling	5	3
EA3b029	Freezer Recycling	4	3
EA3b030	Room Air Conditioner Recycling	3	3
EA3b037	Dehumidifier Recycling	4	3

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA3b027	Refrigerator Recycling	ES Products	1	1	n/a	1	1	0.79	0.65	4,5,6
EA3b028	Secondary Refrigerator Recycling	ES Products	1	1	n/a	1	1	0.86	0.52	4,5,6

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA3b029	Freezer Recycling	ES Products	1	1	n/a	1	1	0.91	0.68	4,5,6
EA3b030	Room Air Conditioner Recycling	ES Products	1	1	n/a	1	1	0.46	0	4,5,6
EA3b037	Dehumidifier Recycling	ES Products	1	1	n/a	1	1	0.82	0.17	4,5,6

Energy Load Shape:

See Appendix 1 – "Primary Refrigerator" for primary refrigerator recycling, "Secondary Refrigerator" for secondary refrigerator recycling, "Freezer" for secondary freezer recycling, "Dehumidifier" for dehumidifier recycling, "Room or Window Air Conditioner" for room air conditioner recycling.

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
Primary Refrigerator	18.20%	20.90%	29.00%	31.90%
Secondary Refrigerator	19.90%	23.60%	26.30%	30.20%
Freezer	17.10%	20.70%	28.70%	33.60%
Dehumidifier	24.90%	29.70%	22.00%	23.30%
Room or Window Air Conditioner	47.50%	47.40%	2.90%	2.20%

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EA3b027	Refrigerator Recycling	ES Products				0.38	7
EA3b028	Refrigerator Recycling	ES Products				0.38	7
EA3b029	Freezer Recycling	ES Products				0.39	7
EA3b030	Room Air Conditioner Recycling	ES Products				0.36	7
EA3b037	Dehumidifier Recycling	ES Products				0.30	7

Revision History:

Revision Number	Effective Date	Description
84	12/1/2022	Dehumidifier recycling measure added.
319	1/1/2027	Incorporated updates on deemed savings values and NTG per the 2026 ES Products Study.

Endnotes:

1: Unit kWh savings are deemed per the 2026 ES Products Memo. NMR (2026) Energy Star Products Memo.

2: Unit kW savings are deemed. Savings were calculated by multiply the kWh savings from the ES Products study by the max demand factor associated with the relevant measure's load shape.

3: California Public Utilities Commission, 2014 Database for Energy-Efficient Resources, Feb. 4, 2014. https://www.caetrm.com/

4: All installations have a 100% in-service rate unless an evaluation finds otherwise.

5: Program savings are deemed based on study results and therefore apply a 100% realization rate.

6: Coincidence factors are based on the Navigant Demand Impact Model. Navigant Consulting (2018) RES1 Demand Impact Model Update https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

7: NTG values are applied per the 2026 ES Products Memo. NMR (2026) Energy Star Products Memo.

Appliances Refrigerator

Measure Code	RES-APP-RFG
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Appliances

Measure Description:

Refrigerators exceeding minimum qualifying efficiency standards established as ENERGY STAR®.

Baseline Efficiency:

The new product baseline efficiency case is a refrigerator that meets the Federal standard effective September 15, 2014. Specific baseline coefficients and constants by product class found in the Code of Federal Regulations, 10 CFR 430.32(a)

The retrofit baseline efficiency case is an existing refrigerator. It is assumed that income eligible customers would otherwise replace their refrigerators with a used inefficient unit.

High Efficiency:

The high efficiency case is a refrigerator that meets the ENERGY STAR standard as of September 15, 2014. For a new refrigerator the measured energy use must be 10% less than the minimum federal efficiency standards.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EB1a049	Refrigerator (Retrofit)	HEA	Modeled	Modeled
EA2a049	Refrigerator (Retrofit)	HEP	Modeled	Modeled
EA1a025	Refrigerator (New Construction)	ES Homes	44.2	0.01
EA3b022	Refrigerator (ENERGY STAR®)	ES Products	44.2	0.01
EA3b023	Refrigerator (Most Efficient)	ES Products	96.4	0.02

HEA and HEP savings are modelled using whole home building simulation.

Unit energy savings for Energy Star are based on consumption values from New Hampshire evaluation results[1]. Demand savings are derived from the Navigant Demand Impact Model[2]

Source algorithms for calculating deemed energy savings:

$\Delta kWh = (kWh_{BASE} - kWh_{ES}) \times SLF$

Where:

kWh_{BASE} = Average baseline usage: a new refrigerator meeting federal standards, average energy consumption assumed to be 502 kWh for lost-opportunity, site-specific for retrofit

kWh_{ES} = Average usage of a new refrigerator meeting ENERGY STAR® standards with an average energy consumption of 452 kWh for ENERGY STAR refrigerators, or 393 kWh for Most Efficient refrigerator

SLF = Site/Lab adjustment factor (an adjustment for real-world performance (site) versus testing (lab)) = 0.881[3]

BC ID	Measure Name	Program	ΔkWh	ΔkW
EB1a049	Refrigerator (Retrofit)	HEA	Calculated	Calculated
EA2a049	Refrigerator (Retrofit)	HEP	Calculated	Calculated
EA1a025	Refrigerator (New Construction)	ES Homes	44.2	0.01
EA3b022	Refrigerator (ENERGY STAR®)	ES Products	44.2	0.01
EA3b023	Refrigerator (Most Efficient)	ES Products	96.4	0.02

Measure Life:

The measure life is 12 years.[4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a049	Refrigerator (Retrofit)	Electric	HEA	1	1	n/a	1	1	1.29	0.93
EA2a049	Refrigerator (Retrofit)	Electric	HEP	0.99	0.96	n/a	0.96	0.96	1.29	0.93
EA1a025	Refrigerator (New Construction)	Electric	ES Homes	1	1	n/a	1	1	1.29	0.93
EA3b022	Refrigerator (ENERGY STAR®)	Electric	ES Products	1	1	n/a	1	1	1.29	0.93
EA3b023	Refrigerator (Most Efficient)	Electric	ES Products	1	1	n/a	1	1	1.29	0.93

In-Service Rates:

Installations have 100% in service rate for ES Products unless an evaluation finds otherwise, 100% for HEA , and 99% for HEP[5] [6].

Realization Rates:

Realization rates are 100% for ES Products and ES Homes unless an evaluation finds otherwise. Realization rate for HEA is 100%and 96% for HEP[7] [8].

Coincidence Factors:

A summer coincidence factor of 129% and a winter coincidence factor of 93% are based on the 2024 Connecticut Program Savings Document.

Energy Load Shape:

See Appendix 1 – "Primary Refrigerator".[2]

Revision History:

Revision Number	Date	Description
128	12/1/2022	Corrected HPwES Realization Rate verbiage to 96% from 100% to align with table, study and model.
225	1/1/2025	Updated CF factors
256	1/1/2026	Updated RR's for HEA based on new impact memo.

Endnotes:

1: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

2: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

3: Connecticut Program Savings Document (PSD) (2019).

4: Environmental Protection Agency (2018). Savings Calculator for Energy Star Qualified Appliances.

5: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

6: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

7: NMR, 2025. Impact Analysis Results for Home Energy Assistance Program – Final Memo

8: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

Swimming Pool Heater

Measure Code	RES-CSM-SPH
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Custom

Measure Description:

The installation of a high efficiency heat pump pool heater in residential applications.

Baseline Efficiency:

The base case is a new, standard-efficiency electric resistance pool heater with a COP of 1.00.

High Efficiency:

The high efficiency case is a heat pump pool heater with a COP of 5.[1]

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated using the following algorithm:

Measure ID	Measure Name	Program	ΔkWh	ΔkW
EA3b009	Heat Pump Swimming Pool Heater, COP 5.00	ES Products	Calculated	Calculated
EA3b009	Heat Pump Swimming Pool Heater COP 5.00	ES Products	Calculated	Calculated

Annual Electric Savings:

$$\Delta kWh = \frac{\left(BTU_{Surface} + BTU_{Reheat} + BTU_{Evap}\right)}{3{,}412} X \left(\frac{F_{elec,baseline}}{COP_{baseline}} - \frac{1}{COP_{ee}}\right)$$

Where:

$BTU_{Surface}$[2] $= (T_{pool} - T_{amb}) \times A_{pool} \times U \times [hrs - (hrs_{cover} \times ESF_{cover,surface})]$

BTU_{Reheat}[3] $= V_{pool} \times 8.33 \times (T_{pool} - T_{main}) \times F_{Reheat}$

BTU_{Evap} [4] $= 0.1 \times AF \times A_{pool} \times (P_{\omega} - P_{dp}) \times (T_{pool} - T_{main}) \times [hrs - (hrs_{cover} \times ESF_{cover,evap})]$

Where:

ΔkWh = Annual electricity energy savings

ΔkW = Peak coincident demand electric savings

$BTU_{Surface}$ = Annual heating energy load contributed by convection and radiation heat losses via pool surface, (BTU)

BTU_{Reheat} = Annual heating energy load contributed by heating the full volume of pool water, (BTU)

BTU_{Evap} = Annual heating energy load contributed by evaporation, (BTU)

$F_{elec,baseline}$ = Baseline electric pool heater factor; used to account for the presence or absence of an electric pool heater. Set equal to 1.00

$COP_{baseline}$ = Coefficient of performance, ratio of output energy/input energy of baseline electric resistance pool heater, set to 1.00.

COP_{ee} = Coefficient of performance, ratio of output energy/input energy of heat pump pool heater. Set equal to 5.00

T_{pool} = Pool temperature set point, (ºF)

T_{amb} = Average temperature of surrounding ambient air, (ºF). If outdoor pool looking up in Outdoor Pool table below. If indoor pool, use temperature of the room.

T_{main} = Supply water temperature in water main, (ºF) See cold water inlet temperature in table below based on the nearest town.

A_{pool} = Surface area of pool, (ft2)[5]

V_{pool} = Volume of pool water, (gallons)

F_{Reheat} = Factor capturing annual number of times full pool volume is heated to the desired temperature, whether as the result of refill or heating of pool water from ground water temperature at start of season. If pool is filled by delivery service providing preheated water, set FReheat equal to 0. Otherwise F_{Reheat} shall default to 1.

U = Surface heat loss coefficient, (BTU/hr-ft2 -ºF) set as follows: Indoor pool: 3.9 Outdoor pool, sheltered: 5.3 Outdoor pool, unsheltered: 6.6[6]

AF = Activity Factor, consideration of activity within pool, allowing for splashing and a limited area of wetted deck. set to.5[7]

P_{ω} = Saturation vapor pressure taken at surface water temperature, (in. Hg) See "saturation vapor pressure" table below.

P_{dp} = Saturation pressure at dew point, (in. Hg).See “Ambient Air Temperature and Pressure" table below.

hrs = Total annual swimming season hours.

hrs_{cover} = Total annual hours pool covered during the swimming season. set equal to 0 if pool is uncovered throughout season

$ESF_{cover,surface}$ = Energy Savings Factor of pool cover to insulate from convective and radiation heat losses. Set to.8 based on cost savings for gas and heat pump pool heater savings. [8]

$ESF_{cover,evap}$ = Energy Savings Factor of pool cover to insulate from evaporative heat loss. Set to.95 based on effectiveness of pool covers to reduce evaporation from swimmping pools [9]

0.1 = Simplified empirically derived evaporation factor considering latent heat and air flow; assumes 1,000 BTU/lb. of latent heat required to change water to vapor at surface water temperature and air velocity over water surface ranging from 10 to 30 fpm, (lb./hr-ft2 -in. hg)

8.33 = Energy required (BTU) to heat one gallon of water by one degree Fahrenheit

3,412 = Conversion factor, one kWh equals 3,412 BTU

Cold Water Inlet Temperature (T_{main})

Supply water main temperatures vary according to climate and are approximately equal to the annual average outdoor temperature ply 6ºF.[10] Supply main temperatures are based on the annual outdoor temperature shown below.

Town	Annual Average Outdoor Temperature (°F)[11]	T_{main}(°F)
Berlin	42.5	48.5
Meredith	46.5	52.5
Lebanon	46.0	52.0

Town	Annual Average Outdoor Temperature (°F)[11]	T_{main}(°F)
Concord	47.2	53.2
Keen	45.4	51.4
Epping	47.4	53.4
Manchester	50.1	56.1

Saturation and Vapor Pressure (P_ω)

Look up saturation vapor pressure taken at surface water temperature for indoor and outdoor pools from the table below, based on pool temperature. [12]

Pool Temperature, Tpool (°F)	Pω (in. Hg)
72	0.79
74	0.85
76	0.91
78	0.97
80	1.03
82	1.10
84	1.18

Ambient Air Temperature and Pressure (T_{amb} and P_{dp})

Indoor pools shall apply ambient air temperature based on facility set point temperature. Lookup saturation vapor pressure based on facility set point temperature and relative humidity (RH) from the table below, based on psychrometric analysis. Interpolation may be performed for indoor pool ambient temperatures not listed.

Indoor Pool Temperature, Tamb (°F)	Indoor Pool, Pdp (in. Hg)		
	RH 50%	RH 55%	RH 60%
72	0.40	0.44	0.47
74	0.42	0.47	0.51
76	0.45	0.50	0.54
78	0.48	0.53	0.58
80	0.52	0.56	0.62
82	0.55	0.61	0.66
84	0.59	0.65	0.71
86	0.63	0.69	0.75

For outdoor pools, lookup T_{amb} and P_{dp} from the table below based on location. Ambient temperature averages for outdoor pools apply a 4-month swimming season.

Climate Zone	Outdoor Pool Temperature Tamb (°F)[13]	Outdoor Pool Pdp (in. Hg)[14]
Berlin	61.53	0.43
Lebanon	63.6	0.46
Concord	66.42	0.49
Meredith	64.13	0.48
Epping	65.48	0.49
Keene	65.52	0.48

Climate Zone	Outdoor Pool Temperature Tamb (°F)[13]	Outdoor Pool Pdp (in. Hg)[14]
Manchester	66.6	0.49

Measure Life:

The measure life is 15 years[15].

Other Resource Impacts:

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3b009	Heat Pump Swimming Pool Heater	ES Products	1.00	1.00	n/a	1.00	0.00	0.00	0.00
GA3b016	Gas Swimming Pool Heater	ES Products	1.00	n/a	1.00	1.00	0.00	0.00	0.00

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

The programs assume no summer or winter peak savings because it is assumed heaters are not used during summer peak periods and do not operate during the winter.

Energy Load Shape:

See Appendix 1 "Pool Pump".

Revision History:

Revision Number	Date	Description
136	12/1/2022	Updated algorithms from deemed values to calculated values based on the NYSERDA and Illinois TRMS. Updated Measure life from 13 to 15 years.

Endnotes:

1: Energy.gov states the COP of heat pump water heaters range from 3.00-7.00. 5.00 has been chosen as a median of the stated range. For additional context, CA code requires a COP of 3.5 and FL code requires a COP of 4.0. https://www.energy.gov/energysaver/heat-pump-swimming-pool-heaters

2: ASHRAE Handbook: HVAC Applications, 2019, Ch 51 Service Water Heating, Swimming Pools/Health Clubs. eqn 15

3: ASHRAE Handbook: HVAC Applications, 2019, Ch 51 Service Water Heating, Swimming Pools/Health Clubs. eqn 14

4: ASHRAE Handbook: HVAC Applications, 2019, Ch 6 Indoor Swimming Pools, eqn. 3, multiplied by required heating temperature difference

5: Guidance for determining surface area of common pool shapes can be found at ASHRAE Handbook: HVAC Applications, 2019.

6: ASHRAE Handbook: HVAC Applications, 2019, Ch 51, eqn. 15. Surface heat loss coefficient adjusted from ASHRAE Handbook rolled up surface heat transfer conservations by discounting contribution of evaporation (50-60%) and applying the following assumption for wind velocity: Indoor pools experience average wind speeds less than 3.5 mph (10.5x0.5x0.75), outdoor sheltered pools experience wind speeds between 3.5 and 5 mph (10.5x0.5), and outdoor unsheltered pools experience wind speeds above 5 mph (10.5x0.5x1.25).

7: ASHRAE Handbook, Applications, 2019, Ch 6, Table 1

8: U.S. D.O.E., Swimming Pool Covers.

9: National Plasterers Council, Effectiveness of Pool Covers to Reduce Evaporation from Swimming Pools, prepared by California Polytechnic State University, January 2016. https://rightscape.com/images/PDFs/Evaporation-Study-Final-Report_2.pdf

10: Burch, Jay and Christensen, Craig, "Towards Development of an Algorithm for Mains Water Temperature." National Renewable Energy Laboratory. https://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/AlgorithmForMainsWaterTemperature.pdf

11: Average annual outdoor temperatures taken from NCDC 1981-2010 climate normals. https://www.ncdc.noaa.gov/cdo-web/datatools/normals

12: ASHRAE Handbook: Fundamentals 2017, Ch 1 Psychrometrics, Table 3 Thermodynamic Properties of Water at Saturation

13: DOE Weather Data, TMY3 (Typical Meteorological Year), developed by NREL. Adjusted to apply to outside air temperature from June 1 to September 30 in each climate zone.

14: Brice, Tim; Hall, Todd. "Vapor Pressure Calculator." Weather.gov. Accessed Date November 20, 2022. https://www.weather.gov/epz/wxcalc_vaporpressure

15: Database for Energy Efficient Resources (DEER). "2014 DEER Update Study." July 17, 2013. http://www.deeresources.com/files/home/download/DEER2014UpdatePlan-July2013-v1.pdf

Building Shell Air Sealing

Measure Code	**RES-BS-AS**
Markets	Residential
ProgramTypes	Retrofit, Single Family
Categories	Building Shell

Measure Description:

The reduction of a home's conditioned air loss (leakage) resulting from the sealing of a home's cracks and air gaps. Home air leakage is measured in air loss in Cubic Feet per Minute (CFM), measured at 50 pascals through a blower door test.

Baseline Efficiency:

The baseline efficiency case is an existing home before it is air sealed.

High Efficiency:

The high efficiency case is an existing home after it has been air sealed.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔmmBTU
EA2a001	Air Sealing, Cord Wood	HEP			Modeled
EA2a002	Air Sealing, Electric	HEP	Modeled	Modeled	
EA2a003	Air Sealing, Gas	HEP			Modeled
EA2a004	Air Sealing, Kerosene	HEP			Modeled
EA2a005	Air Sealing, Oil	HEP			Modeled
EA2a006	Air Sealing, Propane	HEP			Modeled
EA2a007	Air Sealing, Wood Pellets	HEP			Modeled
EB1a001	Air Sealing, Cord Wood	HEA			Modeled
EB1a002	Air Sealing, Electric	HEA	Modeled	Modeled	
EB1a003	Air Sealing, Gas	HEA			Modeled
EB1a004	Air Sealing, Kerosene	HEA			Modeled
EB1a005	Air Sealing, Oil	HEA			Modeled
EB1a006	Air Sealing, Oil	HEA			Modeled
EB1a007	Air Sealing, Wood Pellets	HEA			Modeled
GA2a001	Air Sealing, Gas	HEP			Modeled
GB1a001	Air Sealing, Gas	HEA			Modeled
EA2b023	Ancillary Savings – Furnace	HEP	Deemed	Deemed	
GA2b008	Ancillary Savings – Boiler Circulator Pump	HEP	Deemed	Deemed	
GA2b010	Ancillary Savings – Central AC	HEP	Deemed	Deemed	
GA2b009	Ancillary Savings – Furnace	HEP	Deemed	Deemed	
EA2b022	Ancillary Savings – Boiler Circulator Pump	HEP	Deemed	Deemed	
EA2b024	Ancillary Savings – Central AC	HEP	Deemed	Deemed	
EA2b025	Ancillary Savings – Room AC	HEP	Deemed	Deemed	
EA2b026	Ancillary Savings – Mini-Split AC / HP	HEP	Deemed	Deemed	

The programs use whole home energy simulation models to calculate savings for air sealing measures in the Home Energy Performance and Home Energy Assistance programs.

To calculate savings in a whole home energy simulation model, the user inputs a minimum set of technical data about the house, and the software calculates building heating and cooling loads and other key parameters. The software's building model is based on thermal transfer, building gains, and a variable-based heating and cooling degree day (or hour) climate model. This provides an initial estimate of energy use that may be compared with actual billing data to adjust as needed for existing conditions. Then, specific recommendations for improvements are added and savings are calculated using measure-specific heat transfer algorithms.

Rather than using a fixed degree day approach, the building model estimates both heating degree days and cooling degree hours based on the actual characteristics and location of the house to determine the heating and cooling balance point temperatures. Infiltration savings use site-specific seasonal N-factors to convert measured leakage to seasonal energy impacts. HVAC savings are estimated based on changes in system and/or distribution efficiency improvements, using ASHRAE 152 as their basis. Interactivity between architectural and mechanical measures is always included, to avoid overestimating savings due to incorrectly "adding" individual measure results.

Measure Life:

The effective useful life (EUL) for air sealing, which assumes retrofit installation, is 15 years.[1]

Measure lives of ancillary savings are 20 years. As ancillary savings are applied once per weatherization projects, the measure life is a weighted average of the measure lives of air sealing and insulation. The weights are determined by a weight average of Eversource's 2025 HEP data.

Other Resource Impacts:

In addition to the primary heating fuel savings, the following deemed values are applied to Home Performance program measures to reflect ancillary electric savings for heating and cooling load reductions, depending on the equipment used in the home. Heating ancillary savings result from both reduced furnace fan runtime, or reduced boiler pump operation due to the HVAC Load reductions resulting from weatherizing homes. Ancillary cooling savings are derived from the average cooling system runtime reduction. The values are based on evaluation results for weatherized homes and are applied once per home for homes receiving air sealing and/or insulation (rather than separately applying the savings for each measure. Savings are only applicable once per home. Ancillary cooling savings are applicable when air sealing and/or envelope insulation measures are implemented in a home with cooling. When air sealing is completed in a home and CFM reductions are verified through a blower door test, use the 0.0146 MMBtu/100 CFM reduction savings value. When a blower door is not completed, or only envelop insulation measures are implemented, apply the 0.178 MMBtu/Home savings value. Savings are only applicable once per home. [2]

Measure lives of ancillary savings are 20 years. As ancillary savings are applied once per weatherization projects, the measure life is a weighted average of the measure lives of air sealing and insulation. The weights are determined by a weight average of Eversource's 2025 HEP data.

BC ID	Measure Name	Equipment	Savings/unit	Description of Impact	CF $_{SP}$	CF$_{WP}$
EA2b023 GA2b009	Ancillary Savings – Furnace	Furnace fan	86.00 kWh/Home	Per home value reflecting reduced fan operation based on heating load reduction from weatherization measures	0.00	0.45
EA2b022 GA2b008	Ancillary Savings – Boiler Circulator Pump	HW boiler circulation pump(s)	9.00 kWh/Home	Per circulator pump value reflecting reduced pump operation based on heating load reduction from weatherization measures	0.00	1.0
EA2b024 GA2b010	Ancillary Savings – Central AC.	Central HVAC - Cooling system fan, blower door test completed	4.28 kWh/ 100 CFM	Per CFM savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.35	0.00
EA2b024	Ancillary Savings – Central AC	Central HVAC - Cooling system fan, blower door test not completed.	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.35	0.00
EA2b025	Ancillary Savings – Room AC	Room/Windo w AC - Cooling system fan, blower door test completed	4.28 kWh/ 100 CFM	Per CFM savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.33	0.00
EA2b025	Ancillary Savings – Room AC	Room/Windo w AC - Cooling system fan, blower door test not completed	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.33	0.00
EA2b026	Ancillary Savings – Mini-Split AC / HP	Mini- Split AC/ HP - Cooling system fan, blower door test completed	4.28 kWh/ 100 CFM	Per CFM savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.29	0.00
EA2b026	Ancillary Savings – Mini-Split AC / HP	Mini- Split AC/ HP - Cooling system fan, blower door test not completed.	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.29	0.00

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR$_E$	RR$_{NE}$	RR$_{SP}$	RR$_{WP}$	CF$_{SP}$	CF$_{WP}$	Source

EB1a001	Air Sealing, Cord Wood	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a	3,4
EB1a002	Air Sealing, Electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2	3,4
EB1a003	Air Sealing, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a	3
GB1a001	Air Sealing, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a	3
EB1a004	Air Sealing, Kerosene	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a	3
EB1a005	Air Sealing, Oil	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a	3
EB1a006	Air Sealing, Propane	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a	3
EB1a007	Air Sealing, Wood Pellets	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a	3
EA2a001	Air Sealing, Cord Wood	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a	3
EA2a002	Air Sealing, Electric	HEP	1	0.95	n/a	0.95	0.95	0.34	0.2	3,4
EA2a003	Air Sealing, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a	5
GA2a001	Air Sealing, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a	5
EA2a004	Air Sealing, Kerosene	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a	5
EA2a005	Air Sealing, Oil	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a	5
EA2a006	Air Sealing, Propane	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a	5
EA2a007	Air Sealing, Wood Pellets	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a	5
EA2b023	Ancillary Savings – Furnace	HEP	1	0.95	n/a	0.95	0.95	0	0.452	4,5
GA2b009	Ancillary Savings – Furnace	HEP	1	0.77	n/a	0.77	0.77	0	0.452	5
EA2b022	Ancillary Savings – Boiler Circulator Pump	HEP	1	0.95	n/a	0.95	0.77	0	0.535	5
GA2b008	Ancillary Savings – Boiler Circulator Pump	HEP	1	0.77	n/a	0.77	0.77	0	0.535	5

EA2b024	Ancillary Savings – Central AC	HEP	1	0.95	n/a	0.95	0.77	0.346	0	5
GA2b010	Ancillary Savings – Central AC	HEP	1	0.77	n/a	0.77	0.77	0.346	0	5
EA2b025	Ancillary Savings – Room AC	HEP	1	0.95	n/a	0.95	0.77	0.328	0	5
EA2b026	Ancillary Savings – Mini-Split AC / HP	HEP	1	0.95	n/a	0.95	0.77	0.346	0	5

Energy Load Shape:

For air sealing, see Appendix 1. – "Weighted HVAC – Single Family"

For ancillary heating savings in a home with a furnace, see Appendix 1 – "Furnace Fan"

For ancillary heating savings in a home with a boiler, see Appendix 1 – "Boiler Distribution"

For ancillary cooling savings in a home with central or a heat pump, see Appendix 1 "Central Air Conditioner/ Heat pump (cooling)".

For ancillary cooling savings in a home with room or window AC, see Appendix 1 – "Room or Window Air Conditioner"

For ancillary cooling savings in a home with a mini-split AC or heat pump, see Appendix 1 – "Mini-split Air Conditioner/ Heat Pump (Cooling)".

Non-Energy Impacts for Secondary Cost Test:

For HEA programs, a per-project value of $438.72 reflecting participant NEIs—including increased comfort, decreased noise, and health-related NEIs—will be applied annually to each weatherization project over its life.

Revision History:

Revision Number	Issue Date	Description
12	1/14/2022	Updated to reference the "Weighted Whole Home HVAC" load shape for air sealing, rather than the hardwired electric heat load shape.
13	1/14/2022	Added ancillary heating and cooling savings and separate BC ID's
14	1/14/2022	Updated the air sealing load shape to "Weighted Whole Home HVAC", and added load shapes for ancillary savings.
116	12/1/2022	Included additional information on software used for the vendor calculated savings and added gas measure IDs.
199	1/1/2024	Corrected HVAC loads shape CF for electric homes and added cooling CF for FF heated homes. Corrected CF for ancillary electric savings
251	1/1/2026	Updated realization rates according to 2025 HEA and HEP final impact memos

320	1/1/2027	Updated realization rates for delivered fuels, demand savings and ancillary savings according to final HEA/ HEP reports.

Endnotes:

1: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. Microsoft Word - SPWG Measure Life Study for ISO-FCM Spring 07 FINAL 5-25-07.doc, Last Accessed February 13, 2026

2: Ancillary savings values are derived from: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf, Last Accessed February 13, 2026

3: In-service rates and realization rates are applied per NMR, 2026. New Hampshire Home Energy Assistance Impact and Process Evaluation. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

4: CF's are applied per the corresponding energy load shapes: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

5: Realization rates are applied per: NMR(2026) New Hampshire Home Energy Assistance Impact and Process Evaluation

Building Shell Duct Sealing

Measure Code	RES-BS-DS
Markets	Residential
Program Types	Retrofit
Categories	Building Shell

Measure Description:

For existing ductwork in non-conditioned spaces, seal ductwork. This could include sealing leaky fixed ductwork with mastic or aerosol.

Baseline Efficiency:

The baseline efficiency case is existing, non-sealed (leaky) ductwork in unconditioned spaces (e.g. attic or basement).

High Efficiency:

The high efficiency condition is air sealed ductwork in unconditioned spaces.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on study results.[1,2]

BC ID	Measure Name	Program	ΔkWh	ΔkW[3]	ΔMMBTU
EB1a084	Duct Sealing, Cord Wood	HEA			3.9
EA2a070	Duct Sealing, Cord Wood	HEP			3.9
EB1a085	Duct Sealing, Electric	HEA	442.00	0.31	
EA2a071	Duct Sealing, Electric	HEP	442.00	0.31	
EB1a086	Duct Sealing, Gas	HEA			3.9
EA2a072	Duct Sealing, Gas	HEP			3.9
GB1a020	Duct Sealing, Gas	HEA			3.9
EA2a073	Duct Sealing, Kerosene	HEP			3.9
EA2a073	Duct Sealing, Kerosene	HEP			3.9
EB1a088	Duct Sealing, Oil	HEA			4.0
EA2a074	Duct Sealing, Oil	HEP			4.0
EB1a089	Duct Sealing, Propane	HEA			3.9
EA2a075	Duct Sealing, Propane	HEP			3.9
EB1a090	Duct Sealing, Wood Pellets	HEA			3.9
EA2a076	Duct Sealing, Wood Pellets	HEA			3.9

Measure Life:

The measure life for duct sealing is 20 years.[4]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EB1a084	Duct Sealing, Cord Wood	HEA	1	n/a	0.61	n/a	n/a	0	0.35	5
EB1a085	Duct Sealing, Electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2	5
EB1a086	Duct Sealing, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	0	5
GB1a020	Duct Sealing, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	0	5
EB1a087	Duct Sealing, Kerosene	HEA	1	n/a	0.61	n/a	n/a	n/a	0	5
EB1a088	Duct Sealing, Oil	HEA	1	n/a	0.61	n/a	n/a	n/a	0	5
EB1a089	Duct Sealing, Propane	HEA	1	n/a	0.61	n/a	n/a	n/a	0	5
EB1a090	Duct Sealing, Wood Pellets	HEA	1	n/a	0.61	n/a	n/a	n/a	0	5
EA2a070	Duct Sealing, Cord Wood	HEP	1	n/a	0.86	n/a	n/a	n/a	0	6
EA2a071	Duct Sealing, Electric	HEP	1	0.95	n/a	0.95	0.95	0.34	0.2	6
EA2a072	Duct Sealing, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	0	6
EA2a073	Duct Sealing, Kerosene	HEP	1	n/a	0.86	n/a	n/a	n/a	0	6
EA2a074	Duct Sealing, Oil	HEP	1	n/a	0.86	n/a	n/a	n/a	0	6
EA2a075	Duct Sealing, Propane	HEP	1	n/a	0.86	n/a	n/a	n/a	0	6

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA2a076	Duct Sealing, Wood Pellets	HEP	1	n/a	0.86	n/a	n/a	n/a	0	6

Energy Load Shape:

See Appendix 1. – "Weighted HVAC – Single Family"

See Appendix 1. – "Central Air Conditioner/ Heat Pump (cooling)

Revision History:

Revision Number	Issue Date	Description
58	1/14/2022	Omitted Measure Added
170	7/1/2023	Corrected table headers for kW and MMBTU savings; added gas measure ID G21B1a020.
204	1/1/2024	Corrected CFs and Loadshapes for electric and fossil fuel
321	1/1/2027	Updated Realization Rates for the Home Energy Performance program
397	10/30/2026	Added BC ID GB1a020 which had been omitted.

Endnotes:

1: The 84% AFUE baseline is based on the New Hampshire Potential Study Statewide Assessment of Energy Efficiency and Active Demand Opportunities, 2021-2023, Volume III: Residential Market Baseline Study, June 11, 2020, p. 3-17. The 85% AFUE baseline represents value negotiated in MA for new boilers.

2: Connecticut Program Savings Document, 2021. https://www.energizect.com/sites/default/files/documents/Final%202021%20PSD%20(Filed%2010-30-2020).pdf - ESF 2% value was used compared to 5% used in the New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multifamily, and Commercial/Industrial Measures, Version 3, Issue Date – Jun. 1, 2015, p. 98.

3: Guidehouse (2020). Residential Baseline Study Phase 4 Residential Products In Service Rates Memo. 2021_NMR_Products_ISR. https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf, Last Accessed February 13, 2026

4: https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

5: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. GDS_2007_Measure_Life_Report_Residential_and_CI_Lighting_and_HVAC_Measures, Last Accessed February 13, 2026.

6: NMR (2026) New Hampshire Home Energy Assistance Impact and Process Evaluation. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

7: NMR (2026) New Hampshire Home Energy Performance Impact and Process Evaluation. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

Building Shell Door Replacement

Measure Code	RES-BS-DR
Markets	Residential
ProgramTypes	New, Retrofit
Categories	Building Shell

Measure Description:

Installation of insulated exterior doors.

Baseline Efficiency:

The baseline condition is an existing un-insulated or damaged exterior door.

High Efficiency:

The high efficiency case is an insulated exterior door.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔmmBtu
EB1a070	Insulated Door, Cordwood	HEA	Modeled	Modeled	Modeled
EB1a071	Insulated Door, Electric	HEA	Modeled	Modeled	Modeled
EB1a072	Insulated Door, Gas	HEA	Modeled	Modeled	Modeled
GB1A015	Insulated Door, Gas	HEA	Modeled	Modeled	Modeled
EB1a073	Insulated Door, Kerosene	HEA	Modeled	Modeled	Modeled
EB1a074	Insulated Door, Oil	HEA	Modeled	Modeled	Modeled
EB1a075	Insulated Door, Propane	HEA	Modeled	Modeled	Modeled

Measure Life:

The measure life for an efficient door is 25 years.[1]

Other Resource Impacts:

For HEA programs, a per-project value of $438.72 reflecting participant NEIs—including increased comfort, decreased noise, and health-related NEIs—will be applied annually to each weatherization project over its measure life.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}

EB1a070	Insulated Door, Cordwood	HEA	1	n/a	0..61	n/a	n/a	n/a	n/a
EB1a071	Insulated Door, Electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2
EB1a072	Insulated Door, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a
GB1A015	Insulated Door, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a
EB1a073	Insulated Door, Kerosene	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a074	Insulated Door, Oil	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a075	Insulated Door, Propane	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a076	Insulated Door, Wood pellets	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

Realization rate are based on evaluation results. [2]

Coincidence Factors:

For primary savings in electric heated homes with AC, a summer coincidence factor of 34% and a winter coincidence factor of 20% is used, based on the "Weighted Whole Home HVAC" load shape.[3]

For primary savings in fossil fuel heated homes with AC, a summer coincidence factor of 35% and a winter coincidence factor of 0% is used, based on the "Central Air Conditioner/ Heat Pump (Cooling)" load shape. For primary savings, a summer coincidence factor of 23.25% and a winter coincidence factor of 25.41% is used, based on the "Weighted Whole Home HVAC" load shape.[3]

Energy Load Shape:

See Appendix 1. – "Weighted Whole Home HVAC"

See Appendix 1. – "Central Air Conditioner/ Heat Pump (cooling)

Revision History:

Revision Number	Issue Date	Description
19	1/14/2022	Omitted measure added
114	12/1/2022	Updated to vendor calculated for HEA and HPwES and now includes information on software used for the vendor calculated savings.
162	3/1/2023	Added in missing BC ID's for gas.G21b1a015
203	1/1/2024	Correct CF's and load shapes for electric and fossil fuel

Revision Number	Issue Date	Description
322	1/1/2027	Updated RR's based on study results.

Endnotes:

1: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://library.cee1.org/system/files/library/8842/CEE_Eval_MeasureLifeStudyLights%2526HVACGDS_1Jun2007.pdf

2: NMR, 2026, New Hampshire Home Energy Assistance Program Impact and Process Study. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

Building Shell Insulation

Measure Code	RES-BS-INS
Markets	Residential
ProgramTypes	Retrofit
Categories	Building Shell

Measure Description:

The installation of high efficiency insulation in an existing home.

Baseline Efficiency:

The baseline efficiency case is the pre-installation average R-value for an insulation type in an existing home before installation of new insulation.

High Efficiency:

The high efficiency case is the post-installation average R-value for an insulation type in an existing home.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	kWh	mmBTU
EB1a022	Insulation, Cord Wood	HEA		Modeled
EB1a023	Insulation, Electric	HEA	Modeled	
EB1a024	Insulation, Gas	HEA		Modeled
EB1a025	Insulation, Kerosene	HEA		Modeled
EB1a026	Insulation, Oil	HEA		Modeled
EB1a027	Insulation, Propane	HEA		Modeled
EB1a028	Insulation, Wood Pellets	HEA		Modeled
EA2a022	Insulation, Cord Wood	HEP		Modeled
EA2a023	Insulation, Electric	HEP	Modeled	
EA2a024	Insulation, Gas	HEP		Modeled
EA2a025	Insulation, Kerosene	HEP		Modeled
EA2a026	Insulation, Oil	HEP		Modeled
EA2a027	Insulation, Propane	HEP		Modeled
EA2a028	Insulation, Wood Pellets	HEP		Modeled
EA2a095	Insulation, Electric (Multifamily)	HEP	Modeled	

BC ID	Measure Name	Program	kWh	mmBTU
EA2a096	Insulation, Gas (Multifamily)	HEP		Modeled
EA2a097	Insulation, Oil (Multifamily)	HEP		Modeled
EA2a098	Insulation, Propane (Multifamily)	HEP		Modeled
EB1a077	Duct Insulation, Cord Wood	HEA		Modeled
EB1a078	Duct Insulation, Electric	HEA	Modeled	
EB1a079	Duct Insulation, Gas	HEA		Modeled
EB1a080	Duct Insulation, Kerosene	HEA		Modeled
EB1a081	Duct Insulation, Oil	HEA		Modeled
EB1a082	Duct Insulation, Propane	HEA		Modeled
EB1a083	Duct Insulation, Wood Pellets	HEA		Modeled
EA2a063	Duct Insulation, Cord Wood	HEP		Modeled
EA2a064	Duct Insulation, Electric	HEP	Modeled	
EA2a065	Duct Insulation, Gas	HEP		Modeled
EA2a066	Duct Insulation, Kerosene	HEP		Modeled
EA2a067	Duct Insulation, Oil	HEP		Modeled
EA2a068	Duct Insulation, Propane	HEP		Modeled
EA2a069	Duct Insulation, Wood Pellets	HEP		Modeled
GA2a018	Duct Insulation, Gas	HEP		Modeled
GA2a004	Insulation, Gas	HEP		Modeled
GB1a018	Duct Insulation, Gas	HEA		Modeled
GB1a004	Insulation, Gas	HEA		Modeled
EA2b023	Ancillary Savings- Furnace	HEP	86.00 kWh/Home, per wx project	
EA2b022	Ancillary Savings – Boiler Circulator Pump	HEP	9.00 kWh/Home per wx project	
EA2b024	Ancillary Savings – Central AC	HEP	52.17 kWh/Home per wx project	
EA2b025	Ancillary Savings – Room AC	HEP	52.17 kWh/Home per wx project	
EA2b026	Ancillary Savings – Minisplit AC/HP	HEP	52.17 kWh/Home per wx project	
GA2b008	Ancillary Savings – Boiler Circulator Pump	HEP	9.00 kWh/Home per wx project	
GA2b009	Ancillary Savings – Furnace	HEP	86.00 kWh/Home, per wx project	
GA2b010	Ancillary Savings – Central AC	HEP	52.17 kWh/Home per wx project	

The programs use whole home energy simulation models to calculate savings for air sealing measures in the Residential Home Performance and Home Energy Assistance programs.

To calculate savings in a whole home energy simulation model, the user inputs a minimum set of technical data about the house, and the software calculates building heating and cooling loads and other key parameters. The software's building model is based on thermal transfer, building gains, and a variable-based heating and cooling degree day (or hour) climate model. This provides an initial estimate of energy use that may be compared with actual billing data to adjust as needed for existing conditions. Then, specific recommendations for improvements are added and savings are calculated using measure-specific heat transfer algorithms.

Rather than using a fixed degree day approach, the building model estimates both heating degree days and cooling degree hours based on the actual characteristics and location of the house to

determine the heating and cooling balance point temperatures. Infiltration savings use site-specific seasonal N-factors to convert measured leakage to seasonal energy impacts. HVAC savings are estimated based on changes in system and/or distribution efficiency improvements, using ASHRAE 152 as their basis. Interactivity between architectural and mechanical measures is always included, to avoid overestimating savings due to incorrectly "adding" individual measure results.[1]

Measure Life:

The effective useful life (EUL) for insulation, which assumes retrofit installation, is 25 years.[2]

Measure lives of ancillary savings are 20 years. As ancillary savings are applied once per weatherization project, the measure life is a weighted average of the measure lives of air sealing and insulation. The weights are determined by a weighted average of Eversource's 2025 HEP data.

Other Resource Impacts:

In addition to heating fuel savings, the following deemed values are applied to Home Performance program measures to reflect ancillary electric savings for heating and cooling load reductions, depending on the equipment used in the home. The values are based on evaluation results for weatherized homes, and are applied once per home for homes receiving air sealing and/or insulation (rather than separately applying for air sealing and insulation[3]

Ancillary cooling savings are applicable when air sealing and/or envelope insulation measures are implemented in a home. When air sealing is completed in a home and CFM reductions are verified through a blower door test, use the 0.0146 MMBtu/100 CFM reduction savings value. When a blower door is not completed, or only envelop insulation measures are implemented, apply the 0.178 MMBtu/Home savings value. Savings are only applicable once per home

BC ID	Measure Name	Equipment	Savings/unit[5]	Description of Impact	CF_{SP}	CF_{WP}[6]
EA2b023 GA2b009	Ancillary Savings-Furnace	Furnace fan	86.00 kWh/Home	Per home value reflecting reduced fan operation based on heating load reduction from weatherization measures	0.00	0.46
EA2b022 GA2b009	Ancillary Savings – Boiler Circulator Pump	HW boiler circulation pump(s)	9.00 kWh/Home	Per circulator pump value reflecting reduced pump operation based on heating load reduction from weatherization measures	0.00	0.45
EA2b024 GA2b010	Ancillary Savings – Central AC	Central HVAC - Cooling system fan, blower door test not completed.	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.00	.47
EA2b025	Ancillary Savings – Room AC	Room/Window AC - Cooling system fan, blower door test completed	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.00	.48

BC ID	Measure Name	Equipment	Savings/unit[5]	Description of Impact	CF_{SP}	CF_{WP}[6]
EA2b026	Ancillary Savings – Minisplit AC/HP	Mini- Split AC/ HP - Cooling system fan, blower door test not completed.	52.17 kWh/Home	Per home savings value reflecting reduced average system fan runtime reduction due to air sealing.	0.00	.43

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a077	Duct Insulation, Cord Wood	HEA	1	n/a	0.61	n/a	n/a	0	0.35
EB1a078	Duct Insulation, Electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2
EB1a079	Duct Insulation, Gas	HEA	1	n/a	0.58	n/a	n/a	0.35	0
GB1a018	Duct Insulation, Gas	HEA	1	n/a	0.58	n/a	n/a	0	0.35
EB1a080	Duct Insulation, Kerosene	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a081	Duct Insulation, Oil	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a082	Duct Insulation, Propane	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a083	Duct Insulation, Wood Pellets	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a022	Insulation, Cord Wood	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a023	Insulation, Electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2
EB1a024	Insulation, Gas	HEA	1	n/a	0.58	n/a	n/a	0.35	0
GB1a004	Insulation, Gas	HEA	1	n/a	0.58	n/a	n/a	0.35	0
EB1a025	Insulation, Kerosene	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a026	Insulation, Oil	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a027	Insulation, Propane	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EB1a028	Insulation, Wood Pellets	HEA	1	n/a	0.61	n/a	n/a	0.35	0
EA2b022	Ancillary Savings – Boiler Circulator Pump	HEP	1	0.95	n/a	0.95	0.95	0	0.535
GA2b008	Ancillary Savings – Boiler Circulator Pump	HEP	1	0.95	0.95	0.95	0.77	0	0.535
EA2b024	Ancillary Savings – Central AC	HEP	1	0.95	n/a	0.95	0.95	0.346	0
GA2b010	Ancillary Savings – Central AC	HEP	1	0.77	n/a	0.77	0.77	0.346	0
EA2b023	Ancillary Savings – Furnace	HEP	1	0.95	n/a	0.95	0.95	0	0.452
GA2b009	Ancillary Savings – Furnace	HEP	1	0.77	n/a	0.77	0.77	0	0.452
EA2b026	Ancillary Savings – Mini-Split AC / HP	HEP	1	0.95	n/a	0.95	0.95	0.346	0
EA2b025	Ancillary Savings – Room AC	HEP	1	0.95	n/a	0.95	0.95	0.328	0
EA2a063	Duct Insulation, Cord Wood	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a064	Duct Insulation, Electric	HEP	1	0.95	n/a	0.95	0.95	0.34	0.2
EA2a065	Duct Insulation, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a
GA2a018	Duct Insulation, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a
EA2a066	Duct Insulation, Kerosene	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a067	Duct Insulation, Oil	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a

EA2a068	Duct Insulation, Propane	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a069	Duct Insulation, Wood Pellets	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a022	Insulation, Cord Wood	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a023	Insulation, Electric	HEP	1	0.95	n/a	0.95	0.95	0.34	0.2
EA2a095	Insulation, Electric (Multifamily)	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a024	Insulation, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a
GA2a004	Insulation, Gas	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a
EA2a096	Insulation, Gas (Multifamily)	HEP	1	n/a	0.77	n/a	n/a	n/a	n/a
EA2a025	Insulation, Kerosene	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a026	Insulation, Oil	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a097	Insulation, Oil (Multifamily)	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a027	Insulation, Propane	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a098	Insulation, Propane (Multifamily)	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a
EA2a028	Insulation, Wood Pellets	HEP	1	n/a	0.86	n/a	n/a	n/a	n/a

In-Service Rates:

In-service rates are assumed to be 100% as realization rates for HEA and HEP were evaluated by billing analysis.

Realization Rates:

Realization rates for HEA and HEP are based on evaluation results.[7,8]

Coincidence Factors:

For primary savings in electric heated homes with AC, a summer coincidence factor of 34% and a winter coincidence factor of 20% is used, based on the "Weighted Whole Home HVAC" load shape. For primary savings in fossil fuel heated homes with AC, a summer coincidence factor of 35% and a winter coincidence factor of 0% is used, based on the "Central Air Conditioner/ Heat Pump (Cooling)" load shape[9].

Energy Load Shape:

For air insulation, in electric heated homes, see Appendix 1. – "Weighted Whole Home HVAC"

For insulation in fossil fuel heated homes, see Appendix 1 " Central Air Conditioner/Heat Pump (Cooling)"

See Appendix 1. – "Weighted Whole Home HVAC"

For air sealing, see Appendix 1. – "Weighted Whole Home HVAC"

For ancillary heating savings in a home with a furnace, see Appendix 1 – "Furnace Fan"

For ancillary heating savings in a home with a boiler, see Appendix 1 – "Boiler distributor"

For ancillary cooling savings in a home with central or a heat pump, see Appendix 1 "Central Air Conditioner/ Heat pump (cooling)".

For ancillary cooling savings in a home with room or window AC, see Appendix 1 – "Room or Window Air Conditioner"

For ancillary cooling savings in a home with a mini-split AC or heat pump, see Appendix 1 – "Mini-split AC/ Heat Pump (Cooling)".

Non-Energy Impacts for Secondary Cost Test:

For HEA programs, a per-project value of $438.72 reflecting participant NEIs—including increased comfort, decreased noise, and health-related NEIs—will be applied annually to each weatherization project over its measure life.

Revision History:

Revision Number	Issue Date	Description
15	1/14/2022	Updated to reference the "Weighted Whole Home HVAC" load shape for air sealing, rather than the hardwired electric heat load shape.
16	1/14/2022	Added ancillary heating and cooling savings and separate BC ID's
17	1/14/2022	Updated the air sealing load shape to "Weighted Whole Home HVAC", and added load shapes for ancillary savings.
18	1/14/2022	Updated to include duct insulation measures
91	12/1/2022	Fixed broken citation links.
117	12/1/2022	Included additional information on software used for the vendor calculated savings.
205	1/1/2024	Corrected CF's and load shapes for electric and fossil fuel
253	1/1/2026	Adjustments to realization rates for 2025 NMR HEA/HEP impact memos, modify HEP to HP
323	1/1/2027	Updated Weatherization RRs and ML's of ancillary savings.
398	10/30/2026	Corrected the RR for BC ID GB1a018, a gas measure, from the 0.61 delivered fuel RR to the correct gas RR of 0.58.

Endnotes:

1 : Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. Excel file associated with report with calculations, https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf
2 : Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007.
3 : Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. Excel file associated with report with calculations, https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf
5 : Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf
6 : Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-

eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf
7 : NMR, 2026, New Hampshire Home Energy Assistance Program Impact and Process Study. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies
8 : NMR, 2026, New Hampshire Home Energy Performance Program Impact and Process Study. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies
9 : Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Building Shell Window Inserts

Measure Code	RES-BS-WI
Markets	Residential
ProgramTypes	Retrofit
Categories	Building Shell

Measure Description:

The installation of an interior storm window.

Baseline Efficiency:

Baseline efficiency for single and double pane windows are defined below. If unsure of baseline window type, use the "Blended Baseline" below.

Storm Window Type	Weighting[1]	UFactor*	SHGC*	VT*	Air Leakage*
Double Pane	0.6	0.59	0.59	0.64	1.0
Single Pane	0.4	0.98	0.65	0.69	3.0
Blended Baseline	1	0.75	0.61	0.66	1.8

*Values are averages using inputs from Energy Savings of Low-E Storm Windows and Panels Across US Climate Zones.[2] Please see window inserts calculations spreadsheets for detailed calculations of baselines.[3]

High Efficiency:

The high-efficiency case is the existing window with an interior window insert installed.

Algorithms for Calculating Primary Energy Impact:

Savings table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	ΔmmBtu
GB1a017	Window Insert. Gas	HEA			Modeled
EB1a101	Window Insert, Electric	HEA	Modeled	Modeled	
EB1a102	Window Insert, Cordwood	HEA			Modeled

EB1a103	Window Insert, Kerosene	HEA			Modeled
EB1a104	Window Insert, Oil	HEA			Modeled
EB1a105	Window Insert, Propane	HEA			Modeled

Savings are modeled using whole home energy modeling software. Window inserts save energy by improving the thermal performance of the existing window system in a home during the heating season. Window inserts are typically removed during the summer, cooling savings are not claimed.

Measure Life:

The measure life of window inserts is 4 years.[6]

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GB1a017	Window Insert, Gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a
EB1a101	Window Insert, Electric	HEA	1	0.64	n/a	0.46	0.46	0	0.2
EB1a102	Window Insert, Cordwood	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a103	Window Insert, Kerosene	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a104	Window Insert, Oil	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a105	Window Insert, Propane	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

Realization rates are based on evaluation results,[7]

Coincidence Factors:

A winter coincidence factor of 20% is used, based on the “Weighted Whole Home HVAC” load shape.[8]

Energy Load Shape:

See Appendix 1 "Weighted Whole Home HVAC".

Revision History:

Revision Number	Date	Description
89	12/1/2022	New measure added.
90	3/1/2022	Measures updated with BC IDs.
206	1/1/2024	Corrected CFs and load shape
324	1/1/2027	Updated RRs per evaluation results

399	10/30/2026	Corrected the RR for BC ID GB1a017 from the delivered fuel RR of 0.61 to the correct gas RR of 0.58

Endnotes:

1: "Storm Windows V1: Criteria Analysis Report July 2017_Final.pdf" ENERGY STAR Page 7, table 4, climate zones 5& https://www.energystar.gov/sites/default/files/Storm%20Windows%20V1%20Criteria%20Analysis%20Report%20July%202017_final.pdf

2: PNNL (2015) Energy Savings of Low-E Storm Windows and Panels across US climate Zones, Page 4, table 1 and paragraph 2, page 5 table 2. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24826.pdf

3: Window Inserts Savings 11

4: Document provides an overview of inputs used in Resfen to calculate the window inserts savings and their sources. Window Inserts Savings 11

5: Window Inserts Savings 11

6: Efficiency Maine, Retail/Residential TRM (2024) https://www.efficiencymaine.com/docs/EMT-TRM_Retail_Residential_v2020_2.pdf

7: NMR (2026) New Hampshire Home Energy Assistance Impact and Process Evaluation https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

8: Guidehouse (2020) Massachusetts Residential Baseline Study, Demand impact model. https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf

Building Shell Window Replacement

Measure Code	**RES-BS-WR**
Markets	Residential
ProgramTypes	New, Retrofit
Categories	Building Shell

Measure Description:

Replacement of single pane windows or Jalosie mobile home windows.

Baseline Efficiency:

Baseline efficiency is defined as a single pane of Jalosie mobile home window.

High Efficiency:

The high efficiency case are energy efficient double pane window replacements.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔmmBtu
EB1a055	Window Replacement, cord wood	HEA	Modeled	Modeled	Modeled
EB1a064	Window Replacement, electric	HEA	Modeled	Modeled	Modeled
EB1a065	Window Replacement, gas	HEA	Modeled	Modeled	Modeled
GB1a065	Window Replacement, gas	HEA	Modeled	Modeled	Modeled
EB1a066	Window Replacement, kerosene	HEA	Modeled	Modeled	Modeled
EB1a067	Window Replacement, oil	HEA	Modeled	Modeled	Modeled
EB1a068	Window Replacement, propane	HEA	Modeled	Modeled	Modeled
EB1a069	Window Replacement, wood pellets	HEA	Modeled	Modeled	Modeled

Savings are modeled using whole home energy modeling software.

Measure Life:

The measure life for an efficient window is 25 years.[1]

Other Resource Impacts:

For HEA programs, a per-project value of $438.72 reflecting participant NEIs—including increased comfort, decreased noise, and health-related NEIs—will be applied annually to each weatherization project over its measure life.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a055	Window Replacement, cord wood	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a064	Window Replacement, electric	HEA	1	0.64	n/a	0.46	0.46	0.34	0.2
EB1a065	Window Replacement, gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a
GB1a065	Window Replacement, gas	HEA	1	n/a	0.58	n/a	n/a	n/a	n/a

EB1a066	Window Replacement, kerosene	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a067	Window Replacement, oil	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a068	Window Replacement, propane	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a
EB1a069	Window Replacement, wood pellets	HEA	1	n/a	0.61	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

Realization rates are based on evaluation results. [2]

Coincidence Factors:

For primary savings, a summer coincidence factor of 34% and a winter coincidence factor of 20% is used, based on the "Weighted Whole Home HVAC" load shape. [3]

Energy Load Shape:

See Appendix 1. – "Weighted Whole Home HVAC"

Revision History:

Revision Number	Issue Date	Description
20	1/14/2022	Omitted measure added
115	12/1/2022	Included additional information on software used for the vendor calculated savings
161	3/1/2023	Added missing gas BC ID G21b1A016
208	1/1/2024	Corrected CFs and load shape
325	1/1/2027	Updated RR's according to latest evaluation results

Endnotes:

1: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://library.cee1.org/system/files/library/8842/CEE_Eval_MeasureLifeStudyLights%2526HVACGDS_1Jun2007.pdf

2: NMR (2026) New Hampshire Home Energy Assistance Impact and Process Evaluation https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

3: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

HVAC Boiler

Measure Code	RES-HVAC-BLR
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of a new high efficiency condensing forced hot water boiler for space heating.

Baseline Efficiency:

For Home Energy Assistance (HEA), the baseline efficiency is the existing system.

For Home Performance with Energy STAR (HEP) and ENERGY STAR Products, the baseline is a blended condensing and non-condensing baseline of 86.0% based on findings from the 2026 New Hampshire ES Products Program Impact and Process evaluation[1].

High Efficiency:

The high-efficiency case is a gas/propane condensing boiler with an AFUE rating of either 90% or 95% depending on the measure.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔMMBtu/unit
EB1b001	Boiler Replacement, Gas	HEA	Modeled
GB1b001	Boiler Replacement, Gas	HEA	Modeled
EB1b004	Boiler Replacement, Propane	HEA	Modeled
EB1B002	Boiler Replacement, Kerosene	HEA	Modeled
EA2b001	Boiler Replacement, 90% AFUE, Gas	HEP	11.4
GA2b001	Boiler Replacement, 90% AFUE, Gas	HEP	11.4
GA2b011	Boiler Replacement, 95% AFUE, Gas	HEP	17.6
EA2b004	Boiler Replacement, 90% AFUE, Propane	HEP	11.4
EA2b002	Boiler Replacement, 90% AFUE, Kerosene	HEP	11.4
GA3b006	Condensing Boiler >= 90% AFUE (Up to 300 MBH), Gas	ES Products	11.4
GA3b007	Condensing Boiler >= 95% AFUE (Up to 300 MBH), Gas	ES Products	17.6

The HEA program uses whole-building energy modeling to estimate energy savings specific to each installation. The software models building energy usage and predicts the impact of

improvements to various components on building energy consumption based on user inputs of spaces, walls, surfaces, heating and cooling data.

For Energy Star Products and HEP, unit savings are on deemed inputs as per findings of the 2026 Energy Star Products Impact Evaluation [1].

Source Algorithm for Deemed Savings:

$$\Delta MMBtu = units \times \frac{kBtu}{h_{in}} \times \left(\frac{Eff_{ee}}{Eff_{baseline}} - 1\right) \times \frac{EFLH_{heating}}{1000}$$

Where:

ΔMMBtu = Annual fossil fuel savings
Units = number of measures installed under the program
$kBTU/h_{in}$ = Fuel input rating per unit
EFF_{ee}= Efficiency of energy efficient condition
$EFF_{basline}$ = Efficiency of baseline condition
$EFLH_{heating}$= Heating Equivalent full load hours
1,000= Conversion factor, one MMBtu equals 1,000 kBtu

Measure Life:

The measure life for gas boilers is 23 years and for propane boilers is 27 years[2,3].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR$_E$	RR$_{NE}$	RR$_{SP}$	RR$_{WP}$	CF$_{SP}$	CF$_{WP}$	Ref
EB1b001	Boiler Replacement, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	4
GB1b001	Boiler Replacement, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	4
EB1b004	Boiler Replacement, Propane	HEA	1	n/a	0.98	n/a	n/a	n/a	n/a	4
EB1B002	Boiler Replacement, Kerosene	HEA	1	n/a	0.98	n/a	n/a	n/a	n/a	4
EA2b001	Boiler Replacement, 90% AFUE, Gas	HEP	0.99	n/a	1.04	n/a	n/a	n/a	n/a	5
GA2b001	Boiler Replacement, 90% AFUE, Gas	HEP	0.99	n/a	1.04	n/a	n/a	n/a	n/a	5
GA2b011	Boiler Replacement, 95% AFUE, Gas	HEP	0.99	n/a	1.04	n/a	n/a	n/a	n/a	5

EA2b004	Boiler Replacement, 90% AFUE, Propane	HEP	0.99	n/a	1.14	n/a	n/a	n/a	n/a	5
EA2b002	Boiler Replacement, 90% AFUE, Kerosene	HEP	0.99	n/a	1.14	n/a	n/a	n/a	n/a	5
GA3b006	Condensing Boiler >= 90% AFUE (Up to 300 MBH), Gas	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	6
GA3b007	Condensing Boiler >= 95% AFUE (Up to 300 MBH), Gas	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	6

Energy Load Shape:

No electric impacts are claimed.

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

For HPWH delivered through midstream channels, the following factors apply. [13]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
GA3b006	Condensing Boiler >= 90% AFUE (Up to 300 MBH), Gas	ES Products	0.40	0.03	0.00	0.63	6
GA3b007	Condensing Boiler >= 95% AFUE (Up to 300 MBH), Gas	ES Products	0.40	0.03	0.00	0.63	6

Revision History:

Revision Number	Issue Date	Description
28	1/14/2022	Added omitted measures for Kerosene Boiler Replacements for HEA and HPwES
122	12/1/2022	Updated HPwES savings to reflect they are now calculated using Surveyor software. Added additional verbiage about the TREAT softwares used to calculate savings. Removed "Forced Hot Water" text and added avg system sizing for reference from Baseline study.
165	3/1/2023	Added impact factors for g21A3b006 and G21A3b007
252	1/1/2026	Updated high efficiency program requirements to align with application. Updated HEA RR's based on 2025 impact memo.
326	1/1/2027	Included the deemed ΔMMBtu/unit and NTG values for HEP and ES programs based on the reference provided. Corrected existing RR values based on evaluation results

Endnotes:

1: NMR Group Inc. (2026) New Hampshire Energy Star Products Final Impact Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

2: GDS, 2007. Measure Life Report. https://www.caetrm.com/media/referencedocuments/HVAC_Ltg_measure_life_GDS_2007.pdf

3: Massachusetts Residential Baseline Study Table 3-7 **https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf** (Last accessed on March 3, 2026)

4: NMR Group Inc. (2026) New Hampshire Home Energy Assistance Program Impact and Process Study, Prepared for New Hampshire EM&V Working Group https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

5: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. **https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf** (Last accessed on February 19, 2026)

6: NMR Group Inc. (2026) New Hampshire Energy Star Products Final Impact Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

HVAC Boiler Reset Control

Measure Code	RES-HVAC-BRC
Markets	Residential
Program Types	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of reset controls to automatically control boiler water temperature based on outdoor temperature or return water temperature.

Baseline Efficiency:

The baseline efficiency case is a boiler without reset controls.

High Efficiency:

The high-efficiency case is a boiler with reset controls.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on study results.[Error! Reference source not found.]

BC ID	Measure Name	Fuel Type	Program	ΔMMBtu/unit
GA3b005	Boiler Reset Control	Gas	ES Products	4.3

Measure Life:

The measure life of reset controls installed on a existing boiler is 15 years.[2:]

BC ID	Measure Name	Fuel	Program	EUL
GA3b005	Boiler Reset Control	Gas	All	15

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GA3b005	Boiler Reset Control	Gas	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	

See Appendix 1 “Residential - Non-Electric Measures”.

Revision History:

Revision Number	Date	Description
29	1/14/2021	Removed copy and paste formatting error. Baseline verbiage was originally in red text, change to black text.
88	12/1/2022	Updated evaluation references to latest versions; removed LS table and refer to Appdx 1.
327	1/1/2027	Updated energy savings based on a 2024 Massachusetts Evaluation

Endnotes:

1: Guidehouse. 2024 Massachusetts Residential Coordinated Delivery Single Family Impact Evaluation (MA23R58-B-RCD), Table A. Prepared for Massachusetts Program Administrators. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/66cc755735c35a0f2098e5d7/view?authToken=ff7ef0a6603ab2842c8c03d65486870212f80cd2f0355586f971bafc097092493ac66f56db45c7657a950d6643c95cdf6557be7ecb5dca63b3c7ad8add3fce275f332599e2e290 (Last Accessed on March 6, 2026)

2: ACEEE, 2006. Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE. (Last accessed on February 20, 2026)NY TRM V13, Appendix P, Pg 1087

HVAC Central Air-source Heat Pump

Measure Code	RES-HVAC-HPAS
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

This measure includes the installation of a high-efficiency, central air-source heat pump unit (ASHP) to serve the heating and cooling loads of a residential unit. The electric savings for this measure are realized through the increased nameplate efficiency between the baseline and installed equipment.

Baseline Efficiency:

The baseline efficiency varies as a function of replacement scenario. Unless it is verified that the efficient heat pump is a retrofit for existing electric resistance heat, the baseline scenario is assumed to be lost opportunity.

Baseline Scenario	SEER2	HSPF2	EER2	REF
Lost Opportunity	14.3	7.5	12.3	1,2
Retrofit, Electric Resistance	3.412	Site specific	n/a	3

High Efficiency:

The high efficiency case is an ENERGY STAR Certified central air source heat pump that meets Eligibility Criteria Version 6.1, revised January 2022. [3]

Product Type	SEER2	HSPF2	EER2	REF
HP Split Systems (Ducted)	≥15.2	≥8.1	Site Specific	4

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EA3b003	Air-source Heat Pump – Lost Opportunity (Cooling)	ES Products	Calculated	Calculated
EA3b004	Air-source Heat Pump – Lost Opportunity (Heating)	ES Products	Calculated	Calculated
EA3b034	Air-source Heat Pump – Retrofit Resistance	ES Products	Calculated	Calculated
EA3b003	Air-source Heat Pump – Lost Opportunity (Cooling)	ES Products	Calculated	Calculated
EA3b004	Air-source Heat Pump – Lost Opportunity (Heating)	ES Products	Calculated	Calculated
EA3b034	Air-source Heat Pump – Retrofit Resistance	ES Products	Calculated	Calculated

Algorithms for calculating electric demand savings:

$$\Delta kW = max(\Delta kW_{cool}\ or\ \Delta kW_{heat})$$

$$\Delta kW_{cool} = Cap_{cool} \times \left(\frac{1}{EER2_{Base}} - \frac{1}{EER2_{EE}}\right) \times \frac{1}{1000}$$

$$\Delta \mathrm{kW_{heat}} = \mathrm{Cap_{heat}} \times \left(\frac{1}{\mathrm{HSPF2_{BASE}}} - \frac{1}{\mathrm{HSPF2_{EE}}}\right) \times \frac{1}{1000}$$

Algorithms for calculating annual cooling and heating electric energy savings:

$$\Delta kWh_{COOL} = Cap_{COOL} \times \left(\frac{1}{SEER2_{BASE}} - \frac{1}{SEER2_{EE}}\right) \times EFLH_{COOL}$$

$$\Delta kWh_{HEAT} = Cap_{HEAT} \times \left(\frac{1}{HSPF2_{BASE}} - \frac{1}{HSPF2_{EE}}\right) \times EFLH_{HEAT}$$

Parameter	Description	Value	Unit	REF
ΔkWh_{COOL}	Gross annual cooling savings for heat pump unit	Calculated	kWh/year	
ΔkWh_{HEAT}	Gross annual heating savings for heat pump unit	Calculated	kWh/year	
ΔkW_{COOL}	Gross annual cooling demand savings for heat pump unit	Calculated	kW/year	
ΔkW_{HEAT}	Gross annual heating demand savings for heat pump unit	Calculated	kW/year	
Cap_{COOL}	Cooling capacity of the energy efficient heat pump unit For cold climate heat pumps incetnivzed by the program, Cap_{HEAT} = Cap_{COOLl}	Site specific	kBtu/h	From equipment specifications
Cap_{HEAT}	Heating capacity of the energy efficient heat pump unit.	Site specific	kBtu/h	From equipment specifications
$EER2_{BASE}$	Energy Efficiency Ratio of baseline unit	12.3	EER	**Error! Bookmark not defined.**
$EER2_{EE}$	Energy Efficiency Ratio of efficient equipment	Site specific	EER	From equipment specifications
$SEER2_{BASE}$	Seasonal Energy Efficiency Ratio of baseline cooling equipment	Lost opportunity: 14.3 Retrofit: site specific	SEER2	5,6
$SEER2_{EE}$	Seasonal Energy Efficiency Ratio of energy efficient heat pump unit	Site specific	SEER2	From equipment specifications.
$HSPF2_{BASE}$	Heating Seasonal Performance Factor of baseline heat pump unit	Lost opportunity: 7.5 Retrofit: 3.412	HSPF2	4,5
$HSPF2_{EE}$	Heating Seasonal Performance Factor of energy efficient heat pump unit	Site specific	HSPF2	From equipment specifications.
$EFLH_{COOLFULL}$	Equivalent Full Load Hours for Cooling for full displacement	377		7
$EFLH_{HEATPART}$	Equivalent Full Load Hours for heating partial displacement	1,255		6

Parameter	Description	Value	Unit	REF
$EFLH_{HEAT}$	Equivalent Full Load Hours for Heating	1,663		6

Measure Life:

The measure life of a new heat pump unit is 18 years.[8]

BC ID	Measure Name	Program	Measure Life
EA3b003	Air-source Heat Pump – Lost Opportunity (Cooling)	ES Products	18
EA3b004	Air-source Heat Pump – Lost Opportunity (Heating)	ES Products	18
EA3b034	Air-source Heat Pump – Retrofit Resistance	ES Products	18
EB1b021	Ductless Mini-split Heat Pump (Cooling)	HEA	18
EB1b022	Ductless Mini-split Heat Pump (heating)	HEA	18

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA3b003	Air-source Heat Pump – Lost Opportunity (Cooling)	ES Products	1.00	1.00	1.00	1.00	1.00	0.948	0.00	9,10,11
EA3b004	Air-source Heat Pump –Lost Opportunity (Heating)	ES Products	1.00	1.00	1.00	1.00	1.00	n/a	0.898	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**,**Error! Bookmark not defined.**
EA3b034	Air-source Heat Pump – Retrofit Resistance	ES Products	1.00	1.00	1.00	1.00	1.00	0.	0.898	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**
EB1b021	Ductless Mini-split Heat Pump (cooling)	HEA	1.00	0.91	0.91	0.91	0.91	0.948	n/a	**Error! Bookmark not defined.**,13
EB1b022	Ductless Mini-split Heat Pump (heating)	HEA	1.00	0.91	0.91	0.91	0.91	n/a	0.898	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**

Energy Load Shape:

See Appendix 1 – "Central Heat Pump"

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EA3b003	Air-source Heat Pump – Lost Opportunity (Cooling)	ES Products	0.46	0.09	0.00	0.63	14
EA3b004	Air-source Heat Pump –Lost Opportunity (Heating)	ES Products	0.46	0.09	0.00	0.63	3

Revision History:

Revision Number	Issue Date	Description
35	1/14/2022	Updated SEER to EER conversion factor used.
36	1/14/2022	Added omitted ductless mini split heating only and cooling only measures
67	3/1/2022	Added values for EFLH
94	12/1/2022	Updated high efficiency requirements to align with Energy Star Criteria.
95	12/1/2022	Updated baseline values to align with federal energy standards, effective 1/1/2023.
328	1/1/2027	Updated CF's for all measures and added NTG for lost opportunity heat pumps.

Endnotes:

1: Air conditioning split system - heat pumps manufactured on or after January 1, 2023, must have a Seasonal Energy Efficiency Ratio 2 and a Heating Seasonal Performance Factor 2 not less than 14.3 and 7.5 respectively. 10 CFR 430.32(c)(5). https://www.ecfr.gov/current/title-10/part-430#p-430.32(c)(5)

2: EER2 is calculated based on the SEER 2 value, using the following formulas. Estimated SEER = SEER2/0.95. Estimated EER = SEER X0.875. Estimated EER2= EER X 0.95

3: Electric heating system has COP = 1, which converts to an HSPF value of 3.412 Btu/w-h

4: ENERGY STAR® Program Requirements Product Specification for Central Air Conditioner and Heat Pump Equipment Version 6.1, Revised January 2022 (https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%206.1%20Central%20Air%20Conditioner%20and%20Heat%20Pump%20Final%20Specification%20%28Rev.%20January%20%202022%29.pdf)

5: The lost opportunity baseline values is a split system - heat pump manufactured on or after January 1, 2023, must have a Seasonal Energy Efficiency Ratio 2 and a Heating Seasonal Performance Factor 2 not less than 14.3 and 7.5 respectively per federal code 10 CFR 430.32(c)(5). https://www.ecfr.gov/current/title-10/part-430#p-430.32(c)(5)

6: The electric resistance verified retrofit baseline is an electric heating system which has COP of 1, which converts to an HSPF value of 3.412 Btu/w-h

7: EFLH values are applied per the 2026 ES Products Memo. NMR (2026) Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

8: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group; Page 1-3, Table 1.

9: In service rate is applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

10: Realization rates are assumed to be 100% until an evaluation finds otherwise.

11: Coincidence Factors are applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

12: In service rate is assumed to be 100% until an evaluation finds otherwise.

13: In service and realization rates for the HEA are applied per the 2020 Home Energy Assistance Program Evaluation Report. Opinion Dynamics (2020) Home Energy Assistance Program Evaluation Report 2016-2017 - FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf, Last accessed January 25, 2026

14: NTG is applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

HVAC Ductless Mini-Split Heat Pump

Measure Code	RES-HVAC-HPDL
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

This measure includes the installation of a cold climate, high-efficiency, ductless, mini-split heat pump unit (DMSHP) to serve the heating and cooling loads of a residential unit. The savings for this measure are realized through the increased nameplate efficiency between the baseline and installed equipment.

Baseline Efficiency:

The baseline efficiency varies as a function of replacement scenario. Unless it is verified the efficient heat pump is a retrofit for existing electric resistance heat, the baseline scenario for the Energy Star Products Program is assumed to be lost opportunity.

Baseline Scenario	SEER2	HSPF2	EER2	REF

Lost Opportunity	14.3	7.5	12.3	1,2
Retrofit, Electric Resistance	Site specific	3.412	Site Specific	3

High Efficiency:

The high efficiency case is an ENERGY STAR certified cold climate ductless air source heat pump that meets or exceeds Eligibility Criteria Version 6.1, revised January 2022.

Product Type	SEER2	HSPF2	EER2	REF
HP Split Systems (Non-Ducted)	≥15.2	≥8.5	Site Specific	4

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkWh
EA3b005	Ductless Mini-split Heat Pump (cooling) - Lost Opportunity	ES Products	Calculated	Calculated
EA3b006	Ductless Mini-split Heat Pump (heating) - Lost Opportunity	ES Products	Calculated	Calculated
EA3b031	Ductless Mini-split Heat Pump - Retrofit Resistance	ES Products	Calculated	Calculated
EB1b021	Ductless Mini-split Heat Pump (cooling)	HEA	Modeled	Modeled
EB1b022	Ductless Mini-split Heat Pump (heating)	HEA	Modeled	Modeled

The savings for Energy Star Products measures are calculated using the algorithms below. The savings for Home Energy Assistance measures are calculated using program approved whole home modeling software.

Algorithms for calculating electric demand savings:

$$\Delta kW = max(\Delta kW_{cool}\ or\ \Delta kW_{heat})$$

$$\Delta kW_{cool} = Cap_{cool} \times \left(\frac{1}{EER2_{Base}} - \frac{1}{EER2_{EE}}\right) \times \frac{1}{1000}$$

$$\Delta kW_{heat} = Cap_{heat} \times \left(\frac{1}{HSPF2_{BASE}} - \frac{1}{HSPF2_{EE}}\right) \times \frac{1}{1000}$$

Algorithms for calculating annual cooling and heating electric energy savings:

$$\Delta kWh_{COOL} = Cap_{COOL} \times \left(\frac{1}{SEER2_{BASE}} - \frac{1}{SEER2_{EE}}\right) \times EFLH_{COOL}$$

$$\Delta kWh_{HEAT} = Cap_{HEAT} \times \left(\frac{1}{HSPF2_{BASE}} - \frac{1}{HSPF2_{EE}}\right) \times EFLH_{HEAT}$$

Parameter	Description	Value	Unit	REF
ΔkWh_{COOL}	Gross annual cooling savings for heat pump unit	Calculated	kWh/year	
ΔkWh_{HEAT}	Gross annual heating savings for heat pump unit	Calculated	kWh/year	
ΔkW_{COOL}	Gross annual cooling demand savings for ductless, mini-split heat pump unit	Calculated	kW/year	
ΔkW_{HEAT}	Gross annual heating demand savings for heat pump unit	Calculated	kW/year	
Cap_{COOL}	Cooling capacity of the energy efficient heat pump unit,	Site specific	kBtu/h	From equipment specifications
Cap_{HEAT}	Heating capacity of the energy efficient heat pump unit. Use equation to convert from cooling capacity value if standard equipment information does not provide this value.	Site specific	kBtu/h	From equipment specifications
$Cap_{HEAT}(5)$	Heating coefficient of performance of energy efficient HP unit at 5F rating point.	Site specific	COP	From equipment specifications.
$EER2_{BASE}$	Energy Efficiency Ratio of baseline unit	12.3	EER	**Error! Bookmark not defined.**
$EER2_{EE}$	Energy Efficiency Ratio of efficient equipment	Site specific	EER	From equipment specifications
$SEER2_{BASE}$	Seasonal Energy Efficiency Ratio of baseline cooling equipment	Lost opportunity: 14.3 Retrofit: site specific	SEER2	5,6
$SEER2_{EE}$	Seasonal Energy Efficiency Ratio of energy efficient heat pump unit	Site specific	SEER2	From equipment specifications.
$HSPF2_{BASE}$	Heating Seasonal Performance Factor of baseline heat pump unit	Lost opportunity: 7.5 Retrofit: 3.412	HSPF2	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**
$HSPF2_{EE}$	Heating Seasonal Performance Factor of energy efficient heat pump unit	Site specific	HSPF2	From equipment specifications.
$EFLH_{COOLFULL}$	Equivalent Full Load Hours for Cooling for full displacement	377		7
$EFLH_{HEATPART}$	Equivalent Full Load Hours for heating partial displacement	1,255		**Error! Bookmark not defined.**

Parameter	Description	Value	Unit	REF
$EFLH_{HEAT}$	Equivalent Full Load Hours for Heating	1,663		**Error! Bookmark not defined.**

Measure Life:

BC ID	Measure Name	Measure Life	REF
EA3b005	Ductless Mini-split Heat Pump (cooling) - Lost Opportunity	18	**Error! Bookmark not defined.**
EA3b006	Ductless Mini-split Heat Pump (heating) - Lost Opportunity	18	**Error! Bookmark not defined.**
EA3b031	Ductless Mini-split Heat Pump - Retrofit Resistance	18	**Error! Bookmark not defined.**
EB1b021	Ductless Mini-split Heat Pump (cooling)	18	**Error! Bookmark not defined.**
EB1b022	Ductless Mini-split Heat Pump (heating)	18	**Error! Bookmark not defined.**

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA3b005	Ductless Mini-split Heat Pump (cooling) - Lost Opportunity	ES Products	1.00	1.00	1.00	1.00	1.00	0.839	0.00	11,12,13
EA3b006	Ductless Mini-split Heat Pump (heating) - Lost Opportunity	ES Products	1.00	1.00	1.00	1.00	1.00	0.00	0.596	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**,**Error! Bookmark not defined.**
EA3b031	Ductless Mini-split Heat Pump - Retrofit Resistance	ES Products	1.00	1.00	1.00	1.00	1.00	0.00	0.596	**Error! Bookmark not defined.**,**Error! Bookmark not defined.**
EB1b021	Ductless Mini-split Heat Pump (cooling)	HEA	1.00	0.91	0.91	0.91	0.91	0.839	n/a	**Error! Bookmark not defined.**,15
EB1b022	Ductless Mini-split	HEA	1.00	0.91	0.91	0.91	0.91	0.00	0.596	**Error! Bookmark not defined.**,16

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
	Heat Pump (heating)									

Energy Load Shape:

For cooling, see Appendix 1 – Mini-Split Air Conditioner/Heat Pump (Cooling)

For heating, see Appendix 1 – Mini-Split Heat Pump (Heating)

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EA3b005	Ductless Mini-split Heat Pump (cooling) - Lost Opportunity	ES Products	0.48	0.16	0.00	0.68	17
EA3b006	Ductless Mini-split Heat Pump (heating) - Lost Opportunity	ES Products	0.48	0.16	0.00	0.68	**Error! Bookmark not defined.**

Revision History:

Revision Number	Issue Date	Description
37	1/14/2022	Updated SEER to EER Conversion factor used
68	3/1/2022	Added Values for EFLH
96	12/1/2022	Updated high efficiency case to align with updated Energy Star Criteria Version 6.1
97	12/1/2022	Updated baseline values to align with federal energy standards, effective 1/1/2023.
176	1/1/24	Updated verbiage to show the offering is specific to cold climate heat pumps.
329	1/1/2027	Updated CF's for all measures and added NTG for lost opportunity heat pumps.

Endnotes:

1: The lost opportunity baseline values is a split system - heat pump manufactured on or after January 1, 2023, must have a Seasonal Energy Efficiency Ratio 2 and a Heating Seasonal Performance Factor 2 not less than 14.3 and 7.5 respectively per federal code 10 CFR 430.32(c)(5). https://www.ecfr.gov/current/title-10/part-430#p-430.32(c)(5)

2: EER2 is calculated based on the SEER 2 value, using the following formulas. Estimated SEER = SEER2/0.95. Estimated EER = SEER X0.875. Estimated EER2= EER X 0.95

3: The electric resistance verified retrofit baseline is an electric heating system which has COP of 1, which converts to an HSPF value of 3.412 Btu/w-h

4: The energy efficient heat pump is a one that meets or exceeds the ENERGY STAR® Program Requirements Product Specification for Central Air Conditioner and Heat Pump Equipment Version 6.1, Revised January 2022 (https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%206.1%20Central%20Air%20Conditioner%20and%20Heat%20Pump%20Final%20Specification%20%28Rev.%20January%20%202022%29.pdf)

5: The lost opportunity baseline values is a split system - heat pump manufactured on or after January 1, 2023, must have a Seasonal Energy Efficiency Ratio 2 and a Heating Seasonal Performance Factor 2 not less than 14.3 and 7.5 respectively per federal code 10 CFR 430.32(c)(5). https://www.ecfr.gov/current/title-10/part-430#p-430.32(c)(5)

6: The electric resistance verified retrofit baseline is an electric heating system which has COP of 1, which converts to an HSPF value of 3.412 Btu/w-h

7: EFLH values are applied per the 2026 ES Products Memo. NMR (2026) Energy Star Products Memo.

8: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group; Page 1-3, Table 1.

9: In service rate is applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

10: Realization rates are assumed to be 100% until an evaluation finds otherwise.

11: Coincidence Factors are applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

12: In service rate is assumed to be 100% until an evaluation finds otherwise.

13: In service and realization rates for the HEA are applied per the 2020 Home Energy Assistance Program Evaluation Report. Opinion Dynamics (2020) Home Energy Assistance Program Evaluation Report 2016-2017 - FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf, Last accessed January 25, 2026

14: In service and realization rates for the HEP are applied per the 2020 Home Performance with Energy Star Evaluation Report. Opinion Dynamics (2020) Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf, Last accessed January 25, 2026

15: NTG is applied per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo. https://www.energy.nh.gov/energy-information/completed-monitoring-evaluation-studies

HVAC ENERGY STAR Central Air Conditioning

Measure Code	RES-HVAC-ESCAC
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The installation of a high efficiency ENERGY STAR central air conditioning (AC) system.

Baseline Efficiency:

For lost opportunity and replace on failure the baseline efficiency case is the federal code of 13.4 SEER 2.

For early retirement, if values are known, then baseline is the existing air-conditioning unit SEER over its remaining life, and a SEER 14 (13.4 SEER2) central air-conditioning unit for the remaining life of the new unit. If baseline values are unknown, the baseline case over its remaining life should be the average efficiency levels of units replaced in the previous calendar year.

High Efficiency:

The high efficiency case is a program an air conditioning unit meeting the ENERGY STAR Eligibility Criteria version 6.1, revised January 2022. The minimum ENERGY STAR SEER2 requirement for the program is 15.2, the minimum EER2 is 12. [2]

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EA3b015	ENERGY STAR Central AC	ES Products	Calculated	Calculated
EB1b023	ENERGY STAR Central AC, Early Retirement	HEA	Modeled	Modeled
EA2b021	ENERGY STAR Central AC, Early Retirement	HEP	Calculated	Calculated

Source algorithm for deemed savings values:

$$\Delta kWh = Tons \times \frac{12kBtU}{hr} \times \left(\frac{1}{SEER2_{BASE}} - \frac{1}{SEER2_{EE}}\right) \times Hours$$

$$\Delta kW = \Delta kWh \times Annual\ Maximum\ Demand\ Factor$$

Where:

Tons = Cooling capacity of the central AC equipment in tons. Use actual rebated tons or if unknown assume previous year average program rebated tonnage (for 2019, was 2.85 tons).[2]

$SEER_{BASE}$ = Seasonal Energy Efficiency Ratio 2(SEER2).

1. For lost opportunity and replace on failure retrofit installation, baseline AC equipment should be 13.4 SEER2 equipment.
2. For early replacement retrofit, baseline AC equipment is divided into two components
    1. For the remaining useful life of the replaced AC equipment:
        1. if known, use the replaced (old) AC SEER value.
        2. if unknown, assume SEER 12.4[4]
    2. For the remaining useful life of the new AC equipment: baseline AC equipment should be 13.4 SEER2

$SEER2_{EE}$ = Seasonal Energy Efficiency Ratio 2 (SEER2) of new efficient AC equipment. Use actual rebated SEER2, or if unknown, assume previous calendar year average.

BC ID	Measure Name	Program	Tons	$SEER2_{BASE}$	$SEER2_{EE}$	Hours	Annual Max Demand Factor[4]
EA3b015	ENERGY STAR Central AC	ENERGY STAR Products	Use actual, if unknown use 2.85	13.44	Use actual, if unknown use 16.2	385	0.001594
EB1b032 Ea1b032	ENERGY STAR Central AC, Early Retirement	Home Performance HEA	Use actual, if unknown use 2.85	Use actual, if unknown use 10 for remaining useful life of replaced AC, 14 for remaining useful life of new AC	Use actual, if unknown use 16.2	385	0.001594

Measure Life:

The table below includes the effective useful life (EUL) for central air-conditioning units which assumes a lost opportunity installation. Retrofit installations that meet early retirement criteria should receive a remaining useful life of 6 years for a total of 18-year life[5] [6].To calculate lifetime

savings for lost opportunity and replace on failure retrofit installations, use the full EUL of 18 years with the first row of savings assumptions (ENERGY STAR Central AC) above. For retrofit installations that meet early retirement criteria, lifetime savings are based on the sum of two components: 6 years with savings from the second row of savings assumptions above (ENERGY STAR Central AC, Early Retirement) and the remaining 12 years using the lost opportunity savings assumptions (ENERGY STAR Central AC).

BC Measure ID	Measure Name	Program	Measure Life (EUL)	Measure Life (RUL)
EA3b015	ENERGY STAR Central AC	ES Products	18	n/a
EB1b023	ENERGY STAR Central AC, Early Retirement	HEA	18	6
EA2b021	ENERGY STAR Central AC, Early Retirement	Home Performance	18	6

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3b015	ENERGY STAR Central AC	ES Products	1.00	1.00	n/a	1.00	1.00	0.35	0.00
EB1b023	ENERGY STAR Central AC, Early Retirement	HEA	1.00	0.91	n/a	0.91	0.91	0.35	0.00
EA2b021	ENERGY STAR Central AC, Early Retirement	Home Performance	0.99	0.96	n/a	0.96	0.96	0.35	0.00

In-Service Rates:

In-service rates are 100% for ES Products unless an evaluation finds otherwise, 100% for HEA[7], and 99% for Home Performance[8].

Realization Rates:

Realization rates are 100% for ES Products, 91% for HEA[7] , and 96% for Home Performance[8]

Coincidence Factors:

Summer coincidence factors are estimated using the RES1 Demand Impact Model Update[5]. The winter coincidence factor is assumed to be zero

Energy Load Shape:

See Appendix 1 – "Central Air Conditioner/Heat Pump (Cooling)".

Revision History:

Revision Number	Issued Date	Revision
31	1/14/2022	Formatting, added correct BC ID's
32	1/14/2022	Updated baseline for lost opportunity to reflect NH Building code.
66	3/1/2022	Updated EFLH value used
98	12/1/2022	Updated baseline values to align with federal energy standards, effective 1/1/2023. Updated high efficiency case to align with Energy Star 6.1. Corrected algorithms to align with updated baseline and high-efficiency cases and added a conversion table for M to M1 ratings. Corrected HPwES RR value in verbiage to align with table.
177	1/1/2024	Updated $SEER_{ee}$ to most recent available annual average of rebated units, 2020-2021.
330	1/1/2027	Updated all efficiencies to SEER2

Endnotes:

1 : 10 CFR 430.32(c)(5). https://www.ecfr.gov/current/title-10/part-430/section-430.32#p-430.32(c)(5)

2: ENERGY STAR Program Requirements Product Specification for Central Air Conditioner and Heat Pump Equipment https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%206.1%20Central%20Air%20Conditioner%20and%20Heat%20Pump%20Final%20Specification%20%28Rev.%20January%20%202022%29.pdf Itron (2020) New Hampshire Residential Baseline Study. https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200826-Electric-MER-NHSaves-Res-Baseline-Report-Final.pdf

3: Average SEER for Eversource 2020-21 rebated ENERGY STAR central AC according to tracking database summary report. 1 : ENERGY STAR Program Requirements Product Specification for Central Air Conditioner and Heat Pump Equipment https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version

%206.1%20Central%20Air%20Conditioner%20and%20Heat%20Pump%20Final%20Specification%20%28Rev.%20January%20%202022%29.pdf

4 : Itron (2020) New Hampshire Residential Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/20-volume-3-residential-market-baseline-study.pdfhttps://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200826-Electric-MER-NHSaves-Res-Baseline-Report-Final.pdf

5 : Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://library.cee1.org/system/files/library/8842/CEE_Eval_MeasureLifeStudyLights%2526HVACGDS_1Jun2007.pdf

6 : RUL is based on the 2019 MA TRM, Illinois TRM version 9.0, and NEEP TRM version 9.0, which all assume an RUL of one-third the EUL, or six years.

7 : Opinion Dynamics, July 29 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL

8 : Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

HVAC ENERGY STAR Room Air Conditioning

Measure Code	**RES-HVAC-ESRAC**
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The installation of a high efficiency room air conditioning (AC) unit.

Baseline Efficiency:

The lost opportunity baseline efficiency case is a room AC unit meeting current federal standard, effective May 26, 2026, as stated in the Code of Federal Regulations, 430.32(b)(2) Energy and Water conservation Standards and their Compliance dates, section b, Room Air Conditioners.

The early replacement and retrofit baseline is the existing inefficient unit.

Product class	**CEER[1]**
1. Without reverse cycle, with louvered sides, and with a certified cooling capacity[11] of less than 6,000 Btu/h	13.1
2. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 6,000 to 7,999 Btu/h	13.7
3. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 8,000 to 13,999 Btu/h	16

Product class	CEER[1]
4. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 14,000 to 19,999 Btu/h	16
5a. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 20,000 to 27,999 Btu/h	13.8
5b. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 28,000 Btu/h or more	13.2
6. Without reverse cycle, without louvered sides, and with a certified cooling capacity of less than 6,000 Btu/h	12.8
7. Without reverse cycle, without louvered sides, and with a certified cooling capacity of 6,000 to 7,999 Btu/h	12.8
8a. Without reverse cycle, without louvered sides, and with a certified cooling capacity of 8,000 to 10,999 Btu/h	14.1
8b. Without reverse cycle, without louvered sides, and with a certified cooling capacity of 11,000 to 13,999 Btu/h	13.9
9. Without reverse cycle, without louvered sides, and with a certified cooling capacity of 14,000 to 19,999 Btu/h	13.7
10. Without reverse cycle, without louvered sides, and with a certified cooling capacity of 20,000 Btu/h or more	13.8
11. With reverse cycle, with louvered sides, and with a certified cooling capacity of less than 20,000 Btu/h	14.4
12. With reverse cycle, without louvered sides, and with a certified cooling capacity of less than 14,000 Btu/h	13.7
13. With reverse cycle, with louvered sides, and with a certified cooling capacity of 20,000 Btu/h or more	13.7
14. With reverse cycle, without louvered sides, and with a certified cooling capacity of 14,000 Btu/h or more	12.8
15. Casement-Only	13.9
16. Casement-Slider	15.3

High Efficiency:

The high efficiency case is a program-qualified ENERGY STAR room AC unit meeting the specification draft version 7 eligibility criteria, amended May 26, 2026[2].

Product Class	Version 7.0 CEER (Btu/Wh)[2]
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	14.4
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	15.1
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	17.6
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	17.6
5a. Without reverse cycle, with louvered sides, and 20,000 to 27,999 Btu/h	15.2
5b. Without reverse cycle, with louvered sides, and 28,000 Btu/h or more	14.5
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	14.1
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	14.1
8a. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	15.5
8b. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	15.3
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	15.1
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	15.2
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	15.1
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	14.4
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	14.4
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	13.4
15. Casement-Only	15.3

16. Casement-Slider	16.8

Algorithms for Calculating Primary Energy Impact

BC ID	Measure Name	Program	kWh Savings	kW Savings
EA3b016	Room Air Conditioner	ES Products	23.00	0.06
EB1a054	Room Air Conditioner	HEA	Modeled	Modeled
EA2a057	Room Air Conditioner	HEP	Modeled	Modeled

Unit savings for ENERGY STAR products measures are based on a weighted average derived from savings calculated by room air conditioner size and type in the baseline and high-efficiency cases, using 2025 Eversource program equipment mix data. Savings for HEP and HEA are modeled.

Source Algorithms for Deemed Savings Values:

$$\Delta kWh = kWh_{Baseline} - kWh_{Efficient}$$

$$kWh = \frac{Cooling\ Capacity}{CEER} \times \frac{Cooling\ EFLH}{1{,}000}$$

$$\boldsymbol{kW = \frac{Cooling\ Capacity}{CEER} \times \frac{1}{1{,}000}}$$

Where:

Cooling EFLH is 348 hours[3].

Product class	Capacity	kWh Savings	kW Savings	Weight[4]
1. Without reverse cycle, with louvered sides, and with a certified cooling capacity of less than 6,000 Btu/h	5,999	14.39	0.04	0.000
2. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 6,000 to 7,999 Btu/h	7,000	16.48	0.05	0.019
3. Without reverse cycle, with louvered sides, and with a certified cooling capacity of 8,000 to 13,999 Btu/h	11,000	21.75	0.06	0.483
4. Without reverse cycle, with louvered sides and with a certified cooling capacity of 14,000 to 19,900 Btu/h	16,950	33.51	0.10	0.057
5a. Without reverse cycle, with louvered sides and with a certified cooling capacity of 20,000 Btu/h to 27,900 Btu/h	23,950	55.63	0.16	0.005
5b. Without reverse cycle, with louvered sides and with a certified cooling capacity of 28,000 Btu/h or more	28,000	66.18	0.19	0.000
6. Without reverse cycle, without louvered sides, and with a certified cooling capacity less than 6,000 Btu/h	5,999	15.04	0.04	0.005
7. Without reverse cycle, without louvered sides and with a certified cooling capacity of 6,000 to 7,900 Btu/h	6,950	17.42	0.05	0.014
8a. Without reverse cycle, without louvered sides and with a certified cooling capacity of 8,000 to 10,900 Btu/h	9,450	21.07	0.06	0.263

Product class	Capacity	kWh Savings	kW Savings	Weight[4]
8b. Without reverse cycle, without louvered sides and with a certified cooling capacity of 11,000 to 13,900 Btu/h	12,450	28.52	0.08	0.110
9. Without reverse cycle, without louvered sides and with a certified cooling capacity of 14,000 to 19,900 Btu/h	16,950	39.92	0.11	0.000
10. Without reverse cycle, without louvered sides and with a certified cooling capacity of 20,000 Btu/h or more	20,000	46.45	0.13	0.000
11. With reverse cycle, with louvered sides, and with a certified cooling capacity less than 20,000 Btu/h	19,999	22.41	0.06	0.038
12. With reverse cycle, without louvered sides, and with a certified cooling capacity less than 14,000 Btu/h	13,999	17.29	0.05	0.000
13. With reverse cycle, with louvered sides, and with a certified cooling capacity of 20,000 Btu/h or more	20,000	24.70	0.07	0.000
14. With reverse cycle, without louvered sides, and with a certified cooling capacity of 14,000 Btu/h or more	14,000	17.04	0.05	0.000
15. Casement-Only	8,000	18.33	0.05	0.002
16. Casement-Slider	8,000	16.25	0.05	0.002
Weighted Average		**22.96**	**0.06**	

Measure Life:

The table below includes the effective useful life (EUL) for room air-conditioning units which assumes lost opportunity installation. The 4-year remaining useful life (RUL) for early replacement units is multiplied by the early replacement annual savings value above, and the remaining 8 years of the EUL for those units is multiplied by the lost opportunity savings value above.

BC ID	Measure Name	Program	EUL[5]
EA3b016	ENERGY STAR Room AC	ES Products	12
EB1a054	ENERGY STAR Room AC	HEA	12
EA2a057	ENERGY STAR Room AC	HEP	12

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EA3b016	ENERGY STAR Room AC	ES Products	1.00	1.00	n/a	1.00	1.00	0.46	0.00	6,7
EB1a054	ENERGY STAR Room AC	HEA	1.00	0.91	n/a	0.91	0.91	0.46	0.00	6,8
EA2a057	ENERGY STAR Room AC	HPwES	0.99	0.96	n/a	0.96	0.96	0.46	0.00	6,9

Energy Load Shape:

See Appendix 1 – “Residential - Room or Window Air Conditioner”.

Revision History:

Revision Number	Issue Date	Description
33	1/14/2022	Updated HPwES RR in 'Realization Rate' sub section. The RR was correct in the table, but incorrect in the verbiage.
133	12/1/2022	Added references for baseline federal code and energy star. Updated algorithm verbiage for vendor calculated savings in HEA and HPwES. Updated ES products savings from 33 kwh to 36 kwh based on VT TRM.
331	1/1/2027	Updated the baseline and high efficiency and savings value based on the code and Energy Star V7 requirements. Updated summer coincidence factor based on the reference provided

End Notes:

1: Code of Federal Regulations, 430.32 Energy and Water conservation Standards and their Compliance dates, section b, Room Air Conditioners. https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430/subpart-C/section-430.32 (Last accessed March 6, 2026)

2: Energy Star (2020) Energy Star Program Requirements Product Specification for Room Air Conditioners, Eligibility Criteria Draft Version 7, May 26, 20264.2. https://www.energystar.gov/sites/default/files/2024-11/ENERGY%20STAR%20Version%207.0%20Room%20Air%20Conditioners%20Draft%201%20Specification.pdf(Last accessed March 6, 2026)

3: Navigant Consulting, 2018. RES1 Baseline Load Shape Study. Table 3Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf (Last accessed March 6, 2026)

4: Guidehouse Comprehensive TRM Review MA19R17-B-TRM

5: California Public Utilities Commission, 2014 Database for Energy-Efficient Resources. https://cedars.cpuc.ca.gov/deer-resources/deer-versions/archive/ (Last accessed March 6, 2026), Feb. 4, 2014. Available at: http://www.deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx last accessed Sep 3, 2020.

6: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf (Last accessed March 6, 2026).

7: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf (Last accessed March 6, 2026)

8: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf (Last accessed March 6, 2026).

9: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf (Last accessed March 6, 2026)

10: Navigant Consulting, 2018. RES1 Baseline Load Shape StudyDemand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf (Last accessed March 6, 2026).

11: The certified cooling capacity is determined by the manufacturer in accordance with 10 CFR 429.15(a)(3) (Last accessed March 6, 2026)

HVAC Furnace

Measure Code	Res-HVAC-FUR
Markets	Residential
Program Types	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of a new high efficiency space heating furnace with an electronically commutated motor (ECM) for the fan.

Baseline Efficiency:

For Home Energy Assistance (HEA) and Home Energy Performance (HEP) program, the baseline efficiency is the existing system.

For Energy Star Products, the baseline for lost opportunity is 89% AFUE, while for early replacement, the baseline is 87% AFUE[1].

The HEA/HEP program is classified as a retrofit, while the ES program is considered a lost opportunity.

High Efficiency:

The high efficiency case is a new furnace with AFUE ≥ 97% (as of July 2026) with an electronically commutated motor (ECM) for the fan.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	kwh	kw	mmbtu
EA2b005	Furnace Replacement, Gas 95% AFUE	HEP	154	0.104	11
EA2b005	Furnace Replacement, Gas 97% AFUE	HEP	154	0.104	13
EB1b005	Furnace Replacement, Gas	HEA	Modeled	Modeled	Modeled
GA2b002	Furnace Replacement, Gas 95% AFUE	HEP	154	0.104	11.10

GA2b002	Furnace Replacement, Gas 97% AFUE	HEP	154	0.104	13.10
GA3b008	Furnace 95+ AFUE (<150) w/ECM Motor	ES Products	154	0.104	11.10
GA3b009	Furnace 97+ AFUE (<150) w/ECM Motor	ES Products	154	0.104	13.10
EB1b006	Furnace Replacement, Kerosene	HEA	Modeled	Modeled	Modeled
EB1b007	Furnace Replacement, Oil	HEA	Modeled	Modeled	Modeled
EB1b008	Furnace Replacement, Propane	HEA	Modeled	Modeled	Modeled
EA2b006	Furnace Replacement, Kerosene	HEP	168	0.064	Calculated
EA2b007	Furnace Replacement, Oil	HEP	168	0.064	Calculated
EA2b008	Furnace Replacement, Propane	HEP	168	0.064	Calculated
GB1b002	Furnace Replacement, Gas	HEA	Modeled	Modeled	Modeled

The HEA program uses the uses whole-building energy modeling to estimate energy savings specific to each installation. The software models building energy usage and predicts the impact of improvements to various components on building energy consumption based on user inputs of spaces, walls, surfaces, heating and cooling data.

Gas ES Products and HEP program savings are based on the NMR, Energy Star Products Impact Results[1]. Delivered fuels savings can be calculated using the algorithms below:

Saving Algorithm for Delivered Fuels:

$$\Delta MMBtu = Heating\ Load\ \times \left(\frac{1}{AFUE_{base}} - \frac{1}{AFUE_{eff}}\right)$$

Where:

Heating Load is the total heating load of the boiler, site specific

$AFUE_{base}$ is the AFUE for the baseline boiler

$AFUE_{eff}$ is the AFUE for the efficient boiler

Measure Life:

Measure life is 17 years based on MA study results[2].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GA3b008	Furnace 95+ AFUE w/ECM Motor	Gas	ES Products	1	n/a	1	n/a	n/a	n/a	n/a	
GA3b009	Furnace 97+ AFUE w/ECM Motor	Gas	ES Products	1	n/a	1	n/a	n/a	n/a	n/a	
EB1b005	Furnace Replacement	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	3
GB1b002	Furnace Replacement	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	3
EB1b006	Furnace Replacement	Kerosene	HEA	1	n/a	1.09	n/a	n/a	n/a	n/a	4
EB1b008	Furnace Replacement	Propane	HEA	1	n/a	1.20	n/a	n/a	n/a	n/a	4
EB1b007	Furnace Replacement	Oil	HEA	1	n/a	1.10	n/a	n/a	n/a	n/a	4
EA2b005	Furnace Replacement	Gas	HEP	1	n/a	1	n/a	n/a	n/a	n/a	
GA2b002	Furnace Replacement	Gas	HEP	1	n/a	1	n/a	n/a	n/a	n/a	
EA2b006	Furnace Replacement	Kerosene	HEP	1	n/a	1	n/a	n/a	n/a	n/a	
EA2b008	Furnace Replacement	Propane	HEP	1	n/a	1	n/a	n/a	n/a	n/a	
EA2b007	Furnace Replacement	Oil	HEP	1	n/a	1	n/a	n/a	n/a	n/a	

Energy Load Shape:

See Appendix 1.1 Residential “Heating & Cooling”.

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
GA3b008	Furnace 95+ AFUE (<150) w/ECM Motor	ES Products	40%	3%		63%	8
GA3b009	Furnace 97+ AFUE (<150) w/ECM Motor	ES Products	40%	3%		63%	8

Revision History:

Revision Number	Issue Date	Description
34	1/14/2022	Corrected typo in E21B1b007 delta kWh savings. Originally read 6.700, should instead match the propane savings.
123	12/1/2022	Updated HPwES savings to reflect they are now calculated using Surveyor software. Added additional verbiage about the TREAT softwares used to calculate savings.

166	3/1/2023	Added impact factors for es products measures G21A3b006 G21A3b007
253	1/1/2026	Updated HEA Impact factors for 2025 NMR results. Corrected references for ES products/ kwh savings.
332	1/1/2027	Included deemed savings value for HEP and ES products based on the references provided. Updated the impact factors table to include only gas impacts.

Endnotes:

1: NMR (2026) Energy Star Products Impact Evaluation.

2: Guidehouse, Inc (2020). Massachusetts Comprehensive TRM Review - MA19R17-B-TRM. Prepared for the electric and gas program administrators of Massachusetts part of the residential evaluation program area. https://ma-eeac.org/wp-content/uploads/MA19R17-B-TRM_Final_Report_2021-04-12_clean.pdf (Last accessed on March 10, 2026)

3: Opinion Dynamics (2020) https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

4: NMR Group, Inc. New Hampshire Home Energy Assistance Program Impact and Process Study, Prepared for New Hampshire EM&V Working Group, February 2026.

5: NMR, 2025. Impact Analysis Results for Home Energy Assistance Program – Final Memo

HVAC Heat Recovery Ventilator

Measure Code	RES-HVAC-HRV
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Heat recovery ventilators (HRVs) can help make mechanical ventilation more cost effective by reclaiming heat from exhaust airflows.

Baseline Efficiency:

The baseline efficiency case is an ASHRAE 62.2-compliant exhaust fan system with no heat recovery.

High Efficiency:

The high efficiency case is an exhaust fan system with heat recovery.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on study results.[1]

BC ID	Measure Name	Program	Δmmbtu

GA3b010	Heat Recovery Ventilator	ES Products	8.6

Measure Life:

The measure life is 20 years[2].

Other Resource Impacts:

An electric penalty results due to the electricity consumed by the system fans[1].

BC ID	Measure Name	Fuel Type	Program	ΔkWh/Unit	ΔkW/Unit
GA3b010	Heat Recovery Ventilator	Electric	ES Products	-171	-0.02

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GA3b010	Heat Recovery Ventilator	ES Products	1.00	1.00	1.00	1.00	1.00	0.34	0.21	3

Energy Load Shape:

See Appendix 1, Residential Load Shapes "Weighted HVAC - All Homes".

Revision History:

Revision Number	Date	Description
128	12/1/22	Removed reference to ERVs and updated reference to Appendix 1 for Load Shapes.
333	1/1/2027	Updated energy savings and demand savings to match source values.

Endnotes:

1: Guide house, April 2021. Comprehensive TRM Review MA19R17-B-TRM. Prepared for The Electric and Gas Program Administrators of Massachusetts, https://ma-eeac.org/wp-content/uploads/MA19R17-B-TRM_Final_Report_2021-04-12_clean.pdf, Last Accessed February 24, 2026

2: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488606996f2608c7df758/view?authToken=6770a236612f257035862a9c1b14d53b1d0e62cba1d9aa7e447f94d214233671d2ba6bf85fb164e4e1ef18ef6950114f084f370d90203f7c90c4ec9085f79d4611645427327663, Last Accessed February 24, 2026

3: Cadmus Group Inc, June 2012. Demand Impact Model User Manual – Part of the Massachusetts Residential Retrofit and Low Income Program Area Evaluation. https://ma-eeac.org/wp-content/uploads/Demand-Impact-Model-User-Manual.pdf, Last Accessed February 24, 2026

HVAC Programmable Thermostat

Measure Code	RES-HVAC-PGM
Markets	Residential
Program Types	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of a programmable thermostat, which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

Baseline Efficiency:

The baseline efficiency case is an HVAC system without a programmable thermostat.

High Efficiency:

The high efficiency case is an HVAC system that has a programmable thermostat installed.

Algorithms for Calculating Primary Energy Impact:

BC Measure ID	Measure Name	Program	ΔkWh	ΔMMbtu	REF
EB1b010	Programmable Thermostat, Gas	HEA		2.18	1
GB1b003	Programmable Thermostat, Gas	HEA		2.18	1
EB1b011	Programmable Thermostat, Kerosene	HEA		2.03	1
EB1b014	Programmable Thermostat, Wood Pellets	HEA		2.03	1
EB1b012	Programmable Thermostat, Oil	HEA		2.03	1
EB1b013	Programmable Thermostat, Propane	HEA		1.95	1
EB1b009	Programmable Thermostat, Electric	HEA	72.41		1
EB1b009	Programmable Thermostat Electric Heat (Cooling Savings)	HEA	4.42		1
EB1b010	Programmable Thermostat, Gas heating (Cooling Savings)	HEA	8.25		1
EB1b012 EB1b011 EB1b014	Programmable Thermostat - Oil/ Kerosene/ Wood Heat (Cooling Savings)	HEA	7.28		1
EB1b013	Programmable Thermostat Cooling-Propane Heat (Cooling Savings)	HEA	6.88		1
EA2b010	Programmable Thermostat, Gas	HEP		2.63	1
GA2b003	Programmable Thermostat, Gas	HEP		2.63	1

EA2b012	Programmable Thermostat, Oil	HEP		2.44	1
EA2b011	Programmable Thermostat, Kerosene	HEP		2.44	1
EA2b014	Programmable Thermostat, Wood Pellets	HEP		2.44	1
EA2b013	Programmable Thermostat, Propane	HEP		2.35	1
EA2b009	Programmable Thermostat, Electric	HEP	89.75		1
EA2b009	Programmable Thermostat Electric Heat (Cooling Savings)	HEP	8.58		1
EA2b010	Programmable Thermostat, Gas heating (Cooling Savings)	HEP	16.02		1
EA2b012 EA2b011 EA2b014	Programmable Thermostat - Oil/ Kerosene/ Wood Heat (Cooling Savings)	HEP	14.13		1
EA2b013	Programmable Thermostat Cooling-Propane Heat (Cooling Savings)	HEP	13.35		1
GA3b011	Programmable Thermostat, Gas	ES Products	3.20	2.63	1

Source Algorithm for Calculating Deemed Savings:

$$\Delta kWh = \frac{Heating\ Load\ x\ Savings\ Factor}{Units\ Per\ Home}$$

Measure Life:

The measure life is 19 years[7].

Other Resource Impacts:

No other resource impacts are included.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EB1b009	Programmable Thermostat, Electric	Electricity	HEA	1	1	n/a	1	1	0.54	0.19	3,6
EB1b010	Programmable Thermostat, Gas	Gas	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
GB1b003	Programmable Thermostat, Gas	Gas	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b011	Programmable Thermostat, Kerosene	Kerosene	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EB1b012	Programmable Thermostat, Oil	Oil	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b013	Programmable Thermostat, Propane	Propane	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b014	Programmable Thermostat, Wood Pellets	Pellet Wood	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EA2b009	Programmable Thermostat, Electric	Electricity	HEP	0.99	1	n/a	1	1	0.54	0.19	3,6
EA2b010	Programmable Thermostat, Gas	Gas	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b011	Programmable Thermostat, Kerosene	Kerosene	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b012	Programmable Thermostat, Oil	Oil	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b013	Programmable Thermostat, Propane	Propane	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b014	Programmable Thermostat, Wood Pellets	Pellet Wood	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
GA3b011	Programmable Thermostat,	Gas	ES Products	1	n/a	1	n/a	n/a	n/a	n/a	4

Energy Load Shape:

See Appendix 1.1 Residential - “Weighted HVAC- All Homes” and "Central Air Conditioner/Heat Pump (Cooling)"

Revision History:

Revision Number	Issue Date	Description
38	1/14/2022	Corrected E21A2b010 G21A2b003 to reflect kWh savings.
39	1/14/2022	Corrected realization rate verbiage to reflect the correct data shown in the table.
101	12/1/2022	Added KW savings. Updated MMBtu savings reflect a more recent follow up study from MA. Added load shape for cooling.
255	1/1/2026	Updated RR’s based on new NH HEA/HEP study results.
334	1/1/2027	Updated the deemed kWh, kW and MMBtu values based on recent studies.
335	1/1/2027	Updated the measure life based on the latest study.
336	1/1/2027	Updated the summer and winter coincidence factors.

Endnotes:

1: All unit savings are deemed by following the approach of the MAR23R56 and R58 Massachusetts RCD study by applying the programmable thermostat savings factor of 4.1% for fossil fuels and 5.5% for electric resistance from Table 1 of the Massachusetts Residential Wi-Fi and Programmable Thermostat Impacts Study to the residential heating loads for HEA and HEP participants identified in the 2026 New Hampshire HEA and HEP Impact and Process Evaluations. Please see the "NH residential Thermostat Workbook 2026" for details on assumptions. Thermostats that control both heating and cooling systems should claim cooling savings in addition to the relevant heating savings. The HEP heating load is used to calculate the Energy Star Products Savings.

2: Programmable thermostat measure life references the 2026Guidehouse Inc (2020) Massachusetts Residential Baseline Study Table 3-7 https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf (Last accessed on March 10, 2026)

3: Guidehouse (2023). MA RBUECS Demand Impact Model 2023_Guidehouse_MA_RBUECS_Demand_Impact_Model (Last accessed on March 10, 2026)

4: Assumed to be 100% until evaluated.

5: ISR.99 per: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

6: CF's applied per: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf. (Last accessed February 20, 2026)

7: Guidehouse Inc (2020) Massachusetts Residential Baseline Study Table 3-7 https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf (Last accessed on March 10, 2026)

HVAC Repair and Cleaning

Measure Code	RES-HVAC- RC
Markets	Residential
Program Types	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Undertaking of cleaning, tuning and repairs to heating systems.

Baseline Efficiency:

Existing heating system operating unsafely or one that has not been cleaned in more than one year.

High Efficiency:

The high efficiency case is a heating system cleaned or repaired within the last year.

Algorithms for Calculating Primary Energy Impact:

Savings are based on equipment tune-ups by adjusting the burner and cleaning the heat exchanger; therefore, the efficiency improves.

BC ID	Measure Name	Program	ΔTherms/kWh
GB1b005	Gas HVAC Repair: Boiler - Condensing, Water	HEA	Calculated
GB1b006	Gas HVAC Repair: Boiler - Steam	HEA	Calculated
GB1b007	Gas HVAC Repair: Boiler -Water	HEA	Calculated
GB1b008	Gas HVAC Repair: Furnace - Condensing, Ducted	HEA	Calculated
GB1b009	Gas HVAC Repair: Furnace - Ducted	HEA	Calculated
EB1b025	Gas LP HVAC Repair or Cleaning	HEA	Calculated
EB1b024	Oil K1 HVAC Repair or Cleaning	HEA	Calculated
EB1b026	GSHP HVAC Repair or Cleaning	HEA	Calculated
EB1b027	ASHP HVAC Repair or Cleaning	HEA	Calculated

Where the software is unavailable, savings can be calculated using the following algorithms:

Gross Energy Savings, Fossil Fuel

$$\Delta MMBtu = A \times HF \times \frac{1}{AFUE_E} \times ESF \times \frac{1}{1{,}000{,}000}$$

Savings by heating fuel:

$$AOG_H = \frac{\Delta MMBtu \times 1{,}000}{138{,}690}$$

$$APG_H = \frac{\Delta MMBtu \times 1{,}000}{91{,}330}$$

Equipment Type	Building Type	Fuel Type	Annual MMBTU savings	Oil Savings (Gallons)	Propane Savings (Gallons)
Furnace	Single Family	Gas	1.838	N/A	N/A
Furnace	Single Family	Oil	1.887	0.014	N/A
Furnace	Single Family	Propane	1.792	N/A	0.020
Furnace	Multi Family	Gas	0.404	N/A	N/A
Furnace	Multi Family	Oil	0.404	0.003	N/A
Furnace	Multi Family	Propane	0.404	N/A	0.004
Boiler	Single Family	Gas	2.021	N/A	N/A
Boiler	Single Family	Oil	2.074	0.015	N/A
Boiler	Single Family	Propane	1.970	N/A	0.022
Boiler	Multi Family	Gas	0.387	N/A	N/A
Boiler	Multi Family	Oil	0.387	0.003	N/A
Boiler	Multi Family	Propane	0.387	N/A	0.004

Peak Day Savings Natural Gas

$$PD_H = \Delta MMBtu \times PDF_H$$

Where:

Symbol	Description	Units	Values
A	Heated area served by boiler or furnace[1]	ft2	SF = 1,850 MF = 876
ΔMMBtu	Annual MMBtu savings - heating	MMBtu/yr	
PD_H	Natural gas peak day savings	MMBtu	
$AFUE_E$	Annual fuel utilization efficiency, existing[2]	%	For single family: 80% for unknown, 78% for natural gas, 76% for oil furnace For multifamily: boiler AFUE = 92%, furnace AFUE = 88%
HF	Average heating factor based on home's heat load. Calculated by multiplying the capacity by the EFLH[3]	Btu/ ft^2	Capacity x 1,484
ESF	Energy savings factor[4]		0.02

Measure Life:

The measure life for a HVAC cleaning and repairs is 1 year.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GB1b005	HVAC Repair: Boiler - Condensing, Water	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
GB1b006	HVAC Repair: Boiler - Steam	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
GB1b007	HVAC Repair: Boiler - Water	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
GB1b008	HVAC Repair: Furnace - Condensing, Ducted	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
GB1b009	HVAC Repair: Furnace - Ducted	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
EB1b025	Gas LP HVAC Repair or Cleaning	Gas	HEA	1.00	n/a	.91	n/a	.91	n/a	n/a	5
EB1b024	Oil K1 HVAC Repair or Cleaning	Oil	HEA	1.00	n/a	.91	n/a	0.91	n/a	n/a	5
EB1b026	GSHP HVAC Repair or Cleaning	Electric	HEA	1.00	n/a	0.91	0.91	0.91	n/a	n/a	5
EB1b027	ASHP HVAC Repair or Cleaning	Electric	HEA	1.00	n/a	0.91	0.91	0.91	n/a	n/a	5

Energy Load Shape:

No electric impacts are claimed.

Revision History:

Revision Number	Issue Date	Description
30	1/14/2022	Omitted Measure Added
74	6/1/2022	Added omitted gas measures ID's to the TRM, updated electric measures to correspond with electric utility names.
118	12/1/2022	Included additional information on software used for the vendor calculated savings. Updated back up algorithm to align with 2022 CT PSD.

Revision Number	Issue Date	Description
202	1/1/2024	Added heat pump clean and repair BC ID's that are offered in HEA
337	1/1/2027	Updated single family area default values
338	1/1/2027	Removed example calculations to ensure consistency with the rest of the TRM.
339	1/1/2027	Added a deemed savings table

Endnotes:

1: Default single family value selected based on recent data from Cadmus Group, "High Efficiency Heating Equipment Impact Evaluation Final Report", Mar. 2015. Massachusetts, Pg 53. https://neep.org/sites/default/files/resources/High-Efficiency-Heating-Equipment-Impact-Evaluation-Final-Report.pdf (Last Accessed on March 4, 2026). This evaluation reported an average size of 1,850 sq. ft. for homes with boilers in Massachusetts. Default multifamily value selected based on recent data from Energy & Resource Solutions, "R1705 R1609 Multifamily Baseline and Weatherization Opportunity Study", Oct. 2019. Connecticut, Pg 22. https://www.energizect.com/sites/default/files/documents/R1705-1609_MF_Baseline_Weatherization_Study_Final_Report_10.10.19.pdf (Last Accessed on March 4, 2026). This evaluation reported an average size of 876 sq. ft for multifamily units

2: The value of 80% and 78% is based on verified data from Cadmus Group, "High Efficiency Heating Equipment Impact Evaluation Final Report", Mar. 2015. Massachusetts., Table 4, and Multifamily defaults are based on data from Energy & Resource Solutions, "R1705 R1609 Multifamily Baseline and Weatherization Opportunity Study", Oct. 2019. Connecticut, see Table 4-27. https://www.energizect.com/sites/default/files/documents/R1705-1609_MF_Baseline_Weatherization_Study_Final_Report_10.10.19.pdf (Last Accessed on March 4, 2026),. Defaults should be used except in situations where either actual nameplate ratings or actual efficiency test data are available.

3: The heating factor is calculated by multiplying the full-load capacity of the equipment by the EFLH. The EFLH is derived from the residential EFLH values calculator provided as part of the 2026 Energy Star Products study. **4:** ESF minimum value of 2% value from Dethman & Associates, "Building Tune-Up and Operations Program Evaluation", March 2007, Oregon, Pg 5. https://www.energytrust.org/wp-content/uploads/2016/11/0705_BTO_ProgramEvaluation.pdf (Last Accessed on March 4, 2026)

4: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf (Last Accessed on March 4, 2026)

HVAC Room Air Purifier

Measure Code	RES-APP-RAP
Markets	Residential
ProgramTypes	Lost Opportunity, Retrofit
Categories	Appliances

Measure Description:

Room air purifiers exceeding minimum qualifying efficiency standards established as ENERGY STAR®.

Baseline Efficiency:

The baseline efficiency case is in compliance with the Federal Code 10 CFR 430.32**Error! Reference source not found.** [2; 3]. If the manufacturing date or product capacity is not available, please refer to the IEF values listed below, which have been calculated as the average of the other IEF values. The standby power for baseline is assumed to be 1 watt[7].

CADR Range	Weight*	PM 2.5 CADR	HOU**	CF	IEF Baseline (CADR/W)
30-100	11%	59.2	5,840	0.67	1.9
101-150	33%	130.5	5,840	0.67	2.4
151-200	15%	161.0	5,840	0.67	2.9
201-250	22%	226.4	5,840	0.67	2.9
>250	19%	358.5	5,840	0.67	2.9

* 2026 NH TRM. Cited to 2019 - Aug 2020 National Grid rebated units.
**[2] DOE air cleaner test procedure assumption. Consistent with AHAM AC-7-2022.

High Efficiency:

The current Version 3.0 EnergyStar specification[6] based on the product capacity is listed below. These requirements became effective on October 9, 2025. The standby power for the efficient case is assumed to be 0.6 watts[7].

CADR Range	Weight*	PM 2.5 CADR	HOU**	CF	IEF Efficient (CADR/W)
30-100	11%	59.2	5,840	0.67	5.7
101-150	33%	130.5	5,840	0.67	6.8
151-200	15%	161.0	5,840	0.67	6.9
201-250	22%	226.4	5,840	0.67	6.2
>250	19%	358.5	5,840	0.67	8.0

* 2026 NH TRM. Cited to 2019 - Aug 2020 National Grid rebated units.
**[2] DOE air cleaner test procedure assumption. Consistent with AHAM AC-7-2022.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based study results.[4;]

BC ID	Measure Name	Program	ΔkWh	ΔkW
EA3b025	Room Air Purifier	ES Products	250.1	0.035

The weight is based on 2019 - Aug 2020 National Grid rebated units.

CADR Range	Median CADR	Baseline Consumption (kWh)	High Efficiency Consumption (kWh)	Energy Savings (kWh)	Demand Savings (kW)	Weight
30-99	64.5	201.17	87.36	113.81	0.0193	11%
100-149	124.5	305.87	136.40	169.47	0.0288	33%
151-200	150	304.99	158.18	146.81	0.0249	15%
201-250						22%
>250						19%
Unknown	--	--	--	150.66	0.0256	--

Source Algorithm for Deemed Savings Values:

$$\Delta kWh = (\frac{CADR_{PM2.5}}{1000}) \times (\frac{1}{IEF_{Baseline}} - \frac{1}{IEF_{Efficient}}) \times HOU$$

$$\Delta kW = \frac{\Delta kWh}{HOU} * CF$$

Where:

ΔkWh: Annual energy savings per unit (kWh/year)

$CADR_{PM2.5}$: Clean Air Delivery Rate for PM2.5 particulate matter (cfm (cubic feet per minute))

$IEF_{Baseline}$: Integrated Energy Factor of the baseline unit (air cleaning output per unit energy) (CADR/Watt)

$IEF_{Efficient}$: Integrated Energy Factor of the efficient unit (CADR/Watt)

HOU: Annual hours of use (hours/year)

CF: Coincidence factor

Measure Life:

The measure life is 9 years. [4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EA3b025	Room Air Purifier	ES Products	0.97	1.00	n/a	1.00	1.00	0.56	0.63	3,6

Energy Load Shape:

See Appendix 1 – Residential - "24 hour operation".[6:]

Revision History:

Revision Number	Date	Description
134	12/1/2022	Updated savings values to align with the most recent MA study.
340	1/1/2027	Updated the baseline case to align with federal code requirements
341	1/1/2027	Updated the efficient case based on the latest Energy Star Version 3.0 Air Cleaner specifications
342	1/1/2027	Added savings algorithms and updated the deemed savings values

Endnotes:

1: Code of Federal Regulation 10 CFR 430.32 - Energy and water conservation standards and their compliance dates

2: The Clean Air Delivery Rate is voluntary standard made available for comparing the performance of portable air filters in a room at steady-state conditions during a controlled laboratory test: ANSI/AHAM AC-1-2015 (AHAM 2015). It was developed by the Association of Home Appliance Manufacturers (AHAM), a private voluntary standard-setting trade association, and is recognized by the American National Standards Institute (ANSI).

3: NMR (2026) NH ES Products Memo

4: Guidehouse (2021) Comprehensive TRM Review https://ma-eeac.org/wp-content/uploads/MA19R17-B-TRM_Final_Report_2021-04-12_clean.pdf (Last accessed March 3, 2026)

5: NMR Group, Inc. (2018). RLPNC 17-4 and 17-5: Products Impact Evaluation of In-Service and Short Term Retention Rates Study. https://ma-eeac.org/wp-content/uploads/RLPNC_1745_APSProductsSurveys_5Oct2018_Final.pdf (Last accessed February 20, 2026)

6: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf. (Last accessed February 20, 2026)

7: Energy Star Program Requirements for Room Air Cleaners https://www.energystar.gov/sites/default/files/2025-

01/ENERGY%20STAR%20Version%203.0%20Room%20Air%20Cleaners%20Final%20Specification%20with%20Partner%20Commitments.pdf (Last accessed March 3, 2026)

8: Energy Star Appliance Calculator https://dnr.mo.gov/sites/dnr/files/media/file/2021/01/energy-star-appliance-calculator.xlsx (Last accessed March 3, 2026)

HVAC Thermostat - Wi-Fi Communicating

Measure Code	RES-HVAC-CMG
Markets	Residential
Program Types	Retrofit, Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

A communicating Wi-Fi enabled thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems.

Baseline Efficiency:

The retrofit baseline efficiency case for HEA and HEP is a manual thermostat as the incentive is limited to HVAC system with a bimetallic spring for temperature sensing.

The lost opportunity baseline for Energy Star products an existing manual or programmable thermostat.

High Efficiency:

The high efficiency case is an HVAC system that has a Wi-Fi enabled thermostat installed.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh/Tstat	ΔMMbtu/Tstat	REF
EA2b015	Wifi Thermostat , Electric	HEP	192.63		1
EA2b015	Wifi Thermostat , Electric (cooling)	HEP	8.58		1
EA2b016	Wifi Thermostat, Gas	HEP		5.64	1
GA2b004	Wifi Thermostat, Gas	HEP		5.64	1
EA2b016	Wifi Thermostat, Gas (cooling)	HEP	16.02		1
GA2b004	Wifi Thermostat, Gas (cooling)	HEP	16.02		1
EA2b017	Wifi Thermostat, Kerosene	HEP		5.23	1

EA2b017	Wifi Thermostat, Kerosene (cooling)	HEP	14.13		1
EA2b018	Wifi Thermostat, Oil	HEP		5.23	1
EA2b018	Wifi Thermostat, Oil (cooling)	HEP	14.13		1
EA2b019	Wifi Thermostat, Propane	HEP		5.04	1
EA2b019	Wifi Thermostat, Propane (cooling)	HEP	13.35		1
EA2b020	Wifi Thermostat, Wood Pellets	HEP		5.23	1
EA2b020	Wifi Thermostat, Wood Pellets (cooling)	HEP	14.13		1
EB1b015	Wifi Thermostat , Electric	HEA	155.41		1
EB1b015	Wifi Thermostat , Electric (cooling)	HEA	4.42		1
EB1b016	Wifi Thermostat, Gas	HEA		4.69	1
GB1b004	Wifi Thermostat, Gas	HEA		4.69	1
EB1b016	Wifi Thermostat, Gas (cooling)	HEA	8.25		1
GB1b004	Wifi Thermostat, Gas (cooling)	HEA	8.25		1
EB1b017	Wifi Thermostat, Kerosene	HEA		4.35	1
EB1b017	Wifi Thermostat, Kerosene (cooling)	HEA	7.28		1
EB1b018	Wifi Thermostat, Oil	HEA		4.35	1
EB1b018	Wifi Thermostat, Oil (cooling)	HEA	7.28		1
EB1b019	Wifi Thermostat, Propane	HEA		4.19	1
EB1b019	Wifi Thermostat, Propane (cooling)	HEA	6.88		1
EB1b020	Wifi Thermostat, Wood Pellets	HEA		4.35	1
EB1b020	Wifi Thermostat, Wood Pellets (cooling)	HEA	7.28		1
EA3b026	Wifi Thermostat (Heating & Cooling)	ES Products	.100.19	2.11	1
GA3b020	Wifi Thermostat (Heating & Cooling)	ES Products	12.02	3.01	2
GA3b019	Wifi Thermostat (Heating Only)	ES Products		3.01	2

All savings provided are savings per thermostat. Unit savings for HEA and HEP are deemed by applying the manual thermostat replacement factor of 8.8% from Table 1 of the Massachusetts Residential Wi-Fi and Programmable Thermostat Impacts Study to the residential heating loads for HEA and HEP participants identified in the 2026 New Hampshire HEA and HEP Impact and Process Evaluations. Please see the "NH residential Thermostat Workbook 2026" for details on assumptions. Thermostats that control both heating and cooling systems should claim cooling savings in addition to the relevant heating savings.

The utilities are not claiming any peak kW demand reductions until impact evaluation results are available, as savings are driven by runtime reductions rather than demand reductions.

Measure Life:

The measure life is 19 years[3].

Other Resource Impacts:

No other impacts are reported.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EA3b026	Wi-Fi Thermostat Heating and cooling	Fuel Blind	ES Products	0.88	1.00	1.00	n/a	n/a	0.54	0.19	2,6
GA3b020	Wi-Fi Thermostat Heating and cooling	Fuel Blind	ES Products	0.88	1.00	1.00	n/a	n/a	n/a	n/a	2
GA3b019	Wi-Fi Thermostat Heating only	Fuel Blind	ES Products	0.88	1.00	1.00	n/a	n/a	n/a	n/a	2
EB1b015	Wi-Fi Thermostat, Electric	Electricity	HEA	1	1	n/a	1	1	0.54	0.19	4,6
EB1b016	Wi-Fi Thermostat, Gas	Gas	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
GB1b004	Wi-Fi Thermostat, Gas	Gas	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b017	Wi-Fi Thermostat, Kerosene	Kerosene	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b018	Wi-Fi Thermostat, Oil	Oil	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EB1b019	Wi-Fi Thermostat, Propane	Propane	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EB1b020	Wi-Fi Thermostat, Wood Pellets	Pellet Wood	HEA	1	n/a	1	n/a	n/a	n/a	n/a	4
EA2b015	Wi-Fi Thermostat, Electric	Electricity	HEP	0.99	1	n/a	1	1	0.54	0.19	5,6
EA2b016	Wi-Fi Thermostat, Gas	Gas	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
GA2b004	Wi-Fi Thermostat, Gas	Gas	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b017	Wi-Fi Thermostat, Kerosene	Kerosene	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b018	Wi-Fi Thermostat, Oil	Oil	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b019	Wi-Fi Thermostat, Propane	Propane	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5
EA2b020	Wi-Fi Thermostat, Wood Pellets	Pellet Wood	HEP	0.99	n/a	1	n/a	n/a	n/a	n/a	5

Energy Load Shape:

See Appendix 1.1 Residential - “Weighted HVAC- All Homes”, “Central Air Conditioner/Heat Pump (Cooling)” and “Mini-Split Air Conditioner/Heat Pump (Cooling)”

Revision History:

Revision Number	Issue Date	Description
258	1/1/2026	Updated HEP RR's based on study results.
		Updated the deemed kWh, kW and MMBtu values based on recent studies.
343	1/1/2027	Updated the measure life based on the latest study.
344	1/1/2027	Updated the summer and winter coincidence factors.

Endnotes:

1: Unit savings for HEA and HEP are deemed by applying the manual thermostat replacement factor of 8.8% from Table 1 of the Massachusetts Residential Wi-Fi and Programmable Thermostat Impacts Study to the residential heating loads for HEA and HEP participants identified in the 2026 New Hampshire HEA and HEP Impact and Process Evaluations. Please see the “NH residential Thermostat Workbook 2026” for details on assumptions. Thermostats that control both heating and cooling systems should claim cooling savings in addition to the relevant heating savings.

2: Wi-fi Thermostat MMBtu savings, measure life and ISR are applied per the Energy Star Products Program reference the 2026 Energy Star Products Impact Memo. NMR (2026) New Hampshire Energy Star Products Impact Memo

3: Guidehouse Inc (2020) Massachusetts Residential Baseline Study Table 3-7 https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf (Last accessed on March 10, 2026)

Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf (Last accessed on March 10, 2026)

4: ISR.99 per: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

5: Coincidence factors are applied per: Guidehouse (2023). MA RBUECS Demand Impact Model 2023_Guidehouse_MA_RBUECS_Demand_Impact_Model (Last accessed on March 10, 2026)

Hot Water Faucet Aerator

Measure Code	RES-HW-FA
Markets	Residential
ProgramTypes	Retrofit
Categories	Hot Water

Measure Description:

Installation of aerators meeting the EPA Water Sense specification to replace Federal Standard or higher flow faucet aerators.

Baseline Efficiency:

The baseline efficiency case is the existing faucet aerators with Federal Standard[1] flow rate of 2.2 gallons per minute (GPM) or higher.

High Efficiency:

The high-efficiency case is a low flow faucet aerator with EPA Water Sense specified maximum flow rate of 1.5 GPM[2].

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW[4]	ΔMMBtu
EB1a009	Faucet Aerator, Electric	HEA	46.863	0.011	
EB1a010	Faucet Aerator, Gas	HEA			0.156
GB1a002	Faucet Aerator, Gas	HEA			0.156
EB1a011	Faucet Aerator, Kerosene	HEA			0.156

EB1a012	Faucet Aerator, Oil	HEA			0.156
EB1a013	Faucet Aerator, Propane	HEA			0.156
EA2a009	Faucet Aerator, Electric	HPwES	46.863	0.011	
EA2a010	Faucet Aerator, Gas	HPwES			0.156
GA2a002	Faucet Aerator, Gas	HPwES			0.156
EA2a011	Faucet Aerator, Kerosene	HPwES			0.156
EA2a012	Faucet Aerator, Oil	HPwES			0.156
EA2a013	Faucet Aerator, Propane	HPwES			0.156

Measure Life:

The measure life is 7 years.[5]

Other Resource Impacts:

Residential annual water savings for faucet aerators is 586 gallons per unit[6].

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RRN_E	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a009	Faucet Aerator	Electric	HEA	1	1	n/a	1	1	0.31	0.81
EB1a010	Faucet Aerator	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
GB1a002	Faucet Aerator	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a011	Faucet Aerator	Kerosene	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a012	Faucet Aerator	Oil	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a013	Faucet Aerator	Propane	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EA2a009	Faucet Aerator	Electric	HEP	0.99	0.52	n/a	0.96	0.96	0.31	0.81
EA2a010	Faucet Aerator	Gas	HEP	0.99	n/a	0.7	n/a	n/a	n/a	n/a
GA2a002	Faucet Aerator	Gas	HEP	0.99	n/a	0.7	n/a	n/a	n/a	n/a
EA2a011	Faucet Aerator	Kerosene	HEP	0.99	n/a	1.14	n/a	n/a	n/a	n/a
EA2a012	Faucet Aerator	Oil	HEP	0.99	n/a	0.4	n/a	n/a	n/a	n/a
EA2a013	Faucet Aerator	Propane	HEP	0.99	n/a	0.41	n/a	n/a	n/a	n/a

In-Service Rates:

In-service rates are 99% for HEP programs and are 100% HEA programs based on evaluation results[7,8].

Realization Rates:

Realization rates for HEA are based on evaluation results [9] [10]. Realization rates for HEP are 100% for measures that use the deemed savings provided. If savings are modeled, the realization rates from the 2025 NMR final impact memo are used for all fuel types except Kerosene, which references the 2020 HPwES Impact study[11] [12]

Coincidence Factors:

A summer coincidence factor of 31% and a winter coincidence factor of 81% are utilized for faucet aerators with electric fuel type.[13]

Energy Load Shape:

See Appendix 1 "Water Heater – Electric"[4]

Revision History:

Revision Number	Date	Revision
119	12/1/2022	Included additional information on software used for the vendor calculated savings. Updated RR verbiage to align with table.
250	1/1/2026	Updated realization rates according to 2025 HEA and HEP final impact memos.

Endnotes:

1: In 1998, the Department of Energy adopted a maximum flow rate standard of 2.2 gpm at 60 psi for all faucets: 63 Federal Register 13307; March 18, 1998. https://www.epa.gov/sites/production/files/2017-02/documents/ws-specification-home-final-suppstatement-v1.0.pdf

2: Water Sense: Bathroom Faucets. https://www.epa.gov/watersense/bathroom-faucets

3: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200729-NHSaves-HEA-Evaluation-Report-FINAL.pdf

4: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

5: Faucet aerator is an add on measure. Measure life assumes 1/3 the life of the host equipment (faucet).

6: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200729-NHSaves-HEA-Evaluation-Report-FINAL.pdf

7: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

8: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

9: NMR, 2025. Impact Analysis Results for Home Energy Assistance Program – Final Memo

10: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

11: NMR, 2025. Impact Analysis Results for Home Energy Performance Program – Final Memo

12: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/20200729-NHSaves-HEA-Evaluation-Report-FINAL.pdf

13: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Hot Water Heat Pump Water Heater

Measure Code	**RES-HW-HPWH**
Markets	Residential
ProgramTypes	Retrofit, Lost opportunity
Categories	Hot Water

Measure Description:

Installation of an Energy Star ® certified heat pump storage water heater, either through direct installation programs to replace an electric resistance storage water heater, or as a lost opportunity retail offering.

Baseline Efficiency:

The retrofit baseline efficiency case for HEA and HEP is the existing equipment.

The lost opportunity baseline is a blended baseline of electric and fossil fuel water heating based on study results, used for retail and midstream offerings through the Energy Star Product Program where customer-specific baselines are unknown.

			Default Value – Electric[1]	**Default Value – Gas, Propane[2]**	**Default Value – Oil[3]**
Baseline Type	**Storage Capacity**	**Tank size**	**UEF_{base}**	**UEF_{base}**	**UEF_{base}**
Lost Opportunity	≥20 gal and ≤ 55 gal	50	1.02	0.74	0.71
Lost Opportunity	> 55 gal ≤ 120 gal	80	1.02	0.74	0.71

			Default Value – Electric[1]	Default Value – Gas, Propane[2]	Default Value – Oil[3]
Retrofit	Site Specific	Site Specific	Site Specific	Site Specific	Site Specific

Baseline Fuel Weights	Retail Program[4]	Midstream Program[5]
Electric	0.56	0.59
Propane + Gas	0.27	0.16
Oil + Other	0.17	0.25

High Efficiency:

The high efficiency case for a storage, hardwired heat pump water heater is a high efficiency Energy Star ® certified heat pump storage water heater with a UEF of 3.30 or greater. The high efficiency case for a 120V or split system heat pump water heaters is the program requirement of 2.82 UEF or greater.

Heat Pump Water Heater Type	Program Eligibility	REF
Integrated Hardwired HPWH	UEF ≥ 3.30	[6]
Integrated Plug-in HPWH, 120 volt / 15 Amp Circuit*	UEF ≥ 2.82	Program Set Requirement*
Split System HPWH*	UEF ≥ 2.82	Program Set Requirement*

*Program requirements for integrated and split system are beyond ES requirement for cost effectiveness.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	Summer kW	Winter kW	ΔMMbtu	Ref
EB1a043	DHW Heat Pump Water Heater	HEA	Modeled	Modeled	Modeled	Modeled	7
EA2a043	DHW Heat Pump Water Heater	HEP	Modeled	Modeled	Modeled	Modeled	**Error! Bookmark not defined.**
EA3b007	Heat Pump Water Heater, <55 gal - Downstream	ES Products	602	0.12	0.09	5.80	8
EA3b008	Heat Pump Water Heater, >55 gal - Downstream	ES Products	602	0.12	0.09	5.80	**Error! Bookmark not defined.**
EA3b035	Heat Pump Water Heater, <55 gal - Midstream	ES Products	695	0.13	0.10	5.43	**Error! Bookmark not defined.**
EA3b036	Heat Pump Water Heater, >55 gal - Midstream	ES Products	695	0.13	0.10	5.43	**Error! Bookmark not defined.**
EA3b038	Heat Pump Water Heater 120v, <55 gal - Downstream	ES Products	434	0.09	0.07	5.80	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ΔkWh	Summer kW	Winter kW	ΔMMbtu	Ref
EA3b039	Heat Pump Water Heater 120v, >55 gal - Downstream	ES Products	434	0.09	0.07	5.80	**Error! Bookmark not defined.**
EA3b040	Heat Pump Water Heater 120v, <55 gal - Midstream	ES Products	528	0.11	0.08	5.43	**Error! Bookmark not defined.**
EA3b041	Heat Pump Water Heater 120v, >55 gal - Midstream	ES Products	528	0.11	0.08	5.43	**Error! Bookmark not defined.**

Measure Life:

The measure life is 15 years.[9]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EB1a043	Heat Pump Water Heater	HEA	1.00	0.91	n/a	0.91	0.91	0.41	0.74	10,11
EA2a043	Heat Pump Water Heater	HEP	0.99	0.96	n/a	0.96	0.96	0.41	0.74	12,**Error! Bookmark not defined.**
EA3b007	Heat Pump Water Heater, <55 gal - Downstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	13,11
EA3b008	Heat Pump Water Heater, >55 gal - Downstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**
EA3b035	Heat Pump Water Heater, <55 gal - Midstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**
EA3b036	Heat Pump Water Heater, >55 gal - Midstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**
EA3b038	Heat Pump Water	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not**

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
	Heater 120v, <55 gal - Downstream									**defined.,Error! Bookmark not defined.**
EA3b039	Heat Pump Water Heater 120v, >55 gal - Downstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**
EA3b040	Heat Pump Water Heater 120v, <55 gal - Midstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**
EA3b041	Heat Pump Water Heater 120v, >55 gal - Midstream	ES Products	1.00	1.00	n/a	1.00	1.00	0.41	0.74	**Error! Bookmark not defined.,Error! Bookmark not defined.**

Energy Load Shape:

See Appendix 1 – "Water Heater – Heat Pump".

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EA3b007	Heat Pump Water Heater, <55 gal - Downstream	ES Products	0.33	0.01	0.00	0.67	14
EA3b008	Heat Pump Water Heater, >55 gal - Downstream	ES Products	0.33	0.01	0.00	0.67	14
EA3b038	Heat Pump Water Heater 120v, <55 gal - Downstream	ES Products	0.33	0.01	0.00	0.67	14
EA3b039	Heat Pump Water Heater 120v, >55 gal - Downstream	ES Products	0.33	0.01	0.00	0.67	14
EA3b035	Heat Pump Water Heater, <55 gal - Midstream	ES Products	0.23	0.00	0.00	0.77	15
EA3b036	Heat Pump Water Heater, >55 gal - Midstream	ES Products	0.23	0.00	0.00	0.77	15
EA3b040	Heat Pump Water Heater 120v, <55 gal - Midstream	ES Products	0.23	0.00	0.00	0.77	15
EA3b041	Heat Pump Water Heater 120v, >55 gal - Midstream	ES Products	0.23	0.00	0.00	0.77	15

Revision History:

Revision Number	Issue Date	Description
21	1/14/2022	Measure names of the residential ES products heat pump water heater offerings updated to match implementation's naming conventions.
22	1/14/2022	Added BC IDs to encompass all measures in BC model.
92	12/1/2022	Updated measure savings to reflect a lost opportunity offering, as this most closely reflects the current offerings.
93	12/1/2022	Updated measure life based on latest measure life study from CT.

230	1/1/2025	Updated deemed savings based on recommendation from 2023 New Hampshire Baseline Practices Report by NMR to update baseline for direct install HPWHs to align with a baseline of federal minimum efficiency standards.
233	3/17/2025	Updated baseline verbiage for clarity, added new BC ID's for the 120v HPWHs.
345	1/1/2027	Updated baseline efficiency values, savings values and NTG for Energy Star Products Measures per the 2026 NH ES Products study.

Endnotes:

1: Code of Federal Regulations 430.32 Energy and water conservation standards and their compliance dates. https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430/subpart-C/section-430.32#p-430.32(d), Last accessed April 15, 2026

2: R1614/R1613 CT HVAC and Water Heater Process and Impact Evaluation, West Hill Energy and Computing, EMI Consulting & Lexicon Energy Consulting, Jul. 19, 2018. pp. 8.6-8.8. https://www.energizect.com/sites/default/files/documents/R1614-1613_ResHVAC_Report_Final_8.29.18.pdf, Last accessed January 25, 2026;

3: R1614/R1613 CT HVAC and Water Heater Process and Impact Evaluation, West Hill Energy and Computing, EMI Consulting & Lexicon Energy Consulting, Jul. 19, 2018. pp. 8.6-8.8. https://www.energizect.com/sites/default/files/documents/R1614-1613_ResHVAC_Report_Final_8.29.18.pdf, Last accessed January 25, 2026.

4: Blended baseline fuel type weightings for downstream heat pump water haters are derived from the 2026 ES Products Memo. NMR (2026) New Hampshire Energy Star Products Impact Memo

5: Blended baseline fuel type weightings for midstream heat pump water heaters are derived from 2023-2025 NH Energy Star Products Program sales data for units incentivized through instant rebate and installers.

6: Energy Star Heat Pump Water Heater Specification v. 5.0. https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Residential%20Water%20Heaters%20Version%205.0%20Specification%20and%20Partner%20Commitments.pdf, Last accessed January 25, 2026

7: Savings for the HEA and HEP programs are modeled using whole home energy modeling software.

8: Savings for ES Products downstream and midstream measures are derived from the 2026 Energy Star Products Impact Memo. NMR (2026) New Hampshire Energy Star Products Impact Memo

9: Michaels Energy (2022) x2001A CT Measure Life/EUL Update Study- Residential Measures CT, https://www.energizect.com/sites/default/files/2022-07/CT%20X2001A%20EUL%20Res%20Measure%20Report%20FINAL060522.pdf, Last accessed January 25, 2026

10: In service and realization rates for the HEA are applied per the 2020 Home Energy Assistance Program Evaluation Report. Opinion Dynamics (2020) Home Energy Assistance Program Evaluation Report 2016-2017 - FINAL

https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf, Last accessed January 25, 2026

11: Coincidence factors are based on the MA Demand Impact Model Update. Guidehouse Inc (2020) Residential Baseline Study Phase 4 https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf, Last accessed January 25, 2026

12: In service and realization rates for the HEP are applied per the 2020 Home Performance with Energy Star Evaluation Report. Opinion Dynamics (2020) Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf, Last accessed January 25, 2026

13: The in-service rate is applied per the 2026 New Hampshire Energy Start Products Impact Memo. Energy Star Products Savings are deemed based on study results and assume 100% RR. NMR (2026) New Hampshire Energy Star Products Memo.

14: NTG is applied to downstream HPWH measures per the 2026 New Hampshire Energy Star Products Memo. NMR (2026) New Hampshire Energy Star Products Memo.

15: NTG is applied to midstream measures per Michael's Energy, June 26, 2020. Efficiency Maine HPWH Free-ridership and Baseline Assessment Results Memo. https://www.efficiencymaine.com/docs/Heat-Pump-Water-Heater-Free-ridership-and-Baseline-Assessment.pdf. Last accessed January 25, 2026.

Hot Water Pipe Insulation

Measure Code	RES-HW-PI
Markets	Residential
ProgramTypes	Retrofit
Categories	Hot Water

Measure Description:

Installation of insulation on domestic hot water and/or heating pipes. For hot water pipes, savings are limited to the first 6 linear feet of installed pipe insulation per water heater.

Baseline Efficiency:

The baseline efficiency case is the existing uninsulated domestic hot water and/or heating piping system located in non-conditioned spaces.

High Efficiency:

The high efficiency case is the domestic hot water and/or heating piping system in unconditioned spaces with insulation installed.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWH	ΔkW	ΔmmBtu
EA2a037	Pipe Insulation - Hot Water, Electric	HEP	Calculated	Calculated	
EA2a038	Pipe Insulation - Hot Water, Gas	HEP			Calculated
EA2a039	Pipe Insulation - Hot Water, Kerosene	HEP			Calculated
EA2a040	Pipe Insulation - Hot Water, Oil	HEP			Calculated
EA2a041	Pipe Insulation - Hot Water, Propane	HEP			Calculated
EB1a037	Pipe Insulation - Hot Water, Electric	HEA	Calculated	Calculated	
EB1a038	Pipe Insulation - Hot Water, Gas	HEA			Calculated
EB1a039	Pipe Insulation - Hot Water, Kerosene	HEA			Calculated
EB1a040	Pipe Insulation - Hot Water, Oil	HEA			Calculated
EB1a041	Pipe Insulation - Hot Water, Propane	HEA			Calculated
GA2a011	Pipe Insulation - Hot Water, Gas	HEP			Calculated
GB1a011	Pipe Insulation - Hot Water, Gas	HEA			Calculated

Savings Algorithm:

The savings should be limited to the first 6 linear feet of installed pipe insulation per water heater[1]. The calculations are borrowed from the 2022 Connecticut Program Savings Document. Annual savings for DHW and heating pipes are estimated based on pipe size. The savings values are per foot of hot pipe coming from the water heater in unconditioned space and are based on NAIMA's 3E Plus software as recommended by Nexant's Home Energy Solutions 2011 Evaluation Report [2,3].

Electric Gross Energy & Demand Savings

Water heater: $AKWH_w = AKW_w \; x \; L$

Heating: $AKWH_H = AKW_H \; x \; L$

Annual Electrical Savings per Linear Foot of Pipe Insulation.

Pipe Diameter(inches)	AKW_W	AKW_H
0.50	12.1	
0.75	18.1	12.9
1.00		16.0
1.25		19.6
1.50		22.2
2.00		57.74

Retrofit Gross Seasonal Peak Demand Savings, Electric (winter and summer)

For DHW, the summer seasonal peak demand savings is:

$$SKW_w = \frac{AKWH \times PF_S}{1{,}000}$$

For DHW, the winter seasonal peak demand savings is:

$$WKW_w = \frac{AKWH \times PF_w}{1{,}000}$$

For heating, summer seasonal peak demand:

$$SKW_H = 0$$

$$WKW_w = \frac{AKWH \times 0.57}{1{,}000}$$

Retrofit Gross Energy Savings, Fossil Fuel

Water heating, natural gas: $ANG = ANG_w \; x \; L$

Water heating, oil: $AOIL = AOIL_w \; x \; L$

Water heating, propane: $APRO = APRO_w \; x \; L$

Heating, natural gas: $ANG = ANG_H \; x \; L$

Heating, oil: $AOIL = AOIL_H \; x \; L$

Heating, propane: $APRO = APRO_H \; x \; L$

Annual Fossil Fuel Savings per Linear Foot of Domestic Hot Water Pipe Insulation

Pipe Diameter (inches)	ANG_W (mmbtuf/ft)	$AOIL_W$ (mmbtu/ft)	$APRO_W$ (mmbtu/ft)
0.50	0.056	0.056	0.055
0.75	0.083	0.081	0.081

Annual Fossil Fuel Savings per Linear Foot of Heating Pipe Insulation

Pipe Diameter (inches)	ANG_H (mmbtu/ft)	$AOIL_H$ (mmbtu/ft)	$APRO_H$ (mmbtu/ft)
0.75	0.051	0.056	0.055
1.00	0.061	0.069	0.064
1.25	0.082	0.083	0.082
1.50	0.092	0.097	0.091
2.00	0.195	0.197	.198

Retrofit Gross Peak Day Savings, Natural Gas

For DHW:

$PD_w = ANG \times PDF_w$

For heating:

$PD_H = ANG \times PDF_H$

Calculation Parameters Table:

Symbol	Description	Units	Values	Ref
ANG_H	Annual natural gas savings per linear foot, heating	mmbtu/ft		
ANG_W	Annual natural gas savings per linear foot, DHW	mmbtu/ft		
AKW_H	Annual kWh energy savings coefficient, heating	kWh/ft		
AKW_W	Annual kWh energy savings coefficient, DHW	kWh/ft		
$AKWH_H$	Annual energy savings, heating	kWh	Calculated	
$AKWH_W$	Annual energy savings, DHW	kWh	Calculated	
$AOIL_H$	Annual oil savings, heating	mmbtu/ft		
$AOIL_W$	Annual oil savings, DHW	mmbtu/ft		
$APRO_H$	Annual propane savings, heating	mmbtu/ft		
$APRO_W$	Annual propane savings, DHW	mmbtu/ft		
PD_W	Peak day savings, DHW			
PDF_H	Peak day factor, heating		0.00977	4
PDF_W	Peak day factor, DHW		0.00321	4
PF_S	Summer seasonal peak factor	W/kWh	0.1147	5
PF_W	Winter seasonal peak factor	W/kWh	0.1747	5
SKW_H	Summer seasonal peak demand savings, heating	kW		
SKW_W	Summer seasonal Peak demand savings, DHW	kW		

Symbol	Description	Units	Values	Ref
WKW_H	Winter seasonal peak demand savings, heating	kW		
WKW_W	Winter seasonal peak demand savings, DHW	kW		

Measure Life:

The measure life is 15 years.[6]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EB1a037	Pipe Insulation - Hot Water, Electric	HEA	1	1.00	n/a	1.00	1.00	0.31	0.81	7, 9
EB1a038	Pipe Insulation - Hot Water, Gas	HEA	1	n/a	1.00	n/a	n/a	n/a	n/a	7, 9
GB1a011	Pipe Insulation - Hot Water, Gas	HEA	1	n/a	1.00	n/a	n/a	n/a	n/a	7
EB1a039	Pipe Insulation - Hot Water, Kerosene	HEA	1	n/a	1.00	n/a	n/a	n/a	n/a	7,
EB1a040	Pipe Insulation - Hot Water, Oil	HEA	1	n/a	1.00	n/a	n/a	n/a	n/a	7,
EB1a041	Pipe Insulation - Hot Water, Propane	HEA	1	n/a	1.00	n/a	n/a	n/a	n/a	7,
EA2a037	Pipe Insulation - Hot Water, Electric	HEP	0.99	1.00	n/a	1.00	1.00	0.31	0.81	8,9
EA2a038	Pipe Insulation - Hot Water, Gas	HEP	0.99	1.0	1.00	n/a	n/a	0.31	0.81	8, 9
GA2a011	Pipe Insulation - Hot Water, Gas	HEP	0.99	1.0	1.00	n/a	n/a	0.31	0.81	8,9
EA2a039	Pipe Insulation - Hot Water, Kerosene	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a	8
EA2a040	Pipe Insulation - Hot Water, Oil	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a	8
EA2a041	Pipe Insulation - Hot Water, Propane	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a	8

Energy Load Shape:

See Appendix 1 – "Water Heater - Electric"

Revision History:

Revision Number	Date	Description
136	12/1/2022	Updated RR verbiage to align with table values for HPwES. Updated back up calculations to align with 2022 CT PSD.
254	1/1/2026	Updated realization rates according to 2025 HEA and HEP impact memo results.
346	1/1/2027	Adopted deemed savings. Updated RR's to 100%. Corrected savings values that were interchanged for domestic and heating hot water pipes

Endnotes:

1: Cadmus, Draft Impact Evaluation: Home Energy Services—Income-Eligible and Home Energy Services Programs: Volume 2 (R16), Jun. 2, 2014. https://www.energizect.com/sites/default/files/HES%20and%20HES-IE%20Impact%20Evaluation%20(R16),%20Final%20Report,%2012-31-14.pdf, Last Accessed February 5, 2026

2: Nexant, Home Energy Solutions Evaluation: Final Report, submitted to Connecticut Energy Efficiency Board, Mar. 2011. https://www.energizect.com/sites/default/files/documents/HES%20Evaluation%20Final%20Report%20(1)_0.pdf, Last Accessed February 5, 2026

3: NAIMA, 3E Plus software tool, Version 4.1, Released 2021.Last accessed Aug. 19, 2021.

4: Connecticut's 2022 Program Savings Document.:https://www.energizect.com/sites/default/files/documents/Final%202022%20PSD%20FILED%20110122.pdf, Last Accessed January 25, 2026

5: KEMA, Evaluation of the Weatherization Residential Assistance Partnership (WRAP) and Helps Programs, Final Report, Sep. 10, 2010.

6: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://www.energizect.com/sites/default/files/documents/2.1.3.7%20Measure%20Life%20Report%202007.pdf, Last Accessed, February 5, 2026

7: Opinion Dynamics, July 29 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

8: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 –FINAL https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

9: Cadmus, Draft Impact Evaluation: Home Energy Services—Income-Eligible and Home Energy Services Programs: Volume 2 (R16), Jun. 2, 2014. https://www.energizect.com/sites/default/files/HES%20and%20HES-

IE%20Impact%20Evaluation%20(R16),%20Final%20Report,%2012-31-14.pdf, last Accessed January 25, 2026

Hot Water Setback

Measure Code	RES-HW-SB
Markets	Residential
ProgramTypes	Retrofit
Categories	Hot Water

Measure Description:

Manual setback of the thermostat on a water heating device to reduce energy consumption.

Baseline Efficiency:

The baseline efficiency case is a water heater with a standard water temperature of 140°F.

High Efficiency:

The high efficiency case is a water heater with an adjusted water temperature of 125°F.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	Δkwh	Δkw	Δmmbtu
EA2a061	Hot Water Setback Oil (clothes washer only)	HEA	n/a	n/a	0.411
EB1a063	Hot Water Setback, Propane (clothes washer only)	HEA	n/a	n/a	0.411
EA2a042	Hot Water Setback, Electric (both dishwasher and clothes washer configuration)	HEP	51	0.006	n/a
EA2a042	Hot Water Setback, Electric (clothes washer only)	HEP	78.6	0.009	n/a
EA2a059	Hot Water Setback, Gas (clothes washer only)	HEP	n/a	n/a	0.411
EA2a060	Hot Water Setback Kerosene (clothes washer only)	HEA	n/a	n/a	0.411
EA2a062	Hot Water Setback, Propane (clothes washer only)	HEP	n/a	n/a	0.411
EB1a042	Hot Water Setback, Electric (clothes washer only)	HEA	78.6	0.009	n/a
EB1a042	Hot Water Setback, Electric (both dishwasher and clothes washer configuration)	HEA	51	0.006	n/a
EB1a060	Hot Water Setback, Gas (clothes washer only)	HEA	n/a	n/a	0.411
EB1a061	Hot Water Setback Kerosene (clothes washer only)	HEA	n/a	n/a	0.411
EB1a062	Hot Water Setback Oil (clothes washer only)	HEA	n/a	n/a	0.411
GA2a019	Hot Water Setback, Gas (clothes washer only)	HEP	n/a	n/a	0.411

GB1a019	Hot Water Setback, Gas (clothes washer only)	HEA	n/a	n/a	0.411

The programs use vendor calculated energy savings for measures in the Residential Home Performance with ENERGY STAR and Home Energy Assistance programs. The Home Energy Assistance program uses the Targeted Retrofit Energy Analysis Tool (TREAT) Energy Audit Software to model energy savings specific to each installation. TREAT is nationally certified by the Department of Energy for use in Weatherization Assistance Projects for all building classes. It is the only modeling software vendors may use to calculate HEA savings for New Hampshire Saves. TREAT models building energy usage and predicts the impact of improvements to various components on building energy consumption based on user inputs of spaces, walls, surfaces, heating and cooling data. The Home Performance with Energy Star Savings program uses the Surveyor software to calculate energy savings. Surveyor is an energy modeling and data collection software designed by PSD that runs on the TREAT software. Surveyor is the only modeling software vendors may use to calculate HPwES savings for New Hampshire Saves. Please see https://psdconsulting.com/ for more information.

These savings values are calculated using TREAT or Surveyor software, where the user inputs a minimum set of technical data about the house and the software calculates domestic hot water loads and other key parameters. Should the vendor software be unavailable or unable to estimate a home's energy savings from hot water setback, the following deemed savings should be used, based on evaluation results.[1] Note: Savings are due to reduced standby losses, which are assumed to be constant over the year, so $\Delta kW = \Delta kWh / 8760$ hours.

Measure Life:

The measure life of hot water setbacks for existing units and new equipment is two years. [2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

[1]

BC ID	Measure Name	Program	Fuel	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a042	Hot Water Setback, Electric	HEA	Electric	1.00	0.91	n/a	0.91	0.91	1.00	1.00
EB1a063	Hot Water Setback, Propane	HEA	Propane	1.00	n/a	0.91	n/a	n/a	n/a	n/a
EB1a062	Hot Water Setback, Oil	HEA	Oil	1.00	n/a	0.91	n/a	n/a	n/a	n/a

BC ID	Measure Name	Program	Fuel	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a060	Hot Water Setback, Gas	HEA	Gas	1.00	n/a	0.91	n/a	n/a	n/a	n/a
EB1a061	Hot Water Setback, Kerosene	HEA	Kerosene	1.00	n/a	0.91	n/a	n/a	n/a	n/a
EA2a042	Hot Water Setback, Electric	HEP	Electric	0.99	0.96	n/a	0.96	0.96	1.00	1.00
EA2a062	Hot Water Setback, Propane	HEP	Propane	0.99	n/a	1.14	n/a	n/a	n/a	n/a
EA2a061	Hot Water Setback, Oil	HEP	Oil	0.99	n/a	1.14	n/a	n/a	n/a	n/a
EA2a059	Hot Water Setback, Gas	HEP	Gas	0.99	n/a	1.04	n/a	n/a	n/a	n/a
EA2a060	Hot Water Setback, Kerosene	HEP	Kerosene	0.99	n/a	1.14	n/a	n/a	n/a	n/a

In-Service Rates:

In-service rates are 99% for HPwES programs and are 100% for HEA programs based on evaluationresults.[1,4]

Realization Rates:

All PAs use a realization rate of 96% for the HPwES program for electric, 114% for oil propane and wood fuel types, 104% for gas fuel types, and a realization rate of 91% for the HEA program.[1, 4]

Coincidence Factors:

Coincidence factors for electric hot water are assumed to be 100% because savings are from reduced standby losses, which are assumed to be constant over the year.

Energy Load Shape:

See Appendix 1 – "24 Hour Operation".[4]

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
24-hour operation	15.20%	18.30%	30.50%	36.10%

Revision History:

Revision Number	Issue Date	Description
23	1/14/2022	Added BC ID's and HEA and HPwES measures for the Kerosene fuel type.
121	12/1/2022	Included additional information on software used for the vendor calculated savings and added gas measure IDs.

Endnotes:

1: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

2: Illinois TRM Version 9.0, measure 5.4.6 water heater temperature setback.

3: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

4: Savings are from reduced standby losses, which are assumed to be constant over the year.

Hot Water Showerhead

Measure Code	RES-HW-SH
Markets	Residential
ProgramTypes	Retrofit
Categories	Hot Water

Measure Description:

An existing shower head with high flow rate is replaced with a new low flow shower head.

Baseline Efficiency:

The baseline efficiency case is the existing showerhead with a baseline flow rate of 2.5 gallons per minute (GPM).

High Efficiency:

The high efficiency case is a low flow shower head having a maximum flow rate of 2.0 GPM or less.

Algorithms for Calculating Primary Energy Impact:

The programs use vendor calculated energy savings for measures in the Residential Home Performance with ENERGY STAR and Home Energy Assistance programs.

The Home Energy Assistance program uses the Targeted Retrofit Energy Analysis Tool (TREAT) Energy Audit Software to model energy savings specific to each installation. TREAT is nationally certified by the Department of Energy for use in Weatherization Assistance Projects for all building classes. It is the only modeling software vendors may use to calculate HEA savings for New Hampshire Saves. TREAT models building energy usage and predicts the impact of improvements to various components on building energy consumption based on user inputs of spaces, walls, surfaces, heating and cooling data. The Home Performance with Energy Star Savings program uses the Surveyor software to calculate energy savings. Surveyor is an energy modeling and data collection software designed by PSD that runs on the TREAT software. Surveyor is the only modeling software vendors may use to calculate HPwES savings for New Hampshire Saves. Please see https://psdconsulting.com/ for more information.

These savings values are calculated using TREAT and Surveyor software, where the user inputs a minimum set of technical data about the house and the software calculates domestic hot water loads and other key parameters. Should the vendor software be unavailable or unable to estimate a home's energy savings from low flow showerheads, the following deemed savings should be used, based on assumptions from an earlier impact study.[1] kW savings are calculated using the demand impact model.[2]

BC ID	Measure Name	Hot Water Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EB1a016	Handheld Showerhead	Electric	HEA	145.226	0.050	
EB1a017 GB1a003	Handheld Showerhead	Gas	HEA			0.633
EB1a018	Handheld Showerhead	Kerosene	HEA			0.633
EB1a019	Handheld Showerhead	Oil	HEA			0.633
EB1a020	Handheld Showerhead	Propane	HEA			0.633
EA2a016	Handheld Showerhead	Electric	HPwES	145.226	0.050	
EA2a017 GA2a003	Handheld Showerhead	Gas	HPwES			0.633
EA2a018	Handheld Showerhead	Kerosene	HPwES			0.633
EA2a019	Handheld Showerhead	Oil	HPwES			0.633
EA2a020	Handheld Showerhead	Propane	HPwES			0.633
EB1a030	Low flow Showerhead	Electric	HEA	145.226	0.050	
EB1a031 GB1a010	Low flow Showerhead	Gas	HEA			0.633
EB1a032	Low flow Showerhead	Kerosene	HEA			0.633
EB1a033	Low flow Showerhead	Oil	HEA			0.633
EB1a034	Low flow Showerhead	Propane	HEA			0.633

BC ID	Measure Name	Hot Water Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EA2a030	Low flow Showerhead	Electric	HPwES	145.226	0.050	
EA2a031 GA2a010	Low flow Showerhead	Gas	HPwES			0.633
EA2a032	Low flow Showerhead	Kerosene	HPwES			0.633
EA2a033	Low flow Showerhead	Oil	HPwES			0.633
EA2a034	Low flow Showerhead	Propane	HPwES			0.633

Measure Life:

The measure life is 15 years.[3]

Other Resource Impacts:

Annual water savings are 1,246 gallons per unit[4]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EB1a016	Handheld showerhead	Electric	HEA	1	0.91	n/a	0.91	0.91	0.31	0.81
EB1a017	Handheld showerhead	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
GB1a003	Handheld showerhead	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a018	Handheld showerhead	Kerosene	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a019	Handheld showerhead	Oil	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a020	Handheld showerhead	Propane	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EA2a016	Handheld showerhead	Electric	HEP	0.99	1.31	n/a	1	1	0.31	0.81
EA2a017	Handheld showerhead	Gas	HEP	0.99	n/a	0.90	n/a	n/a	n/a	n/a
GA2a003	Handheld showerhead	Gas	HEP	0.99	n/a	0.90	n/a	n/a	n/a	n/a
EA2a018	Handheld showerhead	Kerosene	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a
EA2a019	Handheld showerhead	Oil	HEP	0.99	n/a	1.04	n/a	n/a	n/a	n/a

BC ID	Measure Name	Hot Water Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA2a020	Handheld showerhead	Propane	HEP	0.99	n/a	1.23	n/a	n/a	n/a	n/a
EB1a030	Low flow Showerhead	Electric	HEA	1	0.91	n/a	0.91	0.91	0.31	0.81
EB1a031	Low flow Showerhead	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
GB1a010	Low flow Showerhead	Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a032	Low flow Showerhead	Kerosene	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a033	Low flow Showerhead	Oil	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EB1a034	Low flow Showerhead	Propane	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a
EA2a030	Low flow Showerhead	Electric	HEP	0.99	0.65	n/a	1	1	0.31	0.81
EA2a031	Low flow Showerhead	Gas	HEP	0.99	n/a	0.88	n/a	n/a	n/a	n/a
GA2a010	Low flow Showerhead	Gas	HEP	0.99	n/a	0.88	n/a	n/a	n/a	n/a
EA2a032	Low flow Showerhead	Kerosene	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a
EA2a033	Low flow Showerhead	Oil	HEP	0.99	n/a	1.01	n/a	n/a	n/a	n/a
EA2a034	Low flow Showerhead	Propane	HEP	0.99	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

In-service rates are 99% for HEP and are 100% for HEA based on evaluation results[5] [6].

Realization Rates:

Realization rates for HEA are based on evaluation results[7]. Realization rates for HEP are 100% for measures that use the deemed savings provided. If savings are modeled, the realization rates provided in the table as established by the 2025 HEP Final Impact Memos are used[8].

Coincidence Factors:

A summer coincidence factor of 31% and a winter coincidence factor of 81% are utilized.[2]

Energy Load Shape:

See Appendix 1 “Water Heater – Electric”.

Revision History:

Revision Number	Issue Date	Description
24	1/14/2022	Added missing BC measures ID's to the algorithms for primary energy impact tables.
25	1/14/2022	Updated typos in footnote numbering.
120	12/1/2022	Included additional information on software used for the vendor calculated savings. Added oil savings. Updated RR verbiage to align with table for HEP values
257	1/1/2026	Savings algorithm edited for clarity. Updated RR's based on new NH HEA/HEP study results.

Endnotes:

1: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. kWh were estimated using the input values and methodology described in 'Table C-7. Algorithms and Inputs for Efficient Showerheads'.

2: Navigant Consulting,2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

3: Guidehouse, Inc. (2020). Massachusetts Comprehensive TRM Review - MA19R17-B-TRM. Prepared for the electric and gas program administrators of Massachusetts' part of the residential evaluation program area.

4: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. kWh were estimated using the input values and methodology described in 'Table C-7. Algorithms and Inputs for Efficient Showerheads'. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

5: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

6: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

7: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/17-home-energy-assistance-program-eval-report.pdf

8: NMR, 2025. Impact Analysis Results for Home Energy Performance Program – Final Memo

Hot Water Heater

Measure Code	RES-HW-WH
Markets	Residential
ProgramTypes	Retrofit, Lost opportunity
Categories	Hot Water

Measure Description:

Installation of a new high-efficiency natural gas tankless and storage water heaters.

Baseline Efficiency:

The baseline efficiencies are summarized in the table below. Energy star products savings are calculated with the lost opportunity baseline values. HEP savings are calculated with the retrofit values.

Measure	Baseline Equipment	UEF_{base} or Eff_{base}	Source
Gas-Fired Storage Water Heater	Gas-Fired Storage Water Heater	0.60	1
Integrated Boiler/water heater	Indirect Water Heater	0.85	2
	Storage Water Heater	0.60	2
Indirect Water Heater	Storage Water Heater	0.60	2
Condensing water heater	Gas-Fired Storage Water Heater	0.60	1
Tankless water heater	Storage Water Heater	0.63	3

Measure	Baseline Equipment	UEF_{base} or Eff_{base}	Source
Indirect Water Heater	Indirect Water Heater	0.60	
	Storage Water Heater	0.58	4

High Efficiency:

The high efficiency conditions are summarized in the table below per program requirements:

Measure	Specification	UEF_i or Eff_i
Indirect Water Heater	> 85% AFUE	0.82
Integrated Boiler/water heater	90-94% AFUE	0.87
	95% AFUE	0.89
Condensing water heater	EF 0.95	0.95
Tankless water heater	Energy Star	0.95
Gas-Fired Storage Water Heater	Energy Star	0.84

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu	REF
EA2a082	Indirect Water Heater	Oil	HEP			8.6	5

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu	REF
EA2a083	Indirect Water Heater	Propane	HEP			8.6	5
EB1a096	Stand Alone Storage Water Heater	Electric	HEA	Modeled	Modeled	Modeled	
EB1a097	Stand Alone Storage Water Heater	Gas	HEA	Modeled	Modeled	Modeled	
EB1a098	Indirect Water Heater	Oil	HEA	Modeled	Modeled	Modeled	
EB1a099	Stand Alone Storage Water Heater	Propane	HEA	Modeled	Modeled	Modeled	
GA3b012	Indirect Water Heater (attached to ES FHW Boiler; Combined eff rating >=85% (EF=.82)	Gas	ES Products	n/a	n/a	8.6	5
GA3b013	Integrated Water Heater w/Condensing Boiler >= 90% AFUE	Gas	ES Products	n/a	n/a	8.4	2
GA3b014	Integrated Water Heater w/Condensing Boiler >= 95% AFUE	Gas	ES Products	n/a	n/a	12.8	2
GA3b015	Condensing Water Heater (EF 0.95)	Gas	ES Products	-43.08	-0.0031	8.5	5
GA3b016	Stand Alone Storage Tank Water Heater (EF 0.67)	Gas	ES Products	-43.08	-0.0031	6.6	5
GA3b017	Tankless On-Demand Water Heater, >=.82	Gas	ES Products	-43.08	-0.0031	5.7	5
GA3b018	Tankless On-Demand Water Heater, >=.94	Gas	ES Products	n/a	n/a	7.4	5
GB1b010	Stand Alone Storage Water Heater, Gas	Gas	HEA	Modeled	Modeled	Modeled	
GB1b011	Indirect Water Heater, Gas	Gas	HEA	Modeled	Modeled	Modeled	
GB1b012	Water Heater - Indirect (attached to ES FHW Boiler; Combined eff rating >=85% (EF=.82), Gas	Gas	HEA	Modeled	Modeled	Modeled	
GB1b013	Water Heater - Integrated with Condensing Boiler >= 90% AFUE, Gas	Gas	HEA	Modeled	Modeled	Modeled	
GB1b014	Water Heater - Integrated with Condensing Boiler >= 95% AFUE, Gas	Gas	HEA	Modeled	Modeled	Modeled	
GB1b015	Water Heater - Tankless, OnDemand UEF >=.87, Gas	Gas	HEA	Modeled	Modeled	Modeled	

Savings for measure offered through HEA and HEP are modeled using whole home energy modeling software.

Savings for measures offered through Energy Star Products are deemed.

Source Algorithms for Deemed Fossil Fuel Savings

Storage and Tankless Water Heaters

$$\Delta MMBtu = \frac{GPY \times \Delta T \times 8.3 \times 1.0}{1{,}000{,}000} \times \left(\frac{1}{UEF_{base}} - \frac{1}{UEF_i}\right)$$

Indirect Water Heaters

$$\Delta MMBtu = \left(\frac{GPY \times 8.33 \times 1.0 \times \Delta T}{1{,}000{,}000} \times \left(\frac{1}{Eff_{base}} - \frac{1}{Eff_i}\right) + \left(\frac{UA_{base}}{Eff_{base}} - \frac{UA_i}{Eff_i}\right) \times \frac{\Delta T_{amb} \times 8{,}760}{1{,}000{,}000}\right)$$

Variable	Description	Value	Units	Ref
ΔMMBtu	Annual fossil fuel impact	Calculated	MMBtu	
GPY	Hot water consumption (gal/yr)	22,265 (storage) 19,438 (indirect)	Gallons	6
ΔT	Difference between hot water setpoint temperature and inlet water temperature (based on HW temperature of 125F and entering water temperature of 50F)	75	Deg F	6
8.3	Water density	8.3	lb/gal	
1.0	Water specific heat	1.0	Btu/lb-F	
1,000,000	Conversion constant	1,000,000	Btu/MM Btu	
UEFi	Installed water heater uniform energy factor	See Table 5.		Program Requirement
UEFbase	Baseline water heater uniform energy factor	See Table 1 or Table 2		
Effbase	Baseline indirect water heater efficiency	See Table 1 or Table 2		6
Effi	Installed indirect water heater efficiency	See Table 5		6
UAbase	Baseline indirect water heater tank heat loss coefficient	7.85	Btu/hr-F	
UAi	Installed indirect water heater tank heat loss coefficient	5.4	Btu/hr-F	
ΔT_{amb}	Hot water to room temperature difference (based on a HW temperature of 125F and room temperature of 70F)	55	Deg F	

Measure Life:

The table shows the measure life for each measure.[1,2,3,4]

BC ID	Measure Name	Fuel Type	Program	Measure Life
GA3b012	Water Heater - Indirect (attached to ES FHW	Gas	ES Products	20

	Boiler; Combined eff rating >=85% (EF=.82) (Retrofit)			
GA3b013	Water Heater - Integrated with Condensing Boiler >= 90% AFUE (Retrofit)	Gas	ES Products	19
GA3b014	Water Heater - Integrated with Condensing Boiler >= 95% AFUE (Retrofit)	Gas	ES Products	19
GA3b015	Condensing Water Heater (EF 0.95)	Gas	ES Products	15
GA3b016	Stand Alone Storage Tank Water Heater (EF 0.67)	Gas	ES Products	13
GA3b018	Water Heater - Tankless, On-Demand >=.87	Gas	ES Products	20
EB1a096	Stand Alone Storage Water Heater	Electric	HEA	13
EB1a097 GB1b010	Stand Alone Storage Water Heater	Gas	HEA	13
EB1a099	Stand Alone Storage Water Heater	Propane	HEA	13
EB1a098	Indirect Water Heater	Oil	HEA	13
EA2a082	Indirect Water Heater	Oil	HPwES	13
EA2a083	Indirect Water Heater	Propane	HPwES	13
GB1B011	Indirect Water Heater	Gas	HEA	13

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GA3b012	Water Heater - Indirect (attached to ES FHW Boiler; Combined eff rating >=85% (EF=.82) (Retrofit)	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	11
GA3b013	Water Heater - Integrated with Condensing Boiler >= 90% AFUE (Retrofit)	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	11
GA3b014	Water Heater - Integrated with Condensing Boiler >= 95% AFUE (Retrofit)	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	12

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GA3b015	Condensing Water Heater (EF 0.95)	ES Products	1.00	n/a	1.00	n/a	n/a	n/a	n/a	11
GA3b016	Stand Alone Storage Tank Water Heater (EF 0.67)	ES Products	1.00	1.00	1.00	n/a	n/a	0.21	0.40	11,13
GA3b017	Tankless On-Demand Water Heater, >= .82	ES Products	1.00	1.00	1.00	n/a	n/a	0.21	0.40	Error! Bookmark not defined.,**Error! Bookmark not defined.**
GA3b018	Water Heater - Tankless, On-Demand >=.94 (New Construction)	ES Products	1.00	1.00	1.00	n/a	n/a	0.21	0.40	11,13
EB1a096	Stand Alone Storage Water Heater	HEA	1	0.91	n/a	n/a	n/a	0.21	0.4	14,13
EB1a097 GB1b010	Stand Alone Storage Water Heater	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	14
EB1a099	Stand Alone Storage Water Heater	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	14
EB1a098	Indirect Water Heater Oil	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	14
EA2a082	Indirect Water Heater Oil	HEP	0.99	n/a	1.14	n/a	n/a	n/a	n/a	15
EA2a083	Indirect Water Heater, Propane	HEP	0.99	n/a	1.14	n/a	n/a	n/a	n/a	15
GB1b011	Indirect Water Heater, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	14**Error! Bookmark not defined.**
GB1b012	Water Heater - Indirect (attached to ES FHW Boiler; Combined eff rating >=85% (EF=.82), Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GB1b013	Water Heater - Integrated with Condensing Boiler >= 90% AFUE, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GB1b014	Water Heater - Integrated with Condensing Boiler >= 95% AFUE, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GB1b015	Water Heater - Tankless, OnDemand UEF >=.87, Gas	HEA	1	n/a	0.91	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**

Energy Load Shape:

See Appendix 1 – "Water Heater - Natural Gas/Fuel Oil"

Revision History:

Revision Number	Issue Date	Description
26	1/14/2022	Fixed broken link in reference #3 for Navigant (2018). Home Energy Service Impact Evaluation. Prepared for program administrators in Massachusetts.
27	1/14/2022	Added entries for non-gas water heaters which had been omitted from the TRM. New entries include BC ID's E21B1a096, E21B1a097, E21B1a099, E21B1a098, E21A2a082, E21A2a083
168	3/1/2023	Gas HEA BC ID's were missing adding in the following BC ID's G21B1b010 , G21B1b011 and updated verbiage to reflect measure savings for HEA are modeled, however the deemed savings can be used for planning purposes.
347	1/1/2027	Added baseline efficiencies table and updated efficiencies based on federal standards Added high efficiencies table Updated deemed savings values Added underlying equations Updated realization rates
400	10/30/2026	Corrected impact factors for EA2a082 EA2a083, GB1b011 to reflect the accurate RRs from the HEP and HEA studies,

Endnotes:

1: The gas storage lost opportunity baseline is based on a weighted average of Federal Standards for a 40 gal Medium Draw (wt =.506) and 50 gal High Draw (wt =.449) storage water heater. See Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task 7: Residential Water Heater Analysis Memo and The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing. The calculation of the adjustment can be found in MA PAs (2021). 2020 Annual Report Gas HVAC and Water Heating Calculations Workbook. MA_PAs_2020 Annual Report_Gas_HVAC_WH_Calculations_GH_2021-03-08.

2: Savings and parameters are applied per: NMR (2026) New Hampshire Energy Star Products Impact Memo.

3: Based on the early replacement baseline for "Propane On Demand Tankless Water Heater, Energy Star" as defined per: Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task 7: Residential Water Heater Analysis Memo and The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing. The calculation of the adjustment can be found in MA PAs (2021). 2020 Annual Report Gas HVAC and Water Heating Calculations Workbook. MA_PAs_2020 Annual Report_Gas_HVAC_WH_Calculations_GH_2021-03-08.

4: Based on the early replacement baseline for "Gas Storage Water Heater, Energy Star, Blended Draw (Retire)" as defined per: Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task 7: Residential Water Heater Analysis Memo and The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing. The calculation of the adjustment can be found in MA PAs (2021). 2020 Annual Report Gas HVAC and Water Heating Calculations Workbook. MA_PAs_2020 Annual Report_Gas_HVAC_WH_Calculations_GH_2021-03-08.

5: Deemed savings are based on the parameters defined in 'Table 5: Calculation Parameters.' See the 2027 Res Hot Water Heaters Workbook"

6: Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task 7: Residential Water Heater Analysis Memo and The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing. MA_PAs_2020 Annual Report_Gas_HVAC_WH_Calculations_GH_2021-03-08

7: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. https://ma-eeac.org/wp-content/uploads/5_Natural-Gas-EE-Potenial-in-MA.pdf, Last Accessed January 25, 2026. http://ma-eeac.org/wordpress/wp-content/uploads/5_Natural-Gas-EE-Potenial-in-MA.pdf

8: Environmental Protection Agency (2009). Life Cycle Cost Estimate for ENERGY STAR Qualified Boiler.

https://www.energystar.gov/sites/default/files/asset/document/Savings_and_Cost_Estimate_Summary.pdf, Last Accessed January 25, 2026

9: DOE (2008). Energy Star Residential Water Heaters: Final Criteria Analysis Refrigerator Analysis, Last Accessed January 25, 2026 and The Cadmus Group (2013). 2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing. cadmus_2013_hehe_cool-smart_ntg_evaluation_report.pdf, Last Accessed January 25, 2026

10: Guidehouse, Inc. (2020). Massachusetts Comprehensive TRM Review - MA19R17-B-TRM. Prepared for the electric and gas program administrators of Massachusetts part of the residential evaluation program area. MA19R17-B-TRM_Final_Report_2021-04-12_clean.pdf, Last Accessed January 25, 2026

11: Assumed to be 100% until evaluated.

12: ISR is 100% per the 2026 ES products Impact Memo. Measure savings are deemed per study results and realization rate is set to 100% accordingly. NMR (2026) New Hampshire Energy Star Products Impact Memo.

13: Navigant Consulting (2018). Water Heating, Boiler, and Furnace Cost Study (RES 19) Add-On Task 7: Residential Water Heater Analysis Memo.
2018_Navigant_Water_Heater_Analysis_Memo, Last Accessed January 25, 2026

14: ISR and RR are applied per: Opinion Dynamics (2020) New Hampshire Utilities Home Energy Assistance Program Evaluation Report 2016-2017 – FINAL

15: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/16-home-perfomance-energy-star-program-eval-report.pdf

Lighting Fixture

Measure Code	RES-LF-LGT
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Lighting

Measure Description:

The installation of Light-Emitting Diode (LED) fixtures, which offer comparable luminosity to incandescent and halogen fixtures at significantly less wattage and significantly longer lifetimes.

Baseline Efficiency:

The baseline efficiency case for a lost opportunity LED fixture is a combination of an incandescent fixture, halogen fixture, and a compact fluorescent fixture. The baseline efficiency case for a retrofit LED fixture is a combination of an incandescent fixture and halogen fixture.

High Efficiency:

The high-efficiency case is an ENERGY STAR ® rated LED fixture.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	Delta Watts per Fixture	Daily HOU[2]	Number of Bulbs	ΔkWh	ΔkW
E21A3a009	LED Fixture	ES Products	34.7	2.1	1	26.35	0.03
E21A2a048	LED Fixture	Home Performance	Modeled				
E21B1a048	LED Fixture	HEA	Modeled				
E21A3a010	LED Fixture (Hard to Reach)	ES Products	34.7	2.1	1	26.35	0.03
E21A1a024	LED Fixture	ES Homes	37.51	1.75	1	24	.04

Unit savings are based on the algorithm below. Demand savings are derived from the Navigant Demand Impact Model.

Vendor calculated unit savings are calculated using the following algorithms and assumptions:

ΔkWh = ((Watts_Ineff- Watts_EE) × HOU)))/1000 × Qty_Bulbs × 365

ΔkW = ΔkWh × kW/kWh

kW/kWh = Average kW reduction per kWh reduction: 0.00025 kW/kWh

Watts_Ineff = Rated watts of inefficient bulbs (either removed, through retrofit, or assumed to have been installed, through lost opportunity)

Watts_EE = Rated watts of efficient bulbs installed

Qty_Bulbs = Number of bulbs per fixture

365 = Days per year

HOU = Daily hours of use. The hours of use are largely based on recent NH evaluation studies for the ENERGY STAR Products Program and the Home Performance Program, as well as increased hours of operation for ENERGY STAR Products to account for cross-sector sales at retailers (i.e., businesses purchasing program incented fixtures). The direct installation delivery strategies (Home Performance) are based on residential hours only but reflect higher hours of use since the programs direct contractors to only replace fixtures that are used for at least three hours

per day. The following summarizes the key assumptions for daily hours by program type and application before adjustments for the ES products Program:

• Lost opportunity LEDs installed in residential applications: 1.75 hours/day

• Lost opportunity LEDs installed in commercial applications (7% of all lost opportunity fixtures):7 hours/day

• Retrofit Home Performance LEDs all installed in residential applications: 3.0 hours/day

• Retrofit HEA LEDs: all installed in residential applications: 3.0 hours/day

Delta watts (WattsINEFF – WattsEE) are broken out by delivery strategy, and reflect a mix of program fixture wattages (for the efficient wattage), removed fixtures (for retrofit inefficient fixtures), and a blended mix of incandescents, halogens, and CFLs that would have been purchased in absence of the program measure.[1]

Measure Life:

The table below summarizes the measure lives for each of the measures listed above. Note these measure lives have been adjusted to account for the differential in measure life between the inefficient fixtures and LED fixtures (as well as the remaining useful life in the retrofit cases), and the potential for future lighting standards to lead the same sockets reached through the program to have been occupied by an LED in a period shorter than the technical life of the LED.[3] Note- Lighting measures with lost opportunity baselines (e.g., ES Products) add a year to measure life to reflect the different baseline as well as significantly lower hours of use.

BC ID	Measure Name	Program	Adjusted Measure Life
EA3a009	LED Fixture	ES Products	3
EA2a048 EB1a048	LED Fixture	Home Performance/HEA	2
EA3a010	LED Fixture (Hard to Reach)	ES Products	3
EA1a024	LED Fixture	ES Homes	3

Other Resource Impacts:

Based on the 2018 NH Energy Star Products Program Evaluation report, fossil fuel interactive penalties for residential lighting programs are -2,272 Btu/kWh saved.[4]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3a009	LED Fixture	ES Products	1.00	1.00	n/a	1.00	1.00	0.55	0.85
EA2a048	LED Fixture	Home Performance	0.99	0.96	n/a	0.96	0.96	0.55	0.85
EB1a048	LED Fixture	HEA	1.00	0.91	n/a	0.91	0.91	0.55	0.85

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3a010	LED Fixture (Hard to Reach)	ES Products	1.00	1.00	n/a	1.00	1.00	0.55	0.85
EA1a024	LED Fixture	ES Homes	1.00	1.00	n/a	1.00	1.00	0.55	0.85

In-Service Rates:

All HEA installations use an in-service rate of 100% because HEA realization rates account for uninstalled measures. All Home Performance installations use in-service rate of 99% based on evaluation results.[5] [6] All other installations have a 100% in-service rate unless an evaluation finds otherwise.[7]

Realization Rates:

Based on evaluation results, all HEA installations use a realization rate of 91% and all Home Performance installations use a realization rate of 100% because gross savings assumptions are adjusted to reflect evaluated results.[5. 6.] All other installations have a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are based on prescriptive loadshapes from the updated Navigant Massachusetts

Demand Impact Model.[8]

Energy Load Shape:

See Appendix 1 – "Lighting".[8.]

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EA3a009	LED Fixture	ES Products	77%	n/a	n/a	23%
EA3a010	LED Fixture (Hard to Reach)	ES Products	57%	n/a	n/a	43%

Revision History:

Revision Number	Issue Date	Description
73	3/1/2022	NTG updated for 2022 values.
131	21/1/2022	Added back in measure life table, updated delta watts to reflect latest study values for 2021, updated savings accordingly.

Revision Number	Issue Date	Description
200	1/1/2024	Added Home Performance Multifamily BC ID's

Endnotes:

1: The delta watts are based off of the "MA PAs (2018). 2019-2021 Lighting Worksheet" (https://etrm.anbetrack.com/etrm/api/v1/etrm/documents/5bd06d1d6c50367b3deba017/view?authToken=fe238b4571e888c7558f844a02040d1941948e021564ac20156f12ece790e6a86c8a6c488b1d838694b8d9). Note the delta watts for ES Homes is reduced by 75% to reflect the requirement that 75% of lamps be high-efficacy lamps for new construction (https://www.energycodes.gov/sites/default/files/becu/2015_IECC_residential_requirements.pdf)

2: Hours of use (residential) for the ES Products and HTR channel are based off of "New Hampshire ENERGY STAR® Products Program", prepared by Cadmus for the New Hampshire ENERGY STAR Products New Hampshire Evaluation Measurement & Verification Working Group, October 17, 2018.(: Cadmus (2018) New Hampshire Energy Star Products Program, Evaluation Report. https://www.puc.nh.gov/electric/Monitoring%20and%20Evaluation%20Reports/20181017-Monitor-Evaluation-Report-Energy-Star-Products-Final-Report.pdf) The values reflect the daily weighted average LED hours of use. Cross-sector sales are based upon MA RLPNC Cross-Sector Sale HOU Update", Prepared by the NMR Group for the Massachusetts Program Administrators (PAs), August 2, 2018. The 2.1 hours per day for ES Products and HTR are calculated as the weighted combination of residential and commercial hours of use: (residential HOU*residential %)+(commercial HOU*commercial %) = (1.75*0.93)+(7.0*0.07). HOU for ES Homes reflects the residential HOU only. Hours of use for the HPwES and HEA are based on program requirements for contractors to only replace fixtures that are used for at least three hours per day.

3: The direct installation measure life values come from RLPNC 18-5 Home Energy Assessment LED Net-to-Gross Consensus, Prepared by NMR Group, Inc. for the 2019—21 Planning Assumptions: Lighting Hours-of-Use and In-Service Rate, Prepared by NMR Group, Inc. for the Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) Consultants, July 23, 2018 (http://ma-eeac.org/wp-content/uploads/RLPNC_185_HEALEDNTG_REPORT_23July2018_Final.pdf). These values reflect early replacement baselines, and assume that the replaced bulb, when it burnt out, would have been replaced by an LED at that time. Lighting measures with lost opportunity baselines (e.g., ES Products) add a year to measure life to reflect the different baseline as well as significantly lower hours of use.

4: Table 22. PY2016 Residential Lighting Energy Savings by Utility. Shows evaluated annual net electric energy savings, and evaluated penalties for gas, oil, and propane. Using the values for Eversource, a total calculated heating energy penalty of 341,757,000,000 Btu was assessed on the 150,403,000 kWh of electrical energy savings. "New Hampshire ENERGY STAR® Products Program 2016 Evaluation Report", prepared by Cadmus for the New Hampshire ENERGY STAR Products New Hampshire Evaluation Measurement & Verification Working Group, October 17, 2018.

5: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.

6: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

7: In-service rates for ES Products and HTR channel, as well as ES Homes, are based on MA assumptions of 100% ISR for fixtures. In-service rates for HPwES and HEA are based on the NH study "Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL," Prepared by Opinion Dynamics Corporation, June 11, 2020. https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

8: Navigant, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

9: "R1615 Light Emitting Diode (LED) Net-to- Gross Evaluation," Prepared by the NMR Group, Inc. for the Connecticut EEB, August 7, 2017. The 2020 Connecticut net-to-gross values are applied to New Hampshire for 2021 to account for the relatively slower pace of market transformation, due in part to fewer program bulbs per home in New Hampshire (2.5 bulbs per home in 2019) compared to Connecticut (4 bulbs per home in 2019).

Lighting LED Bulb

Measure Code	RES-LTG-LEDB
Markets	Residential
ProgramTypes	Retrofit/Lost opportunity
Categories	Lighting

Measure Description:

The installation of Light-Emitting Diode (LED) screw-in lamps and linear LEDs. LEDs offer comparable luminosity to incandescent and halogen lamps at significantly less wattage and significantly longer lamp lifetimes.

Baseline Efficiency:

Effective July 2023, the revived EISA backstop will make LEDs the lost opportunity baseline for all general service lamps (GSL). The baseline efficiency case for retrofit LED lamps is a combination of an incandescent lamp and halogen lamp.

High Efficiency:

The high efficiency case is an ENERGY STAR ® rated LED lamp.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	Delta Watts	Daily HOU	ΔkWh	ΔkW

EA3a003	Other Specialty	ES Products	29	3.0	31.75	0.008
EA3a002	Linear	ES Products	17.9	1.6	10.5	0.003
EA2a046	Other Specialty	HEP	46.2	3.0	50.6	0.013
EA2a101	Other Specialty	HEP	46.2	3.0	50.6	0.013
EA2a045	Linear	HEP	17.9	3.0	19.6	0.005
EA2a100	Linear	HEP	17.9	3.0	19.6	0.005
EB1a046	Other Specialty	HEA	Modeled	Modeled	Modeled	Modeled
EB1a045	Linear	HEA	Modeled	Modeled	Modeled	Modeled
EA3a007	Other Specialty (Hard to Reach)	ES Products	29	3.0	31.75	0.008
EA3a006	Linear (Hard to Reach)	ES Products	17.9	1.6	10.5	0.003
EA1a023	ES Homes Lighting	ES Homes	10.2	1.75	6.5	0.002

Unit savings are based on the algorithm below. Demand savings are derived from the Navigant Demand Impact Model.

Vendor calculated unit savings are calculated using the following algorithms and assumptions:[2]

$\Delta kWh = ((Watts_Ineff - Watts_EE) \times HOU)/1000 \times 365$

$\Delta kW = \Delta kWh \times kW/kWh$

kW/kWh = Average kW reduction per kWh reduction: 0.00025 kW/kWh

$Watts_{Ineff}$ = Rated watts of inefficient lamps (either removed, through retrofit, or assumed to have been installed in lieu of the program lamps, through lost opportunity)

$Watts_{EE}$ = Rated watts of efficient lamps installed

365 = Days per year

HOU = Daily hours of use.[3]

ES Products and Hard to Reach (HTR): 2.1.

Calculated as the weighted combination of residential and commercial hours of use: (residential HOU*residential %)+(commercial HOU*commercial %) = (1.75*0.93)+(7.0*0.07) to account for cross sector sales at retailers.

ES Homes: 1.75

HOU for ES Homes reflects the residential HOU only.

Retrofit Home Performance and HEA: 3.

Based on program requirements for contractors to only replace fixtures that are used for at least three hours per day.

Delta watts (Watts_Ineff – Watts_EE) = Delta Watts.

See table abobe. Detla watts are broken out by lamp style and delivery strategy, and reflect a mix of program lamp wattages (for the efficient wattage), removed lamps (for retrofit inefficient lamps), and a blended mix of incandescents, halogens, and CFLs that would have been

purchased in absence of the program measure (for lost opportunity inefficient lamps).[4] [5] Note that the ENERGY STAR Homes values represent a weighted average (based on the distribution of LEDs in NH homes as identified as part of a recent saturation study) of general service lamps, reflectors, and other specialty values.[6]

The linear lamp values are based off of a separate research project in MA that specifically examined the characteristics (e.g., incented technologies, rooms with linear lamps) of linear LEDs.[7]

Measure Life:

The table below summarizes the measure lives for each of the measures listed above. Note, AMLs for general service lamps and reflectors have been reduced to 1, as the revived EISA back stop will be enacted July 1, 2023. Note these measure lives have been adjusted to account for the differential in measure life between the inefficient lamps and LEDs (as well as the remaining useful life in the retrofit cases), and the potential for future lighting standards to lead the same sockets reached through the program to have been occupied by an LED in a period shorter than the technical life of the LED.[8]

BC ID	Measure Name	Program	Adjusted Measure Life
EA3a003	Other Specialty	ES Products/Drop Ship	3
EA3a002	Linear	ES Products	7
EA2a046 EB1a046	Other Specialty	HPwES/HEA	2
EA2a045 EB1a045	Linear	HPwES/HEA	7
EA3a007	Other Specialty (Hard to Reach)	ES Products	3
EA3a006	Linear (Hard to Reach)	ES Products	7
EA1a023	ES Homes Lighting	ES Homes	3

Other Resource Impacts:

Based on the 2018 NH Energy Star Products Program Evaluation report, fossil fuel interactive penalties for residential lighting programs are -2,272 Btu/kWh saved.[7]

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA3a003	Other Specialty	ES Products	0.89	1	n/a	1	1	0.55	0.85
EA3a002	Linear	ES Products	0.89	1	n/a	1	1	0.55	0.85
EA2a046	Other Specialty	HEP	0.99	0.96	n/a	0.96	0.96	0.55	0.85
EA2a101	LED Bulb, Other Specialty (Multifamily)	HEP	0.99	0.96	n/a	0.96	0.96	0.55	0.85
EA2a045	Linear	HEP	0.99	0.96	n/a	0.96	0.96	0.55	0.85

EA2a100	LED Bulb, Linear (Multifamily)	HEP	0.99	0.96	n/a	0.96	0.96		
EB1a046	Other Specialty	HEA	1	0.91	n/a	0.91	0.91	0.55	0.85
EB1a045	Linear	HEA	1	0.91	n/a	0.91	0.91	0.55	0.85
EA3a007	Other Specialty (Hard to Reach)	ES Products	0.89	1	n/a	1	1	0.55	0.85
EA3a006	Linear (Hard to Reach)	ES Products	0.89	1	n/a	1	1	0.55	0.85
EA1a023	ES Homes Lighting	ES Homes	1	1	n/a	1	1	0.55	0.85

In-Service Rates:

All HEA installations use an in-service rate of 100% because HEA realization rates account for uninstalled measures.[10] All HPwES installations use an in-service rate of 99%.[11] In-service for all other installations are based on MA evaluations.[12]

Realization Rates:

Based on evaluation results, all HEA installations use a realization rate of 91%.[13] All HPwES installations use a realization rate of 100% because gross savings assumptions are adjusted to reflect evaluated results.[14] All other installations have a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are based on prescriptive loadshapes from the updated Navigant Massachusetts Demand Impact Model.[15]

Energy Load Shape:

See Appendix 1 – "Lighting."

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EA3a001	General Service Lamps	ES Products	77%	n/a	n/a	23%
EA3a004	Reflector	ES Products	77%	n/a	n/a	23%
EA3a003	Other Specialty	ES Products	77%	n/a	n/a	23%
EA3a002	Linear	ES Products	77%	n/a	n/a	23%
EA3a005	General Service Lamps (Hard to Reach)	ES Products	57%	n/a	n/a	23%

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EA3a008	Reflector (Hard to Reach)	ES Products	57%	n/a	n/a	23%
EA3a007	Other Specialty (Hard to Reach)	ES Products	57%	n/a	n/a	23%
EA3a006	Linear (Hard to Reach)	ES Products	57%	n/a	n/a	23%

Revision History:

Revision Number	Issue Date	Description
58	1/14/2022	Removed drop ship measures which are not being offered.
85	12/1/2022	Updated Baseline to reflect EISA backstop. Reduced AML's affected by EISA back stop to 1. Added missing links for studies in references.

Endnotes:

1: Department of Energy (2022) Energy Conservation Program: Energy Conservation Standards for General Service Lamps. https://www.govinfo.gov/content/pkg/FR-2022-05-09/pdf/2022-09477.pdf#page=1

2: Note that interactive effects require modeling HVAC end-use consumption based on home characteristics and equipment (e.g., cooling, heating fuel) saturation assumptions. The data and models were not available for New Hampshire, so are not included in the TRM.

3: Hours of use (residential) for the ES Products and HTR channel are based off of "New Hampshire ENERGY STAR® Products Program", prepared by Cadmus for the New Hampshire ENERGY STAR Products New Hampshire Evaluation Measurement & Verification Working Group, October 17, 2018. https://www.puc.nh.gov/electric/Monitoring%20and%20Evaluation%20Reports/20181017-Monitor-Evaluation-Report-Energy-Star-Products-Final-Report.pdf The 2.1 hours per day for ES Products and HTR channel are calculated as the weighted combination of residential and commercial hours of use: (residential HOU*residential %)+(commercial HOU*commercial %) = (1.75*0.93)+(7.0*0.07). HOU for ES Homes reflects the residential HOU only. Hours of use for the HPwES and HEA are based on program requirements for contractors to only replace fixtures that are used for at least three hours per day. The values reflect the daily weighted average LED hours of use. Cross-sector sales are based upon MA RLPNC Cross-Sector Sale HOU Update", Prepared by the NMR Group for the Massachusetts Program Administrators (PAs), August 2, 2018. The 2.1 hours per day for ES Products and HTR channel are calculated as the weighted combination of residential and commercial hours of use: (residential HOU*residential %)+(commercial HOU*commercial %) = (1.75*0.93)+(7.0*0.07). HOU for ES Homes reflects the residential HOU only. Hours of use for the HPwES and HEA are based on program requirements for contractors to only replace fixtures that are used for at least three hours per day.

4: NMR Group, Inc (2022). RCD Lighting Memo. Note that Massachusetts data were used because the New Hampshire ENERGY STAR Product evaluation had not stratified the program data or forecasted baseline wattage by style at the time of this TRM. The delta watts for ES Homes is reduced by 75% to reflect the requirement that 75% of lamps be high-efficacy lamps for new construction (https://codes.iccsafe.org/content/IECC2018). LED Bulb_ 2022_NMR_RCD_Lighting_Memo

5: Delta watts for HPwES are based on NH study "Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL," Prepared by Opinion Dynamics Corporation, June 11, 2020.
https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

6: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.
https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

7: RLPNC 18-7: TLED Product Impact Factor Estimation, Memo from NMR Group, Inc. to the Massachusetts Program Administrators, August 3, 2018

8: The direct installation measure life values come from RLPNC 18-5 Home Energy Assessment LED Net-to-Gross Consensus, Prepared by NMR Group, Inc. for the 2019—21 Planning Assumptions: Lighting Hours-of-Use and In-Service Rate, Prepared by NMR Group, Inc. for the Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) Consultants, July 23, 2018 (https://ma-eeac.org/wp-content/uploads/RLPNC_185_HEALEDNTG_REPORT_23July2018_Final.pdf). These values reflect early replacement baselines, and assume that the replaced bulb, when it burnt out, would have been replaced by an LED at that time. Lighting measures with lost opportunity baselines (e.g., ES Products) add a year to measure life to reflect the different baseline as well as significantly lower hours of use.

9: Table 22. PY2016 Residential Lighting Energy Savings by Utility. Shows evaluated annual net electric energy savings, and evaluated penalties for gas, oil, and propane. Using the values for Eversource, a total calculated heating energy penalty of 341,757,000,000 Btu was assessed on the 150,403,000 kWh of electrical energy savings. "New Hampshire ENERGY STAR® Products Program 2016 Evaluation Report", prepared by Cadmus for the New Hampshire ENERGY STAR Products New Hampshire Evaluation Measurement & Verification Working Group, October 17, 2018.

10: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

11: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL.
https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

12: In-service rates for ES Products and HTR channel are based on the MA study "Residential Lighting Hours-of Use Quick Hit Study MA20R21-E," Prepared by the NMR Group, Inc. for the

Massachusetts Program Administrators, July 13, 2018. Note the ISR is adjusted downward for lamps that are assumed to never be installed but does account (through discounted values) for lamps that are not immediately installed but are likely to be installed in the future. The ISR for Drop Ship is estimated based on program experience with lighting kits and will be evaluated. https://ma-eeac.org/wp-content/uploads/MA20R21-E-LTGHOU-Report-Final-2020.03.31.pdf

13: Opinion Dynamics, July 29, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – FINAL.

14: Opinion Dynamics, June 11, 2020, Home Performance with Energy Star Program Evaluation Report 2016-2017 – FINAL. https://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NHSaves-HPwES-Evaluation-Report-Final-20200611.pdf

15: Navigant Consulting, 2018. RES1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

16: "R1615 Light Emitting Diode (LED) Net-to- Gross Evaluation," Prepared by the NMR Group, Inc. for the Connecticut EEB, August 7, 2017. The 2020 Connecticut net-to-gross values are applied to New Hampshire for 2021 to account for the relatively slower pace of market transformation, due in part to fewer program bulbs per home in New Hampshire (2.5 bulbs per home in 2019) compared to Connecticut (4 bulbs per home in 2019). https://www.energizect.com/sites/default/files/R1615_CT%20LED%20Net-To-Gross%20Evaluation%20Report_Final_8.5.17.pdf

Motors and Drives ECM Circulator Pump

Measure Code	RES-MND-ECP
Markets	Residential
ProgramTypes	Lost Opportunity, Retrofit
Categories	Motors and Drives

Measure Description:

Installation of high efficiency circulator pumps, equipped with variable speed electronically commutated motors (ECM) on a residential hydronic heating system.

Baseline Efficiency:

The baseline efficiency case is the installation of a standard circulator pump for a lost opportunity measure. The baseline efficiency case is replacing an existing circulating pump for a retrofit measure.

High Efficiency:

The high efficiency case is the installation of an ECM circulator pump.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW	Ref
EA3b013	ECM Motor for FWH Circulating Pump	ES Products	75.2	0.075	1
EB1b028	ECM Motor for FWH Circulating Pump	HEA	Modeled	Modeled	

Energy Savings Algorithm:

kWh savings

$$\Delta kWh = \frac{(W_{base} - W_{ee})}{1000} \times EFLH$$

kW savings

$$\Delta kW = \frac{(W_{base} - W_{ee})}{1000}$$

Calculation Parameters Table

Variable	Description	Value	Units	Ref
ΔkWh	Annual electricity savings	Calculated	kWh/yr	N/A
W_{base}	Baseline Pump electricity consumption	90	W	1
W_{ee}	Efficient Pump electricity consumption	14.4	W	1
EFLH	Pump equivalent full load operating hours	1027	hr	1

Measure Life:

The measure life is 15 years[2:].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}[4:]	Ref
EA3b013	ECM Motor for FWH Circulating Pump	ES Products	1.00	1.00	n/a	1.00	1.00	0.00	0.87	4
EB1b028	ECM Motor for FWH Circulating Pump	HEA	1.00	0.91	n/a	0.91	0.91	0.00	0.87	4, 5

Energy Load Shape:

See Appendix 1 – "Boiler Distribution"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

For ECM motors delivered through midstream channels, the following factors apply[3:].

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	Ref
EA3b013	ECM Motor for FWH Circulating Pump	ES Products	0.40	0.09	0.00	0.69	3

Revision History:

Revision Number	Date	Description
348	1/16/2026	Updated the program types and included Retrofit
349	1/16/2026	Updated the deemed savings values
350	1/16/2026	Updated the winter coincidence factor values
351	1/16/2026	Updated the reference links
352	1/1/2027	Added algorithms that were used to calculate deemed savings; Updated deemed savings

Endnotes:

1: Savings were derived from the ECM Circulator Study, by Guidehouse. 2021_Guidehouse_ECM Circulator. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/616996543b0e447ee97cdfc3/view?authToken=3187157a6f71c346a7939268d347299b779ee6c0fdf54d249d3c74e73bed931ba193655c0e8b1b43ca44711bc12abf51385a268946a3962d2de54fe59af21cc90bd55b333d0b0a(Last accessed January 16, 2026)

2: Assumed to be consistent with C&I Electric Motors & Drives – Energy & Resources Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1. (Last accessed January 16, 2026)

3: Impact Factors are from Massachusetts Residential Programs Net-to-Gross Research of RCD and Select Products Measures for Electric HVAC. (Last accessed January 16, 2026)

4: Guidehouse (2023).

5: MA RBUECS Demand Impact Model. Boiler Distribution Load Shape Winter System Peak CF from Summary Data Tab.

6: NMR Group, Inc. New Hampshire Home Energy Assistance Program Impact and Process Study, Prepared for New Hampshire EM&V Working Group, February 2026.

Motors and Drives Pool Pump

Measure Code	**RES-MND-PP**
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Motors and Drives

Measure Description:

The installation of a variable-speed drive pool pump, 0.5 HP or larger. Operating a pool pump for a longer period at a lower wattage can move the same amount of water, using significantly less energy.

Baseline Efficiency:

The baseline efficiency case is a pump that meets the July 2021 federal standard 10 CFR part 431 in table 1.3.1.[1]

Equipment Class			
Dedicated-Purpose Pool Pump Variety	Hydraulic HP Applicability*	Motor Phase	Minimum allowable WEF ** Score
Standard-Size Self-Priming Pool Filter Pumps	<2.5 hhp and>=.711	Single	WEF= -2.30*ln(hhp)+6.59
Small-Size Self-Priming Pool Filter Pumps	Hhp<.711hp	Single	WEF = 5.55 for hhp ≤ 0.13 hp, -1.30 * ln (hhp) + 2.90 for hhp > 0.13 hp
Non-Self Priming Pool Filter Pumps	hhp < 2.5 hp	Any	WEF = 4.60 for hhp ≤ 0.13 hp, -0.85 * ln (hhp) + 2.87 for hhp > 0.13 hp
Pressure Cleaner Booster Pumps	any	Any	WEF = 0.42

*All instances of hhp refer to rated hydraulic horsepower determined in accordance with the DOE test procedure at 10 CFR 431.464 and applicable sampling plans. ** WEF is measured by kgal/kWh.

High Efficiency:

The high efficiency case is a pool pump meeting Energy Star Program Requirements for pool Pump version 3.1 [2]

Algorithms for Calculating Primary Energy Impact:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	REF
EA3b024	Pool Pump (Variable Speed)	ES Products	157.62	0.18	3

Measure Life:

The measure life is 6 years.[4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	REF
EA3b024	Pool Pump (Variable Speed)	ES Products	0.99	1.00	n/a	1.00	1.00	0.88	0.00	5,6,7

Energy Load Shape:

See Appendix 1 – "Pool Pump".[8]

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EA3b024	Pool Pump (Variable Speed)	ES Products	0.24	0.13		0.88	9

Revision History:

Revision Number	Effective Date	Description
138	12/1/2022	Clarified high efficiency values from Energy Star
178	1/1/2024	Updated baseline to align with new federal standard and savings.
179	1/1/2024	Updated measure life to reflect most recent study
353	1/1/2027	Updated kW savings, ISR, CF_{SP} and NTG per the 2026 NH ES Products memo.

Endnotes:

1: DOE, December 2016. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment; Dedicated – Purpose Pool Pumps. https://www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105

2: Energy Star (2021) Pool Pumps Key Product Criteria https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%203.1%20Pool%20Pumps%20Final%20Specification_0.pdf

3: Unit kWh and kW savings are deemed per the 2026 NH ES Products Memo. NMR (2026) New Hampshire Energy Star Products Memo.

4: DOE Direct Final Rule Technical Support Document Dedicated-Purpose Pool Pumps table 7.4.1 https://www.regulations.gov/document/EERE-2015-BT-STD-0008-0105

5: All installations have a 100% in-service rate unless an evaluation finds otherwise.

6: All programs use a 100% realization rate unless an evaluation finds otherwise.

7: CF factors of 88% for Summer peak and 0% for winter peak are applied per the 2026 NH ES Products Memo. NMR (2026) New Hampshire Energy Star Products Memo.

8: Navigant, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

9: NTG is applied per the 2026 NH ES Products Memo. NMR (2026) New Hampshire Energy Star Products Memo.

Whole Home - New Construction

Measure Code	RES-WH-NC
Markets	Residential
ProgramTypes	Lost Opportunity
Categories	Whole Home

Measure Description:

The Program Administrators currently use vendor calculated energy savings using a RESNET accredited Rating Software Tool where a user inputs a detailed set of technical data about a project, comparing as-built projected energy consumption to that of a Baseline Home. This process is used to calculate electric and fossil fuel energy savings due to heating, cooling, and water heating for all homes.[1]

Baseline Efficiency:

The Baseline Home is based on a User Defined Reference Home (UDRH) specific to the building type, single family or multifamily, which reflects the New Hampshire Energy Code. See "Appendix 3: UDRH".

High Efficiency:

The high-efficiency case is represented by the specific energy characteristics of each "as-built" home completed through the program.

Algorithms for Calculating Primary Energy Impact:

Unit savings are custom calculated for each home for heating, cooling, and water heating end uses. Demand savings are derived from the Navigant Demand Impact Model. As noted below, because the values are custom generated on a site-by-site basis, they are not shown in the table below.

BC ID	Measure Name	Program
EA1a001 EA1a012 GA1a001 GA1a004	Cooling, Electric Cooling, Electric SF Cooling, Electric, MF	ES Homes
EA1a002 EA1a013	Heating, Electric	ES Homes
EA1a003 EA1a014 GA1a002 GA1a005	Heating, Gas Heating, Gas, SF Heating, Gas, MF	ES Homes
EA1a004 E21A1a015	Heating, Oil	ES Homes
EA1a005 EA1a016	Heating, Propane	ES Homes
EA1a006 EA1a017	Heating, Wood Pellets	ES Homes
EA1a007 EA1a018	Hot Water, Electric	ES Homes
EA1a008 EA1a019 GA1a003 GA1a006	Hot Water, Gas Hot Water, Gas, SF Hot Water, Gas, MF	ES Homes
EA1a009 EA1a020	Hot Water, Oil	ES Homes
EA1a010 EA1a021	Hot Water, Propane	ES Homes
EA1a011 EA1a022	Hot Water, Wood Pellets	ES Homes

Measure Life:

The measure life is shown below and varies by end use.[5]

BC ID	Measure Name	Program	EUL
EA1a002 EA1a013 EA1a003 EA1a014 EA1a004 EA1a015 EA1a005 EA1a016 EA1a006 EA1a017 GA1a001 GA1a005	Heating	ES Homes	25
EA1a001 EA1a012 GA1a001 GA1a004	Cooling	ES Homes	25
EA1a007 EA1a018 EA1a008	Water Heating	ES Homes	15

BC ID	Measure Name	Program	EUL
EA1a019 EA1a009 EA1a020 EA1a010 EA1a021 EA1a011 EA1a022 GA1a003 GA1a006			

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA1a001 EA1a012	Cooling, Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.35	0.00
EA1a002 EA1a013	Heating, Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.00	0.43
EA1a003 EA1a014	Heating, Gas	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a004 EA1a015	Heating, Oil	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a005 EA1a016	Heating, Propane	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a006 EA1a017	Heating, Wood Pellets	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a007 EA1a018	Hot Water, Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.31	0.81
EA1a008 EA1a019	Hot Water, Gas	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a009 EA1a020	Hot Water, Oil	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a010 EA1a021	Hot Water, Propane	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EA1a011 EA1a022	Hot Water, Wood Pellets	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a001	Cooling, Electric, SF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a002	Heating, Gas, SF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a003	Hot Water, Gas, SF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GA1a004	Cooling, Electric, MF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a005	Heating, Gas, MF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a006	Hot Water, Gas, MF	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a007	LED Bulb	ES Homes	1.00	1.00	1.00	1.00	1.00	0.336	0.201
GA1a008	LED Fixture	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GA1a009	Clothes Washer	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	1.00

In-Service Rates:

All installations have 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

All energy realization rates are 100% because energy and demand savings are custom calculated based on project specific details.

Coincidence Factors:

Coincidence factors for electric end uses are based on prescriptive load shapes from the updated Navigant Demand Impact Model for Massachusetts.[6]

Coincidence factors for non-electric end uses are set to 100% as no electrical energy impacts are expected.

Energy Load Shape:

See appendix one for relevant loadshapes.

Revision History:

Revision Number	Issue Date	Description
40	1/14/2022	Fixed broken link in references
86	12/1/2022	Updated evaluation and code references to latest versions and added reference to Energy Star v3.1 baseline doc.
354	1/1/2027	Updated baseline verbiage to reflect new UDRH results. Removed references to old software in measure description.
401	10/30/2026	Added in omitted gas BC ID's GA1a001 through GA1a009

Endnotes:

1: Note that there are also prescriptive rebates for appliances, including clothes washers, clothes dryers, and refrigerators, as well as lighting, which are covered in other sections of the TRM

2: See "ESHOME UDRH update 02-23-2018, Revised 5-17-2019.docx"; https://www.energystar.gov/ia/partners/downloads/ES_Combined_Path_v3.1.pdf

3: Note the UDRH represents both single family and multifamily homes, and all measures (cooling heating, and hot water) are present in both single family and multifamily homes.

4: Energy and Resource Solutions, December 7, 2018. New Hampshire ENERGY STAR Homes Program Impact Evaluation. Prepared for the NH Program Administrators. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/NH_ESHomes_Report_Final_v4-2017.pdf

5: MA Technical Reference Manual 2022-24 Plan Version, Page 252, "Chapter 1.64: Whole Home New Construction" section, https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/14154670.

6: Navigant Consulting, 2018. RES 1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Whole Home - Energy Report

Measure Code	RES-BE-ER
Markets	Residential
ProgramTypes	Custom
Categories	Behavior

Measure Description:

Residential home energy report ("HER") programs levereage behavior science to influence customers' energy use practices. The program strategy involves sending customer-specific energy use reports to a sample of electric and / or natural gas customers. The implementation vendor calculates savings results based on statistical analysis of the differences in energy usage for the treatment group when compared to the energy usage of a control group.

Baseline Efficiency:

The baseline efficiency case is a control-group customer who does not receive home energy reports.

High Efficiency:

The high efficiency case is a customer who receives periodic mailed and/or emails home energy reports tailored and has access to a web-based dashboard that includes tailored messaging regarding ways of reducing energy use.

Algorithms for Calculating Primary Energy Impact:

Unit savings for Home Energy Reports are based on calculations from vendor results.

A lagged-dependent variable (LDV) model (sometimes also referred to as a post-period regression with pre-period controls) utilizes a panel data set (a cross-sectional time-series) to estimate energy savings from a randomized control trial (RCT) using pre-treatment (lagged) energy consumption value(s) as an independent control.

$$ADU_{k,t} = \alpha + \beta_1 treatment_k + \sum_j \beta_{2j} Month_t + \sum_i \beta_{3i} ADUlag_{k,t,i} + \varepsilon_{k,t}$$

Where:

$ADU_{k,t}$ is average daily consumption of kWh by household k in month t,

α is the model intercept,

$treatment_k$ is a binary variable with a value of 0 if household k is assigned to the control group and 1 if assigned to the treatment group,

$Month_j$ is a binary variable with a value of 1 when t=j, and is 0 otherwise,

$ADUlag_{k,t,i}$ is a vector of i baseline usage control variables. An evaluator may choose the form of these control values, as pre-treatment data availability may allow. A suggested formulation for this vector is the following three (i=3) LDV terms:

A. $avg_preusage_k$ is the average daily usage across household k's available pre-treatment meter reads for the year prior to the start of treatment,

B. $avg_preusage_winter_k$ is the average daily usage over the months of December through March across household k's available pre-treatment meter reads for the year prior to the start of treatment and,

C. $avg_preusage_winter_k$ is the average daily usage over the months of June through September across household k's available pre-treatment meter reads for the year prior to the start of treatment.

A simpler, alternative, formulation of this $ADUlag_{k,t,i}$ term can be a single (i=1) LDV representing household k's average daily energy use in the same calendar month as t in year immediately preceding the program.

6. $\varepsilon_{k,t}$ is the cluster-robust idiosyncratic error term for household k in month t.

The coefficient β_1 is the coefficient of interest; it is the estimate of average daily energy savings for a household in the treatment group.

Measure Life:

The measure life for Home Energy Reports is 1 year[1]. As a behavioral measure, the intervention of regularly receiving a Home Energy Report is required to claim savings.

BC ID	Measure Name	Program	Measure Life
E21A4a001 G21A4a001	Residential Whole Home Energy Report	Residential Behavior	1

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EA4a001	Residential Whole Home Energy Report	Residential Behavior	1.00	1.00	NA	1.00	1.00	0.547	0.848
GA4a001	Residential Whole Home Energy Report	Residential Behavior	1.00	NA	1.00	NA	NA	NA	NA

In-Service Rates:

All installations have 100% in-service rates since reports are sent out regularly to participants.[1.]

Realization Rates:

Realization rates from Navigant's 2016 evaluation of Eversource New Hampshire Home Energy Report pilot program found that the realization rate for the normative behavior program design was 99.9%.[1.]

Coincidence Factors:

Summer and winter coincidence factors are based on a residential lighting loadshape.[2]

Energy Load Shape:

See Appendix 1.

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
Non-Electric Measures	0.00%	0.00%	0.00%	0.00%
Clothes Washer	18.30%	15.40%	36.40%	29.90%
24-hour operation	15.20%	18.30%	30.50%	36.10%
Clothes Dryer - Electric	16.90%	14.20%	38.90%	30.00%
Clothes Dryer - Natural Gas	15.90%	16.40%	37.60%	30.10%
Hardwired Electric Heat	0.00%	0.00%	43.10%	56.90%

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
Lighting	19.00%	15.10%	35.10%	30.70%
Primary TV and Peripherals	15.40%	17.60%	32.20%	34.80%
Primary Desktop Computer	17.50%	17.30%	33.50%	31.70%
Primary Refrigerator	18.20%	20.90%	29.00%	31.90%
Secondary Refrigerator	19.90%	23.60%	26.30%	30.20%
Freezer	17.10%	20.70%	28.70%	33.60%
Dehumidifier	24.90%	29.70%	22.00%	23.30%
Pool Pump	54.50%	38.20%	4.90%	2.40%
Dishwasher	14.80%	16.30%	34.10%	34.80%
Water Heater - Electric	15.20%	11.90%	41.50%	31.40%
Water Heater - Heat Pump	14.90%	13.00%	39.10%	33.00%
Water Heater - Natural Gas/Fuel Oil	13.30%	11.60%	40.90%	34.20%
Central Air Conditioner/Heat Pump (Cooling)	47.30%	42.20%	6.60%	3.80%
Room or Window Air Conditioner	47.50%	47.40%	2.90%	2.20%
Mini-Split Air Conditioner/Heat Pump (Cooling)	43.40%	40.20%	7.40%	9.00%
Mini-Split Heat Pump (Heating)	0.00%	0.00%	42.90%	57.10%
Furnace Fan	0.00%	0.00%	44.60%	55.40%
Boiler Distribution	0.00%	0.00%	45.00%	55.00%
Weighted HVAC - All Homes	23.20%	21.70%	25.40%	29.70%
Weighted HVAC - Multi-family	25.20%	23.70%	23.20%	27.90%
Weighted HVAC - Multi-family Low Income	22.40%	21.60%	25.40%	30.60%
Weighted HVAC - Single Family	22.50%	20.80%	26.10%	30.50%
Weighted HVAC - Single Family Low Income	23.10%	21.70%	25.30%	29.90%
Central Heat Pump	10.10%	9.00%	35.10%	45.70%
DMSHP	8.00%	7.40%	36.40%	48.20%
Electric Resistance with AC	6.00%	5.00%	45.00%	44.00%

Revision History:

Revision Number	Issue Date	Description

41	1/14/2022	Fixed broken link in references

Endnotes:

1: Navigant Consulting (2016). Home Energy Report Pilot Program Evaluation Final Report, Feb 2014- Feb 2015. Prepared for Eversource New Hampshire.

2: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf
2018_Navigant_Baseline_Loadshape_Comprehensive_Report

2. Commercial and Industrial

Active Demand Response

Measure Code	COM-ADR-ADR
Markets	Commercial
ProgramTypes	Custom
Categories	Active Demand Response

Measure Description:

Active Demand Reduction includes C&I Load Curtailment Targeted Dispatch and Storage Daily Dispatch Performance.

The Load Curtailment offering is technology agnostic and provides an incentive for verifiable shedding of load in response to a signal or communication from the Program Administrators coinciding with system peak conditions. Large C&I customers that are subject to demand charges and/or direct capacity charges (determined by ICAP tags) with the ability to control lighting, HVAC, and/or process loads, can use this demand reduction performance offering to generate revenue by altering their operations a few times per year. The offering focuses on reducing demand during summer peak events typically targeting fewer than twenty hours per summer.

Baseline Efficiency:

Baseline conditions will be determined based on technology.

For Load Curtailment, baseline conditions are based on an adjustment settlement baseline with symmetric, additive adjustment. The symmetrically adjusted settlement baseline is developed based on a pool of the most recent 10 non-holiday weekdays. The baseline shape consists of average load per interval across the eligible days. The baseline is adjusted based on the difference between baseline and facility load in the second hour prior to the event (the baseline adjustment period), and the adjustment can be either to increase or decrease the estimated load reduction (i.e., symmetric adjustment). This adjustment accounts for weather-related and other differences of load magnitude.[1]

High Efficiency:

Active Demand Reduction does not directly increase efficiency. Load curtailment does reduce power consumption by curtailing use but does not inherently reduce energy consumption.

Algorithms for Calculating Primary Energy Impact:

The Active Demand Reduction measure generates site-specific vendor-reported demand savings, which are validated by evaluation. Savings estimates for these projects are calculated using engineering analysis with project-specific details.

Measure Life:

As all C&I active demand response measures are based on Program Administrators calling demand reduction events each year, the deemed measure life is one year.

BC ID	Measure Name	Program	Measure Life

EC5a001	Load Curtailment Targeted Dispatch P4P Summer	C&I Active Demand Response	1

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC5a001	Load Curtailment Targeted Dispatch P4P Summer	C&I Active Demand Response	1.00	0.876	1.00	0.876	1.00	1.00	0.00

In-Service Rates:

In-service rates for commercial and industrial active demand response are assumed to be 100% by default, as measured performance in the ADR program is required to claim savings.

Realization Rates:

Electrical energy realization rates for this measure are assumed to be equal to summer peak demand realization rates.

Summer peak realization rates for interruptible load are based on a program evaluation of the 2023 summer demand reduction period for New Hampshire.[2] These realization rates are based on the overall program savings, rather than individual measure savings, and represent the retrospective realization rate (i.e. the evaluated symmetric savings estimate divided by the reported asymmetric savings estimate).

Coincidence Factors:

Coincidence factors for this measure are assumed to be 100%, as the scaling factor accounts for the coincidence of program events with the system peak. The programs are not claiming winter peak impacts due to the fact that the ISO-NE system is summer peaking.

Energy Load Shape:

As commercial active demand response events are called on the day preceding the event, the most appropriate load shape to use is a symmetric load based on the 10 baseline day load shape at the same facility.[3]

Revision History:

Revision Number	Date	Revision
214	1/1/2025	Updated RR based on 2024 C&I tristate ADR Study. Removed measures not being offered by NH Saves.

Endnotes:

1: DNV (2024). MA23DR01-E-C&I / CT2214 – Cross-State C&I Active Demand Reduction Initiative Summer 2023 Evaluation Report

2: DNV (2024). MA23DR01-E-C&I / CT2214 – Cross-State C&I Active Demand Reduction Initiative Summer 2023 Evaluation Report

3: Avoided Energy Supply Components in New England: 2018 Report, page 105. https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf

Appliances Advanced Power Strip

Measure Code	COM-APP-APS
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Appliances

Measure Description:

Advanced power strips can automatically eliminate standby power loads of electronic peripheral devices that are not needed (computer printer, scanner, etc.) either automatically or when an electronic control device (typically a television or personal computer) is in standby or off mode.

Baseline Efficiency:

The baseline efficiency case is the customers' electronic peripheral devices as they are currently operating. Baseline usage estimates for

High Efficiency:

The high efficiency case is the installation of an Advanced Power Strip purchased through the C&I online market place. Limit, 10 per year per account.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on refenced study results.[1]

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC1c055 EC2c055	Smart Strip, Tier I	LBES SBES	105.00	0.010
EC1c056 EC2c056	Smart Strip, Tier II	ES LBES SBES	207.00	0.024

Measure Life:

The measure life is 5 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c055	Smart strip, Tier 1	Electric	LBES Mid	1	1	n/a	1	1	0.58	0.86
EC2c055	Smart strip, Tier 1	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.58	0.86
EC1c056	Smart strip, Tier 2	Electric	LBES Mid	1	1	n/a	1		0.58	0.86
EC2c056	Smart strip, Tier 2	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.58	0.86

In-Service Rates:

In-service rates are assumed to be 100% until evaluated.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[3]. Realization rates are assumed to be 100% until evaluated.

Coincidence Factors:

Programs use a summer coincidence factor of 58% and a winter coincidence factor of 86%[4].

Energy Load Shape:

See Appendix 1 – "Primary TV and Peripherals"[2.]

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c055 EC2c055	Smart Strip, Tier I	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%
EC1c056 EC2c056	Smart Strip, Tier II	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%

Revision History:

Revision Number	Date	Description
103	12/1/2022	New Measures Added
297	1/1/2026	Updated RRs for SBES according to 2025 impact study results.

Endnotes:

1: NMR Group Inc (2019) RLPNC 17-3: Advanced Power Strip Metering Study https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488726996f2b1b57df7a3/view?authToken=3da42fae99

dc586f4b471345dbea348c0ac998555ebf2a55d95ce1a98360bfa95531073edab1860626068ca5d53d6c9c23447fbfa467295248e785a1649ff5ecb5c8a2459de6f2

2: This value is borrowed from the Massachusetts Common Assumptions.

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: Guidehouse (2021) Massachusetts Residential Baseline Study Phase 4 https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

Appliances Clothes Washer, High Speed

Measure Code	COM- APP- CWHS
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Appliances

Measure Description:

This measure applies to the installation of clothes washers with extraction speeds of 200G or greater, which is significantly higher than traditional hard-mount washers. Standard washer extractors in laundromats operate at speeds of 70-80G1535. The high-speed extraction process in the wash cycle removes more water from each compared to standard washers, reducing operating time and gas consumption of clothes dryers. Heat exposure and mechanical action are also reduced, resulting in less linen wear.

Baseline Efficiency:

The baseline equipment is assumed to be a clothes washer with an extraction speed of 100G or less, installed in a commercial laundromat.

High Efficiency:

The efficient equipment is assumed to be a clothes washer with an extraction speed of 200G or greater, installed in a commercial laundromat.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔmmBtu
GC1b032	Clothes Washer, High Speed	LBES New	Calculated
GC1c022	Clothes Washer, High Speed	SBES New	Calculated
GC2b032	Clothes Washer, High Speed	LBES Mid	Calculated
GC2c022	Clothes Washer, High Speed	SBES Mid	Calculated
GC3b032	Clothes Washer, High Speed	Muni New	Calculated

Algorithms for Calculating Fossil Fuel Savings:

$$\Delta Therms = (Ncycles \times Days \times Capacity \times RMC \times h_e / \eta_{dryer} / 100{,}000) \times DryerUse \times LF$$

Where:

Ncycles = Average number of washer cycles per day

= Use values below, depending on application

Application	Ncycles
Coin op	4.2[1]
MF	3.4[2]
Hotel/motel hospital	10.4[3]

Days = Days per year of commercial laundromat operation, if unknown assume 360 days, assumes closure on holidays.

Capacity= Clothes washer rated capacity (lb/cycle). Use actual based on the weight of dry clothing.

RMC = Retained Moisture Content (%) reduction from replacing a low extraction speed washer, assume 15%. [4]

h_e = Heat required by a dryer to evaporate 1 lb of water = Assume 1,200 Btu/lb [5]

ηdryer = Efficiency of the clothes dryer = Actual, or if unknown, assume 60%[6]

100,000 = Converts Btus to therms

DryerUse = % of washer loads dried in the field = Assume 91%[7]

LF = Load Factor (%) to account for the pounds per washer load, as a percentage of rated capacity. Assume 66%[8]

Measure Life:

The measure life is 7 years.[9]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1b032 GC1c022 GC2b032 GC2c022 GC3b032	Clothes Washer, High Speed	LBES New SBES New LBES Mid SBES Mid Muni New	1.00	1.00	n/a	1.00	1.00	N/A	N/A

In-Service Rates:

In-service rate is 100% until evaluated.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

N/A

Energy Load Shape:

N/A

Revision History:

Revision Number	Revision Date	Description
180	1/1/2024	New Measure Added

Endnotes:

1: 2021 2020-2021 State of the Self-Service Laundry Industry (Part 2), Bruce Beggs, April 1, 2021. https://americancoinop.com/articles/2020-2021-state-self-service-laundry-industry-part-2

2: Assessment of Water Savings for Commercial Washers: Report on the Monitoring and Assessment of Water Savings from the Coin-Operated Multi-Load Clothes Washers Voucher Initiative Program." San Diego County Water Authority October 2016. https://kipdf.com/assessment-of-water-savings-for-commercial-washers_5ad8603f7f8b9af21d8b4594.html

3: "Laundry Planning Guide." EDRO, January 2015. EDRO Laundry Planning Guide

4: "Laundry Planning Guide." EDRO, January 2015. Using Moisture Retention Chart on page 11 and assuming a 50/50 cloth blend load of cotton and polyester, the retained moisture drops from approximately 65% to 50% when a 100 g washer is replaced with a 200 g washer. Chart from "Laundry Planning Guide." EDRO, January 2015. The Department of Energy test procedures for commercial clothes washers specifies, "…the use of energy test cloth consisting of a pure finished bleach cloth, made with a momie or granite weave, which is a blended fabric of 50-percent cotton and 50-percent polyester." – Energy Conservation Program: Energy Conservation Standards for Commercial Clothes Washers; Final Rule, Notice of Proposed Rulemaking, DOE, March 2014 (10 CFR Part 431) EDRO Laundry Planning Guide

5: "Laundry Planning Guide." EDRO, January 2015. EDRO Laundry Planning Guide

6: ACEEE (2010), "Are We Missing Energy Savings in Clothes Dryers?" Paul Bendt (Ecos), 2010, https://www.aceee.org/files/proceedings/2010/data/papers/2206.pdf

7: "Dryer Field Study." Northwest Energy Efficiency Alliance, November 20, 2014., https://ecotope-publications-database.ecotope.com/2014_005_1_DryerStudy.pdf

8: Assessment of Water Savings for Commercial Washers: Report on the Monitoring and Assessment of Water Savings from the Coin-Operated Multi-Load Clothes Washers Voucher Initiative Program." San Diego County Water Authority October 2016. https://kipdf.com/assessment-of-water-savings-for-commercial-washers_5ad8603f7f8b9af21d8b4594.html

9: Assessment of Water Savings for Commercial Washers: Report on the Monitoring and Assessment of Water Savings from the Coin-Operated Multi-Load Clothes Washers Voucher Initiative Program." San Diego County Water Authority October 2016. https://kipdf.com/assessment-of-water-savings-for-commercial-washers_5ad8603f7f8b9af21d8b4594.html

Appliances Dehumidifier

Measure Code	COM-APP-DEH
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Appliances

Measure Description:

Dehumidifiers exceeding minimum qualifying efficiency standards established as ENERGY STAR.

Baseline Efficiency:

The lost opportunity baseline efficiency case is a dehumidifier that meets the federal standard effective June 13, 2019. Specific baseline Energy Factors (EFs) by product capacity found in the Code of Federal Regulations, 10 CFR 430.32(v)(2). The retrofit baseline efficiency case is the existing dehumidifier.

High Efficiency:

The high efficiency case is a dehumidifier that meets the ENERGY STAR standard as of October 31, 2019[1]. For a new dehumidifier with a capacity less than 25 pints/day the minimum EF is 1.57 liters/kWh. For a new dehumidifier with a capacity between 25.01 and 50 pints/day the minimum EF is 1.8 liters/kWh. For a new dehumidifier with a capacity greater than or equal to 50 pints/day the minimum EF is 3.3 liters/kWh.

Capacity (pints)	Energy Factor (2019 Federal Standard)	Energy Factor (ENERGY STAR)
≤ 25	1.30	1.57
25.01-50	1.60	1.80
≥ 50	2.80	3.30

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
EC1c063	OMP Dehumidifier	LBES Mid	82.3	0.02
EC2c063	OMP Dehumidifier	SBES Mid	82.3	0.02

Source Algorithm for Deemed Savings:

Unit savings are calculated as below. Demand savings are derived from the Navigant Demand Impact Model.[1]

ΔkWh =Load×[(1÷Eff_{BASE})−(1÷ Eff_{ES})]×Hours

Where:

Load = Typical dehumidification load, 1520 Liters/year[1.]

Eff_{BASE} = Average efficiency of model meeting the federal standard, in Liters/kWh

Eff_{ES} = Efficiency of ENERGY STAR® model, in Liters/kWh

Hours = Dehumidifier annual operating hours, site-specific if available, or deemed 2,851 hour/year[2]

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC1c063	OMP Dehumidifier	LBES Mid	82.3	0.02
EC2c063	OMP Dehumidifier	SBES Mid	82.3	0.02

Measure Life:

The measure life is 12 years[3.]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c063	Dehumidifier	LBES Mid	1	1	n/a	1	1	0.82	0.17
EC2c063	Dehumidifier	SBES Mid	1	0.998	n/a	1.103	0.885	0.82	0.17

In-Service Rates:

Installations have 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. Realization rates are 100% for unless an evaluation finds otherwise for all other programs.

Coincidence Factors:

All programs use a summer coincidence factor of 82% and a winter coincidence factor of 17%[1].

Energy Load Shape:

See Appendix 1 – "Dehumidifier".

Revision History:

Revision Number	Revision Date	Description
102	12/1/2022	Added new measure: C&I OMP Dehumidifier
304	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Navigant Consulting, 2018. RES1 Demand Impact Model Update. https://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

2: Environmental Protection Agency (2019). Dehumidifier Key Efficiency Criteria. https://www.energystar.gov/products/appliances/dehumidifiers/key_efficiency_criteria

3: Environmental Protection Agency (2014). Savings Calculator for Energy Star Qualified Appliances. ENERGY_STAR_2015_Appliance_Calculator

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Appliances Room Air Purifier

Measure Code	COM-APP-RAP
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Appliances

Measure Description:

Room air purifiers exceeding minimum qualifying efficiency standards established as ENERGY STAR®.

Baseline Efficiency:

There are no appliance standards for room air purifiers. Consistent with the MA TRM, the baseline efficiency case is a room air purifier with 2.0 CADR/ Watt. Partial on power is set at the Energy Star threshold of 2 Watts.

High Efficiency:

The high efficiency case is a room air purifier with a 3.0 CADR/ Watt, consistent with the MA TRM and partial on power of 2 Watts or less purchased through the C&I Online Market Place. Limit, 10 per year per account.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
Ec2c054	Room Air Purifier	LBES Mid	Calculated	Calculated
Ec1c054	Room Air Purifier	SBES Mid	Calculated	Calculated

Algorithms for Calculating Savings:

$$DkWh = kWh_{base} - kWh_{EE}$$

$$kWh_{Base} = hr \times \left(\frac{Smoke\ CADR_{,base}}{Smoke\ CADR/Watt_{,base} \times 1000}\right) + (8760 - hr) \times \frac{Watt_{partial\ on,base}}{1000}$$

$$kWh_{EE} = hr \times \left(\frac{Smoke\ CADR_{,EE}}{Smoke\ CADR/Watt_{,EE} \times 1000}\right) n + (8760 - hr) \times \frac{Watt_{partial\ on,EE}}{1000}$$

Gross annual kW savings:

$$DkW = DkWh/hr \times CF$$

where:

kWh_{Base} = Annual Electrical Usage for baseline unit (kWh)

kWh_{EE} = Annual Electrical Usage for efficient unit (kWh)

hr = Annual active operating hours. See Table below.

$Smoke\ CADR_{base}$ = Smoke CADR for baseline units (cfm)

$Smoke\ CADR/Watt_{base}$ = Smoke CADR delivery rate per watt for baseline units (cfm/W) = 2

$Watt_{partial\ on,\ base}$ = Partial On Power for baseline units (watts) = 2

1000 = Conversion factor from watts to kilowatts

$Smoke\ CADR_{EE}$ = Smoke CADR for baseline units (cfm)

$Smoke\ CADR/Watt_{EE}$ = Smoke CADR delivery rate per watt for baseline units (cfm/W) = 3

$Watt_{partial\ on,\ EE}$ = Partial On Power for baseline units (watts) = 2

The energy and peak demand savings for a unit with a CADR = 500 cfm across 3 building types is shown below:

Building Type	Hours of Use	CADR (cfm)	CADR/ W_{base}	CADR/ W_{EE}	kWh savings	CF	kW savings
Education	2,967	500	2	3	247	0	0.000
Retail	4,939	500	2	3	412	1	0.083
Small Office	3,748	500	2	3	312	1	0.083

Measure Life:

The measure life is 3 years.[3]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{SP}
Ec2c054	Room Air Purifier	LBES Mid	1.00	1.00	n/a	0.00	0.00	1.00	1.00
Ec1c054	Room Air Purifier	SBES Mid	1.00	0.998	n/a	0.998	1.103	1.00	1.00

In-Service Rates:

In-service rate is 100% until evaluated.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are 100% for both summer and winter peaks, since the air purifiers are expected to operate continuously during peak hours.

Energy Load Shape:

See Appendix 1 – "24 hour operation."[5]

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
Ec2c054 Ec1c054	OMP Room Air Purifier	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%

Revision History:

Revision Number	Revision Date	Description
104	12/1/2022	New Measure Added
164	3/1/2023	BC ID's corrected, previously listed residential BC ID.
305	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: The Clean Air Delivery Rate is voluntary standard made available for comparing the performance of portable air filters in a room at steady-state conditions during a controlled laboratory test: ANSI/AHAM AC-1-2015 (AHAM 2015). It was developed by the Association of Home Appliance Manufacturers (AHAM), a private voluntary standard-setting trade association, and is recognized by the American National Standards Institute (ANSI).

2: Air purifier hours of use assumed to be equal to the lighting hours of use. Lighting hours of use taken from: DNV GL, September 25, 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

3: The Residential 9-year measure life can't be expected due to the driver for customer interest for this measure is COVID which is expected to be temporary. Additionally, plug load in C&I where equipment is transient is a concern.

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf.

Building Shell Air Sealing and Insulation

Measure Code	COM-BS-ASI
Markets	Commercial
ProgramTypes	Retrofit
Categories	Building Shell

Measure Description:

Air Sealing: Air sealing will decrease the infiltration of outside air through cracks and leaks in the building. Air sealing measures apply to small commercial and municipal buildings without continuous ventilation air during occupied hours.

Insulation: The installation of high efficiency insulation in an existing structure.

Baseline Efficiency:

Air Sealing: Baseline flow rate will come from blower door testing where available. If pre-implementation blower door results are unavailable, use default of 0.4 CFM_{75}/SF[1].

Insulation: The baseline efficiency case is characterized by the total R-value of the existing attic, basement, or sidewall (Rexist). This is calculated as the R-value of the existing insulation, estimated by the program contractor, plus R-Assembly, calculated as the R-value of the ceiling, floor, or wall. Where project specific R-Assembly values are unavailable, default values are applied (RCEILING = 3.36; RFLOOR = 6.16; RWALL = 6.65)[13].

High Efficiency:

Air Sealing: The high efficiency case is the existing building after the air sealing measure is implemented. The high efficiency case is characterized by the new air changes per hour, which is measured after the air sealing measure is implemented. The high efficiency flow rate will come from the post-installation blower door air test. If test results are unavailable, use 0.25 CFM_{75}/SF[2]

Insulation: The high efficiency case is characterized by the total R-value of the attic after the installation of additional attic, basement, or sidewall insulation. This is calculated as the sum of the existing R-value (Rexist) plus the R-value of the added insulation.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	Δmmbtu
EC3a015	Air Sealing, Electric	Muni Retro	Calculated	Calculated	Calculated
EC3a016	Air Sealing, Gas	Muni Retro	Calculated	Calculated	Calculated
EC3a017	Air Sealing, Oil	Muni Retro	Calculated	Calculated	Calculated
EC3a018	Air Sealing, Propane	Muni Retro	Calculated	Calculated	Calculated
EC3a051	Insulation, Electric	Muni Retro	Calculated	Calculated	Calculated
EC3a052	Insulation, Gas	Muni Retro	Calculated	Calculated	Calculated
EC3a053	Insulation, Oil	Muni Retro	Calculated	Calculated	Calculated
EC3a054	Insulation, Propane	Muni Retro	Calculated	Calculated	Calculated
EC3d017	Air Sealing, Electric	Muni DI	Calculated	Calculated	Calculated
EC3d018	Air Sealing, Gas	Muni DI	Calculated	Calculated	Calculated
EC3d019	Air Sealing, Oil	Muni DI	Calculated	Calculated	Calculated
EC3d020	Air Sealing, Propane	Muni DI	Calculated	Calculated	Calculated
EC3d051	Insulation, Electric	Muni DI	Calculated	Calculated	Calculated
EC3d052	Insulation, Gas	Muni DI	Calculated	Calculated	Calculated
EC3d053	Insulation, Oil	Muni DI	Calculated	Calculated	Calculated
EC3d054	Insulation, Propane	Muni DI	Calculated	Calculated	Calculated
GC1a017	Air Sealing, Gas	LBES Retro	Calculated	Calculated	Calculated
GC1a018	Insulation, Gas	LBES Retro	Calculated	Calculated	Calculated
GC2a017	Air Sealing, Gas	SBES Retro	Calculated	Calculated	Calculated
GC2a018	Insulation, Gas	SBES Retro	Calculated	Calculated	Calculated
GC3a017	Air Sealing, Gas	Muni Retro	Calculated	Calculated	Calculated
GC3a018	Insulation, Gas	Muni Retro	Calculated	Calculated	Calculated

Air Sealing:

Unit savings are calculated using the following algorithms and assumptions:

Annual Electric Savings:

$\Delta kWh_{\text{heating and cooling}}$ = SF x 0.65

$\Delta kWh_{\text{heating}}$ = SF x 0.64

$\Delta kWh_{\text{cooling}}$ = SF x 0.01

Δmmbtu = SF x 0.00118

Where:

SF = The square footage of the envelope receiving air sealing.

0.65 = the average kwh per square foot of envelope receiving air sealing saved for electric heating and cooling assuming the default inputs below.

0.64 = the average kwh per square foot of envelope receiving air sealing saved for electric heating assuming the default inputs below.

0.01 = the average kwh per square foot of envelope receiving air sealing saved for electric cooling assuming the default inputs below.

0.001 = the average mmbtu per square foot of envelope receiving air sealing saved assuming the default inputs below.

The below formulas and default inputs were used to create the average kwh and mmbtu per square foot of air sealed envelope space. See the 'Air Sealing Savings Calculations 2025' spreadsheet for further detail.

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

$$\Delta kWh_{cooling} = \frac{\left[\left(\left(\frac{CFM75}{SF}\right)_{baseline} - \left(\frac{CFM75}{SF}\right)_{ee}\right) \div \left(F_{n,cooling} \times F_h\right)\right] \times SF \times LM \times 1.08 \times CDD \times F_{vent,c} \times 24}{EFF_{ElecCool} \times 1000}$$

$$\Delta kWh_{heating} = \frac{\left[\left(\left(\frac{CFM75}{SF}\right)_{baseline} - \left(\frac{CFM75}{SF}\right)_{ee}\right) \div \left(F_{n,heating} \times F_h\right)\right] \times SF \times 1.08 \times HDD \times F_{vent,h} \times 24 \times F_{ElectHeat}}{HSPF \times 1000}$$

Summer Peak Coincident Demand Savings

$$\Delta kW = \frac{\left[\left(\left(\frac{CFM75}{SF}\right)_{baseline} - \left(\frac{CFM75}{SF}\right)_{ee}\right) \div \left(F_{n,cooling} \times F_h\right)\right] \times SF \times LM \times F_{vent,c} \times 1.08}{EER \times 1{,}000}$$

Annual Fossil Fuel Energy Savings:

$$\Delta MMBtu = \frac{\left[\left(\left(\frac{CFM75}{SF}\right)_{baseline} - \left(\frac{CFM75}{SF}\right)_{ee}\right) \div \left(F_{n,heating} \times F_h\right)\right] \times SF \times 1.08 \times HDD \times 24 \times F_{vent,h} \times F_{FuelHeat}}{EFF_{FuelHeat} \times 1{,}000{,}000}$$

Variable	Definition	Value	
ΔkWh	Annual electric energy savings		
ΔkW	Peak coincident demand electric savings		

Variable	Definition	Value	
ΔMMBtu	Annual fossil fuel energy savings		
$\Delta kWh_{cooling}$	Annual electric cooling energy savings		
$\Delta kWh_{heating}$	Annual electric heating energy savings		
baseline	Characteristic of baseline condition	0.40 CFM75/SF	This value is derived from 2018 IECC c402.4 Air leakage-thermal envelope (Mandatory)
ee	Characteristic of energy efficient condition	0.25 CFM75/SF	
(CFM75/SF)	Infiltration rate (cubic foot per minute per building square foot) at a negative pressure differential of 75 Pa or 0.3 inches of water[3]	See baseline and ee values to use above.	This value is derived from 2018 IECC c406.9 Reduced air infiltration
$Fn_{,cooling}$	Infiltration-Leakage Ratio, used to convert pressurized blower door testing results to natural infiltration rates, climate zone factor during cooling season	15.88	This value is based upon the infiltration leakage ratio tables provided in the 2024 NYSERDA TRM, using the temperature zones for Albany (climate zone 5) and Binghamton (Climate Zone 6). The value was produced by assuming a shielding class of 3 and calculating a weighted average using commercial site location data from the 2024 NH Commercial Building Baseline Study.
$Fn_{,heating}$	Infiltration-Leakage Ratio, used to convert pressurized blower door testing results to natural infiltration rates, climate zone factor during heating season	14.75	This value is based upon the infiltration leakage ratio tables provided in the 2024 NYSERDA TRM, using the temperature zones for Albany (climate zone 5) and Binghamton (Climate Zone 6). The value was produced by assuming a shielding class of 3 and calculating a weighted average using commercial site location data from the 2024 NH Commercial Building Baseline Study.
F_h	Infiltration-Leakage Ratio, used to convert pressurized blower door testing results to natural infiltration rates, building height factor	0.87	The infiltration leakage ration is calculated by Fh = n stories to the power of (-.3.) The average # of stories in commercial buildings in NH is 1.6 per the 2023 NH

Variable	Definition	Value	
			Commercial Building Baseline study.
Nstories	Number of conditioned stories in the building.[4] The selected value should reflect the number of stories located inside the conditioned envelope of the building. Unconditioned basements and attics should not be included. Upper levels without full height perimeter walls shall be considered as half-stories (0.5).	1.6	The average # of stories in commercial buildings in NH is 1.6 per the 2023 NH Commercial Building Baseline study.
LM	Latent Multiplier, used to convert the sensible cooling savings calculated to a value representing sensible and latent cooling loads	6.0	The latent multiplier is based upon Concord data. The Latent Multiplier is the ratio of total heat load (latent and sensible) to sensible heat load. Set indoor conditions are taken as 75ºF and 50% rh.
SF	Square footage treated	From auditor	
CDD	Cooling Degree Day Base 72[15]	125.84	See Cooling Degree Day Table below.
HDD	Heating Degree Day	4907.24	See Heating Degree Day Table below
EffElecCool	Seasonal average energy efficiency of electric cooling equipment, BTU/watthour, using either SEER SEER or IEER based on nameplate rating metric of existing equipment	11.79 SEER	Value derived from 2024 NH Baseline Study
HSPF	Seasonal average energy efficiency of site's electric heating equipment. Heating Seasonal Performance Factor, BTU/watt-hour, total heating output (supply heat) in BTU (including resistance heating) during the heating season / total electric energy heat pump consumed (in watt-hour); if equipment efficiency is reported in COP, convert to HSPF using the equivalency HSPF = COP x 3.412	9.32 HSPF	Value derived from 2024 NH Baseline Study
EER	Energy efficiency ratio under peak conditions (BTU/watt-hour)	10.46	Value derived from 2024 NH Baseline Study

Variable	Definition	Value	
EffFuelHeat	Efficiency of fossil fuel heating equipment (AFUE, Et, or Ec)	0.84	Value derived from 2024 NH Baseline Study
FElecHeat	Electric heating factor; used to account for the presence or absence of an electric heating system	Use a value of 1.0 if the building is electrically heated. Otherwise, use 0.0.	
FFuelHeat	Fossil fuel heating factor; used to account for the presence or absence of a fossil fuel heating system	Use a value of 1.0 if the building is fossil fuel heated. Otherwise, use 0.0.	
$F_{vent,c}$	Factor to account for mechanical ventilation – based on ratio of unoccupied hours to total hours (cooling)		See Mechanical Ventilation Factors Section
$F_{vent,h}$	Factor to account for mechanical ventilation – based on ratio of unoccupied hours to total hours (heating)		See Mechanical Ventilation Factors Section
CF	Coincidence factor	See impact factor section.	
1.08	Specific heat of air x density of inlet air @ 70ºF x 60 min/hr, in BTU/h-ºFCFM[8]		
24	Hours in a day		
1,000	Conversion factor, one kW equals 1,000 Watts		
1,000,000	Conversion factor, one MMBtu equals 1,000,000 BTU		

Heating and Cooling Degree days

Heating degree days are tabulated as a function of the building heating balance point and the climate. Building balance points for a set of typical small commercial buildings were taken from the CT Program Savings Document, and were applied to TMY3 climate data, as shown in the table below.

Facility type	Heating balance point temperature		HDD[4]		
	Occupied	Unoccupied	Concord	Manchester	Berlin
Convenience Store	52.6	47.4	3,863	2,902	4,772
Library	62.7	67.4	7,894	6,818	9,324
Medical Office	52.7	46.8	3,813	2,853	4,710
Office (General Office Types)	57	50.1	4,385	3,407	5,387
Office/Retail	57	50.1	4,385	3,407	5,387
Post Office	53.3	52.4	4,437	3,457	5,458
Retail	52.6	47.4	3,863	2,902	4,772
Schools	63.3	51.4	5,579	4,567	6,741
Small Services	52.6	47.4	3,863	2,902	4,772
Town Hall	62.7	67.4	7,894	6,818	9,324
Weighted Average			5,725	4,711	6,863

The cooling balance point was set at 72F for all building types.[15] The CDD values by climate are shown below:

City	CDD(72)
Concord	638
Manchester	348
Berlin	92

Mechanical Ventilation Factors

Commercial buildings generally operate with continuous mechanical ventilation during occupied hours, pressurizing the building relative to the outdoors. When the building is pressurized during periods of continuous mechanical ventilation, air leakage sealing does not affect infiltration rates. The mechanical ventilation factors shown in Table xxx adjust the air leakage sealing savings to account for mechanical ventilation.[15] If the building does not have continuous mechanical ventilation, the factors should be set to 1.0

Facility type	$F_{vent,c}$	$F_{vent,h}$
Convenience Store	0.13	0.56
Library	0.33	0.76
Medical Office	0.27	0.56
Office (General Office Types)	0.43	0.69
Office/Retail	0.43	0.69
Post Office	0.36	0.74
Retail	0.13	0.56
Schools	0.21	0.51
Small Services	0.13	0.56
Town Hall	0.33	0.76
Weighted Average	0.29	0.67

Infiltration-Leakage Ratio, Climate Zone

The Infiltration-Leakage Ratio, Climate Zone tables below are based on the NYSERDA TRM, using the temperature zones representative of New Hampshire - Albany (climate zone 5) and Binghamton (Climate Zone 6).[8] Look up $F_{n,cooling}$ and $F_{n,heating}$ in the tables below based on climate zone and shielding class, as defined below, based on application.

Shielding Class[10]

(1) No shielding on any side

(2) A few nearby obstructions

(3) A collection of obstructions within 25 feet

(4) Substantial number of obstructions shield most of the perimeter – typical suburban setting

(5) Building surrounded by large structures – typical urban setting

Shielding Class	$F_{n,cooling}$	
	Climate Zone 5	Climate Zone 6
1	12	11
2	14	13
3	16	15
4	20	19
5	34	32

Shielding Class	$F_{n,heating}$	
	Climate Zone 5	Climate Zone 6
1	12	10
2	13	11
3	15	13
4	19	17
5	28	26

Latent Multiplier:

The Latent Multiplier converts the sensible cooling load savings captured in the savings equation to a savings capturing both latent and sensible load savings. The multiplier accommodates the energy savings impacts associated with decreased humidity influx in a building with improved air sealing. During the cooling season, humidity poses an additional load on the cooling system. The Latent Multiplier is the ratio of total cooling load (latent and sensible) to sensible cooling load. Indoor conditions are taken as 74ºF and 50% rh.[17]

City	Latent Load (ton-hours/SCFM)	Sensible Load (ton-hours/SCFM)	LM
Concord	2.0	0.4	6

Insulation:

Unit savings are calculated using the following algorithms and assumptions:

For fossil fuel heated buildings,

$$MMBtu_{annual} = ((1/R_{exist} - 1/R_{new}) \times HDD \times 24 \times Area)/(1{,}000{,}000 \times EFF_{FuelHeat})$$

For electrically heated buildings,

$$kWh_{annual} = MMBtu_{annual} \times 293.1$$

$$kW = kWh_{annual} \times kW/kWh_{heating} factor$$

If Facility has central cooling then also calculate air conditioning savings:

$$kWh_{cool} = ((1/R_{exist} - 1/R_{new}) \times CDD \times DUA \times Area)/(1{,}000 \times EFF_{ElecCool})$$

$$kW = kWh_{annual} \times kW/kWh_{cooling}$$

Where,

Variable	Definition	Value
ΔkWh_{annual}	Annual electric energy savings	
ΔkW	Peak coincident demand electric savings	
$\Delta MMBtu_{annual}$	Annual fossil fuel energy savings	
$\Delta kWh_{cooling}$	Annual electric cooling energy savings	
$\Delta kWh_{heating_g}$	Annual electric heating energy savings	
R_{exist}	Existing effective R-value (R-ExistingInsulation + R-Assembly),ft2-°F/Btuh	
R_{new}	New total effective R-value (R-ProposedMeasure + R-ExistingInsulation+ R-Assembly), ft2-°F/Btuh	
Area	Square footage of insulated area	
DUA	Discretionary Use Adjustment to account for the fact that people do not always operate their air conditioning system when the outside temperature is greater than 75°F	0.75[13]
$EFF_{FuelHeat}$	Efficiency of fossil fuel heating equipment (AFUE, Et, or Ec)	
$EFF_{ElecCool}$	Seasonal average energy efficiency of electric cooling equipment, BTU/watthour, using either SEER or IEER based on nameplate rating metric of existing equipment	
293.1	Conversion constant (1MMBtu = 293.1 kWh)	
24	Conversion for hours per day	
CDD	Cooling Degree Day Base 72[15]	125.84
HDD	Heating Degree Day	4907.24
1,000,000	Conversion from Btu to MMBtu	
$kW/kWh_{cooling}$ factor	Average annual kW reduction per kWh reduction[2]	Table xx

Measure Life:

The measure life is shown in the table below.[12]

BC ID	Measure Name	Program	Measure Life
EC3a015 EC3a016 EC3a017 EC3a018 EC3d017 EC3d018 EC3d019 EC3d020	Air Sealing	Muni Retro Muni D	15

BC ID	Measure Name	Program	Measure Life
EC3a051 EC3a052 EC3a053 EC3a054 EC3d051 EC3d052 EC3d053 EC3d054	Insulation	Muni Retro Muni DI	30
GC1a017 GC2a017 GC3a017	Air Sealing	LBES Retro SBES Retro Muni Retro	15
GC1a018 GC2a018 GC3a018	Insulation	LBES Retro SBES Retro Muni Retro	30

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3a015 EC3d017	Air Sealing	Electric	Muni Retro Muni DI	1.00	1.00	n/a	n/a	n/a	0.00	0.43
EC3a016 EC3d018	Air Sealing	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
EC3a017 EC3d019	Air Sealing	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
EC3a018 EC3d020	Air Sealing	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
EC3a051 EC3d051	Insulation	Electric	Muni Retro Muni DI	1.00	1.00	n/a	n/a	n/a	0.34	0.17
EC3a052 EC3d052	Insulation	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
EC3a053 EC3d053	Insulation	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
EC3a054 EC3d054	Insulation	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
GC1a017 GC2a017 GC3a017	Air Sealing	Gas	LBES Retro SBES Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
			Muni Retrofit							
GC1a018 GC2a018 GC3a018	Insulation	Gas	LBES Retro SBES Retro Muni Retrofit	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Summer and winter coincidence factors for insulation are estimated using demand allocation methodology described in the Demand Impact Model.

A winter coincidence factor of 43% is utilized for air sealing.[2.]

Energy Load Shape:

For electric air sealing and insulation, see Appendix 1 Residential Load Shapes "Hardwired Electric Heat"

For non-electric air sealing, see Appendix 1 Residential Load Shapes "Non-Electric Measures"

For non- electric insulation, see Appendix 1 Residential Load Shapes "Central Air Conditioner/ Heat Pump (Cooling)

Revision History:

Revision Number	Date	Description
156	12/1/2022	Updated algorithm and baselines for air sealing as previously unable to trace baseline and high efficiency to sources.
355	1/1/2027	Updated algorithm to include simplified kWh/sf approach Updated algorithm to use factors Fvent,c and Fvent,h
356	1/1/2027	Updated to NH specific values for HDD, CDD and LM

Endnotes:

1: IECC 2018 C402.5 Air leakage – thermal envelope (Mandatory) https://codes.iccsafe.org/content/iecc2018/chapter-4-ce-commercial-energy-efficiency#IECC2018_CE_Ch04_SecC402.5, Last Accessed February 16, 2026

2: IECC 2018, C406.9 Reduced Air Infiltration. https://codes.iccsafe.org/content/iecc2018/chapter-4-ce-commercial-energy-efficiency#IECC2018_CE_Ch04_SecC406.9, Last Accessed February 16, 2026

3: IECC 2020 C402.5 Air leakage – thermal envelope (Mandatory)

4: LBL, Exegesis of Proposed ASHRAE Standard 119: Air Leakage Performance for Detached Single-Family Residential Buildings, M. Sherman, July 1986, p. 12 exegesis_of_proposed_ashrae_std_119.pdf, Last Accessed February 19, 2026

5: EIA (2021) Cooling Degree Days by Census Division in 2021. https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php, Last Accessed February 19, 2026

6: EIA (2021) Heating Degree Days by Census Division in 2021. https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php, Last Accessed February 19, 2026

7: DOE, Building America House Simulation Protocols, October 2010

8: The sensible heat constant at standard conditions of 1.08 is applied in accordance with standard HVAC industry practice per NYSERDA TRM. https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23decff52920a85257f1100671bdd/$FILE/NYS%20TRM%20V9.pdf

9: NYSERDA TRM (2022) Commercial and Industrial Measures, Air Leakage Sealing Pg 337. nys-trm-v13_consolidated_clean.pdf, Last Accessed February 19, 2026

10: ASHRAE Handbook – Fundamentals, 2017. Chapter 16 Ventilation and Infiltration, Section 10 Simplified Models of Residential Ventilation and Infiltration, Table 5 Local Shelter Classes

11: NYSERDA TRM (2026) Commercial and Industrial Measures, Air Leakage Sealing Pg 338. nys-trm-v13_consolidated_clean.pdf, Last Accessed February 19,

12: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://library.cee1.org/system/files/library/8842/CEE_Eval_MeasureLifeStudyLights%2526HVACGDS_1Jun2007.pdf

13: Assumptions from National Grid program vendor.

14: Guidehouse (2020). Residential Baseline Study Phase 4 2020_Guidehouse_Residential_Baseline_Phase_4 , Last Accessed February 24, 2026

15: DNV (2025), RX2242B: Extending Weatherization for Commercial Study, Updated. https://www.energizect.com/sites/default/files/documents/2025-12-01_Final%20Report%20%28Revision%20%231%29_RX2242B_CI_IMP_SBEA%2CEO_DNV.docx

16: Energize CT (2026). Connecticut's 2026 Program Savings Document

17: ASHRAE Journal, Dehumidification and Cooling Loads From Ventilation Air, Lewis Harriman, November 1997.

Compressed Air Adding Compressor Capacity and/or Storage

Measure Code	COM-CA-CS
Markets	Commercial
ProgramTypes	Retrofit
Categories	Compressed Air

Measure Description:

Adding storage capacity to compressed air systems with previously insufficient storage results in less system pressure fluctuations and allows lower average system pressures, leading to air compressor energy savings when operated at lower system pressures. It also reduces cycling losses in compressor systems that use a compressor with load-unload controls for part-load modulation.

Baseline Efficiency:

The baseline is the site-specific air compressor energy consumption operating at the higher average system pressure with insufficient compressed air storage.

High Efficiency:

The high efficiency case is the site-specific air compressor energy consumption operating at the lower average system pressure after the added compressed air storage, and with reduced cycling losses for load/unload compressors.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkWh
EC1b020	Compressed air – compressor storage	LBES New	Calculated	Calculated
EC2b020	Compressed air – compressor storage	SBES New	Calculated	Calculated
EC3b032	Compressed air – compressor storage	Muni New	Calculated	Calculated

The energy savings are based on air compressor energy efficiency improvements resulting from two components: the lower average pressure after air storage capacity is added, and reduced cycling losses. The measure may realize one or both savings components, depending on baseline conditions.

The algorithm for calculating electric demand savings from the system pressure reduction is:

$$\Delta kW_{PR} = kW_{BASE} \times (psi_{BASE} - psi_{EE}) \times 0.4\%$$

Where:

ΔkW_{PR} = Average kW savings from the system pressure reduction

kW_{BASE} = Baseline air compressor system average input kW

psi_{BASE} = Baseline average system pressure, in psi

psi_{EE} = Energy efficient average system pressure with added storage, in psi

0.4%/psi = Compressor kW reduction factor[1]

The algorithm for calculating annual electric energy savings from the system pressure reduction is:

$$\Delta kWh_{PR} = \Delta kW_{PR} \times \frac{hr}{yr}$$

Where:

ΔkWh_{PR} = Gross annual kWh savings from system pressure reduction

ΔkW_{PR} = Average kW savings from the system pressure reduction

$\frac{hr}{yr}$ = Annual compressed air system pressurization hours

The algorithm for calculating savings from the reduction in cycling losses is:

$$\Delta kW_{CL} = kW_{BASE,MOD} \times (\%kW_{BASE} - \%kW_{EE})$$

Where:

ΔkW_{CL} = Average kW savings from the reduction in cycling losses for load/unload compressors

$kW_{BASE,MOD}$ = Baseline air compressor input kW for the load-unload compressor that is the modulating or topping compressor

$\%kW_{BASE}$ = Percentage kW input in the base case (refer to %kW table, interpolate as needed)

$\%kW_{EE}$ = Percentage kW input in the energy efficient case after added storage (refer to % kW table, as needed)

Average Percent Capacity	**Tank Plus Distribution System Storage per Compressor Capacity (use the modulating compressor capacity only)**	**% kW[2]**
25%	1 gal/cfm	70%
	3 gal/cfm	55%
	5 gal/cfm	50%
	10 gal/cfm	48%
50%	1 gal/cfm	88%
	3 gal/cfm	76%
	5 gal/cfm	71%
	10 gal/cfm	68%
75%	1 gal/cfm	96%

	3 gal/cfm	92%
	5 gal/cfm	89%
	10 gal/cfm	86%

The algorithm for calculating annual electric energy savings from the cycling losses is

$$\Delta kWh_{CL} = \Delta kW_{CL} \times \frac{hr}{yr}$$

Where:

ΔkWh_{CL} = Gross annual kWh savings from the reduction in cycling losses for load/unload compressors

ΔkW_{CL} = Average kW savings from the reduction in cycling losses for load/unload compressors

$\frac{hr}{yr}$ = Annual operating hours of the load/unload topping compressor

Measure Life:

The measure life is 17 years for non-mechanical infrastructure[3]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b020	Compressed air – compressor storage	LBES New	1	0.99	n/a	1	1	1.17	0.98
EC2b020	Compressed air – compressor storage	SBES New	1	1	n/a	1	1	1.17	0.98
EC3b032	Compressed air – compressor storage	Muni New	1	0.998		1.103	0.885	1.17	0.98

In-Service Rates:

All installations have 100% a in-service rate unless an evaluation finds otherwise.

Realization Rates:

Programs use a 100% realization rate unless an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[4] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study.[5]

Coincidence Factors:

A summer coincidence factor of 117% and a winter coincidence factor of 98% is utilized.[6]

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Compressed Air- VFD Compressor".

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
C&I Compressed Air - VFD Compressor	26.50%	23.70%	25.90%	23.90%

Revision History:

Revision Number	Date	Revision
262	1/1/2026	Updated SBES Rr's based on 2025 Impact Study

Endnotes:

1: Estimate based on ERS data of CAGI Compressor Data Sheets of 40 operating points of 10 compressors from 4 manufacturers, downloaded 5/21/20.

2: Department of Energy Compressed Air Challenge. Improving Compressed Air System Performance A Sourcebook for Industr, Third Edition, DOE/EE-1340, (approx. 2015) p. 40.

3: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities. https://www.ers-inc.com/wp-content/uploads/2018/04/Measure-Life-Study_MA-Joint-Utilities_ERS.pdf Measure life value represents the median MA Measure Life for 15-75 HP Efficient Compressors in the Compressed Air Category shown in Table 3-9 of the study.

4: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for The Massachusetts Joint Utilities. DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for The Massachusetts Joint Utilities. DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

Compressed Air Compressor

Measure Code	COM-CA-AC

Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Compressed Air

Measure Description:

Covers the installation of oil flooded, rotary screw compressors with Variable Speed Drive or Variable Displacement capacity control with properly sized air receiver. Efficient air compressors use various control schemes to improve compression efficiencies at partial loads.

This measure covers air compressors rated 15 - 100 HP. This measure is not applicable to units larger than 75 HP if the total operating HP of the compressed air system is greater than 200 HP.

Baseline Efficiency:

The baseline efficiency case is a fixed-speed compressor with load/no load controls[1].

Measure Description	Proposed ISP Baseline
General industrial air compressors larger than 15 hp and up to 75 hp	Compressor type/staging: Screw-compressor, single-stage, minimum isentropic efficiency Lubrication/cooling: To match installed case Control type: Load/no load for base-loaded and trim compressors Storage: Dependent upon control type • For new construction: 4 gal/cfm
General industrial air compressors larger than 75 hp and up to 350 hp	Compressor type/staging: Screw-compressor, single-stage, minimum isentropic efficiency Lubrication/cooling: To match installed case Control type: Depends on total system size excluding redundant backup compressors • Variable speed drive for trim compressors in a total system size > 200 hp • Load/no load for base-loaded compressors in a total system size > 200 hp • Load/no load for base-loaded and trim compressors in a total system size ≤ 200 hp Storage: Dependent upon control type of trim compressor • For new construction: 4 gal/cfm L/NL and 3 gal/CFM for VSD
General industrial compressors larger than 350 hp and up to 450 hp	

High Efficiency:

The high efficiency case is an oil-flooded, rotary screw compressor with Variable Speed Drive or Variable Displacement capacity control with a properly sized air receiver. Air receivers are designed to provide a supply buffer to meet short-term demand spikes which can exceed the compressor capacity. Installing a larger receiver tank to meet occasional peak demands can allow for the use of a smaller compressor. Rated 15 - 100 HP. This measure is not applicable to units larger than 75 HP if the total operating HP of the compressed air system is greater than 200 HP.

Algorithms for Calculating Primary Energy & Peak Demand Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC2b016	Air Compressor	SBES New	Calculated	Calculated
EC1b016	Air Compressor	LBES New	Calculated	Calculated

EC3b016	Air Compressor	Muni New	Calculated	Calculated

Savings Algorithm:

$\Delta kWh = HP_{Compressor} \times kW/HP \times Hours$

$\Delta kW = HP_{Compressor} \times kW/HP$

Calculation Parameters Table

Variable	Description	Value	Units	Ref
$HP_{Compressor}$	Nominal rated horsepower of high efficiency air compressor	Site specific	HP	
Hours	Annual operating hours of the air compressor	Site specific	Hours	
kW/HP	Air compressor kW reduction per HP	See table below	kW/HP	2, 3, 4

The kw/hp values provided by the study have been reduced by 0.6% per DOE's estimate that the 2025 code update will result in a savings of 0.6% savings relative to a scenario in which no new standards are adopted[2].

Horsepower	kW/HP	Ref
15-24 HP[3:]	0.124	3
25-74 HP[3:]	0188	3
75+ HP[4:]	0.215	4

Measure Life:

The measure life is 15 years[5:].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC2b016	Air Compressor	SBES New	1	0.998	n/a	1.103	0.885	0.70	0.64	7, 8
EC1b016	Air Compressor	LBES New	1	0.99	n/a	1.00	1.00	0.70	0.64	6, 8
EC3b016	Air Compressor	Muni New	1	1.00	n/a	1.00	1.00	0.70	0.64	8

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Compressed Air – VFD Compressor"

Revision History:

Revision Number	Date	Revision
212	1/1/2025	A separate savings value has been added for units of 75 HP. Previously all size units used the same kw reduction per HP (.189).
235	6/27/2025	Added savings value for 15-24 HP compressor.
237	1/1/2026	Baseline updated per new federal code. Savings values adjusted to account for increased efficiency of baseline. Updated RR's for SBES according to 2025 impact study results.
357	1/1/2027	Baseline updated per the 2025 ISP: Compressed Air study

Endnotes:

1: MA24C09-E-ISPCAIR: Industry Standard Practice: Compressed Air Memo to: Massachusetts Program Administrators (PAs) Energy Efficiency Advisory Council (EEAC) Consultants Rhode Island Energy (RIE) https://ma-eeac.org/wp-content/uploads/MA-RI-Compressed-Air-ISP-Memo-11.1.2025_Clean.pdf (Last accessed on January 23, 2026)

2: 020-01-10 Energy Conservation Program: Energy Conservation Standards for Air Compressors; Final rule. Section C, "National Benefits and Costs". https://www.regulations.gov/document/EERE-2013-BT-STD-0040-0095 (Last accessed on January 23, 2026)

3: DNV GL, October 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for the MA PAs and EEAC. https://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf (Last accessed on January 23, 2026)

4: NMR, November 20, 2023. New Hampshire Baseline Practices Final Report. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/27-nh-baseline-practices-report.pdf (Last accessed on January 23, 2026)

5: ERS, November 2005. Measure Life Study. Prepared for MA Joint Utilities. (Last accessed on January 23, 2026)

6: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on January 23, 2026)

7: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation (Last accessed on January 23, 2026)

8: 2024 C&I Loadshape study Table 3-1. DNV (2024). C&I Impact Shape Study https://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf (Last accessed on January 23, 2026)

Compressed Air Zero Loss Condensate Drain

Measure Code	COM-CA-ZLCD
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Compressed Air

Measure Description:

Drains remove water from a compressed air system. Zero loss condensate drains remove water from a compressed air system without venting any air, resulting in less air demand and consequently less air compressor energy use.

Baseline Efficiency:

The baseline efficiency case a standard condensate drain on a compressor system.

High Efficiency:

The high efficiency case is installation of a zero loss condensate drain on a single operating compressor rated ≤ 75 HP.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21C1d046	Zero Loss Condensate Drains	LBES DI	Calculated	Calculated
E21C1b051	Zero Loss Condensate Drains	LBES New	Calculated	Calculated
E21C1a046	Zero Loss Condensate Drains	LBES Retro	Calculated	Calculated
E21C3d090	Zero Loss Condensate Drains	Muni DI	Calculated	Calculated
E21C3b082	Zero Loss Condensate Drains	Muni New	Calculated	Calculated
E21C3a090	Zero Loss Condensate Drains	Muni Retro	Calculated	Calculated
E21C2d046	Zero Loss Condensate Drains	SBES DI	Calculated	Calculated
E21C2b051	Zero Loss Condensate Drains	SBES New	Calculated	Calculated
E21C2a046	Zero Loss Condensate Drains	SBES Retro	Calculated	Calculated

Savings algorithm:

ΔkWh = (CFMpipe) x (CFMsave) x (Save) x (Hours)

ΔkW = (CFMpipe) x (CFMsave) x (Save)

Where:

ΔkWh = Energy Savings

ΔkW = Demand savings

CFMpipe = CFM capacity of piping that is served by the condensate drain, site specific

CFMsaved = Average CFM saved per CFM of piping capacity: 0.049[1]

Save = Average savings per CFM, site specific if available, default value of 0.21 kW/CFM[1.]

Hours = Annual operating hours of the zero loss condensate drain. Site-specific, if unknown use hours below.

Default Operating Hours

Shift	Hours	Notes
Single shift (8/5)	1,976	7 AM – 3 PM, weekdays, minus some holidays and scheduled down time
2-shift (16/5)	3,952	7AM – 11 PM, weekdays, minus some holidays and scheduled down time
3-shift (24/5)	5,928	24 hours per day, weekdays, minus some holidays and scheduled down time
4-shift (24/7)	8,320	24 hours per day, 7 days a week minus some holidays and scheduled down time

Measure Life:

The measure life is 5 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1d046	Zero Loss Condensate Drains	LBES DI	1	0.99	1	1	1	0.8	0.54
E21C1b051	Zero Loss Condensate Drains	LBES New	1	0.99	1	1	1	0.8	0.54
E21C1a046	Zero Loss Condensate Drains	LBES Retro	1	0.99	1	1	1	0.8	0.54
E21C3d090	Zero Loss Condensate Drains	Muni DI	1	1	1	1	1	0.8	0.54
E21C3b082	Zero Loss Condensate Drains	Muni New	1	1	1	1	1	0.8	0.54
E21C3a090	Zero Loss Condensate Drains	Muni Retro	1	1	1	1	1	0.8	0.54
E21C2d046	Zero Loss Condensate Drains	SBES DI	1	0.998	1	1.103	0.885	0.8	0.54

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C2b051	Zero Loss Condensate Drains	SBES New	1	0.998	1	1.103	0.885	0.8	0.54
E21C2a046	Zero Loss Condensate Drains	SBES Retro	1	0.998	1	1.103	0.885	0.8	0.54

In-Service Rates:

All installations have a 100% in-service rate since unless an evaluation finds otherwise.

Realization Rates:

All program use a 100% realization rate unless an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs[3]. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4].

Coincidence Factors:

Summer and winter coincidence factors are based on Massachusetts TRM values. Latest 2015 evaluation study did not yield a statistically significant sample size for updating CF values.

Energy Load Shape:

See Appendix 1, C&I Load Shapes Table "C&I Compressed Air – VFD Compressor"

Revision History:

Revision Number	Date	Revision
145	12/1/2022	Added default operating hours based on CT PSD
247	6/27/2025	Corrected ML citation
248	1/1/2026	Updated SBES RR's for 2025 Impact memo results

Endnotes:

1: Prescriptive_CAIR_ZLD_LPDF_Tool.xlsx referenced by the Massachusetts TRM.

2: The EM&V working group has agreed upon a 5 year measure life in absence of effective useful life research specific to zero loss condensate drains. The available research is specific to air compressor measure life. Due to the operating environment of the drains, the EMV WG does not feel it is appropriate to use the measure life of the air compressor.

3: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for The Massachusetts Joint Utilities. DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. rt.pdf https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation Appendices:

Compressed Air Nozzle

Measure Code	COM-CA-AN
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Compressed Air

Measure Description:

Covers the installation of engineered air nozzles which provide effective air nozzle action while reducing compressed air system air flow.

Baseline Efficiency:

The baseline efficiency case is a a standard nozzle on a compressed air system.

High Efficiency:

The high efficiency case is an engineered nozzle on the same compressed air system.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
EC1b017	Air Nozzle	LBES New	Calculated	Calculated
EC2b017	Air Nozzle	SBES New	Calculated	Calculated
EC3b017	Air Nozzle	Muni New	Calculated	Calculated

Savings are calculated in a spreadsheet tool per the following:

$$\Delta kW = (FLOW_{BASE} - FLOW_{EE}) \times \frac{kW}{cfm}$$

$$\Delta kWh = \Delta kW \times hr$$

Where:

$FLOW_{BASE}$ = base case nozzle flow in cfm, at site specific pressure if available, or else at 80 psig[1]

$FLOW_{EE}$ = energy efficient nozzle flow in cfm, at site specific pressure if available, or else at 80 psig[2]

$\frac{kW}{cfm}$ = site specific compressor efficiency, default value of 0.29 if unavailable

hr = annual operating hours times % nozzle use factor (site specific if available, else default to 0.05 use factor)

Measure Life:

The measure life is 13 years.

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b017	Air Nozzle	LBES New	1	0.99	n/a	1	1	0.8	0.54
EC3b017	Air Nozzle	Muni New	1	1	n/a	1	1	0.8	0.54
EC2b017	Air Nozzle	SBES New	1	0.998	n/a	1.103	0.885	0.8	0.54

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[3] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]

Coincidence Factors:

CFs from the prospective results of the 2015 study of prescriptive compressed air.[5]

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Compressed Air – VFD Compressor".

Revision History:

Revision Number	Issue Date	Description
42	1/14/2022	Fixed broken link in references
100	12/1/2022	Updated default pressure from 100psi to 80psi. Added operating hour description and use factor based on MA TRM assumption
263	1/1/2026	Updated SBES RR based on 2025 Impact Study

Endnotes:

1: NH Baseline Practices Lit Review Presentation_2022

2: NH Baseline Practices Lit Review Presentation_2022

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: DNV GL, October 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for Massachusetts Program Administrators and Massachusetts Energy Efficiency Advisory Council. http://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf

Compressed Air Leak Detection

Measure Code	COM-CA-CALD
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Compressed Air

Measure Description:

This measure covers the detection of compressed air losses through ultrasonic leak detection, and the repair of compressed air leaks. Air leaks are common in compressed air systems, often wasting 20%-30% of the compressor's output. Air leak loss rate depend on the supply pressure in an uncontrolled system, as well as leak size quantity and time. This measure is applicable for general plant compressed air systems in manufacturing environments (70 to 125 psig).

Baseline Efficiency:

The baseline efficiency case is the air compressor operating with leaks.

High Efficiency:

The high efficiency case is the air compressor with leaks repaired.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
EC1b059	Compressed air leak detection	LBES New	Calculated	Calculated
EC2b059	Compressed air leak detection	SBES New	Calculated	Calculated

EC3b088	Compressed air leak detection	Muni New	Calculated	Calculated

Retrofit Gross Energy Savings, Electric

$$\Delta kWh = NL \times CFM_{leak} \times EFF_{comp} \times MEF \times H$$

Retrofit Gross Peak Demand Savings, Electric

$$SkW = \frac{\Delta kWh}{H} CF_s$$

$$WkW = \frac{\Delta kWh}{H} CF_w$$

Where:

ΔKWH = Annual electric energy savings

kW = Demand Savings

NL = Number of detected leaks

CFM_{Leak} = Flow rate loss per leak in cubic feet per minute (CFM) in kw/CFM see table for CFM per Leak Size for Compressed Air Leaks below.

EFF_{Comp} = Efficiency of air compressor in kW/ % load, see table "kW/CFM Efficiencies for Several Air Compressor Types (EFFComp), use 0.19 kW/CFM", if unknown, use.19kW/CFM[1]

MEF = Marginal efficiency factor per control type for air compressor, see table "Marginal Efficiency Factors per Control Type for Air Compressor Types (MEF)"

H = Annual Hours the compressed air system is pressurized

Most gaps are irregular and sometimes ragged, which decreased the flow rate relative to the equivalent area. For well-rounded orifices, values should be multiplied by 0.97 and by 0.61 for sharp ones.

Leakage rates (CFM) for different supply pressures and approximately equivalent orifice sizes						
Pressure (psig)	Orifice Diameter (inches)					
	1/64	1/32	1/16	1/8	¼	3/8
70	0.29	1.16	4.66	18.62	74.40	167.8
80	0.32	1.26	5.24	20.76	83.10	187.2
90	0.36	1.46	5.72	23.1	92.00	206.6
100	0.40	1.55	6.31	25.22	100.9	227.00
125	0.48	1.94	7.66	30.65	122.2	275.50

Air Compressor Type	**SAVE (kW/CFM)**

Single-acting Reciprocating Air Compressor	0.230
Double-acting Reciprocating Air Compressor	0.155
Lubricant-injected Rotary Screw Compressor	0.185
Lubricant-free Rotary Screw Compressor	0.200
Centrifugal Compressor	0.180
Average	0.19

Marginal Efficiency Factors per Control Type for Air Compressor Types (MEF)[3]

Control Type	Percent kW/Percent Load
Inlet Valve Modulated	0.31
Variable Displacement	0.69
Variable Speed Drive	0.85

Measure Life:

The measure life is 5 years.[4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b059	Compressed air leak detection	LBES New	1.00	0.99	n/a	1.00	1.00	0.80	0.54
EC2b059	Compressed air leak detection	SBES New Muni New	1	0.998	n/a	1.103	0.885	0.8	0.54
EC3b088	Compressed air leak detection	Muni New	1.00	1.00	n/a	1.00	1.00	0.80	0.54

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs[5] . The SBES program uses a realization rate of 99.8% RR from a 2025 Impact study[6] .

Coincidence Factors:

CFs from the prospective results of the 2015 study of prescriptive compressed air.7

Energy Load Shape:

See Appendix 1 C&I Load Shapes “C&I Compressed Air – VFD Compressor".

Revision History:

Revision Number	Issue Date	Description
181	1/1/2024	New Measure
240	1/1/2026	Updated SBES RRs based on 2025 Impact memo

Endnotes:

1: Compressed Air Challenge "Fundamentals of Compressed Air Systems" Pgs. 90-91.

2: US Department of Energy. Energy Tips – Compressed Air. August 2004. Available online: https://www.energy.gov/sites/prod/files/2014/05/f16/compressed_air3.pdf. Originally from Fundamentals of Compressed Air Systems Training offered by the Compressed Air Challenge®

3: Compressed Air Challenge "Fundamentals of Compressed Air Systems" Pgs. 90-91.

4: Energy & Resource Solutions. ERS Measure Life Study.: Prepared for the MassachusettJoint Utilities, Oct. 10, 2005. P 4-9

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

7: DNV, 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. https://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf

Compressed Air Low Pressure Drop Filter

Measure Code	COM-CA-LPDF
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Compressed Air

Measure Description:

Filters remove solids and aerosols from compressed air systems. Low pressure drop filters have longer lives and lower pressure drops than traditional coalescing filters, resulting in low air compressor energy use.

Baseline Efficiency:

The baseline efficiency case is a standard coalescing filter with initial drop of between 1 and 2 pounds per sq inch (psi) with an end-of-life drop of 10 psi.

High Efficiency:

The high efficiency case is a low pressure drop filter with initial drop not exceeding 1 psi over life and 3 psi at element change. Filters must be deep-bed, "mist eliminator" style and installed on a single operating compressor rated 15 - 75 HP.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkWh
EC1d032	Low Pressure Drop Filter	LBES DI	Calculated	Calculated
EC1b043	Low Pressure Drop Filter	LBES New	Calculated	Calculated
EC1a032	Low Pressure Drop Filter	LBES Retro	Calculated	Calculated
EC3d055	Low Pressure Drop Filter	Muni DI	Calculated	Calculated
EC3b065	Low Pressure Drop Filter	Muni New	Calculated	Calculated
EC3a055	Low Pressure Drop Filter	Muni Retro	Calculated	Calculated
EC2d032	Low Pressure Drop Filter	SBES DI	Calculated	Calculated
EC2b043	Low Pressure Drop Filter	SBES New	Calculated	Calculated
EC2a032	Low Pressure Drop Filter	SBES Retro	Calculated	Calculated

Savings Algorithms:

$$\Delta kW = kW_{BASE} \times (psi_{BASE} - psi_{EE}) \times 0.4\%$$

$$\Delta kWh = \Delta kW \times \frac{hr}{yr}$$

Where:

ΔkW = Average kW savings

ΔkWh = Gross annual kWh savings

kW_{BASE} = Air compressor system average input kW, site specific

psi_{BASE} = Baseline standard filter pressure drop, in psi. Use the mid point of 1.5 psi were existing conditions are unavailable.

psi_{EE} = Energy efficient filter pressure drop, in psi

0.4%/psi = Compressor kW reduction factor[1]

$\frac{hr}{yr}$ = Annual compressed air system pressurization hours. Where system actual is unavailable, use the table below to determine annual hours.

Shift	Hours	Notes
Single shift (8/5)	1,976	7 AM – 3 PM, weekdays, minus some holidays and scheduled down time
2-shift (16/5)	3,952	7AM – 11 PM, weekdays, minus some holidays and scheduled down time
3-shift (24/5)	5,928	24 hours per day, weekdays, minus some holidays and scheduled down time
4-shift (24/7)	8,320	24 hours per day, 7 days a week minus some holidays and scheduled down time

Measure Life:

The measure life is 5 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d032	Low Pressure Drop Filter	LBES DI	1	0.99	n/a	1	1	0.8	0.54
EC1b043	Low Pressure Drop Filter	LBES New	1	0.99	n/a	1	1	0.8	0.54
EC1a032	Low Pressure Drop Filter	LBES Retro	1	0.99	n/a	1	1	0.8	0.54
EC3d055	Low Pressure Drop Filter	Muni DI	1	1	n/a	1	1	0.8	0.54
EC3b065	Low Pressure Drop Filter	Muni New	1	1	n/a	1	1	0.8	0.54
EC3a055	Low Pressure Drop Filter	Muni Retro	1	1	n/a	1	1	0.8	0.54
EC2d032	Low Pressure Drop Filter	SBES DI	1	0.998	n/a	1.103	0.885	0.8	0.54
EC2b043	Low Pressure Drop Filter	SBES New	1	0.998	n/a	1.103	0.885	0.8	0.54
EC2a032	Low Pressure Drop Filter	SBES Retro	1	0.998	n/a	1.103	0.885	0.8	0.54

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[3] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]

Coincidence Factors:

Summer and winter coincidence factors are CFs based on impact evaluation of PY 2004 compressed air installations[5].

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Compressed Air – VFD Compressor".

Revision History:

Revision	Date	Description
144	12/1/2022	Added clarified baseline set point where existing system data is unavailable. Added in default hours table.
267	1/1/2026	Fixed references for LBES realization rates. Updates SBES RRs based on 2025 impact study.

Endnotes:

1: Estimate based on ERS data of CAGI Compressor Data Sheets of 40 operating points of 10 compressors from 4 manufacturers, downloaded 5/21/20.

2: ERS, November 2005. Measure Life Study. Prepared for MA Joint Utilities. https://www.ers-inc.com/wp-content/uploads/2018/04/Measure-Life-Study_MA-Joint-Utilities_ERS.pdf

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: DMI, 2006. Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Results analyzed in RLW Analytics, 2006. Sample Design and Impact Evaluation Analysis for Prescriptive Compressed Air Measures in Energy Initiative and Design 2000 Programs.

Compressed Air Refrigerated Air Dryer

Measure Code	COM-CA-RAD
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Compressed Air

Measure Description:

The installation of cycling or variable frequency drive (VFD)-equipped refrigerated compressed air dryers. Refrigerated air dryers remove the moisture from a compressed air system to enhance overall system performance. An efficient refrigerated dryer cycles on and off or uses a variable speed drive as required by the demand for compressed air instead of running continuously. Only properly sized refrigerated air dryers used in a single-compressor system are eligible.

Baseline Efficiency:

The baseline efficiency case is a non-cycling refrigerated air dryer.

High Efficiency:

The high efficiency case is a cycling refrigerated dryer or a refrigerated dryer equipped with a VFD.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
EC1b047	Refrigerated Air Dryer	LBES New	Calculated	Calculated
EC2b047	Refrigerated Air Dryer	SBES New	Calculated	Calculated
EC3b078	Refrigerated Air Dryer	Muni New	Calculated	Calculated

Savings Algorithms:

Δ kWh = (CFM DRYER) x (Save) x (HRS)

Δ kW = (CFM DRYER) x (Save)

Where:

CFM DRYER = Full flow rated capacity of the refrigerated air dryer in cubic feet per minute (CFM) obtained from equipment's Compressed Air Gas Institute Datasheet.

Save = Refrigerated air dryer kW reduction per dryer full flow rated CFM: 0.00554[1]

HRS = Annual operating hours of the refrigerated air dryer. Site specific, if unavailable use default operating hours below.

Default Operating Hours

Shift	Hours	Notes
Single shift (8/5)	1,976	7 AM – 3 PM, weekdays, minus some holidays and scheduled down time
2-shift (16/5)	3,952	7AM – 11 PM, weekdays, minus some holidays and scheduled down time

3-shift (24/5)	5,928	24 hours per day, weekdays, minus some holidays and scheduled down time
4-shift (24/7)	8,320	24 hours per day, 7 days a week minus some holidays and scheduled down time

Measure Life:

The measure life is 15 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b047	Refrigerated Air Dryer	Electric	LBES New	1	1.56	n/a	1	1	1.17	0.98
EC2b047	Refrigerated Air Dryer	Electric	SBES New	1	0.998	n/a	1.103	0.885	1.17	0.98
EC3b078	Refrigerated Air Dryer	Electric	Muni New	1	1.56	n/a	1	1	1.17	0.98

In-Service Rates:

All installations have a 100% in-service rates unless an evaluation finds otherwise.

Realization Rates:

Realization rates for LBES and Muni are from the prospective results of the 2015 study of prescriptive compressed air[3].The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4].

Coincidence Factors:

Summer and winter coincidence factors are from the prospective results of the 2015 study of prescriptive compressed air.[5]

Energy Load Shape:

See Appendix 1, C&I Load Shapes Table "C&I Compressed Air – Air Dryer"

Revision History:

Revision Number	Date	Revision
146	12/1/2022	Added default operating hours based on CT PSD
261	1/1/2026	Updated SBES RR based on 2025 Impact Study

Endnotes:

1: DNV GL, October 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for MA Joint Utilities and MA EEAC. http://ma-eeac.org/wordpress/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf

2: ERS, November 2005. Measure Life Study. Prepared for MA Joint Utilities. https://www.ers-inc.com/wp-content/uploads/2018/04/Measure-Life-Study_MA-Joint-Utilities_ERS.pdf

3: DNV GL, October 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for MA Joint Utilities and MA EEAC. http://ma-eeac.org/wordpress/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: DNV GL, October 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for MA Joint Utilities and MA EEAC. http://ma-eeac.org/wordpress/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf

Custom Measures

Measure Code	COM-CUS-LCI
Markets	Commercial
Program Types	Retrofit/Lost opportunity
Categories	Custom

Measure Description:

The Custom project track is offered for electric and natural gas energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offerings.

Baseline Efficiency:

Retrofit projects will use the existing system or performance as the baseline as the first baseline and code or industry standard practice (ISP) as the second baseline. Lost opportunity projects will generally refer to code for measures where code applies, until such time as the EM&V working group selects appropriate ISP values from relevant research. Other factors being equal, New Hampshire jurisdiction-specific results will be favored over results from other jurisdictions, however when relevant results exist from both New Hampshire and from other states, it may be necessary to balance the desirable attributes of state-specificity and data reliability. When considering whether to apply results from a study originating in another jurisdiction to New Hampshire programs, the EM&V working group (with support from independent evaluation firms as needed), will make the determination based on 1) the similarity of evaluated program/measures to those offered in NH; 2) the similarity of relevant markets and customer base, 3) the recency of the study relative to the recency of any applicable NH results, and 4) the quality of the study's methodology and sample size. If a relevant ISP has been established, lost opportunity projects should refer to that ISP if applicable. If code does not apply and an ISP is

not available, engineering judgment should be used to determine a project baseline. Baseline selection by engineering judgment should be justified by interviews with equipment vendors or subject matter experts; or by examining similar equipment installation by customer in other facilities.

High Efficiency:

The high efficiency scenario is specific to the custom project and may include one or more energy efficiency measures. Energy and demand savings calculations are based on projected or measured changes in equipment efficiencies and operating characteristics and are determined on a case-by-case basis.

Algorithms for Calculating Primary Energy Impact:

Gross energy and demand savings estimates for custom projects are calculated using engineering analysis with project-specific details. Custom analyses typically include a weather dependent load bin analysis, whole building energy model simulation, end-use metering or other engineering analysis and include estimates of savings, costs, and an evaluation of the projects' cost-effectiveness.

Measure Life:

For both lost-opportunity and retrofit custom applications, the measure life is determined on a case-by-case basis. Measure life for similar prescriptive measures may be used as default values. Remaining useful life (RUL) for existing equipment should be justified based on maintenance and repair history. As a default, RUL can be equal to one third of the equipment life may be used.

Other Resource Impacts:

Other resource impacts should be determined on a case-by-case basis for custom projects.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC1a001	Custom Large Compressed Air Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	3
EC1a002	Custom Large Hot Water Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	3
EC1a003	Custom Large HVAC Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	3
EC1a004	Custom Large Lighting Retro – Interior	LBES	1	0.99	n/a	1	1	custom	custom	4
EC1a005	Custom Large Motors Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error ! Bookmark not**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										defined.
EC1a006	Custom Large Process Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1a007	Custom Large Refrigeration Retro	LBES	1	0.865	n/a	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1a008	Custom Large Other Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1a010	Custom Large Other Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1a025	Custom Energy Management System Retro	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1a047	Custom Large Lighting Retro – Exterior	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1a048	Custom Large Lighting Retro – Controls	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC1b001	Custom Large Compressed Air New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b002	Custom Large Hot Water New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b003	Custom Large HVAC New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b004	Custom Large Lighting New – Interior	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1b005	Custom Large Motors New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b006	Custom Large Process New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b007	Custom Large Refrigeration New	LBES	1	0.865	n/a	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1b008	Custom Large Other New	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
EC1b054	Custom Large Lighting New – Exterior	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1b055	Custom Large Lighting New – Controls	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1d001	Custom Large Compressed Air Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d002	Custom Large Hot Water Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d003	Custom Large HVAC Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d004	Custom Large Lighting Direct Install – Interior	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1d005	Custom Large Lighting Direct Install – Exterior	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC1d006	Custom Large Lighting Direct Install – Controls	LBES	1	0.99	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC1d007	Custom Large Motors Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d008	Custom Large Process Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d009	Custom Large Refrigeration Direct Install	LBES	1	0.865	n/a	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
EC1d027	Custom Energy Management System Direct Install	LBES	1	0.865	0.925	0.94	0.88	custom	custom	**Error! Bookmark not defined.**
GC1a001	Custom Large Hot Water Retro	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1a002	Custom Large HVAC Retro	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1a003	Custom Large Other Retro	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
GC1a004	Custom Large Process Retro	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1a012	Custom Energy Management System Retro	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1b001	Custom Large Hot Water New	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1b002	Custom Large HVAC New	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1b003	Custom Large Other New	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC1b004	Custom Large Process New	LBES	1	n/a	0.925	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
EC3a001	Custom Muni Compressed Air Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	5
EC3a002	Custom Muni Hot Water Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										defined.
EC3a003	Custom Muni HVAC Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3a004	Custom Muni Lighting Retro – Interior	MUNI	1	1.066	n/a	1.123	0.974	custom	custom	**Error! Bookmark not defined.**
EC3a005	Custom Muni Motors Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3a006	Custom Muni Process Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3a007	Custom Muni Refrigeration Retro	MUNI	1	0.998	n/a	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3a008	Custom Muni Other Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3a038	Custom Energy Management System Retro	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC3a091	Custom Muni Lighting Retro – Exterior	MUNI	1	0.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC3a092	Custom Muni Lighting Retro – Controls	MUNI	1	1	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC3b001	Custom Muni Compressed Air New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b002	Custom Muni Hot Water New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b003	Custom Muni HVAC New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b004	Custom Muni Lighting New – Interior	MUNI	1	0.998	n/a	1.123	0.974	custom	custom	**Error! Bookmark not defined.**
EC3b005	Custom Muni Motors New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b006	Custom Muni Process New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
EC3b007	Custom Muni Refrigeration New	MUNI	1	0.998	n/a	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b008	Custom Muni Other New	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3b085	Custom Muni Lighting New – Exterior	MUNI	1	.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC3b086	Custom Muni Lighting New – Controls	MUNI	1	1	n/a	1	1	custom	custom	6
EC3d001	Custom Muni Compressed Air Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d002	Custom Muni Hot Water Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d003	Custom Muni HVAC Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d004	Custom Muni Lighting Direct Install – Interior	MUNI	1	0.864	n/a	1.123	0.974	custom	custom	**Error! Bookmark not**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										defined.
EC3d005	Custom Muni Lighting Direct Install – Exterior	MUNI	1	0.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC3d006	Custom Muni Lighting Direct Install – Controls	MUNI	1	1	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC3d007	Custom Muni Motors Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d008	Custom Muni Process Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d009	Custom Muni Refrigeration Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d010	Custom Muni Other Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC3d040	Custom Energy Management System Direct Install	MUNI	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
GC3a001	Custom Small Hot Water Retro	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3a002	Custom Small HVAC Retro	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3a003	Custom Small Other Retro	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3a004	Custom Small Process Retro	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3b001	Custom Small Hot Water New	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3b002	Custom Small HVAC New	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3b003	Custom Small Other New	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark not defined.**
GC3b004	Custom Small Process New	MUNI	1	n/a	0.956	n/a	n/a	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
EC2a001	Custom Small Compressed Air Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a002	Custom Small Hot Water Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a003	Custom Small HVAC Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a004	Custom Small Lighting Retro - Interior	SBES	1	0.864	n/a	1.123	0.974	custom	custom	**Error! Bookmark not defined.**
EC2a005	Custom Small Motors Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a006	Custom Small Process Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a007	Custom Small Refrigeration Retro	SBES	1	0.998	n/a	1.103	0.885	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC2a008	Custom Small Other Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a025	Custom Energy Management System Retro	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2a047	Custom Small Lighting Retro- Exterior	SBES	1	0.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC2a048	Custom Small Lighting Retro - Controls	SBES	1	1.00	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC2b001	Custom Small Compressed Air New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b002	Custom Small Hot Water New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b003	Custom Small HVAC New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b004	Custom Small Lighting New - Interior	SBES	1	0.864	n/a	1.123	0.974	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
EC2b005	Custom Small Motors New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b006	Custom Small Process New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b007	Custom Small Refrigeration New	SBES	1	0.998	n/a	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b008	Custom Small Other New	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2b054	Custom Small Lighting New - Exterior	SBES	1	0.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC2b055	Custom Small Lighting New - Controls	SBES	1	1	n/a	1	1	custom	custom	**Error! Bookmark not defined.**
EC2d001	Custom Small Compressed Air Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
EC2d002	Custom Small Hot Water Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2d003	Custom Small HVAC Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2d004	Custom Small Lighting Direct Install - Interior	SBES	1	0.864	n/a	1.123	0.974	custom	custom	**Error! Bookmark not defined.**
EC2d005	Custom Small Lighting Direct Install - Exterior	SBES	1	0.864	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC2d006	Custom Small Lighting Direct Install - Controls	SBES	1	1	n/a	1.00	1.00	custom	custom	**Error! Bookmark not defined.**
EC2d007	Custom Small Motors Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2d008	Custom Small Process Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2d009	Custom Small Refrigeration Direct Install	SBES	1	0.998	n/a	1.103	0.885	custom	custom	**Error! Bookmark**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
										not defined.
EC2d010	Custom Small Other Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
EC2d027	Custom Energy Management System Direct Install	SBES	1	0.998	0.956	1.103	0.885	custom	custom	**Error! Bookmark not defined.**
GC2a001	Custom Small Hot Water Retro	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC2a002	Custom Small HVAC Retro	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC2a003	Custom Small Other Retro	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC2a004	Custom Small Process Retro	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC2a012	Custom Energy Management System Retro	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**

BC ID	Measure Name	Program	ISR[1]	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}[2]	CF_{WP}[2]	REF
GC2b001	Custom Small Hot Water New	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error ! Bookmark not defined.**
GC2b002	Custom Small HVAC New	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error ! Bookmark not defined.**
GC2b003	Custom Small Other New	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error ! Bookmark not defined.**
GC2b004	Custom Small Process New	SBES	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error ! Bookmark not defined.**

Energy Load Shape:

See Appendix 1, C&I Load Shapes Table

"C&I Interior Lighting – Prescriptive"

"C&I Exterior Lighting"

"C&I Lighting Controls"

"C&I Refrigeration"

Impact Factors for Calculating Net Savings:

Free-ridership and spillover for custom lighting are based on study results from CT the nearby jurisdiction with programs and markets most similar to those in NH.[7]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC2b004	Custom Small Lighting New - Interior	SBES	11%	5%	0%	94%
EC2b054	Custom Small Lighting New - Exterior	SBES	11%	5%	0%	94%
EC2b055	Custom Small Lighting New - Controls	SBES	11%	5%	0%	94%
EC2a004	Custom Small Lighting Retro - Interior	SBES	11%	5%	0%	94%
EC2a047	Custom Small Lighting Retro- Exterior	SBES	11%	5%	0%	94%

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC2a048	Custom Small Lighting Retro - Controls	SBES	11%	5%	0%	94%
EC2d004	Custom Small Lighting Direct Install - Interior	SBES	11%	5%	0%	94%
EC2d005	Custom Small Lighting Direct Install - Exterior	SBES	11%	5%	0%	94%
EC2d006	Custom Small Lighting Direct Install - Controls	SBES	11%	5%	0%	94%
EC3b004	Custom Muni Lighting New – Interior	MES	11%	5%	0%	94%
EC3b085	Custom Muni Lighting New – Exterior	MES	11%	5%	0%	94%
EC3b086	Custom Muni Lighting New – Controls	MES	11%	5%	0%	94%
EC3a004	Custom Muni Lighting Retro – Interior	MES	11%	5%	0%	94%
EC3a091	Custom Muni Lighting Retro – Exterior	MES	11%	5%	0%	94%
EC3a092	Custom Muni Lighting Retro – Controls	MES	11%	5%	0%	94%
EC3d004	Custom Muni Lighting Direct Install – Interior	MES	11%	5%	0%	94%
EC3d005	Custom Muni Lighting Direct Install – Exterior	MES	11%	5%	0%	94%
EC3d006	Custom Muni Lighting Direct Install – Controls	MES	11%	5%	0%	94%
EC1b004	Custom Large Lighting New – Interior	LBES	11%	5%	0%	94%
EC1b054	Custom Large Lighting New – Exterior	LBES	11%	5%	0%	94%
EC1b055	Custom Large Lighting New – Controls	LBES	11%	5%	0%	94%
EC1a004	Custom Large Lighting Retro – Interior	LBES	11%	5%	0%	94%
EC1a047	Custom Large Lighting Retro – Exterior	LBES	11%	5%	0%	94%
EC1a048	Custom Large Lighting Retro – Controls	LBES	11%	5%	0%	94%
EC1d004	Custom Large Lighting Direct Install – Interior	LBES	11%	5%	0%	94%
EC1d005	Custom Large Lighting Direct Install – Exterior	LBES	11%	5%	0%	94%
EC1d006	Custom Large Lighting Direct Install – Controls	LBES	11%	5%	0%	94%

Revision History:

Revision Number	Date	Description
135	12/1/2022	Added verbiage to clarify process for baseline and measure life calculation.
249	1/1/2026	Updated realization rates for electric and gas measures in the LBES program per 'Impact Evaluation of 2020 and 2021 PY Large Business Energy Solutions Program Custom Measures' by DNV, 2024. Added in missing references for SBES and MES lighting and non-lighting realization rates and coincidence factors. Updated CF's for LBES and hot water measures. Updated SBES RRs for 2025 impact results.
358	1/1/2027	Updated CF verbiage to reflect they are custom calculated for each project. Correct application of SBES and Muni RR's.
402	10/30/2026	Extended RR's to three decimal places to resolve inconsistencies between TRM and BC Models

Endnotes:

1: All installations have 100% in-service-rates as programs include verification of equipment installations.

2: Gross summer and winter peak coincidence factors are custom-calculated for each custom project based on project-specific information. The actual or measured coincidence factors are included in the summer and winter demand realization rate.

3: Custom non-lighting measures offered through the LBES program utilize a 86.5% realization rate for electric savings, 94.4% for summer on peak demand, 88.5% winter on peak demand and 92.5% for gas savings per the 2024 DNV LBES Custom Impact Study

4: The realization rate for custom lighting measures offered through LBES is 99.0% based on the 2015 Large Commercial and Industrial (C&I) Retrofit And New Equipment & Construction Program Impact Evaluation by DNV. DNV GL, September 2015. New Hampshire Utilities Large Commercial and Industrial (C&I) Retrofit And New Equipment & Construction Program Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

5: Measures offered through the SBES and Municipal Programs utilize a 0.998 electric realization rate, a 0.956 non electric realization rate, a summer peak realization rate of 1.103 and a winter realization rate of 0.885 per the 2025 NH Saves Small Business Energy Solutions 2023 Process and Impact Evaluation. In lieu of a program specific evaluation, the SBES values are applied to the MUNI program. Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: Realization rates are assumed to be 100% until evaluated.

7: Downstream NTG values are based on Energy Opportunities NTG Study Results for Lighting shown in Table ES-1-1 on p. ES-3. EMI, (2019). C1644 EO Net-to-Gross Study, Final Report. https://www.energizect.com/sites/default/files/C1644%20-%20EO%20NTG%20Final%20Report_9.25.19.pdf

Food Service Conveyor Broiler

Measure Code	COM-FS-CB
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an energy efficient underfired broiler to replace a conventional automatic constant input rate conveyor broiler. This measure has both electric and gas savings.

Baseline Efficiency:

Baseline broiler must be an automatic conveyor broiler capable of maintaining a temperature above 600 F with a tested idle rate greater than:

• 40 kBtu/h for a belt narrower than 22"

• 60 kBtu/h for a belt between 22 and 28"

• 70 kBtu/h for a belt wider than 28"

High Efficiency:

An efficient conveyor broiler must be installed with a catalyst and have an input rate of less than 80 kBtu/h OR a dual-stage or modulating gas valve with a capacity of throttling the input rate below 80 kBtu/h. Must be installed under a Type II Hood.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the SoCalGas Commercial Conveyor Broilers workpaper WPSCGNRCC171226A.[1]

BC ID	Measure Name	Program	ΔkWH[1]	ΔkW[1]	ΔmmBTU[1]
EC1c047 EC2c047	Conveyor Broiler <22”	LBES Mid SBES Mid	7,144	1.48	114.5
EC1c047 EC2c047	Conveyor Broiler 22-28”	LBES Mid SBES Mid	6,403	.88	193.3
EC1c047 EC2c047	Conveyor Broiler >22”	LBES Mid SBES Mid	23,849	3.29	316.1

Measure Life:

The measure life for a conveyor broiler is 12 years. [2]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c047	Midstream Conveyor Broiler	Electric	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC2c047	Midstream Conveyor Broiler	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise.The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR’s from a 2025 Impact study[3].

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.[4]

Energy Load Shape:

See Appendix 1 C&I Load Shapes “LS_111 C&I Food Service”

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG	REF
EC1c047 EC2c047	Conveyor Broiler <22"	LBES Mid SBES Mid	0.225	0.085	0.00	0.86	5
EC1c047 EC2c047	Conveyor Broiler 22-28"	LBES Mid SBES Mid	0.225	0.085	0.00	0.86	5
EC1c047 EC2c047	Conveyor Broiler >22"	LBES Mid SBES Mid	0.225	0.085	0.00	0.86	5

Revision History:

Revision Number	Date	Revision
60	3/1/2022	Conveyor Broiler Measures Added to TRM
295	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01.

2: California Public Utilities Commission (CPUC), Energy Division. 2014. "DEER2014-EUL-table-update_2014-02-05.xlsx" https://www.caetrm.com/media/reference-documents/DEER2014-EUL-table-update_2014-02-05_PUq4NzL.xlsx

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01.

5: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Dishwasher

Measure Code	COM-FSE-DWS
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Dishwasher High Temperature: Installation of a qualified ENERGY STAR® high temperature commercial dishwasher in a building with gas domestic hot water. High temperature dishwashers use a booster heater to raise the rinse water temperature to 180 F – hot enough to sterilize dishes and assist in drying. Electric savings are achieved through savings to the electric booster.

Dishwasher Low Temperature: Installation of a qualified ENERGY STAR® low temperature commercial dishwasher in a facility with electric hot water heating. Low temperature dishwashers use the hot water supplied by the kitchen's existing water heater and use a chemical sanitizing agent in the final rinse cycle and sometimes a drying agent.

Baseline Efficiency:

Dishwasher High Temp: The baseline efficiency case is a commercial dishwasher with idle energy rates and water consumption as follows[1]

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption
High Temp Under Counter Dishwasher	0.36	1.09(gal/rack)
High Temp Door Type Dishwasher	0.51	1.29(gal/rack)
High Temp Single Tank Conveyer Dishwasher	1.30	0.87(gal/rack)
High Temp Multi Tank Conveyer Dishwasher	1.84	0.97(gal/rack)
High Temp Pots & Pans Dishwasher	1.10	0.70(gal/sqft)

Dishwasher Low Temp: The baseline efficiency case is a commercial dishwasher with idle energy rates and water consumption as follows[2].

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption (gal/rack)
Low Temp Under Counter Dishwasher	0.41	1.73
Low Temp Door Type Dishwasher	0.32	2.10
Low Temp Single Tank Conveyor Dishwasher	0.75	1.31
Low Temp Multi Tank Conveyor Dishwasher	1.74	1.04

High Efficiency:

Dishwasher High Temp: The high efficiency case is a commercial dishwasher with idle energy rates and water consumption following ENERGY STAR® Efficiency Requirements[3] as follows:

Dishwasher Type	Idle Energy Rate (kW)	*Washing Energy*	Water Consumption
High Temp Under Counter Dishwasher	$\leq$ 0.30kW	$\leq$ 0.35 kWh/rack	0.86 (gal/rack)
High Temp Door Type Dishwasher	$\leq$ 0.55kW	$\leq$ 0.35 kWh/rack	0.89 (gal/rack)
High Temp Single Tank Conveyer Dishwasher	$\leq$ 1.20kW	$\leq$ 0.36 kWh/rack	0.70 (gal/rack)
High Temp Multi Tank Conveyer Dishwasher	$\leq$1.85kW	$\leq$ 0.36 kWh/rack	0.54 (gal/rack)
High Temp Pots & Pans Dishwasher	$\leq$0.90kW	$\leq$ 0.55 + 0.05 x SFrack k	0.58 (gal/sq ft)

Dishwasher Low Temp: The high efficiency case is a commercial dishwasher with idle energy rates and water consumption following ENERGY STAR® Efficiency Requirements[4]. as follows:

Dishwasher Type	Idle Energy Rate (kW)	*Washing Energy*	Water Consumption (gal/rack)
Low Temp Under Counter Dishwasher	≤ 0.25 kW	≤ 0.15 kWh/rack	1.19
Low Temp Door Type Dishwasher	≤ 0.30 kW	≤ 0.15 kWh/rack	1.18
Low Temp Single Tank Conveyor Dishwasher	≤ 0.85 kW	≤ 0.16 kWh/rack	0.79
Low Temp Multi Tank Conveyor Dishwasher	≤ 1.00 kW	≤ 0.22 kWh/rack	0.54

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure	Program	ΔkW	ΔkWh
EC1b026 EC2b026 EC3b040 EC1c024 EC2c024	High Temp Under Counter Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	0.23	1,480
EC1b022 EC2b022 EC3b036 EC1c020 EC2c020	High Temp Door Type Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	1.81	11,897
EC1b025 EC2b025 EC3b039 EC1c023 EC2c023	High Temp Single Tank Conveyer Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	1.55	10,204
EC1b023 EC2b023 EC3b037 EC1c021 EC2c021	High Temp Multi Tank Conveyer Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	6.86	45,074
EC1b024 EC2b024 EC3b038 EC1c022 EC2c022	High Temp Pots & Pans Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	1.67	10,979
EC1b030 EC2b030 EC3b044 EC1c028 EC2c028	Low Temp Under Counter Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	0.94	6,182
EC1b027 EC2b027 EC3b041 EC1c025 EC2c025	Low Temp Door Type Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	2.63	17,255
EC1b029 EC2b029 EC3b043 EC1c027 EC2c027	Low Temp Single Tank Conveyor Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	2.34	15,387

BC ID	Measure	Program	ΔkW	ΔkWh
EC1b028 EC2b028 EC3b042 EC1c026 EC2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES New SBES New Muni New LBES Mid SBES Mid	3.48	22,863

Dishwasher High Temp: Unit kwh savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator[5].

Measure Life:

The measure life for a new commercial dishwasher is 13 years[6]

Other Resource Impacts:

Dishwasher high temp: There are water savings associated with this measure.[7]

Dishwasher Type	Annual water savings (gal/unit)
High Temp Under Counter Dishwasher	6,296
High Temp Door Type Dishwasher	40,880
High Temp Single Tank Conveyer Dishwasher	24,820
High Temp Multi Tank Conveyer Dishwasher	94,170
High Temp Pots & Pans Dishwasher	8,760

Dishwasher low temp: There are water savings associated with this measure.[8]

Dishwasher Type	Annual water savings (gal/unit)
Low Temp Under Counter Dishwasher	14,783
Low Temp Door Type Dishwasher	94,024
Low Temp Single Tank Conveyor Dishwasher	75,920
Low Temp Multi Tank Conveyor Dishwasher	109,500

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c024	High Temp Under Counter Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c020	High Temp Door Type Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c022	High Temp Pots & Pans Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c028	Low Temp Under Counter Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c025	Low Temp Door Type Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1b026	High Temp Under Counter Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b022	High Temp Door Type Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b025	High Temp Single Tank Conveyer Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b023	High Temp Multi Tank Conveyer Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b024	High Temp Pots & Pans Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b030	Low Temp Under Counter Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b027	Low Temp Door Type Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b029	Low Temp Single Tank Conveyor Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b028	Low Temp Multi Tank Conveyor Dishwasher	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC3b040	High Temp Under Counter Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b036	High Temp Door Type Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b039	High Temp Single Tank Conveyer Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b037	High Temp Multi Tank Conveyer Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b038	High Temp Pots & Pans Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b044	Low Temp Under Counter Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b041	Low Temp Door Type Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b043	Low Temp Single Tank Conveyor Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3b042	Low Temp Multi Tank Conveyor Dishwasher	Muni New	1	1	n/a	1	1	0.9	0.9
EC2c020	High Temp Door Type Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c021	High Temp Multi Tank Conveyer Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c022	High Temp Pots & Pans Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c023	High Temp Single Tank Conveyer Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c024	High Temp Under Counter Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c025	Low Temp Door Type Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c026	Low Temp Multi Tank Conveyor Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c027	Low Temp Single Tank Conveyor Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c028	Low Temp Under Counter Dishwasher	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b022	High Temp Door Type Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b023	High Temp Multi Tank Conveyer Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b024	High Temp Pots & Pans Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b025	High Temp Single Tank Conveyer Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b026	High Temp Under Counter Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b027	Low Temp Door Type Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b028	Low Temp Multi Tank Conveyor Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b029	Low Temp Single Tank Conveyor Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b030	Low Temp Under Counter Dishwasher	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

In-service rates are assumed to be 100% until an evaluation finds otherwise.

Realization Rates:

Realization rates are assumed to be 100% until an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[9] The SBES program uses a realization rate of 99.8% RR from a 2025 Impact study.[10]

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1, C&I Load Shapes Table- "C&I Food Services"

Impact Factors for Calculating Net Savings:

[11]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c024 EC2c024	High Temp Under Counter Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c020 EC2c020	High Temp Door Type Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c023 EC2c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c021 EC2c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c022 EC2c022	High Temp Pots & Pans Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c028 EC2c028	Low Temp Under Counter Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c025 EC2c025	Low Temp Door Type Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c027 EC2c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86
EC1c026 EC2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Description
141	12/1/2022	Updated high efficiency case, all kW, kWh and water savings according to the new Energy Star Food Service Calculator release in 2021.
241	1/1/2026	Updated savings to align with new energy star calculator idle energy rates. Resulted in updated savings for all measures and updated water savings for high temp pots and pans also updated. Measure life updated to align with recent study results. SBES RR's updated to align with 2025 SBES impact Study

Endnotes:

1: ENERGY STAR Commercial Kitchen Equipment Calculator. Updated March 2021. Note: High temperature units are assumed to have natural gas hot water and electric temperature boosters. Low temperature units are assumed to have electric hot water https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

2: ENERGY STAR Commercial Kitchen Equipment Calculator. Updated March 2021. Note: High temperature units are assumed to have natural gas hot water and electric temperature boosters. Low temperature units are assumed to have electric hot water. https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

3: ENERGY STAR Commercial Dishwashers Key Product Criteria, version 3.0. Effective July 27, 2021. https://www.energystar.gov/sites/default/files/Commercial%20Dishwashers%20Final%20Version%203.0%20Specification.pdf

4: ENERGY STAR Commercial Dishwashers Key Product Criteria, version 3.0. Effective July 27, 2021. https://www.energystar.gov/sites/default/files/Commercial%20Dishwashers%20Final%20Version%203.0%20Specification.pdf

5: https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

6: NMR,2023. Appliance Standards Energy Savings Report (MA23x12-B-ASGS) https://ma-eeac.org/wp-content/uploads/MA23X12-B-ASGS-Appliance-Standards-Gross-Savings-Report_FINAL_2023.10.31.pdf

7: https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

8: https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

9: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

10: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

11: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Freezer

Measure Code	COM-FS-FRZR
Markets	Commercial

ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Installation of a qualified ENERGY STAR qualified reach-in freezer that replaces a standard efficiency unit of the same configuration and capacity. The freezer may have a solid door or transparent door. Measure savings are defined by configuration and internal volume as specified in the ENERGY STAR commercial requirements presented below.

Baseline Efficiency:

The baseline case includes standard-efficiency, reach-in, solid and transparent door freezers and are defined by the U.S. Department of Energy (DOE) federal requirements.

High Efficiency:

The high-efficiency case is an ENERGY STAR qualified reach-in freezer having the same configuration and capacity as the baseline equipment.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkW	ΔkWh
EC1c029	Midstream Freezer - Solid Door	LBES Mid	Calculated	Calculated
EC1c030	Midstream Freezer - Glass Door	LBES Mid	Calculated	Calculated
EC2c029	Midstream Freezer - Solid Door	SBES Mid	Calculated	Calculated
EC2c030	Midstream Freezer - Glass Door	SBES Mid	Calculated	Calculated

Unit savings are calculated and based on the ENERGY STAR Commercial Kitchen Equipment Calculator.

$$\Delta kWh = kWh_{BL} - kWh_{EE}$$

$$kWh_{BL} = (kWh_D)_{BL} \times D$$

$$kWh_{EE} = (kWh_D)_{EE} \times D$$

Where,

ΔkWh = Annual electric energy savings (kWh)

kWh_{BL} = Annual electric energy consumption of baseline equipment (kWh). Calculate from table below.

kWh_{EE} = Annual electric energy consumption of efficient equipment (kWh). Calculate from table below.

kWh_D = Daily electric energy consumption (kWh)

D = Number of days of operation of the unit. Use site specific data if possible (365 days is default).

V = Internal volume of equipment (ft3)

Equipment Daily Consumption[1] [2]

Door Type	Size Thresholds	Baseline Freezer Daily Energy Consumption $(kWh_D)_{BL}$	Efficient Freezer Daily Energy Consumption $(kWh_D)_{EE}$
Solid Door	0 < V < 15	(0.22 x V) + 1.38	(0.021 x V) + 0.90
	15 < V < 30		(0.012 x V) + 2.248
	30 < V < 50		(0.285 x V) - 2.703
	50 < V		(0.142 x V) + 4.445
Transparent Door	All	(0.29 x V) + 2.95	(0.232 x V) + 2.36

Measure Life:

[3]

BC ID	Measure Name	Measure Life
EC1c030 EC2c030	Freezer, Transparent Door	12
EC1c029 EC2c029	Freezer, Solid Door	12

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c029	Midstream Freezer - Solid Door	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c030	Midstream Freezer - Glass Door	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC2c029	Midstream Freezer - Solid Door	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c030	Midstream Freezer - Glass Door	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Food Service".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[5]

BC ID	Measure Name	Program	FR	SOP	SONP	NTG
EC1c030 EC2c030	Freezer, Transparent Door	LBES Mid SBES Mid	0.225	0.085	0	0.86
EC1c029 EC2c029	Freezer, Solid Door	LBES Mid SBES Mid	0.225	0.085	0	0.86

Revision History:

Revision Number	Date	Revision
279	1/1/2026	Updated SBES rr's for 2025 impact study results

Endnotes:

1: Efficient equipment daily energy consumption is in line with ENERGY STAR. 2016. "ENERGY STAR® Program Requirements Product Specification for Commercial Refrigerators and Freezers - Eligibility Criteria Version 4.0." Effective on March 27, 2017.

2: Baseline equipment daily energy consumption is defined by the U.S. Department of Energy (DOE) federal requirements. Code of Federal Regulations at 10 CFR 431.66.

3: California Public Utilities Commission (CPUC), Energy Division. 2014. "DEER2014-EUL-table-update_2014-02-05.xlsx."

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Fryer

Measure Code	COM-FS-FRYR

Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Electric Fryer: Installation of a qualified ENERGY STAR standard or large vat commercial fryer. ENERGY STAR commercial fryers save energy during cooking and idle times due to improved cooking efficiency and idle energy rates.

Gas Fryer: The installation of a natural-gas fired fryer that is either ENERGY STAR rated or has a heavy-load cooking efficiency of at least 50%. Qualified fryers use advanced burner and heat exchanger designs to use fuel more efficiently, as well as increased insulation to reduce standby heat loss

Baseline Efficiency:

Electric Fryer: The baseline efficiency case for both, standard sized fryers and large capacity fryers is an electric deep-fat fryer of the same size with a cooking energy efficiency, shortening capacity, and idle energy rate as defined by any relevant U.S. federal requirements.

Gas Fryer: The baseline efficiency case is a gas deep-fat fryer of the same size with a cooking energy efficiency, shortening capacity, and idle energy rate as defined by any relevant U.S. federal requirements.

High Efficiency:

Electric Fryer: The high efficiency case for both, standard sized fryer and large capacity fryers is an electric deep-fat fryer with a cooking energy efficiency, shortening capacity, and idle energy rate in line with ENERGY STAR Commercial Fryer Program Requirements Version 3.0 effective October 1st, 2016.

Gas Fryer: The high efficiency case is a deep-fat gas fryer with a cooking energy efficiency, shortening capacity, and idle energy rate in line with ENERGY STAR ENERGY STAR Commercial Fryer Program Requirements Version 3.0 effective October 1st, 2016.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh[2]	ΔkW	ΔMMBtu[3]
EC1b033 EC2b033 EC3b050 EC1c032 EC2c032	Electric Fryer, Standard Vat	LBES New SBES New Muni LBES Mid SBES Mid	3,272	0.56	n/a

EC1b032 EC2b032 EC3b049 EC1c031 EC2c031	Electric Fryer, Large Vat	LBES New SBES New Muni New LBES Mid SBES Mid	2,696	0.61	n/a
GC1b024 GC2b024 GC1c004 GC2c004 GC3b024	Gas Fryer	LBES New SBES New LBES Mid SBES Mid Muni New	n/a	n/a	51.2

Energy Savings for Commercial Fryer are deemed using the Energy Star CFS Calculator. [1]

Measure Life:

The measure life for a new commercial fryer is 12 years[4]

Other Resource Impacts:

There are no other resource impacts for these measures.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c031	Electric Fryer, Large Vat	Electric	LBES Mid	1	0.99	n/a	1	1	0.9	0.9
EC2c032	Electric Fryer, Standard Vat	Electric	LBES Mid	1	0.99	n/a	1	1	0.9	0.9
GC1c004	Gas Fryer	Gas	LBES Mid	1	n/a	1	1	1	n/a	n/a
EC1c032	Electric Fryer, Standard Vat	Gas	LBES Mid	1	n/a	1	1	1	n/a	n/a
EC1b032	Electric Fryer, Large Vat	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b033	Electric Fryer, Standard Vat	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
GC1b024	Gas Fryer	Gas	LBES New	1	n/a	1	1	1	n/a	n/a
EC3b049	Electric Fryer, Large Vat	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b050	Electric Fryer, Standard Vat	Gas	Muni New	1	n/a	1	1	1	n/a	n/a
GC3b024	Gas Fryer	Gas	Muni New	1	n/a	1	1	1	n/a	n/a

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC2c031	Electric Fryer, Large Vat	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
GC2c004	Gas Fryer	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2b033	Electric Fryer, Standard Vat	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2b024	Gas Fryer	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2b032	Electric Fryer, Large Vat	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[5] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a 95.6% gas RR from a 2025 Impact study[6]. All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 C&I Load Shapes, "C&I Food Services"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[6]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c032 EC2c032	Electric Fryer, Standard Vat	LBES Mid SBES Mid	0.225	0.085	0	0.86
EC1c031 EC2c031	Electric Fryer, Large Vat	LBES Mid SBES Mid	0.225	0.085	0	0.86
GC1c004 GC2c004	Gas Fryer	LBES Mid SBES Mid	0.237	0.07	0	0.83

Revision History:

Revision	Date	Description
152	12/1/2022	Updated electric and gas savings to align with 2021 Energy Star Commercial Food Service Calculator.
280	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: CFS_calculator_07-15-2021 (4)_Fryer 2022

2: California Energy Wise Commercial Kitchen Energy Savings Calculators, Available online at: https://caenergywise.com/calculators/

3: California Energy Wise Commercial Kitchen Energy Savings Calculators, Available online at: https://caenergywise.com/calculators/, last accessed Jul. 30, 2019.

4: SupportTable_EUL.csv, from DEER Database for Energy-Efficient Resources; Version 2016, READI v.2.4.3 (Current Ex Ante data) found at http://www.deeresources.com/

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

7: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Griddle

Measure Code	COM-FS-GRDL
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Electric Griddle: Installation of a qualified ENERGY STAR electric griddle.

Gas Griddle: Installation of a qualified ENERGY STAR gas griddle.

ENERGY STAR griddles save energy cooking and idle times due to improved cooking efficiency and idle energy rates.

Baseline Efficiency:

Electric Griddle: The baseline efficiency case is a typically sized, (6 sq. ft.) electric, commercial griddle with a cooking energy efficiency, production capacity, and idle energy rate as defined by any applicable U.S. federal requirements.

Gas Griddle: The baseline efficiency case is a typically sized, (6 sq. ft.) gas, commercial griddle with a cooking energy efficiency, production capacity, and idle energy rate as defined by any applicable U.S. federal requirements.

High Efficiency:

Electric Griddle: The high efficiency case is a typically sized (6 sq. ft.), electric, commercial griddle with a cooking energy efficiency, production capacity, and idle energy rate meeting the minimum ENERGY STAR program requirements version 1.2. [1]

Gas Griddle: The high efficiency case is a typically sized (6 sq. ft.), gas, commercial griddle with a cooking energy efficiency, production capacity, and idle energy rate meeting the minimum ENERGY STAR program requirements version 1.2.[2]

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed using the 2021 Energy Star Commercial Food Service Calculators.[3]

BC ID	Measure Name	Program	ΔkW	ΔkWh	ΔMMBtu
EC1b034 EC2b034 EC3b055 EC1c033 EC2c033	Commercial Electric Griddle, double sided	LBES New SBES New Muni New LBES Mid SBES Mid	0.73	3,179	n/a
GC1b025 GC2b025 GC1c005 GC2c005 GC3b025	Commercial Gas Griddle, double sided	LBES New SBES New LBES Mid SBES Mid Muni New	n/a	n/a	22.1

For electric Griddle:

ΔkWh = ΔkWh

ΔkW = ΔkWh / Hours

Where:

ΔkWh = gross annual kWh savings from the measure per table above

ΔkW = gross average kW savings from the measure per table above

Hours = annual operating hours

For Gas Griddle:

ΔMMBtu = MMBtu

Where:

ΔMMBtu = gross annual MMBtu gas savings from the measure per table above.

Measure Life:

The measure life for a new commercial griddle is 12 years.[4]

Other Resource Impacts:

There are no other resource impacts for these measures.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c033	Electric Griddle	Electric	LBES Mid	1	0.99	n/a	1	1	0.9	0.9
GC1c005	Gas Griddle	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
EC1b034	Electric Griddle	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
GC1b025	Gas Griddle	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
EC3b055	Electric Griddle	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
GC3b025	Gas Griddle	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC2c033	Electric Griddle	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
GC2c005	Gas Griddle	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	0.9	0.9
EC2b034	Electric Griddle	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
GC2b025	Gas Griddle	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[5] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a 95.6% gas RR from a 2025 Impact study[6]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 C&I Load Shapes, "C&I Food Services".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[7]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c033 EC2c033	Electric Griddle	LBES Mid SBES Mid	0.225	0.085	0	0.86
GC1c005 GC2c005	Gas Griddle	LBES Mid SBES Mid	0.237	0.07	0	0.83

Revision History:

Revision Number	Date	Description
155	12/1/2022	Updated high efficiency case with energy star program requirements citation. Updated savings calcs to align with latest energy star commercial food services calculator.
281	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Energy Star Program Requirements for Commercial Griddles version 1.2. https://www.energystar.gov/sites/default/files/Commercial%20Griddles%20Version%201.2%20%28Rev%20December%20-%202020%29.pdf

2: Energy Star Program Requirements for Commercial Griddles version 1.2. https://www.energystar.gov/sites/default/files/Commercial%20Griddles%20Version%201.2%20%28Rev%20December%20-%202020%29.pdf

3: CFS_calculator_07-15-2021 (4)_griddle

4: SupportTable_EUL.csv, from DEER Database for Energy-Efficient Resources; Version 2016, READI v.2.4.3 (Current Ex Ante data) found at http://www.deeresources.com/

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

7: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Hand-Wrap Machine

Measure Code	COM-FS-HWM
Markets	Commercial
ProgramTypes	New, Retrofit

Categories	Food Service Equipment

Measure Description:

Installation of an on-demand hand-wrap machine with Mechanical or optical control system. Food items, such as meat and cheese, are often placed on trays and wrapped in plastic film before being displayed for purchase. The plastic wrap protects the food from airborne organisms and dust, allows customers to view the product, and provides a surface for pasting information labels. A hand-wrap machine consists of a heating bar and a heating platform, rated at approximately 0.05 kW and 0.55 kW, respectively. The heating bar cuts the wrapping film as it comes in contact with itself. The heating platform heats up the wrapping film. When the wrapping film is heated, the film sticks to the package and seals the product.

Baseline Efficiency:

The baseline is defined as an always-on commercial electric hand-wrap machine.[1]

High Efficiency:

An efficient hand-wrap machine is defined as an on-demand model with a mechanical or optical control system.[1]

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh[2]	ΔkW[3]
EC1c051 EC2c051	Hand-wrap Machine	LBES Mid SBES Mid	1,565	0.181

Assumptions:

Annual Energy					
Hand-Wrap Case	**Supermarket Chain 1 (kWh/yr)**	**Supermarket Chain 2 (kWh/yr)**	**Supermarket Chain 3 (kWh/yr)**	**Supermarket Chain 4 (kWh/yr)**	**Annual Energy Consumption (kWh/yr)**
Baseline	2,310.55	1,809.70	1,776.20	1,983.14	1,969.90
Efficient Case	411.64	395.1	452.3	361.21	405.06
Annual Savings	1898.91	1414.6	1323.9	1621.93	1564.84
Demand					
Hand-Wrap Case	**Supermarket Chain 1 (kW)**	**Supermarket Chain 2 (kW)**	**Supermarket Chain 3 (kW)**	**Supermarket Chain 4 (kW)**	**Demand Savings (kW)**
Baseline	0.267	0.227	0.201	0.229	0.231
Efficient Case	0.054	0.043	0.059	0.043	0.05

Annual Savings	0.21	0.18	0.14	0.19	0.181

Measure Life:

The measure life for a hand-wrap machine is 10 years. [3]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c051	Hand-wrap Machine	LBES Mid	1	1	1	1	1	0.9	0.9
EC2c051	Hand-wrap Machine	SBES Mid	1	0.998	1	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.[5]

Energy Load Shape:

See Appendix 1 C&I Load Shapes "LS_111 C&I Food Service"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR[6]	SO_p[5]	SO_{NP}[5]	NTG[5]
EC1c051 EC2c051	Hand-wrap Machine	LBES Mid SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
62	3/1/2022	New Measure Added
282	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Southern California Edison (SCE), Emerging Products. 2015. Commercial Hand Wrap Machines for Food Service Applications Field Test. ET13SCE1190. https://www.caetrm.com/media/reference-documents/SCE_2014_ET13SCE1190_Report.pdf

2: Southern California Edison (SCE). 2016. "SCE17CC014.0 Com Hand Wrap Machines Costs 2016.xlsx." https://www.caetrm.com/media/reference-documents/SCE17CC014.0_Com_Hand_Wrap_Machines_Costs_2016.xlsx

3: University of California, Office of the President, Purchasing Services. 2018. "Useful Life Index, G8605: Cutters, Slicers, Saws, Choppers, Graters, Grinders, Universal Mach, Food Prep." Download https://www.caetrm.com/media/reference-documents/UC_EUL_for_Hand_Wrap_Food_Prep_2018.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01.

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service High Efficiency Condensing Unit

Measure Code	COM-HVAC-HECU
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an efficient condensing unit defined as having three requisite attributes: an efficient scroll compressor, floating head pressure controls, and modulating compressor fan speed capabilities. The collective effect of these three features results in the refrigeration load requirements being met while using less power as compared to a baseline unit.

Baseline Efficiency:

A baseline condensing unit is one with a standard compressor efficiency rating (as defined and established by Efficiency Vermont's Refrigeration Analysis Tool), no floating head pressure controls, and single speed compressor fan motors.[1]

High Efficiency:

An efficient condensing unit is defined by units incorporating three requisite attributes: an efficient scroll compressor, floating head pressure controls, and modulating compressor fan speed capabilities.[2]

Algorithms for Calculating Primary Energy Impact:

Deemed savings will be claimed based on a unit's temperature application, power phase requirements and compressor horsepower rating. The prescriptive, deemed savings in the table below are based on linear interpolation and extrapolation of currently available data from the 2018 Vermont TRM[3].

BC ID	Program	HECU Type	Single Phase Low Temp		Single Phase Medium Temp		Three Phase Low Temp		Three Phase Medium Temp	
		HP	ΔkW	ΔkWh	ΔkW	ΔkWh	ΔkW	ΔkWh	ΔkW	ΔkWh
EC1c052 EC2c052 EC3b033 EC3b034	LBES Mid SBES Mid Muni-New	1	0.283	1,112	0.426	2,239	0.210	992	0.341	1,854
		1.5	0.333	1,612	0.400	2,237	0.269	1,413	0.354	2,014
		2	0.384	2,285	0.467	2,2609	0.329	2,003	0.413	2,349
		2.5	0.422	2,579	0.547	3,056	0.382	2,356	0.483	2,751
		3	0.471	2,878	0.641	3,730	0.426	2,629	0.563	3,282
		3.5	0.570	3,483	0.781	4,399	0.516	3,182	0.694	3,907
		4	0.583	3,528	0.864	4,865	0.557	3,450	0.769	4,321
		4.5	0.618	3,802	0.879	4,952	0.611	3,718	0.783	4,398
		5	0.683	4,240	0.829	4,904	0.673	4,416	0.805	4,678
		6	0.783	5,083	0.829	4,904	0.788	4,979	0.805	4,678

Measure Life:

The measure life for a HECU is 13 years. [4]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c052	High Efficiency Condensing Unit	LBES Mid	1	1	1	1	1	1.00	1.15
EC2c052	High Efficiency Condensing Unit	SBES Mid	1	0.998	1	1.103	0.885	1.00	1.15
EC3b033 EC3b034	High Efficiency Condensing Unit up to 300MBH , oil	Muni New	1	N/A	1	N/A	N/A	N/A	N/A
EC3b033 EC3b034	High Efficiency Condensing Unit up to 300MBH, propane	Muni New	1	N/A	1	N/A	N/A	N/A	N/A

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[5]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Summer and winter coincidence factors align with the loadshapes used to capture the coincident peak demand savings associated with the scroll compressor and the floating head pressure control components of the measure, as used in the VT TRM methodology.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "LS_111 C&I Food Service"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG	REF
EC1c052 EC2c052	High Efficiency Condensing Unit	LBES Mid SBES Mid	0.225	0.085	0.0	0.86	6

Revision History:

Revision Number	Date	Revision
63	3/1/2022	New Measure Added
236	1/1/2026	Fixed measure code (was FS, should be HVAC). Updated SBES RR and fixed references. Updated CF.
403	10/30/2026	Added omitted BC ID's EC3b033 and EC3b034

Endnotes:

1: SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01.

2: Efficiency Vermont, 2018. Technical Reference User Manual (TRM). https://puc.vermont.gov/sites/psbnew/files/doc_library/Vermont%20TRM%20Savings%20Verification%202018%20Version_FINAL.pdf

3: Efficiency Vermont, 2018. Technical Reference User Manual (TRM). https://puc.vermont.gov/sites/psbnew/files/doc_library/Vermont%20TRM%20Savings%20Verification%202018%20Version_FINAL.pdf

4: Efficiency Vermont, 2018. Technical Reference User Manual (TRM). https://puc.vermont.gov/sites/psbnew/files/doc_library/Vermont%20TRM%20Savings%20Verification%202018%20Version_FINAL.pdf

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52).

Food Service Holding Cabinet

Measure Code	COM-FS-HC
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Installation of a qualified ENERGY STAR hot food holding cabinet (HFHC). ENERGY STAR hot food holding cabinets are 70 percent more energy efficient than standard models. Models that meet this requirement incorporate better insulation, reducing heat loss, and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closures, or Dutch doors. The insulation of the cabinet also offers better temperature uniformity within the cabinet from top to bottom. Offering full size, 3/4 size, and 1/2 size HFHC.

Baseline Efficiency:

The baseline efficiency idle energy rate for a HFHC is a unit meeting any applicable federal energy efficiency standards.

High Efficiency:

The high efficiency idle energy rate for HFHC is based on the product interior volume in cubic feet (V) as shown below[1]

Size Category	Product Interior Volume, V (ft^3)	Product Idle Energy Consumption Rate (W)
Half size	$0 < V < 13$	$\leq 21.5\ V$
3/4 size	$13 \leq V < 28$	$\leq 2.0\ V + 254.0$
Full size	$28 \leq V$	$\leq 3.8\ V + 203.5$

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkW	ΔkWh[2]
EC1b037	Hot Food Holding Cabinet Full Size	LBES New	1.15	3,807
EC2b037		SBES New		
EC3b058		Muni		
EC1c035		LBES Mid		
EC2c035		SBES Mid		
EC1b036	Hot food Holding Cabinet 3/4 Size	LBES New	0.32	1,189
EC2b036		SBES New		
EC3b057		Muni		
EC1c034		LBES Mid		

EC2c034		SBES Mid		
EC1b038 EC2b038 EC3b059 EC1c036 EC2c036	Hot Food Holding Cabinet 1/2 Size	LBES New SBES New Muni LBES Mid SBES Mid	0.05	223

Unit kWh savings are deemed using the below inputs in the Energy Star Commercial Food Services Calculator, updated March 2021. kW savings are calculated using the algorithm below.[3]

kWh = kWh

kW = kWh / Hours

Where:

kWh = gross annual kWh savings from the measure: See table below.

kW = gross average kW savings from the measure: See table below.

Hours = 3,285 annual operating hours, 9 hours per day as specified in the Energy Star Commercial Food Service Calculator

Energy Savings for Commercial Hot Food Holding Cabinets

EnergyStar Commercial Food Service Equipment Calculator Inputs:

Size	Quantity	Volume*	Operating Hours Per Day	Operating Days Per Year
Full Size	1	52	9	365
3/4 Size	1	22	9	365
1/2 Size	1	8	9	365

*Volume inputs are based on the average volume of products within the specified size range for full, 3/4 size and 1/2 size[4].

Measure Life:

The measure life for a new commercial HFHC is 12 years.[5]

Other Resource Impacts:

There are no other resource impacts for these measures.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3b058	Hot Food Holding Cabinet Full Size	Muni New	1	1	n/a	1	1	0.9	0.9
EC1c036	Hot Food Holding Cabinet Half Size	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c034	Hot Food Holding Cabinet 3/4 Size	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c035	Hot Food Holding Cabinet Full Size	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1b036	Hot Food Holding Cabinet 3/4 Size	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b037	Hot Food Holding Cabinet Full Size	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b038	Hot Food Holding Cabinet Half Size	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC3b057	Hot Food Holding Cabinet 3/4 Size	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b059	Hot Food Holding Cabinet Half Size	Muni New	1	1	n/a	1	1	0.9	0.9
EC2c034	Hot Food Holding Cabinet 3/4 Size	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c035	Hot Food Holding Cabinet Full Size	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c036	Hot Food Holding Cabinet Half Size	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b037	Hot Food Holding Cabinet Full Size	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b036	Hot Food Holding Cabinet 3/4 Size	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b038	Hot Food Holding Cabinet Half Size	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate since programs include verification of equipment installations.

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[6] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[7]. All other Programs assume 100% RR until evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 C&I Load Shapes, "C&I Food Services".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only):[7]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c035 EC2c035	Hot Food Holding Cabinet Full Size	LBES Mid SBES Mid	0.225	0.085	0	0.86
EC1c034 EC2c034	Hot Food Holding Cabinet 3/4 Size	LBES Mid SBES Mid	0.225	0.085	0	0.86
EC1c036 EC2c036	Hot Food Holding Cabinet Half Size	LBES Mid SBES Mid	0.225	0.085	0	0.86

Revision History:

Revision Number	Date	Description
167	3/1/2023	Updated kWh and kW savings to align with Energy Star CFS Calculator.
284	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
359	1/1/2027	Fixed deemed savings to align with referenced size inputs

Endnotes:

1: ENERGY STAR Program Requirements Product Specification for Commercial Hot Food Holding Cabinets, Version 2.0. Effective October 1, 2011. https://www.energystar.gov/ia/partners/prod_development/revisions/downloads/hfhc/Final_V2.0_HFHC_Program_Requirements.pdf?b187-e770

2: ENERGY STAR (2021) Commercial Kitchen Equipment Tools, Materials and Resources. CFS Equipment Calculator.https://www.energystar.gov/sites/default/files/asset/document/CFS_calculator_07-15-2021.xlsx

3: Energy Star Certified Commercial Hot Food Holding Cabinets. https://www.energystar.gov/productfinder/product/certified-commercial-hot-food-holding-cabinets/results

4: ENERGY STAR (2021) Commercial Kitchen Equipment Tools, Materials and Resources. CFS Equipment Calculator.https://www.energystar.gov/sites/default/files/asset/document/CFS_calculator_07-15-2021.xlsx

5: FSTC Life Cycle Savings Calculators https://fishnick.com/saveenergy/tools/calculators/

6: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities.

https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

7: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

8: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52).

Food Service Ice Machine

Measure Code	COM-FS-IM
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Installation of a qualified ENERGY STAR commercial ice machine. Commercial ice machines meeting the ENERGY STAR specifications are on average 15 percent more energy efficient and 10 percent more water-efficient than standard models. ENERGY STAR qualified equipment includes ice-making head (IMH), self-contained (SCU), and remote condensing units (RCU).

Baseline Efficiency:

The baseline efficiency case is a non-ENERGY STAR commercial ice machine, which must be compliant with the applicable federal standard[1]

High Efficiency:

The high efficiency case is a commercial ice machine meeting the ENERGY STAR V3.0 Efficiency Requirements for commercial ice machines.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated on a per-unit basis, based on the equipment type and daily ice harvest rate.

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWH	ΔkW
EC3b063	Ice Machine - Self Contained	Muni New	Calculated	Calculated
EC1c037	Ice Machine - Ice Making Head	LBES Mid	Calculated	Calculated
EC1c038	Ice Machine - Remote Cond./Split Unit - Batch	LBES Mid	Calculated	Calculated

EC1c039	Ice Machine - Remote Cond./Split Unit - Continuous	LBES Mid	Calculated	Calculated
EC1c040	Ice Machine - Self Contained	LBES Mid	Calculated	Calculated
EC1b039	Ice Machine - Ice Making Head	LBES New	Calculated	Calculated
EC1b040	Ice Machine - Remote Cond./Split Unit - Batch	LBES New	Calculated	Calculated
EC1b041	Ice Machine - Remote Cond./Split Unit - Continuous	LBES New	Calculated	Calculated
EC1b042	Ice Machine - Self Contained	LBES New	Calculated	Calculated
EC3b061	Ice Machine - Remote Cond./Split Unit - Batch	Muni New	Calculated	Calculated
EC3b062	Ice Machine - Remote Cond./Split Unit - Continuous	Muni New	Calculated	Calculated
EC3b060	Ice Machine - Ice Making Head	Muni New	Calculated	Calculated
EC2c037	Ice Machine - Ice Making Head	SBES Mid	Calculated	Calculated
EC2c038	Ice Machine - Remote Cond./Split Unit - Batch	SBES Mid	Calculated	Calculated
EC2c039	Ice Machine - Remote Cond./Split Unit - Continuous	SBES Mid	Calculated	Calculated
EC2c040	Ice Machine - Self Contained	SBES Mid	Calculated	Calculated
EC2b042	Ice Machine - Self Contained	SBES New	Calculated	Calculated
EC2b039	Ice Machine - Ice Making Head	SBES New	Calculated	Calculated
EC2b040	Ice Machine - Remote Cond./Split Unit - Batch	SBES New	Calculated	Calculated
EC2b041	Ice Machine - Remote Cond./Split Unit - Continuous	SBES New	Calculated	Calculated

$$\Delta kWh = units\, x\, (kWh_{baseline} - kWh_{ee})\, x\, 365\, x\, Cycle\, x\, \left(\frac{IHR}{100}\right)$$

$$\Delta kW = \frac{\Delta kWh}{8{,}760\ x\ Cycle} x\ CF$$

Where:

ΔkWh = Annual electric energy savings

ΔkW = Peak coincident demand electric savings

units = Number of measures installed under the program

baseline = Baseline condition or measure

ee = Energy efficient condition or measure

kWh = Daily electric energy consumption per 100 pounds of ice

Cycle = Compressor duty cycle [2] =.75

IHR = Ice Harvest Rate (lbs/day) of the energy efficient ice maker.

CF = Coincidence factor

365 = Days in one year

100 = Factor to convert IHR to units of 100 lbs/day

8,760 = Hours in one year

The baseline condition is a non-ENERGY STAR commercial ice machine, which must be compliant with the applicable federal standard updated January 28, 2018.[1] The baseline daily energy usage per 100 pounds of ice is established in accordance with the current federal energy standards as specified in the Code of Federal Energy Regulations, updated January 28, 2018.

Baseline Efficiency Inputs for Automatic Ice Machines[1]:

Equipment Type	**IHR**	**Maximum energy use kWh/100 lb ice[1]**
Continuous Type		
Air cooled ice-Making Head	<310	9.19-0.00629IHR
Air cooled ice-Making Head	≥310 and <820	8.23-0.0032IHR
Air cooled ice-Making Head	≥820 and <4,000	5.61
Air cooled remote Condensing (no remote compressor)	<800	9.7-0.0058IHR
Air cooled remote Condensing (no remote compressor)	≥800 and <4,000	5.06
Air cooled remote Condensing & Remote Compressor	<800	9.9-0.0058IHR
Air cooled self-Contained	<200	14.22-0.03IHR
Air cooled self-Contained	≥200 and <700	9.47-0.00624IHR
Air cooled self-Contained	≥700 and <4,000	5.1

Batch Type		
Air cooled ice-Making Head	< 300	10-0.01233IHR
Air cooled ice-Making Head	≥ 300 and < 800	7.05-0.0025IHR
Air cooled ice-Making Head	≥ 800 and < 1,500	5.55-0.00063IHR
Air cooled ice-Making Head	≥ 1500 and < 4,000	4.61
Air cooled remote Condensing (no remote compressor)	< 988	7.97-0.00342IHR
Air cooled remote Condensing (no remote compressor)	≥ 988 and < 4,000	4.59
Air cooled remote Condensing & Remote Compressor	< 930	7.97-0.00342IHR
Air cooled remote Condensing & Remote Compressor	≥ 930 and < 4,000	4.79
Air cooled self-Contained	< 110	14.79-0.0469IHR
Air cooled self-Contained	≥ 110 and < 200	12.42-0.02533IHR
Air cooled self-Contained	≥ 200 and < 4,000	7.35

The high efficiency condition is commercial ice machine meeting the ENERGY STAR V3.0 Efficiency Requirements for commercial ice machines. Efficient daily energy use per 100 pounds of ice is established based on efficient equipment Ice Harvest Rate in accordance with ENERGY STAR® maximum qualifying specifications.

Energy Efficient Inputs for Automatic Commercial Ice Machines [3]

Equipment Type	IHR	Maximum energy use kWh/100 lb ice[1]
Continuous Type		
Air cooled Ice-Making Head	IHR < 310	7.90 – 0.005409IHR
Air cooled Ice-Making Head	310 ≤ IHR < 820	7.08 – 0.002752IHR
Air cooled Ice-Making Head	820 ≤ IHR ≤ 4000	4.82
Air Cooled Remote Condensing Unit	IHR< 800	7.76 – 0.00464IHR
Air Cooled Remote Condensing Unit	800 ≤ IHR ≤ 4000	4.05
Air Cooled Self-Contained	IHR<200	12.37 – 0.0261IHR
Air Cooled Self-Contained	200 ≤ IHR ≤ 700	8.24 – 0.005429IHR
Air Cooled Self-Contained	700 ≤ IHR ≤ 4000	4.44
Batch Type		
Air cooled Ice-Making Head	IHR<300	9.20 - 0.01134IHR
Air cooled Ice-Making Head	300 ≤ IHR < 800	6.49 - 0.0023IHR
Air cooled Ice-Making Head	800 ≤ IHR < 1,500	5.11 - 0.00058IHR
Air cooled Ice-Making Head	1,500 ≤ IHR ≤ 4000	4.24
Air Cooled Remote Condensing Unit	IHR < 988	7.17 – 0.00308IHR
Air Cooled Remote Condensing Unit	988 ≤ IHR ≤ 4000	4.13
Air Cooled Self-Contained	IHR<110	12.57 - 0.0399IHR
Air Cooled Self-Contained	110 ≤ IHR ≤ 200	10.56 - 0.0215IHR
Air Cooled Self-Contained	200 ≤ IHR ≤ 4000	6.25

Measure Life:

The measure life for a new ice making machine is 8 years.[2.]

Other Resource Impacts:

Water savings associated with this measure are calculated using on the Energy Star Commercial Food Service Calculator, updated in March 2021.[4]

Ice Machine		Water (thousand gallons)
Batch	Ice Making Head	33
	Remote Condensing Unit	57
	Self Contained Unit	9
Continuous	Ice Making Head	22
	Remote Condensing Unit	38
	Self Contained Unit	8

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3b063	Ice Machine - Self Contained	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
EC1c037	Ice Machine - Ice Making Head	Electric	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c038	Ice Machine - Remote Cond./Split Unit - Batch	Electric	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c039	Ice Machine - Remote Cond./Split Unit - Continuous	Electric	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1c040	Ice Machine - Self Contained	Electric	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1b039	Ice Machine - Ice Making Head	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b040	Ice Machine - Remote Cond./Split Unit - Batch	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b041	Ice Machine - Remote Cond./Split Unit - Continuous	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b042	Ice Machine - Self Contained	Electric	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC3b061	Ice Machine - Remote Cond./Split Unit - Batch	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b062	Ice Machine - Remote Cond./Split Unit - Continuous	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b060	Ice Machine - Ice Making Head	Electric	Muni New	1	1	n/a	1	1	0.9	0.9
EC2c037	Ice Machine - Ice Making Head	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC2c038	Ice Machine - Remote Cond./Split Unit - Batch	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c039	Ice Machine - Remote Cond./Split Unit - Continuous	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c040	Ice Machine - Self Contained	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b042	Ice Machine - Self Contained	Electric	SBES New	1	1	n/a	1	1	0.9	0.9
EC2b039	Ice Machine - Ice Making Head	Electric	SBES New	1	1	n/a	1	1	0.9	0.9
EC2b040	Ice Machine - Remote Cond./Split Unit - Batch	Electric	SBES New	1	1	n/a	1	1	0.9	0.9
EC2b041	Ice Machine - Remote Cond./Split Unit - Continuous	Electric	SBES New	1	1	n/a	1	1	0.9	0.9

In-Service Rates:

All installations have 100% in service rate since programs include verification of equipment installations.

Realization Rates:

100% realization rates are assumed because savings are based on researched assumptions. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs. [5] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[411].

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 "C&I Load Shapes, "C&I Food Services".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[4]:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c037	Ice Machine - Ice Making Head	LBES Mid	0.225	0.085	0	0.86
EC2c037	Ice Machine - Ice Making Head	SBES Mid	0.225	0.085	0	0.86
EC1c038	Ice Machine - Remote Cond./Split Unit - Batch	LBES Mid SBES Mid	0.225	0.085	0	0.86

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC2c038	Ice Machine - Remote Cond./Split Unit - Batch	SBES Mid	0.225	0.085	0	0.86
EC1c039	Ice Machine - Remote Cond./Split Unit - Continuous	LBES Mid	0.225	0.085	0	0.86
EC2c039	Ice Machine - Remote Cond./Split Unit - Continuous	SBES Mid	0.225	0.085	0	0.86
EC1c040	Ice Machine - Self Contained	LBES Mid	0.225	0.085	0	0.86
EC2c040	Ice Machine - Self Contained	SBES Mid	0.225	0.085	0	0.86

Revision History:

Revision Number	Date	Revision
43	1/14/2022	Corrected algorithms to provide annualized savings, updated baselines
44	1/14/2022	Added other resource impacts.
183	1/1/2024	Updated usage of H for Harvest Rate to IHR for clarity and consistency
286	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: 10 CFR 431.136. Effective January 28, 2018, https://www.ecfr.gov/cgi-bin/text-idx?node=se10.3.431_1136&rgn=div8

2: FOOD SERVICE COMMERCIAL ICE MACHINE. SWFS006-01. (CA) December 2018. http://www.deeresources.net/workpapers

3: ENERGY STAR Program Requirements For Automatic Commercial Ice Makers. V3.0. https://www.energystar.gov/products/commercial_food_service_equipment/commercial_ice_makers/key_product_criteria

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Laboratory Grade Cold Storage

Measure Code	COM-FS-ULTF
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an ENERGY STAR qualified laboratory grade refrigerator, freezer or ultra low temperature (ULT) freezer to replace a standard efficiency units.

Baseline Efficiency:

The baseline technology is a standard efficiency laboratory grade refrigerator, freezer or ultra low temperature (ULT) freezer.[1]

High Efficiency:

The high efficiency case is ENERGY STAR qualified under the Ultra Low Temperature Freezer Specification.[2]

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on vendor data from ULT freezers offered in MA and the 2017 DMI ULT Base Case Investigation.[3]

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWH	ΔkW
EC1c048	Laboratory Grade High Performance Freezers, 6≤V<22 cu. ft.	LBES Mid	1,608	0.18
EC1c048	Laboratory Grade High Performance Freezers, ≥22 cu. ft.	LBES Mid	2,596	0.30
EC1c048	Laboratory Grade High Performance Refrigerators, 6≤V<25 cu. ft.	LBES Mid	1,403	0.16
EC1c048	Laboratory Grade High Performance Refrigerators, ≥44 cu. ft.	LBES Mid	2,552	0.29
EC1c048	Laboratory Grade High Performance Refrigerators, 25≤V<44 cu. ft.	LBES Mid	1,913	0.22
EC1c048	Midstream Ultra Low-Temp Freezer	LBES Mid	5,737	0.65
EC2c048	Midstream Ultra Low-Temp Freezer	SBES Mid	5,737	0.65
EC2c048	Laboratory Grade High Performance Freezers, 6≤V<22 cu. ft.	SBES Mid	1,608	0.18
EC2c048	Laboratory Grade High Performance Freezers, ≥22 cu. ft.	SBES Mid	2,596	0.30
EC2c048	Laboratory Grade High Performance Refrigerators, 6≤V<25 cu. ft.	SBES Mid	1,403	0.16
EC2c048	Laboratory Grade High Performance Refrigerators, ≥44 cu. ft.	SBES Mid	2,552	0.29
EC2c048	Laboratory Grade High Performance Refrigerators, 25≤V<44 cu. ft.	SBES Mid	1,913	0.22

Measure Life:

The measure life for a Laboratory Grade Refrigerator, Freezer or ULT Freezer is 15 years.[4]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}

EC1c048	Midstream Laboratory Grade Cold Storage	LBES Mid	1	1	1	1	1	0.9	0.9
EC2c048	Midstream Laboratory Grade Cold Storage	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[5]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.[3]

Energy Load Shape:

See Appendix 1 C&I Load Shapes "LS_109 C&I Refrigeration"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG[6]
EC1c048	Midstream Laboratory Grade Cold Storage	LBES Mid	0.225	0.085	0.0	0.86
EC2c048	Midstream Laboratory Grade Cold Storage	SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
64	3/1/2022	New Measure Added
185	1/1/2024	Changed name of measure from Ultra Low Temp Freezer to Cold Storage
196	1/1/2025	Added deemed kW savings from CT PSD.
288	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Eversource Energy ULT Freezer Base Case Investigation, prepared by DMI, October 7, 2017

2: EnergyStar (2016) "Laboratory Grade Refrigerators & Freezers Specification" https://www.energystar.gov/products/other/laboratory_grade_refrigerators_and_freezers

3: Energy Solutions (2021) "Cold Storage Forecast Assumptions"

4: Conservative estimate based on manufacturer's EUL of 20 years.

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52

Food Service Oven

Measure Code	COM-FS-OVN
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Electric: Installation of a qualified ENERGY STAR commercial convection oven or commercial combination oven. ENERGY STAR commercial ovens save energy during preheat, cooking and idle times due to improved cooking efficiency, and preheat and idle energy rates. Combination ovens can be used either as convection ovens or as steamers.

Gas: Installation of a qualified ENERGY STAR commercial convection oven, rack oven or commercial combination oven. ENERGY STAR commercial ovens save energy during preheat, cooking and idle times due to improved cooking efficiency, and preheat and idle energy rates. Combination ovens can be used either as convection ovens or as steamers. Measure also includes conveyor ovens which are not covered by the ENERGY STAR program.

Baseline Efficiency:

The baseline efficiency case is a convection, combination, conveyor, or rack oven that meets applicable minimum federal efficiency standards and uses the same fuel as the proposed high efficiency equipment.

High Efficiency:

The high efficiency case is a commercial oven that meets the ENERGY STAR program requirements version 3 effective January 12th, 2023 for its type and fuel, as shown in the Equipment Efficient Case Default Characteristics Table in the Alogorithms for Calculating Primary Energy Impact section below.[1] Note that no ENERGY STAR program requirements for conveyor ovens have yet been approved.

Ovens must be rated based on ASTM F1496 (Convection Oven), ASTM F2861 (Combination Oven), and ASTM 2093 (Conveyor Oven and Rack Oven).

Algorithms for Calculating Primary Energy Impact:

Energy Savings for Commercial Ovens:

BC ID	Measure Name	Program	ΔkW	ΔkWh	ΔMMBtu
EC1b021	Electric Full Size Convection Oven	LBES New	0.22	1090	n/a
EC2b021	Electric Full Size Convection Oven	SBES New	0.22	1090	n/a
EC3b035	Electric Full Size Convection Oven	Muni New	0.22	1090	n/a
EC1c019	Electric Full Size Convection Oven	LBES Mid	0.22	1090	n/a
EC2c019	Electric Full Size Convection Oven	SBES Mid	0.22	1090	n/a
EC1b021	Electric Half Size Convection Oven	LBES New	0.46	2259	n/a
EC2b021	Electric Half Size Convection Oven	SBES New	0.46	2259	n/a
EC3b035	Electric Half Size Convection Oven	Muni New	0.46	2259	n/a
EC2c019	Electric Half Size Convection Oven	LBES Mid	0.46	2259	n/a
EC1b021	Electric Half Size Convection Oven	SBES Mid	0.46	2259	n/a
EC1b019	Electric Combination Oven	LBES New	1.61	7835	n/a
EC2b019	Electric Combination Oven	SBES New	1.61	7835	n/a
EC3b031	Electric Combination Oven	Muni New	1.61	7835	n/a
EC1c018	Electric Combination Oven	LBES Mid	1.61	7835	n/a
EC2c018	Electric Combination Oven	SBES Mid	1.61	7835	n/a
EC1b019	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	LBES New	0.09	420	n/a
EC2b019	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	SBES New	0.09	420	n/a
EC3b031	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	Muni New	0.09	420	n/a
EC1c018	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	LBES Mid	0.09	420	n/a
EC2c018	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	SBES Mid	0.09	420	n/a
GC1b022	Gas Convection Oven, full size	LBES New	n/a	n/a	11.1
GC2b022	Gas Convection Oven, full size	SBES New	n/a	n/a	11.1
GC1c002	Gas Convection Oven, full size	LBES Mid	n/a	n/a	11.1
GC2c002	Gas Convection Oven, full size	SBES Mid	n/a	n/a	11.1
GC3b022	Gas Convection Oven, full size	Muni New	n/a	n/a	11.1
GC1b021	Gas Combination Oven	LBES New	n/a	n/a	34.1
GC2b021	Gas Combination Oven	SBES New	n/a	n/a	34.1
GC1c001	Gas Combination Oven	LBES Mid	n/a	n/a	34.1
GC2c001	Gas Combination Oven	SBES Mid	n/a	n/a	34.1
GC3b021	Gas Combination Oven	Muni New	n/a	n/a	34.1

GC1b023	Gas Conveyer Oven	LBES New	n/a	n/a	42.2
GC2b023	Gas Conveyer Oven	SBES New	n/a	n/a	42.2
GC1c003	Gas Conveyer Oven	LBES Mid	n/a	n/a	42.2
GC2c003	Gas Conveyer Oven	SBES Mid	n/a	n/a	42.2
GC3b023	Gas Conveyer Oven	Muni New	n/a	n/a	42.2
GC1b026	Gas Single Rack Oven	LBES New	n/a	n/a	22.9
GC2b026	Gas Single Rack Oven	SBES New	n/a	n/a	22.9
GC1c007	Gas Single Rack Oven	LBES Mid	n/a	n/a	22.9
GC2c007	Gas Single Rack Oven	SBES Mid	n/a	n/a	22.9
GC3b026	Gas Single Rack Oven	Muni New	n/a	n/a	22.9
GC1b099	Gas Double Rack Oven	LBES New	n/a	n/a	19.3
GC2b099	Gas Double Rack Oven	SBES New	n/a	n/a	19.3
GC1c099	Gas Double Rack Oven	LBES Mid	n/a	n/a	19.3
GC2c099	Gas Double Rack Oven	SBES Mid	n/a	n/a	19.3
GC3b099	Gas Double Rack Oven	Muni New	n/a	n/a	19.3

The above unit savings are deemed based on the Energy Star Commercial Food Service (CFS) Calculator or the California EnergyWise Calculator (CEWC) using default entries. [2,3] . Details on calculations are included below.

Annual Electric Energy Savings

$$\Delta kWh = days \times \frac{(\Delta Btu_{preheat} + \Delta Btu_{idle} + \Delta Btu_{cooking})}{3412}$$

Annual Fuel Savings

$$\Delta MMBtu = days \times \frac{(\Delta Btu_{preheat} + \Delta Btu_{idle} + \Delta Btu_{cooking})}{1{,}000{,}000}$$

Where:

$$\Delta Btu_{preheat} = N_{preheat} \times (Btu_{preheat,baseline} - Btu_{preheat,ee})$$

$$\Delta BTU_{idle} = Btu/h_{idle,baseline} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{baseline}}] - Btu/h_{idle,ee} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{ee}}]$$

$$\Delta Btu_{cooking} = lbs \times Q_{food} \times (\frac{1}{Eff_{baseline}} - \frac{1}{Eff_{ee}})$$

If a Combination Oven:

Annual Electric Energy Savings

$$\Delta kWh = days \times \frac{(\Delta Btu_{preheat} + \Delta Btu_{idle,conv} + \Delta Btu_{idle,steam} + \Delta Btu_{cooking,conv} + \Delta Btu_{cooking,steam})}{3412}$$

Annual Fuel Savings

$$\Delta MMBtu = days \times \frac{(\Delta Btu_{preheat} + \Delta Btu_{idle,conv} + \Delta Btu_{idle,steam} + \Delta Btu_{cooking,conv} + \Delta Btu_{cooking,steam})}{1{,}000{,}000}$$

Where:

$$\Delta BTU_{idle,conv} = \left\{ Btu/h_{idle,conv,baseline} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{conv,baseline}}] - Btu/h_{idle,conv,ee} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{conv,ee}}] \right\} \times (1 - F_{steam})$$

$$\Delta BTU_{idle,steam} = \left\{ Btu/h_{idle,steam,baseline} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{steam,baseline}}] - Btu/h_{idle,steam,ee} \times [hrs - N_{preheat} \times hrs_{preheat} - \frac{lbs}{(lbs/hr)_{steam,ee}}] \right\} \times F_{steam}$$

$$\Delta Btu_{cooking,conv} = \left[lbs \times Q_{food,conv} \times (\frac{1}{Eff_{conv,baseline}} - \frac{1}{Eff_{conv,ee}}) \right] \times (1 - F_{steam})$$

$$\Delta Btu_{cooking,steam} = \left[lbs \times Q_{food,steam} \times (\frac{1}{Eff_{steam,baseline}} - \frac{1}{Eff_{steam,ee}}) \right] \times F_{steam}$$

Peak Demand Savings

$$\Delta kW_{Peak} = \frac{\Delta kWh}{(days \times hrs)} \times CF$$

Calculation Parameters Table:

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
ΔMMBtu	Annual fuel savings	Calculated	MMBtu/yr	
ΔkW_{Peak}	Peak Demand Savings	Calculated	kW	
$\Delta Btu_{preheat}$	Daily preheat energy savings	Calculated	Btu	
ΔBtu_{idle}	Daily idle energy savings	Calculated	Btu	
$\Delta Btu_{cooking}$	Daily cooking energy savings	Calculated	Btu	
days	Operating days per year	Site-specific, if unknown look up based on equipment type in **Error! Reference source not found.**	Btu	CFS, CEWS
hrs	Daily operating hours	Site-specific, if unknown look up based	hours	CFS, CEWS

Variable	Description	Value	Units	Ref
		on equipment type in **Error! Reference source not found.**		
$Btu_{preheat,baseline}$	Baseline Equipment preheat energy	Look up based on equipment type in baseline tables	Btu	CFS, CEWS
$Btu_{preheat,ee}$	Energy Efficient Equipment preheat energy	Site-specific, if unknown look up based on efficient equipment type in efficient case tables	Btu	CFS, CEWS
$N_{preheat}$	Number of preheats per day	1		CFS, CEWS
$hrs_{preheat}$	Preheat duration	Look up based on equipment type in common variables table	hours	CFS, CEWS
$Btu/h_{idle,baseline}$	Baseline Equipment idle energy rate	Look up based on equipment type in Baseline Table	Btu/h	CFS, CEWS
$Btu/h_{idle,ee}$	Energy Efficient Equipment idle energy rate	Site-specific, if unknown look up based on efficient equipment type in efficient case tables	Btu/h	CFS, CEWS
$(lbs/hr)_{baseline}$	Baseline Equipment production capacity	Look up based on equipment type in Baseline Table	lbs/hr	CFS, CEWS
$(lbs/hr)_{ee}$	Energy Efficient Equipment production capacity	Site-specific, if unknown look up based on efficient equipment type in efficient case tables	lbs/hr	CFS, CEWS
lbs	Total daily food production	Site-specific, if unknown look up based on equipment type in common variables table	lbs	CFS, CEWS
Q_{food}	Heat to food	Look up based on equipment type in common variables table	Btu/lb	CFS, CEWS
$Eff_{baseline}$	Baseline Equipment cooking efficiency	Look up based on equipment type in **Error! Reference source not found.** tables	N/A	CFS, CEWS
Eff_{ee}	Energy Efficient Equipment cooking efficiency	Site-specific, if unknown look up based on efficient equipment type inefficient tables	N/A	CFS, CEWS

Variable	Description	Value	Units	Ref
CF	Electric coincidence factor	See "Impact Factors for Adjusted Gross Savings"	N/A	

Combination Oven Additional Calculation Parameters

Variable	Description	Value	Units	Ref
$\Delta Btu_{idle,conv}$	Daily idle energy savings in convection mode	Calculated	Btu	
$\Delta Btu_{idle,steam}$	Daily idle energy savings in steam mode (combination oven only	Calculated	Btu	
$\Delta Btu_{cooking,conv}$	Daily cooking energy savings in convection mode	Calculated	Btu	
$\Delta Btu_{cooking,steam}$	Daily cooking energy savings in steam mode	Calculated	Btu	
$Btu/h_{idle,conv,baseline}$	Baseline Equipment idle energy rate in convection mode	Look up based on fuel type inbaseline tables	Btu/h	CFS
$Btu/h_{idle,conv,ee}$	Energy Efficient Equipment idle energy rate in convection mode	Site-specific, if unknown look up based on fuel type in **Error! Reference source not found.**	Btu/h	CFS
$Btu/h_{idle,steam,baseline}$	Baseline Equipment idle energy rate in steam mode	Site-specific, if unknown look up based on fuel type in **Error! Reference source not found.**	Btu/h	CFS
$Btu/h_{idle,steam,ee}$	Energy Efficient Equipment idle energy rate in steam mode	Site-specific, if unknown look up based on fuel type in efficient case tables	Btu/h	CFS
$(lbs/hr)_{conv,ee}$	Energy Efficient Equipment production capacity in convection mode	Site-specific, if unknown look up based on fuel type in efficient case tables	lbs/hr	CFS
$(lbs/hr)_{steam,ee}$	Energy Efficient Equipment production capacity in steam mode	Site-specific, if unknown look up based on fuel type in efficient case tables	$(lbs/hr)_{steam,ee}$	CFS
$Q_{food,conv}$	Heat to food in convection mode	250	Btu/lb	CFS
$Q_{food,steam}$	Heat to food in steam mode	105	Btu/lb	CFS
$Eff_{conv,baseline}$	Baseline Equipment cooking efficiency in convection mode	Look up based on fuel type in baseline tables	N/A	CFS

Variable	Description	Value	Units	Ref
$Eff_{steam,baseline}$	Baseline Equipment cooking efficiency in steam mode	Look up based on fuel type in baseline tables	N/A	CFS
$Eff_{conv,ee}$	Energy Efficient Equipment cooking efficiency in convection mode	Site-specific, if unknown look up based on fuel type in efficient case tables		CFS
$Eff_{steam,ee}$	Energy Efficient Equipment cooking efficiency in steam mode	Site-specific, if unknown look up based on fuel type in efficient case tables		CFS
F_{steam}	Fraction of daily operating hours in steam mode	0.5		CFS

Equipment Baselines Case Default Characteristics

Equipment	$Btu_{preheat,baseline}$ (Btu)	$Btu/h_{idle,baseline}$ (Btu/h)	$(lbs/hr)_{baseline}$	$Eff_{baseline}$	Ref
Convection Oven, Electric, Full Size	5,289	5,562	102	0.74	CFS, CEWS
Convection Oven, Electric, Half Size	3,037	5152	45	0.64	CFS, CEWS
Convection Oven, Gas, Full Size	11,320	12,245	95	0.48	CFS, CEWS
Conveyor Oven, Gas	21,270	48,662	150	0.33	CFS, CEWS
Rack Oven, Gas, Double Rack	87,766	35,631	275	0.52	CFS, CEWS
Rack Oven, Gas, Single Rack	56,514	27,120	144	0.44	CFS, CEWS

Combination Oven Baseline Case Default Characteristics

Equipment	Preheat Energy (Btu)	Convection Mode			Steam Mode			Ref
		Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	
Electric Combination Oven	10,236	4,504	0.72	107	17,947	0.55	247	CFS

Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	1,723	2,320	0.65	29	7,131	0.47	45	CFS
Gas Combination Oven	18,000	8,747	0.52	112.1	18,656	0.39	195	CFS

Efficient Case

The compliance condition is food service equipment that meets Energy Star requirements. Operating characteristics should be taken from application. When unavailable, default characteristics shall be taken from **Error! Reference source not found.**.

Equipment Efficient Case Default Characteristics

Equipment	$Btu_{preheat,ee}$ (Btu)	$Btu/h_{idle,ee}$ (Btu/h)	$(lbs/hr)_{ee}$	Eff_{ee}	Ref
Convection Oven, Electric, Full Size	4,640	4,777	98	0.76	CFS, CEWS
Convection Oven, Electric, Half Size	2,388	3412	42	0.71	CFS, CEWS
Convection Oven, Gas, Full Size	10,130	9,500	91	0.49	CFS, CEWS
Conveyor Oven, Gas	15,000	40,000	208	0.46	CFS, CEWS
Rack Oven, Gas, Double Rack	71,598	30,000	289	0.52	CFS, CEWS
Rack Oven, Gas, Single Rack	42,522	25,000	139	0.48	CFS, CEWS

Combination Oven Efficient Case Default Characteristics

Equipment	Preheat Energy (Btu)	Convection Mode			Steam Mode			Ref
		Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	
Electric Combination Oven	10,236	4,026	0.78	174	6,722	0.55	247	CFS
Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	1,723	2,388	0.7	37	6,142	0.51	59	CFS

Equipment	Preheat Energy (Btu)	Convection Mode			Steam Mode			Ref
		Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	Idle Energy Rate (Btu/hr)	Cooking efficiency	Production capacity (LB / HR)	
Gas Combination Oven	16,000	5,200	0.57	124	8,511	0.41	172	CFS

Common Variables

Equipment	hrs	days	$hrs_{preheat}$	lbs	Q_{food}(Btu/lb)	Ref
Convection Oven, Electric, Full Size	12	365	0.144	100	250	CFS
Convection Oven, Electric, Half Size	12	365	0.135	100	250	CFS
Convection Oven, Gas, Full Size	12	365	0.188	100	250	CFS
Conveyor Oven, Gas	12	365	0.25	250	190	CFS
Rack Oven, Gas, Double Rack	12	365	0.33	1200	250	CFS
Rack Oven, Gas, Single Rack	12	365	0.33	600	250	CFS
Electric Combination Oven	12	365	0.25	200	250 (convection mode) 105 (steam mode)	CFS
Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	12	365	.25	125	250 (convection mode) 105 (steam mode)	CFS
Gas Combination Oven	12	365	.25	200	250 (convection mode) 105 (steam mode)	CFS

Measure Life:

The measure life for a new commercial oven is 12 years.[3]

Other Resource Impacts:

There are no other resource impacts for these measures.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b021	Electric Full Size Convection Oven	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC2b021	Electric Full Size Convection Oven	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3b035	Electric Full Size Convection Oven	Muni New	1	1	n/a	1	1	0.9	0.9
EC1c019	Electric Full Size Convection Oven	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC2c019	Electric Full Size Convection Oven	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC1b021	Electric Half Size Convection Oven	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC2b021	Electric Half Size Convection Oven	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3b035	Electric Half Size Convection Oven	Muni New	1	1	n/a	1	1	0.9	0.9
EC1b019	Electric Combination Oven	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC2b019	Electric Combination Oven	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3b031	Electric Combination Oven	Muni New	1	1	n/a	1	1	0.9	0.9
EC1b019	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC2b019	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3b031	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	Muni New	1	1	n/a	1	1	0.9	0.9
GC1b022	Gas Convection Oven, full size	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b022	Gas Convection Oven, full size	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1c002	Gas Convection Oven, full size	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c002	Gas Convection Oven, full size	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1b021	Gas Combination Oven	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b021	Gas Combination Oven	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1c001	Gas Combination Oven	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c001	Gas Combination Oven	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1b023	Gas Conveyer Oven	LBES New	1	n/a	1	n/a	n/a	n/a	n/a

GC2b023	Gas Conveyer Oven	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1c003	Gas Conveyer Oven	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c003	Gas Conveyer Oven	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1b026	Gas Single Rack Oven	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b026	Gas Single Rack Oven	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1c007	Gas Single Rack Oven	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c007	Gas Single Rack Oven	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1b099	Gas Double Rack Oven	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b099	Gas Double Rack Oven	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC1c099	Gas Double Rack Oven	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c099	Gas Double Rack Oven	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b099	Gas Double Rack Oven	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a
GC3b021	Gas Combination Oven	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a
GC3b022	Gas Convection Oven, full size	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a
GC3b023	Gas Conveyer Oven	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a
GC3b026	Gas Single Rack Oven	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have 100% in service rate since programs include verification of equipment installations

Realization Rates:

Installations have a 100% realization rate because programs use researched values for savings estimates. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[4]. The SBES program uses an electric realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak realization rates, and a gas realization rate of 95.6% from a 2025 Impact study[5].

Coincidence Factors:

Coincidence Factors for electric ovens are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1“C&I Load Shapes, “C&I Food Services”.

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[6]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC2c019	Electric Full Size Convection Oven	SBES Mid	0.225	0.085	0	0.860
EC1c019	Electric Half Size Convection Oven	LBES Mid	0.225	0.085	0	0.860
EC2c018	Electric Combination Oven	SBES Mid	0.225	0.085	0	0.860
EC1c018	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	LBES Mid	0.225	0.085	0	0.860
GC1c002	Gas Convection Oven	LBES Mid	0.237	0.07	0	0.833
GC1c001	Gas Combination Oven	LBES Mid	0.237	0.07	0	0.833
GC1c003	Gas Conveyer Oven	LBES Mid	0.237	0.07	0	0.833
GC1c007	Gas Single Rack Oven	LBES Mid	0.237	0.07	0	0.833
GC1c099	Gas Double Rack Oven	LBES Mid	0.237	0.07	0	0.833
EC2c019	Electric Full Size Convection Oven	SBES Mid	0.225	0.085	0	0.860
EC2c019	Electric Full Size Convection Oven	SBES Mid	0.225	0.085	0	0.860
EC2c018	Electric Combination Oven 3-4 Pan and 2/3 Size with 3-5 Pan	SBES Mid	0.225	0.085	0	0.860
EC2c018	Electric Combination Oven	SBES Mid	0.225	0.085	0	0.860
GC2c002	Gas Convection Oven	SBES Mid	0.237	0.07	0	0.833
GC2c001	Gas Combination Oven	SBES Mid	0.237	0.07	0	0.833
GC2c003	Gas Conveyer Oven	SBES Mid	0.237	0.07	0	0.833
GC2c099	Gas Double Rack Oven	SBES Mid	0.237	0.07	0	0.833
GC2c007	Gas Single Rack Oven	SBES Mid	0.237	0.07	0	0.833

Revision History:

Revision Number	Date	Description
153	12/2/2022	Updated high efficiency case to align with new version 3.0 Energy Star program requirements effective 1/12/2023. Updated savings to align with updated new efficiency standards and updated 2021 efficiency calculator.
218	1/1/2025	Updated savings to align with updated Energy Star CFS calculator (updated March 2024). Added equations embedded in the Energy Star and CA Energywise calculators
260	1/1/2026	Updated SBES RR based on 2025 Impact Study
404	10/30/2026	Fixed misprint issue with chapter. 2025 updates are now included again.

Endnotes:

1: ENERGY STAR Program Requirements for Commercial Ovens. Version 3.0 effective January 12th 2023

https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%203.0%20Commercial%20Ovens%20Final%20Specification_0.pdf

2: ENERGY STAR Commercial Foodservice Calculator. https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx

3: CA Energywise Conveyor Oven Calculator. https://caenergywise.com/calculators/natural-gas-conveyor-ovens/#calc /

4: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Equipment- Deck Oven

Measure Code	CI-FS-DO
Markets	Commercial
Program Types	New, Retrofit
Categories	Food Service Equipment
Sub Categories	

Measure Description:

Installation of a Food Service Technology Center (FSTC) pre-approved electric deck oven, with greater than 60% efficiency and less than 1.3 kw idle rate. A commercial electric deck oven is an appliance that cooks food product within a heated chamber. The food product can be placed directly on the floor of the chamber during cooking and energy is delivered to the food product by convective, conductive, or radiant heat transfer. The chamber can be heated by electric forced convection, radiation, or quartz tubes. Top and bottom heat of the oven can be independently controlled.

Baseline Efficiency:

The baseline is defined as a commercial electric deck oven with equal to or greater than 40% cooking efficiency, an idle energy rate less than or equal to 1.9 kW and a measure pre heat energy of less than or equal to 6.5 kWh.[1]

High Efficiency:

An efficient deck oven is defined as having greater than or equal to 60% efficiency, less than or equal to 1.3 Kw idle energy rate, and a preheat energy us of less than or equal to 3 kWh and

included on the Food Service Technology Center (FSTC) pre-approved list found at : https://caenergywise.com/rebates/

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC Measure ID	Measure Name	Program	ΔkWh[1,2]	ΔkW[1,2]
EC1c050	Electric Deck Oven	LBES Mid	7,519	1.545
EC2c050	Electric Deck Oven	SBES Mid	7,519	1.545

KW savings numbers are calculated based on PSD AKW savings equation:

$$\Delta KW = \frac{\Delta KWH}{8{,}760\ hrs/yr}$$

Measure Life:

The measure life for an electric deck oven is 12 years. [3]

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c050	Electric Deck Oven	LBES Mid	1.00	1.00	n/a	1.00	1.00	0.90	0.90
EC2c050	Electric Deck Oven	SBES Mid	1.00	0.998	n/a	1.103	0.885	0.90	0.90

In-Service Rates:
All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:
The SBES program uses an electric realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak realization rates, and a gas realization rate of 95.6% from a 2025 Impact study[3].

All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:
Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.[1]

Energy Load Shape:

See Appendix 1 C&I Load Shapes “LS_111 C&I Food Service”

Impact Factors for Calculating Net Savings[2]:

BC Measure ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG
EC1c050	Electric Deck Oven	LBES Mid	0.225	0.085	0.0	0.86
EC2c050	Electric Deck Oven	SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
61	3/1/2021	New Measure Added
XX	1/1/2026	Updated RRs per 2025 SBES impact study
405	10/30/2026	Add in omitted chapter

Endnotes:

1. **1:** SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01.

2. NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52

Food Service Pasta Cooker

Measure Code	COM-FS-PC
Markets	Commercial
ProgramTypes	New
Categories	Food Service Equipment

Measure Description:

This measure applies to natural gas fired dedicated pasta cookers with removable strainers as determined by the manufacturer and installed in a commercial kitchen.

Baseline Efficiency:

The baseline equipment is an existing natural gas fired stove where pasta is cooked in a pan.

High Efficiency:

The installed dedicated natural gas fueled high efficiency pasta cooker with removable strainer equivalent to 50% efficiency steam kettle.

Algorithms for Calculating Primary Energy Impact:

Savings are shown as annual therms savings per pasta cooker. [1]

Savings Table:

BC ID	Measure Name	Program	Δmmbtu
GC1b033	Efficient Pasta Cooker	LBES New	140.2
GC1c023	Efficient Pasta Cooker	SBES New	140.2
GC2b033	Efficient Pasta Cooker	Muni New	140.2
GC2c023	Efficient Pasta Cooker	LBES Mid	140.2
GC3b033	Efficient Pasta Cooker	SBES Mid	140.2

Measure Life:

The measure life for an energy efficient pasta cooker is 12 years. [2]

Other Resource Impacts:

There are no other resource impacts for these measures.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1b033	Efficient Pasta Cooker	LBES Mid	1	n/a	1.00	n/a	n/a	n/a	n/a
GC1c023	Efficient Pasta Cooker	LBES New	1	n/a	1.00	n/a	n/a	n/a	n/a
GC2b033	Efficient Pasta Cooker	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2c023	Efficient Pasta Cooker	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b033	Efficient Pasta Cooker	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

SBES Program uses a 95.6% realization rate based on evaluation results[3]. All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

N/a as it is a gas only measure

Energy Load Shape:

See Appendix 1 C&I Load Shapes, "C&I Food Services"

Impact Factors for Calculating Net Savings:

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
GC1c023	Efficient Pasta Cooker	LBES Mid	0.225	0.085	0	0.86	4

GC2c023	Efficient Pasta Cooker	SBES Mid	0.225	0.085	0	0.86	4

Revision History:

Revision	Date	Description
182	7/1/2023	New Measure Added
289	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: : Arkansas Deemed TRM Table for Gas Food Service xls. From v4 Volume 2 Arkansas Technical Reference Manual. http://www.apscservices.info/pdf/10/10-100-R_118_3.pdf

2: Arkansas Deemed TRM Table for Gas Food Service xls. From v4 Volume 2 Arkansas Technical Reference Manual. http://www.apscservices.info/pdf/10/10-100-R_118_3.pdf

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018

Food Service Underfired Broilers

Measure Code	COM-FS-UFB
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an efficient underfired broiler with an input rate ≤ 22 kBtu/hr/len-ft while maintaining a surface temperature of 600 °F. An underfired broiler is composed of a heavy-duty cooking grate suspended above a radiant heat source. Below the grate is a set of atmospheric burners spaced every four to twelve inches along the width of the broiler, covered by a protective radiant material.

Baseline Efficiency:

The baseline is defined as underfired broiler with an input rate greater than 22 Kbtu/hr/ln-ft at 600 degrees F, and an idle and cooking energy rate of 25,000.00. [1]

High Efficiency:

The high efficiency case is defined as an underfired broiler with an input rate of less than 22 kbtu/hr at 600 degrees F and an idle and cooking energy of less than or equal to 20,000 as specified per the ASTM F1695 standard, and of similar size to the replacement unit.[2]

Algorithms for Calculating Primary Energy Impact:

Savings are deemed based on work paper findings.[3]

Savings Table:

BC ID	Measure Name	Program	Δmmbtu
GC1c021	Underfired broiler	LBES Mid	21.78
GC2c021	Underfired broiler	SBES Mid	21.78

Δ Therms = (base_idlebtuh_ft – Measure_idlebtuh_ft) x opHr_day*Op_Day

Where:

base_idlebtuh_ft = idle energy rate, baseline (btu/hr)

measure_idlebtuh = idle energy rate, efficient (btu/hr)

opHr_day = operating hours per day

op_Day = operating days per year

Inputs and Assumptions[4]:

Description	Standard Model	Efficient Model
Preheat Time (min)	30	30
Broiler Idle Energy Rate (Btuh)	25,000	20,000
Broiler Production Capacity (lb/h)	25	20
Operating Hours/Day	12	12
Operating Days/Year	363	363

Measure Life:

The measure life for an underfired broiler is 15 years.[1]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1c021	Underfired Broiler	LBES Mid	1	n/a	1	1	1	n/a	n/a
GC2c021	Underfired Broiler	SBES Mid	1	n/a	0.956	1	1	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

SBES uses a gas realization rate of 95.6% per 2025 evaluation results[4]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.[5]

Energy Load Shape:

There are no other resource impacts for this measure.

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG[6]
GC1c021	Underfired Broiler	LBES Mid	0.225	0.085	0.0	0.86
GC2c021	Underfired Broiler	SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
65	3/1/2022	New Measure Added
272	1/1/2026	Updates SBES gas RR per 2025 evaluation results.

Endnotes:

1: Fisher-Nickel, Inc. 2014. Emerging Technologies (ET) Lidded Thermostatic Infrared Broiler Field Study. Emerging Technologies project ET13PGE1311. Prepared for Pacific Gas and Electric Company (PG&E). December 15. https://www.caetrm.com/media/referencedocuments/et13pge1311liddedbroilerfinal_201412161.pdf

2: American Society for Testing and Materials (ASTM). 2015. ASTM F1695-03, Standard Test Method for the Performance of Underfired Broilers. West Conshohocken (PA): ASTM International.

3: Southern California Gas Company (SCG). 2018. "SWFS019-02 Energy and Cost Calculations.xlsx." https://www.caetrm.com/media/reference-documents/SWFS019-02_Energy_and_Cost_Calculations.xlsx

4: Livchack, D. (Fisher-Nickel, Inc.). 2017. Energy Efficient Underfired Broilers. ET Project Number ET16PGE1941. Prepared for Pacific Gas and Electric Company (PG&E). March 24. https://www.caetrm.com/media/referencedocuments/et16pge1941_energy_efficient_broilers_20170329.pdf

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: SoCalGas, 2019. "WPSCGNRCC171226A – Commercial Conveyor Broilers" Revision 01

7: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52

Food Service Refrigerator

Measure Code	COM-FS-RFGR
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Installation of a qualified ENERGY STAR qualified reach-in refrigerator that replaces a standard efficiency unit of the same configuration and capacity. The refrigerator may have a solid door or transparent door. Measure savings are defined by configuration and internal volume as specified in the Energy Star commercial requirements presented below.

Baseline Efficiency:

The baseline case includes standard-efficiency, reach-in solid and transparent door refrigerators and are defined by the U.S. Department of Energy (DOE) federal requirements.

High Efficiency:

The high efficiency case is a reach-in refrigerator having the same configuration and capacity as the baseline equipment, meeting Energy Star Program Requirements version 5 updated December 2022. [1]

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC1c041	Refrigerator, Transparent Door	LBES Mid	Calculated	Calculated
EC2c041	Refrigerator, Transparent Door	SBES Mid	Calculated	Calculated
EC1c042	Refrigerator, Solid Door	LBES Mid	Calculated	Calculated
EC2c042	Refrigerator, Solid Door	SBES Mid	Calculated	Calculated

Unit savings are calculated and based on the Energy Star Commercial Kitchen Equipment Calculator.

$$\Delta kWh = kWh_{BL} - kWh_{EE}$$

$$kWh_{BL} = (kWh_D)_{BL} \times D$$

$$kWh_{EE} = (kWh_D)_{EE} \times D$$

Where,

ΔkWh= Annual electric energy savings (kWh)

kWhBL = Annual electric energy consumption of baseline equipment (kWh). Calculate from table below.

kWhEE = Annual electric energy consumption of efficient equipment (kWh). Calculate from table below.

kWhD = Daily electric energy consumption (kWh)

D = Number of days of operation of the unit. Use site specific data if possible (365 days is default).

V = Internal volume of equipment (ft3)

Equipment Daily Consumption[1] [3]

Door Type	Size Thresholds	Baseline Refrigerator Daily Energy Consumption $(kWh_D)_{BL}$	Efficient Refrigerator Daily Energy Consumption $(kWh_D)_{EE}$
Solid Door	0 < V < 15	(0.05 x V) + 1.36	(0.022 x V) + 0.97
	15 < V < 30		(0.066 x V) + 0.31
	30 < V < 50		(0.04 x V) + 1.09
	50 < V		(0.024 x V) + 1.89
Transparent Door	0 < V < 15	(0.1 x V) + 0.86	(0.095 x V) + 0.445
	15 < V < 30		(0.05 x V) + 1.12
	30 < V < 50		(0.076 x V) + 0.34
	50 < V		(0.105 x V) - 1.111

Measure Life:

BC ID	Measure Name	Program	Measure Life	REF
EC1c041 EC2c041	Refrigerator, Transparent Door	LBES Mid SBES Mid	12	4
EC1c042 EC2c042	Refrigerator, Solid Door	LBES Mid SBES Mid	12	4

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c041	Midstream Refrigerator - Glass Door	LBES Mid	1	1	n/a	1	1	1	1
EC2c041	Midstream Refrigerator - Glass Door	SBES Mid	1	0.998	n/a	1.103	0.885	1	1
EC1c042	Midstream Refrigerator - Solid Door	LBES Mid	1	1	n/a	1	1	1	1
EC2c042	Midstream Refrigerator - Solid Door	SBES Mid	1	0.998	n/a	1.103	0.885	1	1

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[5]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

All programs use a 100% coincidence factor unless an evaluation finds otherwise.

Energy Load Shape:

See Appendix 1

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[6]

BC ID	Measure Name	Program	FR	SOP	SONP	NTG
EC1c041	Refrigerator, Transparent Door	LBES Mid	0.225	0.085	0	0.86
EC2c041	Refrigerator, Transparent Door	SBES Mid	0.225	0.085	0	0.86
EC1c042	Refrigerator, Solid Door	LBES Mid	0.225	0.085	0	0.86
EC2c042	Refrigerator, Solid Door	SBES Mid	0.225	0.085	0	0.86

Revision History:

Revision Number	Date	Revision
291	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Energy Star (2022). Energy Star Program Requirements for Commercial Refrigerators and Freezers, Version 5. https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%205.0%20%28Rev.%20November%20-%202022%29%20Commercial%20Refrigerators%20and%20Freezers%20Specification.pdf

2: Efficient equipment daily energy consumption is in line with ENERGY STAR. 2016. "ENERGY STAR® Program Requirements Product Specification for Commercial Refrigerators and Freezers - Eligibility Criteria Version 4.0." Effective on March 27, 2017

3: Baseline equipment daily energy consumption is defined by the U.S. Department of Energy (DOE) federal requirements. Code of Federal Regulations at 10 CFR 431.66

4: California Public Utilities Commission (CPUC), Energy Division. 2014. "DEER2014-EUL-table-update_2014-02-05.xlsx."

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Refrigerated Chef Base

Measure Code	COM-FS-RCB
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an efficient refrigerated chef base. Refrigerated chef bases are found in almost all commercial kitchens. A refrigerated chef base is used to keep ingredients or prepared meals close to the cooking station, making food preparation more efficient. The capacity or size of a chef base is represented by its exterior length (feet), ranging from approximately three feet to about ten feet. The refrigerated compartment can be equipped with drawers or doors according to customer specifications.

Baseline Efficiency:

The baseline condition is defined as a refrigerated chef base which uses more energy than the high efficiency case specified for the equivalent exterior length, in the table below:

Baseline Efficiencies[1]:

Exterior Length (inches)	Daily Energy Use Intensity (kWh/day/ ft^3)
35-54	0.6000
55-73	0.5400
74-89	0.4751
90-120	0.4694

High Efficiency:

The high efficiency case is defined as a refrigerated chef base that uses energy less than or equal to the maximum daily energy consumption specified in the table below:

High Efficiencies[1]:

Exterior Length (inches)	Daily Energy Use Intensity (kWh/day/ft^3)
35-54	0.1785
55-73	0.1600
74-89	0.1408
90-120	0.1391

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh/ year[2]	ΔkW[3]
EC1c053	Refrigerated Chef Base 35-54 inches	LBES Mid	1,052	.1152
EC1c053	Refrigerated Chef Base 55-73 inches	LBES Mid	1,637	.177
EC1c053	Refrigerated Chef Base 74-89 inches	LBES Mid	1,985	.2142
EC1c053	Refrigerated Chef Base 90-120 inches	LBES Mid	2,673	.2885
EC2c053	Refrigerated Chef Base 35-54 inches	SBES Mid	1,052	.1152
EC2c053	Refrigerated Chef Base 55-73 inches	SBES Mid	1,637	.177
EC12053	Refrigerated Chef Base 74-89 inches	SBES Mid	1,985	.2142
EC12c053	Refrigerated Chef Base 90-120 inches	SBES Mid	2,673	.2885

Savings Algorithms[4]:

$$\Delta kWh = \left(\frac{base\ kwh/day}{ft^3} - \frac{measure\ kwh/day}{ft^3}\right) \times constRef_{Vol} \times const_{opDaysyr}$$

$$\Delta kW = \left(\frac{base\ kW}{ft^3} - \frac{measure\ kW}{ft^3}\right) \times constRef_{Vol}$$

Where:

Base kwh/day/ft^3 = Baseline efficiency daily energy use intensity

Measure kwh/day/ ft^3 = High efficiency daily energy use intensity

$ConstRef_{vol}$= refrigerated volume (ft^3)

$Const_{opsDaysyr}$= 365 annual days of operation

Measure Life:

The measure life for a refrigerated chef base is 12 years. [3]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c053	Midstream Refrigerated Chef Base	LBES Mid	1	1	na	1	1	0.9	0.9

EC2c053	Midstream Refrigerated Chef Base	SBES Mid	1	0.998	na	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have 100% in service rate since until an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4].

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "LS_109 C&I Refrigeration"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_p	SO_{NP}	NTG[5]
EC1c053	Midstream Refrigerated Chef Base	LBES Mid	0.225	0.085	0.0	0.86
EC2c053	Midstream Refrigerated Chef Base	SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
59	3/1/2022	New Measure Added
159	12/1/2022	Added in missing impact factor table.
271	1/1/2026	Updated SBES RR's for 2025 impact study results.

Endnotes:

1: Southern California Edison (SCE), Emerging Products. 2016. Chef Bases for Foodservice Applications. ET15SCE1010 Report. August. https://www.caetrm.com/media/reference-documents/ET15SCE1010_Chef_Bases_Report_final2.pdf

2: Southern California Edison (SCE). 2019. "SWFS016-01 – Savings and Cost Analysis.xlsx." https://www.caetrm.com/media/reference-documents/SWFS016-01_Savings_and_Cost_Analysis.xlsx

3: California Public Utilities Commission (CPUC), Energy Division. 2014. "DEER2014-EUL-table-update_2014-02-05.xlsx" https://www.caetrm.com/media/reference-documents/DEER2014-EUL-table-update_2014-02-05_PUq4NzL.xlsx

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

Food Service Steam Traps

Measure Code	COM-HVAC-ST
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Repair or replace malfunctioning steam traps.

Baseline Efficiency:

The baseline efficiency case is a failed steam trap.

High Efficiency:

The high efficiency case is a repaired or replaced steam trap.

Algorithms for Calculating Primary Energy Impact:

Deemed annual unit savings are as detailed in the table below: [1]

BC ID	Measure Name	Fuel Type	ΔMMBtu
EC3a084	Steam Trap, gas	Muni Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
EC3a085	Steam Trap, oil	Muni Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
EC3a086	Steam Trap, propane	Muni Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
EC3d084	Steam Trap, gas	Muni DI	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
EC3d085	Steam Trap, oil	Muni DI	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
EC3d086	Steam Trap, propane	Muni DI	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
GC1a014	Steam Trap, gas	LBES Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
GC2a014	Steam Trap, gas	SBES Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6
GC3a014	Steam Trap, gas	Muni Retro	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6

BC ID	Measure Name	Fuel Type	ΔMMBtu
GC3b027	Steam Trap, gas	Muni New	Low pressure (≤= 10 psig): 8.4 High pressure (>10 psig): 35.6

Measure Life:

The measure life is 6 years.[2]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3a084	Steam Trap	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a085	Steam Trap	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a086	Steam Trap	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3d084	Steam Trap	Gas	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d085	Steam Trap	Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d086	Steam Trap	Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
GC1a014	Steam Trap	Gas	LBES Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC2a014	Steam Trap	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3a014	Steam Trap	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC3b027	Steam Trap	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100.0% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% electric realization rate[3]. The SBES program uses a 95.6% gas realization rate based on evaluation results [4]. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See Appendix 1 – "Boiler Distribution".

Revision History:

Revision Number	Date	Revision
270	1/1/2026	Updated SBES RR's for 025 impact study results.

Endnotes:

1: Energy and Resource Solutions, April 2018. Two-Tier Steam Trap Savings Study. Prepared for National Grid and Eversource of Massachusetts. http://maeeac.org/wordpress/wp-content/uploads/MA-CIEC-Two-Tier-Steam-Traps-MemoFINAL.pdf

2: DNV GL, June 2015. Massachusetts 2013 Prescriptive Gas Impact Evaluation – Steam Trap Evaluation Phase I. Prepared for Massachusetts Gas Program Administrators and Massachusetts Energy Efficiency Advisory Council. http://maeeac.org/wordpress/wp-content/uploads/MA-2013-Prescriptive-Gas-Impact-EvaluationSteam-Trap-Evaluation-Phase-1.pdf

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Food Service Steam Cooker

Measure Code	COM-FS-SC
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Food Service Equipment

Measure Description:

Electric Steam Cooker: Installation of a qualified ENERGY STAR commercial steam cooker. ENERGY STAR steam cookers save energy during cooling and idle times due to improved cooking efficiency and idle energy rates.

Gas Steam Cooker: The installation of an ENERGY STAR rated natural-gas fired steamer, either connectionless or steam-generator design. Qualified steamers reduce heat loss due to better insulation, improved heat exchange, and more efficient steam delivery systems.

Baseline Efficiency:

Electric Steam Cooker: The Baseline Efficiency case is an electric steam cooker with a cooking efficiency, pan production capacity, preheat energy, and idle energy rate as defined by any relevant U.S. federal requirements.

Gas Steam Cooker: The baseline efficiency case is a gas steam cooker with a cooking efficiency, pan production capacity, preheat energy, and idle energy rate as defined by any relevant U.S. federal requirements.

High Efficiency:

Electric Steam Cooker: The High Efficiency case is an electric steam cooker with a cooking energy efficiency, pan production capacity, preheat energy, and an idle energy rate meeting the minimum ENERGY STAR requirements.

Gas Steam Cooker: The high efficiency case is a gas steam cooker with a cooking energy efficiency, pan production capacity, preheat energy, and an idle energy rate meeting the minimum ENERGY STAR Program Requirements for Commercial Steam Cookers.

Energy Efficiency Requirements for Electric Steam Cookers[1]		
Pan Capacity	**Heavy Load Cooking Energy Efficiency**	**Idle Rate (watts)**
3-pan	50%	400
4-pan	50%	530
5-pan	50%	670
6-pan and larger	50%	800

Gas Steam Cooker: The high efficiency case is a gas steam cooker with a cooking energy efficiency, pan production capacity, preheat energy, and an idle energy rate meeting the minimum ENERGY STAR Program Requirements for Commercial Steam Cookers.

Energy Efficiency Requirements for Gas Steam Cookers[1]		
Pan Capacity	**Heavy Load Cooking Energy Efficiency**	**Idle Rate (btu/h)**
3-pan	38%	6,250
4-pan	38%	8,350
5-pan	38%	10,400
6-pan and larger	38%	12,500

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔMMBtu
EC1b048	Electric Steam Cooker	LBES New	6,550	2.28	n/a
EC1c043	Electric Steam Cooker	LBES Mid	6,550	2.28	n/a
EC3b079	Electric Steam Cooker	Muni New	6,550	2.28	n/a
EC2c043	Electric Steam Cooker	SBES Mid	6,550	2.28	n/a
EC2b048	Electric Steam Cooker	SBES New	6,550	2.28	n/a
GC1b027	Gas Steam Cooker	LBES New	n/a	n/a	71.3
GC1c008	Gas Steam Cooker	LBES Mid	n/a	n/a	71.3
GC3b027	Gas Steam Cooker	Muni New	n/a	n/a	71.3
GC2c008	Gas Steam Cooker	SBES Mid	n/a	n/a	71.3
GC2b027	Gas Steam Cooker	SBES New	n/a	n/a	71.3

Quantity = Number of pans (3 pans per unit for electric; 6 pans per unit for gas based on ENERGY STAR 1.2 default values)

Hours = Average annual equipment operating hours (9 hours per day x 311 days = 2,873 hours based on ENERGY STAR 1.2 default values)

Measure Life:

The measure life for a new steamer is 12 years.[1]

Other Resource Impacts:

Electric Steam Cooker: Deemed annual water savings.

Gas Steam Cooker: Deemed annual water savings.[2]

Measure Name	Annual water savings (gal/unit)
Electric Steam Cooker	69,975
Gas Steam Cooker	103,563

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c043	Electric Steam Cooker	LBES Mid	1	1	n/a	1	1	0.9	0.9
GC1c008	Gas Steam Cooker	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
EC1b048	Electric Steam Cooker	LBES New	1	0.99	n/a	1	1	0.9	0.9
GC1b027	Gas Steam Cooker	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
EC3b079	Electric Steam Cooker	Muni New	1	1	n/a	1	1	0.9	0.9
GC3b027	Gas Steam Cooker	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC2c043	Electric Steam Cooker	SBES Mid		0.998		1.103	0.885	0.9	0.9
GC2c008	Gas Steam Cooker	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2b048	Electric Steam Cooker	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
GC2b027	Gas Steam Cooker	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[3] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a gas rr of 95.6% from a 2025 Impact study[8]

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR[6]	SO_p	SO_{NP}	NTG[6]
EC2c043	Electric Steam Cooker	LBES Mid	0.225	0.085	0.0	0.86
GC2c008	Gas Steam Cooker	SBES Mid	0.225	0.085	0.0	0.86
EC1c043	Electric Steam Cooker	LBES Mid	0.225	0.085	0.0	0.86
GC1c008	Gas Steam Cooker	LBES Mid	0.225	0.085	0.0	0.86

Energy Load Shape:

See Appendix 1 See Appendix 1"C&I Load Shapes, "C&I Food Services".

Revision History:

Revision Number	Issue Date	Description
142	12/1/2022	Updated deemed savings for kWh, kW, MMBtu and water according to the Savings Calculator for ENERGY STAR Commercial Food Service (CFS) Products release in 2021.
184	1/1/2024	Updated end notes for high efficiency section and added table from Energy Star Requirements documentation
293	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
Xxx		Included omitted NTG values that were applied in the model

Endnotes:

1: SupportTable_EUL.csv, from DEER Database for Energy-Efficient Resources; Version 2016, READI v.2.4.3 (Current Ex Ante data) found at http://www.deeresources.com/

2: ENERGY STAR Commercial Kitchen Equipment Calculator. Updated July 2021. https://www.energystar.gov/sites/default/files/asset/document/CFS_calculator_07-15-2021.xlsx

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

Food Service Induction Cook Top

Measure Code	COM-FS-ICT
Markets	Commercial
ProgramTypes	New, Retrofit
Categories	Food Service Equipment

Measure Description:

Installation of an induction cooktop replacing an existing electric or natural gas cook top.

Baseline Efficiency:

The baseline efficiency case for the induction cooktop is a traditional electric resistance.

High Efficiency:

The high efficiency case is a cooktop with an induction heating element.

Algorithms for Calculating Primary Energy Impact:

Unit kwh savings are deemed per burner assuming use in a cook to order restaurant.[1] Demand savings are derived from the demand impact model, developed as part of the MA residential baseline study.

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC1d047	Induction Cooktop Displacing Electric Resistance	LBES DI	2,488	0.43
EC1c064	Induction Cooktop Displacing Electric Resistance	LBES Mid	2,488	0.43
EC1a050	Induction Cooktop Displacing Electric Resistance	LBES New	2,488	0.43
EC1b058	Induction Cooktop Displacing Electric Resistance	LBES Retro	2,488	0.43
EC3d091	Induction Cooktop Displacing Electric Resistance	Muni New	2,488	0.43
EC3b088	Induction Cooktop Displacing Electric Resistance	Muni Retro	2,488	0.43
EC3a093	Induction Cooktop Displacing Electric Resistance	SBES DI	2,488	0.43
EC2d047	Induction Cooktop Displacing Electric Resistance	SBES Mid	2,488	0.43
EC2a050	Induction Cooktop Displacing Electric Resistance	SBES New	2,488	0.43
EC2c064	Induction Cooktop Displacing Electric Resistance	SBES New	2,488	0.43
EC2b058	Induction Cooktop Displacing Electric Resistance	SBES Retro	2,488	0.43

Measure Life:

The measure life for an induction cooktop is 12 years.[2]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d047	Induction Cooktop Displacing Electric Resistance	LBES DI	1	0.99	n/a	1	1	0.9	0.9
EC1c064	Induction Cooktop Displacing Electric Resistance	LBES Mid	1	1	n/a	1	1	0.9	0.9
EC1a050	Induction Cooktop Displacing Electric Resistance	LBES New	1	0.99	n/a	1	1	0.9	0.9
EC1b058	Induction Cooktop Displacing Electric Resistance	LBES Retro	1	0.99	n/a	1	1	0.9	0.9

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3d091	Induction Cooktop Displacing Electric Resistance	Muni New	1	1	n/a	1	1	0.9	0.9
EC3b088	Induction Cooktop Displacing Electric Resistance	Muni Retro	1	1	n/a	1	1	0.9	0.9
EC3a093	Induction Cooktop Displacing Electric Resistance	SBES DI	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2d047	Induction Cooktop Displacing Electric Resistance	SBES Mid	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2a050	Induction Cooktop Displacing Electric Resistance	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2c064	Induction Cooktop Displacing Electric Resistance	SBES New	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2b058	Induction Cooktop Displacing Electric Resistance	SBES Retro	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise

Realization Rates:

Large Business Energy Solution uses a 99.9% realization rate2. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study3

Coincidence Factors:

Coincidence Factors are 0.9 for both summer and winter seasons to account for the fact that some restaurants close one day per week and some may not serve both lunch and dinner on weekdays.

Energy Load Shape:

See Appendix 1"C&I Load Shapes, "C&I Food Services".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR[6]	SO_p	SO_{NP}	NTG[6]
EC1c064	Induction Cooktop	LBES Mid	0.225	0.085	0.0	0.86
EC2c064	Induction Cooktop	SBES Mid	0.225	0.085	0.0	0.86

Revision History:

Revision Number	Date	Revision
186	7/1/2023	New Measure Added
266	1/1/2026	Updated SBES RR's based on 2025 impact study

Endnotes:

1: FSTC Report # 501311088-R0 https://www.caenergywise.com/report-library/cooktops/Vollrath_HIDC-HIMC_Induction_Range_Comparison.pdf

2: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

HVAC Boilers

Measure Code	COM-HVAC-BLR
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description

Installation of a high efficiency natural gas condensing boiler.

Baseline Efficiency:

Baseline efficiency for lost opportunity in existing buildings and new construction is shown below.[1]

Capacity (Input, MBH)	Existing Buildings Replace on Failure (ROF)	New Construction (NC)
< 300	82% AFUE	92% AFUE
≥ 300 and ≤ 2,500	80% Et	92% Et
> 2,500	82% Etc	82% Etc

High Efficiency:

High efficiency is per the table of efficiency thresholds below. Note that the measure efficiencies shown are nameplate efficiencies for the individual boiler capacities. Assumptions for the actual operating efficiency of the boilers are addressed later in this chapter.

BC ID	Measure Name	Program	Measure Efficiency
GC1b009	Boiler < 300 MBH (0.90 AFUE)	LBES New	90% AFUE
GC2b009	Boiler < 300 MBH (0.90 AFUE)	SBES New	90% AFUE
GC3b009	Boiler < 300 MBH (0.90 AFUE)	Muni New	90% AFUE
GC1b010	Boiler < 300 MBH (0.95 AFUE)	LBES New	95% AFUE
GC2b010	Boiler < 300 MBH (0.95 AFUE)	SBES New	95% AFUE
GC3b010	Boiler < 300 MBH (0.95 AFUE)	Muni New	95% AFUE
GC1b008	Boiler 300-499 MBH (0.90 TE)	LBES New	90% Et
GC2b008	Boiler 300-499 MBH (0.90 TE)	SBES New	90% Et
GC3b008	Boiler 300-499 MBH (0.90 TE)	Muni New	90% Et

GC1b007	Boiler 500-999 MBH (0.90 TE)	LBES New	90% Et
GC2b007	Boiler 500-999 MBH (0.90 TE)	SBES New	89% Et
GC3b007	Boiler 500-999 MBH (0.90 TE)	Muni New	89% Et
GC1b006	Boiler 1000-1700 MBH (0.90 TE)	LBES New	90% Et
GC2b006	Boiler 1000-1700 MBH (0.90 TE)	SBES New	90% Et
GC3b006	Boiler 1000-1700 MBH (0.90 TE)	Muni New	90% Et
GC1b005	Boiler 1701 - 2500 MBH (0.90 TE)	LBES New	90% Et
GC2b005	Boiler 1701 - 2500 MBH (0.90 TE)	SBES New	90% Et
GC3b005	Boiler 1701 - 2500 MBH (0.90 TE)	Muni New	90% Et

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔMMBtu
GC1b010	**Boiler <= 300 MBH (0.95 AFUE)**	LBES New	9.6
GC2b010	Boiler <= 300 MBH (0.95 AFUE)	SBES New	9.6
GC3b010	Boiler <= 300 MBH (0.95 AFUE)	MUNI New	9.6
GC1b009	Boiler <= 300 MBH (0.90 AFUE)	LBES New	9.6
GC2b009	Boiler <= 300 MBH (0.90 AFUE)	SBES New	9.6
GC3b009	Boiler <= 300 MBH (0.90 AFUE)	MUNI New	9.6
GC1b008	Boiler 301-499 MBH (0.90 TE)	LBES New	33.6
GC2b008	Boiler 301-499 MBH (0.90 TE)	SBES New	33.6
GC3b008	Boiler 301-499 MBH (0.90 TE)	MUNI New	33.6
GC1b007	Boiler 500-999 MBH (0.90 TE)	LBES New	62.9
GC2b007	Boiler 500-999 MBH (0.90 TE)	SBES New	62.9
GC3b007	Boiler 500-999 MBH (0.90 TE)	MUNI New	62.9
GC1b006	Boiler 1000-1700 MBH (0.90 TE)	LBES New	113.3
GC2b006	Boiler 1000-1700 MBH (0.90 TE)	SBES New	113.3
GC3b006	Boiler 1000-1700 MBH (0.90 TE)	MUNI New	113.3
GC1b005	Boiler 1701 - 2500 MBH (0.90 TE)	LBES New	176.3
GC2b005	Boiler 1701 - 2500 MBH (0.90 TE)	SBES New	176.3
GC3b005	Boiler 1701 - 2500 MBH (0.90 TE)	MUNI New	176.3

$\Delta MMBtu = Capacity * (1/(Eff_{base}) - 1/(Eff_{EE})) * Heating\ EFLH\ /1000$

Where:

Capacity = Rated boiler output capacity (kBtu/hr)

Heating EFLH = Use heating Full Load Hours from Appendix 2. If building, HVAC type and climate zone unknown, use average value of 664.[2]

Eff_{BASE} = Rated efficiency of the baseline boiler per the table above.

Eff_{EE} = 89% thermal efficiency[3]

Unit energy savings for Lost Opportunity Replace on Failure installations in existing buildings are shown below. The savings are calculated using the above equations using average heating EFLH and mid-point boiler input capacities in each size category.

Measure Life:

The measure life is 25 years.[4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1b009	Boiler < 300 MBH (0.90 AFUE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b009	Boiler < 300 MBH (0.90 AFUE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b009	Boiler < 300 MBH (0.90 AFUE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b010	Boiler < 300 MBH (0.95 AFUE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b010	Boiler < 300 MBH (0.95 AFUE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b010	Boiler < 300 MBH (0.95 AFUE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b008	Boiler 300-499 MBH (0.90 TE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b008	Boiler 300-499 MBH (0.90 TE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b008	Boiler 300-499 MBH (0.90 TE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b007	Boiler 500-999 MBH (0.90 TE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b007	Boiler 500-999 MBH (0.90 TE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b007	Boiler 500-999 MBH (0.90 TE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b006	Boiler 1000-1700 MBH (0.90 TE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b006	Boiler 1000-1700 MBH (0.90 TE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b006	Boiler 1000-1700 MBH (0.90 TE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b005	Boiler 1701 - 2500 MBH (0.90 TE)	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC2b005	Boiler 1701 - 2500 MBH (0.90 TE)	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3b005	Boiler 1701 - 2500 MBH (0.90 TE)	Muni New	1	n/a	1	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise. The SBES program uses a realization rate of 95.6% RR from a 2025 Impact study[5].

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See Appendix 1 "C&I Heating & Cooling".

Revision History:

Revision Number	Date	Description
213	1/1/2025	Baseline updated based on NMR baseline study, new deemed values provided.
238	1/1/2026	Added efficiency adjustment factors as a function of return water temperature and revised heating EFLH based on commercial baseline study. Updated SBES RR's based on 2025 SBES Impact study
360	1/1/2027	Updated high efficiency values per new evaluation

Endnotes:

1: NMR Group and DNV, 2023. New Hampshire Baseline Practices Final Report. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/27-nh-baseline-practices-report.pdf

2: Weighted average of heating full-load hours by building type, climate zone and HVAC type. Weights developed from NH Commercial Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nh_commercial_baseline_final.pdf. See Weighting Calculations for Boiler Measure.xlsx

3: Ridgeline Analytics, May 2026. Condensing Boiler Study

4: ASHRAE Applications Handbook, 2003; Page 36.3.

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation.

HVAC Boiler Reset Controls

Measure Code	COM-HVAC-BRC
Markets	Commercial & Industrial
Program Types	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Boiler Reset Controls: Boiler Reset Controls are devices that automatically control boiler water supply temperature based on outdoor or return water temperature using a software program.

Baseline Efficiency:

The baseline efficiency case is a boiler without reset controls.

High Efficiency:

The High efficiency case is a boiler with reset controls.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	Program	ΔMMBtu/unit
EC3a019	Boiler Reset Controls, Gas	Muni Retro	25.00
GC3a010	Boiler Reset, Gas	Muni Retro	25.00
EC3a020	Boiler Reset Controls, Oil	Muni Retro	25.00
EC3a021	Boiler Reset Controls, Propane	Muni Retro	25.00
EC3d021	Boiler Reset Controls, Gas	Muni DI	25.00
EC3d022	Boiler Reset Controls, Oil	Muni DI	25.00
EC3d023	Boiler Reset Controls, Propane	Muni DI	25.00
GC1a010	Boiler Reset, Gas	LBES Retro	25.00
GC2a010	Boiler Reset, Gas	SBES Retro	25.00

Savings algorithm:

$$\Delta MMBTU = Units \times \frac{Cap_{heat}}{1{,}000} \times EFLH_{heating} \times ESF$$

Calculation Parameters Table

Variable	Description	Value	Units	Ref
ΔMMBTU	MMBtu Savings	25.00	MMBTU	
Units	Number of Units	1	Each.	
Cap_{heat}	Fuel input rating (kBTU/h) of the controlled boiler.	753	kBTU/hr	1
$EFLH_{heating}$	Heating equivalent full-load hours are weighted by NH Baseline data for climate zones 5 and 6.	664	EFLH	2
ESF	Energy Savings Factor	5%		3

Measure Life:

The measure life is 15 years.[4]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3a019	Boiler Reset Controls, Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC3a010	Boiler Reset Controls, Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a020	Boiler Reset Controls, Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a021	Boiler Reset Controls, Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3d021	Boiler Reset Controls, Gas	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d022	Boiler Reset Controls, Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d023	Boiler Reset Controls, Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
GC1a010	Boiler Reset Controls, Gas	LBES Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC2a010	Boiler Reset Controls, Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a

Energy Load Shape:

See Appendix 1 Residential Load Shapes “Non- Electric Measures”

Revision History:

Revision Number	Date	Description
129	12/1/2022	Removed reference to electric measures.
361	1/1/2027	Updated savings based on a more recent study.

Endnotes:

1: Cap_{heat} is calculated as the average of the central boiler efficiencies in Table 28 of the New Hampshire Commercial Existing Buildings Baseline Study. Demand Side Analytics (2024) New Hampshire Commercial Existing Buildings Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nh_commercial_baseline_final.pdf

2: Heating equivalent full-load hours are weighted by NH Baseline data for climate zones 5 and 6 using the EFLH assumptions in the EFLH appendix. Demand Side Analytics (2024) New

Hampshire Commercial Existing Buildings Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nh_commercial_baseline_final.pdf

3: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts.

4: ACEEE, 2006. Emerging Technologies Report: Advanced Boiler Controls.https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488606996f25d7f7df759/view?authToken=2ec31c0c3366eefbec8e238482b281636b0584a3d60865531cfd0e2397768bae977a9e60ee77c3b5c1aee11a038f90b5cc03f151c54423cddbcf40254d6e3407c389f4490c5224

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation (Last accessed on March 3, 2026)

HVAC Circulator Pump

Measure Code	COM-HVAC-CP
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Single-phase circulator pumps used in C&I buildings used for hydronic heating and system hot water.

Baseline Efficiency:

The baseline system is a pump without an EC motor. The baseline system may have no control, a timer, aquastat, or be on demand. The baseline system is assumed to run a weighted average of these four control types.

High Efficiency:

The high efficiency case is a circulator pump with an ECM.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkW	ΔkWh
EC1c001	Midstream Circulator Pump	LBES Mid	Calculated	Calculated
EC1b018	Circulator Pump	LBES New	Calculated	Calculated
EC3b030	Circulator Pump	Muni New	Calculated	Calculated
EC2c001	Midstream Circulator Pump	SBES Mid	Calculated	Calculated
EC2b018	Circulator Pump	SBES New	Calculated	Calculated

Savings depend on application and pump size as described in table below.[1]

Size	Type	kW	kWh

<= 1 HP	Hydronic Heating	ΔkW = 0.245 * HP rated + 0.02	ΔkWh = 1,325 * HP rated+ 111
<= 1 HP	Service Hot Water	ΔkW = 0.245 * HP rated+ 0.02	ΔkWh = 2,780 * HP rated+ 233
> 1 HP	Hydronic Heating	ΔkW = 0.265	ΔkWh = 1,436
> 1 HP	Service Hot Water	ΔkW = 0.265	ΔkWh = 3,013

Measure Life:

The measure life is 20 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c001	Midstream Circulator Pump	LBES Mid	1	1	n/a	1	1	0.82	0.05
EC1b018	Circulator Pump	LBES New	1	0.999	n/a	1	1	0.82	0.05
EC3b030	Circulator Pump	Muni New	1	1	n/a	1	1	0.82	0.05
EC2c001	Midstream Circulator Pump	SBES Mid	1	0.998	n/a	1.103	0.885	0.82	0.05
EC2b018	Circulator Pump	SBES New	1	0.998	n/a	1.103	0.885	0.82	0.05

In-Service Rates:

All installations have a 100.0% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% realization rate[3]. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

A summer coincidence factor of 82.0% and a winter coincidence factor of 5.0% are utilized. [5]

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Heating & Cooling."

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EC1c001 EC2c001	Midstream Circulator Pump	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.860	4

Revision History:

Revision Number	Date	Revision
264	1/1/2026	Updated SBES based on 2025 impact study

Endnotes:

1: The Cadmus Group, 2017. Circulator Pump Technical Memo. Prepared for National Grid and Eversource engineers.

2: Energy & Resource Solutions, November 2005. Measure Life Study. Prepared for The Massachusetts Joint Utilities. https://www.ers-inc.com/wp-content/uploads/2018/04/Measure-Life-Study_MA-JointUtilities_ERS.pdf

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: Navigant Consulting (2018). RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

6: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

HVAC Condensing Unit Heaters

Measure Code	COM-HVAC-CUH
Markets	Commercial
ProgramTypes	Lost Opportunity, Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of a condensing gas-fired, propane or oil unit heater for space heating with capacity up to 300 MBH and minimum combustion efficiency of 90%. The condensing unit heater should have a condensate drain pipe.

Baseline Efficiency:

The baseline efficiency case is a standard efficiency gas, oil or propane fired unit heater with minimum combustion efficiency of 80%[1], interrupted or intermittent ignition device (IID), and either power venting or an automatic flue damper.

High Efficiency:

The high efficiency case is a condensing gas, oil, propane unit heater with 90% AFUE or greater.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed.

Savings Table:

BC ID	Measure Name	Program	ΔMMBtu
GC1b013	Condensing Unit Heater (<= 300 MBH) – Gas	LBES New	16.60
GC2b013	Condensing Unit Heater (<= 300 MBH) – Gas	SBES New	16.60
GC3b013	Condensing Unit Heater (<= 300 MBH) – Gas	Muni New	16.60
EC3b033	Condensing Unit Heater (<= 300 MBH) – Oil	Muni New	16.60
EC3b034	Condensing Unit Heater (<= 300 MBH) – Propane	Muni New	16.60

Savings Algorithm

$$\Delta MMBtu = units \times \frac{kBTU/h_{in}}{unit} \times \left(\frac{Eff_{ee}}{Eff_{base}} - 1\right) \times \frac{EFLH_{heating}}{1{,}000}$$

Calculation parameters

Variable	Description	Value	Units	Ref
ΔMMBtu	Annual fossil fuel energy savings	Calculated	MMBtu	
Units	Number of measures installed under the program	Site specific		
$kBTU/h_{in}$	Fuel Input Rating per unit	200	kBTU/h	2
Eff_{ee}	Efficiency of energy efficient condition. Site-specific	90%	AFUE	3
$Eff_{baseline}$	Efficiency of baseline condition	80%	AFUE	4
$EFLH_{heating}$	Heating equivalent full-load hours.	664	EFLH	5
1,000	Conversion factor, one MMBtu equals 1,000 kBTU	1,000		

Measure Life:

The measure life is 18 years[6].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GC1b013	Condensing Unit Heater – Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	8
GC2b013	Condensing Unit Heater – Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	7
GC3b013	Condensing Unit Heater (<= 300 MBH) – Gas	Muni New	1	N/a	1.00	n/a	n/a	n/a	n/a	8
EC3b033	Condensing Unit Heater – Oil	Muni New	1	n/a	1	n/a	n/a	n/a	n/a	8
EC3b034	Condensing Unit Heater – Propane	Muni New	1	n/a	1	n/a	n/a	n/a	n/a	8

Energy Load Shape:

See Appendix 1.2 Commercial "C&I Heating & Cooling".

Revision History:

Revision Number	Date	Description
49	1/14/2022	Corrected baseline to reference most current code.
172	7/1/2023	Updated endnote reference links
274	1/1/2026	Updated SBES RR's based on study results.
362	1/1/2027	Updated measure description. Added savings algorithms updated parameters
406	10/30/2026	Added omitted BC ID GC3b013

Endnotes:

1: 2024 International Energy Conservation Code, September 2025; Table C403.3.2(5) https://codes.iccsafe.org/content/IECC2024V1.2/chapter-ce-4-commercial-energy-efficiency#IECC2024V1.2_CE_Ch04_SecC403.3.2 (Last accessed on March 24, 2026)

2: Input capacity was calculated by using the detailed baseline data from site visits and surveys provided as part of the New Hampshire Commercial Existing Buildings Baseline Study. 200 was found to be the average input capacity of wall and ceiling units, based on the assumption of 80% thermal efficiency. Input capacity was calculated by dividing the output kBTU by the assumed thermal efficiency. Demand Side Analytics (2024) New Hampshire Commercial Existing Buildings Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nh_commercial_baseline_final.pdf.

3: 90% AFUE is the eligibility criteria set by the program which informs the high efficiency assumption.

4: 2024 International Energy Conservation Code, September 2025; Table C403.3.2(5) https://codes.iccsafe.org/content/IECC2024V1.2/chapter-ce-4-commercial-energy-efficiency#IECC2024V1.2_CE_Ch04_SecC403.3.2 (Last accessed on March 24, 2026)

5: Heating equivalent full-load hours are based on the assumptions in the EFLH appendix. Building types and climate zones are weighted by the findings of the 2024 New Hampshire Commercial Existing Buildings Baseline Study. Manchester, Berlin and Concord are used as representation of Climate zones 5 and 6. Demand Side Analytics (2024) New Hampshire Commercial Existing Buildings Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nh_commercial_baseline_final.pdf.

6: Ecotrope, Inc., August 2003. Natural Gas Efficiency and Conservation Measure Resource Assessment for the Residential and Commercial Sectors. Prepared for the Energy Trust of Oregon; Table 1-4 https://ecotope-publications-database.ecotope.com/2003_007_NaturalGasEfficiency.pdf (Last accessed on March 24, 2026)

7: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 24, 2026)

8: Assumed to be 100% until evaluated.

HVAC Demand Control Ventilation

Measure Code	COM-HVAC-DCV
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The measure controls the quantity of outside air to an air handling system based on detected space CO_2 levels. The installed systems monitor the CO_2 in the spaces or return air and reduce the outside air use when possible to save energy while meeting indoor air quality standards. Measure is applicable to situations where not required by the 2018 IECC Energy and Conservation Code section 403.7 Ventilation and Exhaust Systems[1].

Baseline Efficiency:

The baseline efficiency case assumes the relevant HVAC equipment has no ventilation control and has a fixed outside air rate. This measure is not applicable to HVAC systems that do not use outside air.

High Efficiency:

The high efficiency case is the installation of an CO_2 sensor based outside air intake control that is programmed to modulate outside air ventilation.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh/MMBTU	ΔkW
EC1a018	Demand Control Ventilation	LBES Retro	Calculated	Calculated
EC1d020	Demand Control Ventilation	LBES DI	Calculated	Calculated
EC2a018	Demand Control Ventilation	SBES Retro	Calculated	Calculated
EC2d020	Demand Control Ventilation	SBES DI	Calculated	Calculated
EC3a024	Demand Control Ventilation	Muni Retro	Calculated	Calculated
EC3d026	Demand Control Ventilation	Muni DI	Calculated	Calculated
EC1c002 EC2c002	Demand Control Ventilation	LBES Mid	Calculated	Calculated
EC2c002	Demand Control Ventilation	SBES Mid	Calculated	Calculated

The energy and demand savings are calculated using the following algorithms and inputs:

For facilities heated by natural gas,

$$\Delta kWh = \frac{SF}{1{,}000} \times SF_{Cooling}$$

$$\Delta MMBtu = \frac{SF}{1{,}000} \times \frac{SF_{Heating}}{10}$$

For facilities heated by heat pumps,

$$\Delta kWh = \frac{SF}{1{,}000} \times SF_{Cooling} + \frac{SF}{1{,}000} \times SF_{Heat,HP}$$

For facilities heated by electric resistance,

$$\Delta kWh = \frac{SF}{1{,}000} \times SF_{Cooling} + \frac{SF}{1{,}000} \times SF_{Heat,ER}$$

Where,

SF is the actual square footage of conditioned space controlled by sensor.

$SF_{Cooling}$ is the Cooling Savings Factor[7]. Value in table below based on building type and weather zone

$SF_{Heat,HP}$ is the Heating Savings factor for facilities heated by Heat Pump (HP) [7]. Value in table below based on building type and weather zone

$SF_{Heat,ER}$ is the Heating Savings factor for facilities heated by Electric Resistance (ER) [7]. Value in table below based on building type and weather zone

$SF_{Heating}$ is the Heating Savings factor for facilities heated natural gas[7]. Value in table below based on building type and weather zone.

Climate Zone (City based upon)	$SF_{cooling}$ (kWh/1000 sqFt)	$SF_{Heat,HP}$ (kWh/1000 sqFt)	$SF_{Heat,ER}$ (kWh/1000 sqFt)	$SF_{Heating}$ (therm/1000 sqFt)
6 (Concord)	145.62	670.93	2014.03	85.28

Climate Zone (City based upon)	$SF_{cooling}$ (kWh/1000 sqFt)	$SF_{Heat,HP}$ (kWh/1000 sqFt)	$SF_{Heat,ER}$ (kWh/1000 sqFt)	$SF_{Heating}$ (therm/1000 sqFt)
6 (Berlin)	53.14	797.66	2394.46	101.38
5 (Manchester)	244.16	567.21	1702.69	72.09

Measure Life:

The measure life is 15 years[3].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1a018	Demand Control Ventilation	LBES Retro	1	0.999	n/a	1	1	0.82	0.05	4
EC1d020	Demand Control Ventilation	LBES DI	1	0.999	n/a	1	1	0.82	0.05	4
EC2a018	Demand Control Ventilation	SBES Retro	1	0.998	n/a	1.103	0.885	0.82	0.05	5
EC2d020	Demand Control Ventilation	SBES DI	1	0.998	n/a	1.103	0.885	0.82	0.05	5
EC3a024	Demand Control Ventilation	Muni Retro	1	1	n/a	1	1	0.82	0.05	
EC3d026	Demand Control Ventilation	Muni DI	1	1	n/a	1	1	0.82	0.05	
EC1c002	Demand Control Ventilation	LBES Mid	1	0.999	n/a	1	1	0.82	0.05	4
EC2c002	Demand Control Ventilation	SBES Mid	1	0.998	n/a	1.103	0.885	0.82	0.05	5

Energy Load Shape:

Appendix 1.2 – "C&I Heating and Cooling"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):[6]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	2021 NTG
EC1c002	Midstream Demand Control Ventilation	LBES Midstream	0.225	0.085	0.000	0.860
EC2c002	Midstream Demand Control Ventilation	SBES Midstream	0.225	0.085	0.000	0.860

Revision History:

Revision Number	Date	Description
45	1/14/2022	Updated midstream and retrofit baselines.
46	1/14/2022	Fixed broken link.
139	12/1/2022	Added federal code to measure description.
173	7/1/2023	Updated reference links

Revision Number	Date	Description
276	1/1/2026	Updated SBES RR's for 2025 impact evaluation results
363	1/1/2027	Updated the measure life based on the most recent source.
364	1/1/2027	Updated baseline efficiency and high efficiency description
365	1/1/2027	Added location and equipment specific savings factors using NH Degree Days
366	1/1/2027	Updated savings algorithms

Endnotes:

1: 2018 International Energy Conservation Code, Ventilation and Exhaust Systems (Mandatory) https://codes.iccsafe.org/content/IECC2018P5/chapter-4-ce-commercial-energy-efficiency#IECC2018P5_CE_Ch04_SecC403.7 (Last accessed on March 16, 2026)

2: Keena, Kevin, 2008. Analysis of CO2 Control Energy Savings on Unitary HVAC Units. Prepared for National Grid. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee4885b6996f263667df742/view?authToken=1b79e9f56afecfa009188cb15f95b79552dafb0f64ec48e0a751597ada12b944bf6a2dbbdca171c50a6680250af4da60ae5ea7b647c3bdd87433f4c380063d44c3e6cf63ab0be5 (Last accessed on March 16, 2026)

3: DEER 2014 EUL Table https://www.caetrm.com/media/reference-documents/DEER2014-EUL-table-update_2014-02-05_PUq4NzL.xlsx(Last accessed on March 16, 2026)

4: New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Impact Evaluation report. Table 3 https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on March 16, 2026)

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 16, 2026)

6: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. https://ma-eeac.org/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf (Last accessed on March 16, 2026)

7: The electric and natural energy saving factors were calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 90.1 -2010 (code level up until Dec 31, 2015). The savings factor were initially calculated on an annual basis for each given temperature zone in Illinois. These savings factors were prorated for NH based HDD65 and CDD65.

HVAC Dual Enthalpy Economizer Controls

Measure Code	COM-HVAC-DEEC

Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The measure is to install a dual enthalpy economizer on an existing unit with fixed outdoor air. The system will continuously monitor the enthalpy of both the outside air and return air. The system will control the system dampers adjust the outside quantity based on the two readings. This measure also only applies in cases where economizers are not required by federal, state, local or municipal codes or standards

Baseline Efficiency:

The baseline efficiency case for this measure assumes the relevant HVAC equipment is operating without an economizer.

High Efficiency:

The high efficiency case is the installation of an outside air economizer utilizing two enthalpy sensors, one for outdoor air and one for return air.

Algorithms for Calculating Primary Energy Impact:Savings Table:

BC ID	Measure Name	Program	ΔkW	ΔkWh
EC1d022	Dual Enthalpy Economizer Controls	LBES DI	Calculated	Calculated
EC1c004	Midstream Dual Enthalpy Economizer Controls	LBES Mid	Calculated	Calculated
EC1a020	Dual Enthalpy Economizer Controls	LBES Retro	Calculated	Calculated
EC3d028	Dual Enthalpy Economizer Controls	MUNI DI	Calculated	Calculated
EC3a026	Dual Enthalpy Economizer Controls	MUNI Retro	Calculated	Calculated
EC2d022	Dual Enthalpy Economizer Controls	SBES DI	Calculated	Calculated
EC2c004	Midstream Dual Enthalpy Economizer Controls	SBES Mid	Calculated	Calculated
EC2a020	Dual Enthalpy Economizer Controls	SBES Retro	Calculated	Calculated

$$\Delta kWh = kBtuh \times \frac{1\ ton}{12\ kBtuh} \times SAVE_{kWh}$$

Where:

kBtu/h = Capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h)

$SAVE_{kWh}$ = Average annual kWh reduction per ton of cooling capacity: 289 kWh/ton [1].

Measure Life:

The measure life is 10 years [3]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d022	Dual Enthalpy Economizer Controls	LBES DI	1	0.999	n/a	1	1	0.342	0
EC1c004	Midstream Dual Enthalpy Economizer Controls	LBES Mid	1	1	n/a	1	1	0.342	0
EC1a020	Dual Enthalpy Economizer Controls	LBES Retro	1	0.999	n/a	1	1	0.342	0
EC3d028	Dual Enthalpy Economizer Controls	MUNI DI	1	1	n/a	1	1	0.342	0
EC3a026	Dual Enthalpy Economizer Controls	MUNI Retro	1	1	n/a	1	1	0.342	0
EC2d022	Dual Enthalpy Economizer Controls	SBES DI	1	0.998	n/a	1.103	0.885	0.342	0
EC2c004	Midstream Dual Enthalpy Economizer Controls	SBES Mid	1	0.998	n/a	1.103	0.885	0.342	0
EC2a020	Dual Enthalpy Economizer Controls	SBES Retro	1	0.998	n/a	1.103	0.885	0.342	0

In-Service Rates:

All installations have a 100.0% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% realization rate[3]. The SBES program uses a realization rate of 99.8% RR from a 2025 Impact study[4]. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are based on 2011 NEEP C&I Unitary AC Loadshape Project.[5]

Energy Load Shape:

See Appendix 1 – "C&I Heating and Cooling".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EC1c004	Midstream Dual Enthalpy Economizer Controls	LBES Mid	0.225	0.085	0.000	0.860	6
EC2c004	Midstream Dual Enthalpy Economizer Controls	SBES Mid	0.225	0.085	0.000	0.860	6

Revision History:

Revison	Date	Description
140	12/1/2022	Updated baseline to be a unit without an economizer. Removed KW savings as economizers are generally closed under peak summer conditions.
242	1/1/2026	Updated measure description. Updated SBES RRs based on 2025 SBES impact memo.

Endnotes:

1: Patel, Dinesh, 2001. Energy Analysis: Dual Enthalpy Control. Prepared for Eversource (NSTAR).

2: Energy & Resource Solutions, November (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.https://www.ers-inc.com/wpcontent/uploads/2018/04/Measure-Life-Study_MA-Joint-Utilities_ERS.pdf

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: Coincidence Factors are from 2011 NEEP HVAC Loadshape Study Table 0-5 (ISO_NE on Peak for NE-North)
https://neep.org/sites/default/files/resources/NEEP_HVAC_Load_Shape_Report_Final_August2_0.pdf

6: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

HVAC Duct Insulation

Measure Code	COM-HVAC-DI
Markets	Commercial

ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

For existing ductwork in non-conditioned spaces, insulate ductwork. This could include replacing uninsulated flexible duct with rigid insulated ductwork and installing 1" to 2" of duct-wrap insulation.

Baseline Efficiency:

The baseline efficiency case is existing, uninsulated ductwork in unconditioned spaces. An unconditioned space is an area, room or space that is not enclosed within the building thermal envelope and that is not directly or indirectly heated or cooled.

The savings are estimated by using the surface area (in square feet) of uninsulated ductwork located in unconditioned spaces.

High Efficiency:

The high efficiency condition is ductwork insulated to R-6 or better in unconditioned spaces.

Algorithms for Calculating Primary Energy Impact: Savings Table:

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC3a027	Duct Insulation, Electric	Muni Retro	Calculated	Calculated
EC3a028	Duct Insulation, Gas	Muni Retro	Calculated	Calculated
EC3a029	Duct Insulation, Oil	Muni Retro	Calculated	Calculated
EC3a030	Duct Insulation, Propane	Muni Retro	Calculated	Calculated

Savings Algorithms

$$\Delta MMBtu = \frac{\Delta MMBtu}{sqft} \times Area$$

$$\Delta kWh = \frac{\Delta kWh}{sqft} \times Area$$

Where:

Area = Area of ductwork insulated in unconditioned space in sq ft

MMBtu/sq ft = Average annual MMBtu savings per sq ft

Unit savings are deemed per square foot based on study results[1]:

Fuel Type	ΔkWh/sq ft	ΔMMBtu/sq ft
Gas	n/a	0.0315
Oil	n/a	0.0315
Propane	n/a	0.0315

Electric	0.0138	n/a

Savings Algorithm:

$$\Delta Q_{loss} = \frac{(U_{pre} - U_{post}) \times P \times L}{12} \times (T_{duct} - T_{ambient})$$

$$\Delta MMBtu = \Delta Q_{loss} \times EFLH$$

$$\Delta kWh = \frac{\Delta Q_{loss}}{3412.4} \times EFLH$$

Where:

ΔQ_{loss} is duct heat loss in Btu/hr

U_{pre} is the overall heat transfer coefficient of the uninsulated duct in Btu/hr.ft^2.F. If unknown, use 0.66 Btu/hr.ft^2.F.

U_{post} is the overall heat transfer coefficient of the uninsulated duct in Btu/hr.ft^2.F If unknown, use 0.24 Btu/hr.ft^2.F.

P is the perimeter of the duct in inches. If unknown, use 48 inches.

L is the length of the duct in feet. If unknown, use 50 feet.

T_{duct} is the temperature of the duct air in °F. If unknown, use 100°F.

$T_{ambient}$ is the temperature of the ambient space in °F. If unknown, use 50°F.

EFLH is the equivalent full load hours. If unknown, use 1,500 hrs.

Measure Life:

The measure life is 20 years[2].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC3a027	Duct Insulation, Electric	Muni Retro	1	1	n/a	1	1	0.35	0	3,4
EC3a028	Duct Insulation, Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a	4

EC3a029	Duct Insulation, Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a	4
EC3a030	Duct Insulation, Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a	4

Energy Load Shape:

For electric measures, see Appendix 1 C&I Load Shapes "Weighted HVAC – Multi-Family"

For non-electric measures, see Appendix 1 C&I Load Shapes "Non-Electric Measures".

Revision History:

Revision Number	Date	Description
163	3/1/2023	Added in missing BC ID for gas. g21b1a018
367	1/1/2027	Included deemed savings value and savings algorithm for different fuel types.

Endnotes:

1: National Grid Staff Estimate, 2010. MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee4885c6996f2b5047df743/view?authToken=b5920a744c97cf78def739436054d1c51f2952368b8d549b2b0dd8058398ae505926c40a8ffd7ca1201a9e00dfea3a6944d49070a6907767c9c0e07c10becfffdb38c19699b076 (Last accessed on March 16, 2026)

2: National Grid Staff Estimate, 2010. MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee4885c6996f2b5047df743/view?authToken=b5920a744c97cf78def739436054d1c51f2952368b8d549b2b0dd8058398ae505926c40a8ffd7ca1201a9e00dfea3a6944d49070a6907767c9c0e07c10becfffdb38c19699b076 (Last accessed on March 16, 2026)

3: Navigant Consulting, 2018. RES1 Demand Impact Model Update.

4: Impact factors assumed to be 100% until evaluated

HVAC Duct Sealing

Measure Code	COM-HVAC-DS
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

For existing ductwork in non-conditioned spaces, seal ductwork. This could include sealing leaky fixed ductwork with mastic or aerosol.

Baseline Efficiency:

The baseline efficiency case is existing, non-sealed (leaky) in unconditioned spaces. An unconditioned space is an area, room or space that is not enclosed within the building thermal envelope and that is not directly or indirectly heated or cooled.

High Efficiency:

The high efficiency condition is air sealed ductwork in unconditioned spaces.

Algorithms for Calculating Primary Energy Impact:

Savings Table:

BC ID	Measure Name	Program	ΔkWh/MMBTU	ΔkW
EC1d023	Duct Sealing, Electric	LBES DI	Calculated	Calculated
EC1a021	Duct Sealing, Electric	LBES DI	Calculated	Calculated
EC3d033	Duct Sealing, Electric	SBES DI	Calculated	Calculated
EC3d034	Duct Sealing, Electric	SBES DI	Calculated	Calculated
EC3d035	Duct Sealing, Electric	MUNI DI	Calculated	Calculated
EC3d036	Duct Sealing, Gas	MUNI DI	Calculated	Calculated
EC3a031	Duct Sealing, Oil	MUNI DI	Calculated	Calculated
EC3a032	Duct Sealing, Propane	MUNI DI	Calculated	Calculated
EC3a033	Duct Sealing, Electric	MUNI DI	Calculated	Calculated
EC3a034	Duct Sealing, Gas	MUNI DI	Calculated	Calculated
EC2d023	Duct Sealing, Oil	MUNI DI	Calculated	Calculated
EC2a021	Duct Sealing, Propane	MUNI DI	Calculated	Calculated

Method for Calculating Annual Energy and Summer Peak Coincident Demand Savings

Annual Electric Energy Savings

Methodology 1: Test in / test out duct leakage measurements.

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

$$\Delta kWh_{cooling} = \frac{CFM_{25\,base} - CFM_{25\,ee}}{400 \times Cap_{cool}} \times Cap_{cool} \times EFLH_{cool} \times (1 - TRF_{cool}) \times \frac{12}{DE_{base} \times EER}$$

$$\Delta kWh_{heating} = \frac{CFM_{25\,base} - CFM_{25\,ee}}{17 \times Cap_{heat}} \times Cap_{heat} \times EFLH_{heat} \times (1 - TRF_{heat}) \times \frac{1}{DE_{base} \times 3.412 \times COP}$$

$$\Delta MMBtu = \frac{CFM_{25\,base} - CFM_{25\,ee}}{17 \times Cap_{heat}} \times Cap_{heat} \times EFLH_{heat} \times TRF_{heat} \times \frac{1}{DE_{base} \times \eta_{heat} \times 1000}$$

Methodology 2: Evaluation of distribution efficiency, only use if test in/ test out data is unavailable.

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

$$\Delta kWh_{cooling} = \frac{DE_{cool,ee} - DE_{cool,base}}{DE_{cool,ee}} \times EFLH_{cool} \times (1 - TRF_{cool}) \times \frac{Cap_{cool}}{EER}$$

$$\Delta kWh_{heating} = \frac{DE_{heat,ee} - DE_{heat,base}}{DE_{heat,ee}} \times EFLH_{heat} \times (1 - TRF_{heat}) \times \frac{Cap_{heat}}{3.412 \times COP}$$

$$\Delta MMBtu = \frac{DE_{heat,ee} - DE_{heat,base}}{DE_{heat,ee}} \times EFLH_{heat} \times Cap_{heat} \times \frac{1}{\eta_{heat} \times 1000}$$

Summer Peak Coincident Demand Savings

$$\Delta kW_{Peak} = \frac{\Delta kWh_{cooling}}{EFLH_{cool}} \times CF$$

ΔkWh = Annual electric energy savings

$\Delta kWh_{cooling}$ = Annual electric energy savings, cooling

$\Delta kWh_{heating}$ = Annual electric energy savings, heating

ΔMMBtu = Annual fossil fuel energy savings

Cap_{cool} = Output cooling capacity in tons

Cap_{heat} = Output heating capacity in kBTU/h

TRF_{cool} = Cooling thermal regain factor based on duct location (See Thermal Regain Factors table)[5]

TRF_{heat} = Heating thermal regain factor based on duct location (See Thermal Regain Factors table)[5]

EER = Seasonal average energy efficiency ratio in BTU/watt-hour. Use SEER for systems with cooling capacity < 65 kBtu/hr; IEER for systems >= 65 kBtu/hr cooling capacity

COP = heating season average coefficient of performance. Use HSPF/3.412 for heat pumps with cooling capacity < 65 kBtu/hr; COP at 47F for heat pumps with cooling capacity >= 65 kBtu/hr; 1.0 for electric resistance heat.

η_{heat} = heating season average efficiency. Use AFUE for heating systems < 300 kBtu/hr; E_t or E_c for heating systems > 300 kBtu/hr

$EFLH_{cool}$ = Cooling equivalent full-load hours. See appendix 2

$EFLH_{heat}$ = Heating equivalent full-load hours. See appendix 2.

base = Characteristic of baseline condition

ee = Characteristic of energy efficient condition

DE_{base} = Distribution system efficiency of the baseline condition (See Table for cooling and heating distribution efficiency)[5]

DE_{cool} = Distribution system efficiency in cooling mode (See Table for cooling distribution efficiency)[5]

DE_{heat} = Distribution system efficiency in heating mode (See Table for heating distribution efficiency)[5]

$CFM_{25\ base}$ = Standard duct leakage test result at 25 Pascal pressure differential of the duct system prior to sealing

$CFM_{25\ ee}$ = Standard duct leakage test result at 25 Pascal pressure differential of the duct system after sealing

CF = Coincidence factor

3.412 = Conversion factor, one watt-hour equals 3.412 BTU

12 = (kBTU/h)/ton of air conditioning capacity

1,000 = Conversion factor, one MMBtu equals 1,000 kBTU

400 = Assumed cooling cfm per ton

17 = Assumed heating cfm per kBtu/hr based on 55F delta T.

Heating Distribution Efficiency[5]

Duct total leakage (%)	Duct system R-value (supply and return)	Assembly[4]	Fast food	Full Service Restaurant[5]	Small Retail	Other[6]
8%	Uninsulated	0.909	0.809	0.816	0.657	0.798

[4] Public buildings that include community centers, libraries, performance and movie theaters, auditoria, police and fire stations, gymnasia, sports arenas, and transportation terminals.
[5] Full service restaurants with full dishwashing facilities
[6] If a building does not align with any of the specified building types, it is recommended to select 'other' as the appropriate category.

15%	Uninsulated	0.879	0.784	0.789	0.624	0.769
20%	Uninsulated	0.858	0.766	0.770	0.602	0.749
25%	Uninsulated	0.835	0.750	0.753	0.582	0.730
30%	Uninsulated	0.816	0.734	0.736	0.563	0.712
8%	R-6	0.951	0.901	0.904	0.792	0.887
15%	R-6	0.917	0.862	0.866	0.742	0.847
20%	R-6	0.895	0.836	0.840	0.710	0.820
25%	R-6	0.871	0.813	0.816	0.680	0.795
30%	R-6	0.849	0.791	0.794	0.652	0.772

Cooling Distribution Efficiency[5]

Duct total leakage (%)	Duct system R-value (supply and return)	Assembly	Fast food	Full Service Restaurant	Small Retail	Other
8%	Uninsulated	0.870	0.853	0.827	0.825	0.844
15%	Uninsulated	0.859	0.843	0.825	0.818	0.836
20%	Uninsulated	0.850	0.836	0.821	0.812	0.830
25%	Uninsulated	0.840	0.827	0.818	0.805	0.823
30%	Uninsulated	0.829	0.818	0.813	0.798	0.815
8%	R-6	0.948	0.950	0.959	0.932	0.947
15%	R-6	0.932	0.933	0.955	0.921	0.935
20%	R-6	0.920	0.921	0.950	0.912	0.926
25%	R-6	0.906	0.908	0.943	0.903	0.915
30%	R-6	0.892	0.895	0.934	0.892	0.903

Thermal Regain Factors[5]

Duct Location	$TRF_{cooling}$	$TRF_{heating}$
Attic	0.10	0.10
Garage	0.10	0.10
Crawl space, Unvented, Uninsulated	0.60	0.60
Crawl space, Unvented, Insulated building floor and crawl space walls	0.60	0.30
Crawl space, Unvented, Insulated floor only	0.30	0.30
Crawl space, Vented, Uninsulated	0.60	0.55
Crawl space, Vented, Insulated building floor and crawl space walls	0.63	0.60
Crawl space, Vented, Insulated floor only	0.30	0.30
Basement, Uninsulated	0.50	0.50
Basement, Insulated walls	0.60	0.60
Under-slab	0.20	0.20

Measure Life:

The measure life is 20 years[1].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1d023	Duct Sealing, Electric	LBES DI	1	0.999	n/a	1	1	1	1	3
EC1a021	Duct Sealing, Electric	LBES Retro	1	0.999	n/a	1	1	1	1	3
EC3d033	Duct Sealing, Electric	Muni DI	1	1	n/a	1	1	1	1	6
EC3d034	Duct Sealing, Gas	Muni DI	1	n/a	1	n/a	n/a	n/a	1	6
EC3d035	Duct Sealing, Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	1	6
EC3d036	Duct Sealing, Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	1	6
EC3a031	Duct Sealing, Electric	Muni Retro	1	1	n/a	1	1	1	1	6
EC3a032	Duct Sealing, Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	1	6
EC3a033	Duct Sealing, Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	1	6
EC3a034	Duct Sealing, Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	1	6
EC2d023	Duct Sealing, Electric	SBES DI	1	0.998	0.956	1.103	0.885	1	1	4
EC2a021	Duct Sealing, Electric	SBES Retro	1	0.998	0.956	1.103	0.885	1	1	4

Energy Load Shape:

For electric measures, see Appendix 1 C&I Load Shapes “Weighted HVAC – Multi-Family”.

For non-electric measures, see Appendix 1 C&I Load Shapes “Non-Electric Measures”.

Revision History:

Revision Number	Date	Description
196	1/1/2024	Updated the test in- test out methodology to be the primary approach to use, only using the distribution efficiency methodology when test in- test out data is unavailable. Also added in the heating and cooling distribution efficiencies and thermal regain factors.
277	1/1/2026	Updated SBES RR's for 2025 impact study results.
368	1/1/2027	Added a description for the constants 400 cfm/tn and 17 cfm/kBtu/h

		Updated the non-electric RR for LBES program based on the reference provided.

Endnotes:

1: National Grid Staff Estimate, 2010. MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee4885c6996f2b5047df743/view?authToken=b5920a744c97cf78def739436054d1c51f2952368b8d549b2b0dd8058398ae505926c40a8ffd7ca1201a9e00dfea3a6944d49070a6907767c9c0e07c10becfffdb38c19699b076 (Last accessed on March 16, 2026)

2: DNV. 2021. "X1931-2 Load Shape and Coincidence Factor Research." https://www.energizect.com/sites/default/files/documents/X1931-2%20PSD%20Research%20Topic_Peak%20CFs%20Results%20Memo-Final%202021-08-10_0.pdf (Last accessed on March 16, 2026)

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on March 16, 2026)

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation Table 6 and 7 https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 16, 2026)

5: New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures Version 13 Appendix H. HVAC Distribution Efficiencies for Albany were used. https://dps.ny.gov/system/files/documents/2026/01/nys-trm-v13_consolidated_clean.pdf (Last accessed on March 16, 2026)

6: Impact factors assumed to be 100% until evaluated

HVAC Furnaces

Measure Code	**COM-HVAC-FUR**
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The installation of a high efficiency natural gas warm air furnace. High efficiency furnaces are better at converting fuel into direct heat and better insulated to reduce heat loss. Federal

appliance regulations require high efficiency fan motors on new residential furnaces which are also used in small commercial buildings. This measure calculates natural gas savings only.

Baseline Efficiency:

The baseline efficiency in an 85% AFUE or 85% Et furnace

High Efficiency:

The high efficiency scenario assumes either a gas-fired furnace equal or higher than 95% AFUE or 97% AFUE; or 95% E_t or 97% E_t

Algorithms for Calculating Primary Energy Impact:

Unit Savings are deemed based on study results. [1]

BC ID	Measure Name	Program	ΔkWh	ΔkW	ΔMMBtu
GC1b014 GC2b014 GC3b014	Furnace, 95%	LBES New SBES New Muni New	0	0	5.7
GC1b015 GC2b015 GC3b015	Furnace, 97%	LBES New SBES New Muni New	0	0	6.7

Measure Life:

The measure life is 18 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1b014	Furnace, 95%	LBES New	1	1	1	n/a	n/a	0	0.16
GC3b014	Furnace, 95%	Muni New	1	1	1	n/a	n/a	0	0.16
GC2b014	Furnace, 95%	SBES New	1	1	0.956	n/a	n/a	0	0.16
GC1b015	Furnace, 97%	LBES New	1	1	1	n/a	n/a	0	0.16
GC3b015	Furnace, 97%	Muni New	1	1	1	n/a	n/a	0	0.16
GC2b015	Furnace, 97%	SBES New	1	1	0.956	n/a	n/a	0	0.16

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

SBES uses a gas realization rate of 95.6% based on 2025 evaluation results. [3] All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

A winter coincidence factor of 16% is utilized. Values pertain to other resource impacts for the EC motors.[4]

Energy Load Shape:

See Appendix 1 "C&I Heating & Cooling".

Revision History:

Revision Number	Date	Revision
265	1/1/2026	Updated SBES RR's based on 2025 impact study

Endnotes:

1: DNV-GL, 2015. Recalculation of Prescriptive Program Gas Furnace Savings Using New Baseline. Prepared for National Grid, Massachusetts.

2: ASHRAE Applications Handbook, 2003; Page 36.

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: Massachusetts TRM 2019 Plan-Year Report Version, 2020. Measure 3.42: HVAC Combo Furnace, Gas, Commercial Page 510

HVAC Heat and Hot Water Combo Systems

Measure Code	COM-HVAC-HWCS
Markets	Commercial
ProgramTypes	Retrofit, Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Combo Condensing Furnace / Water Heater: Installation of a combination furnace/water heater.

Combo Condensing Boiler / Water Heater: This measure promotes the installation of a combined high efficiency boiler and water heating unit. Combined boiler and water heating systems are more efficient than separate systems because they eliminate the standby heat losses of an additional tank.

Baseline Efficiency:

Combo Condensing Furnace / Water Heater: It is assumed that the baseline is an 85% AFUE furnace and a separate high draw gas fired storage water heater with an efficiency rating of 0.63 UEF[1].

Combo Condensing Boiler / Water Heater: The baseline efficiency case is a standard efficiency gas-fired storage tank hot water heater with a separate 82% AFUE boiler for space heating purposes.

High Efficiency:

Combo Condensing Furnace / Water Heater: A new combination 97% AFUE furnace and 0.90 UEF tankless water heater.

Combo Condensing Boiler / Water Heater: The high efficiency case is either a condensing, integrated water heater/boiler with a boiler AFUE of >=90% or AFUE>=95% and water heater efficiency of 94%.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	ΔMMBtu/unit
GC1b012 GC2b012 GC3b012	Combo Condensing Furnace/Water Heater, Gas, 97% AFUE	15.12
GC1b011 GC2b011 GC3b011	Combo Condensing Boiler/Water Heater, Gas, 95% AFUE	37.2
GC1b035 GC2b035 GC3b035	Combo Condensing Boiler/Water Heater, Gas, 90% AFUE	37.2

Source Algorithms for Deemed Savings Values:

Combo Boiler/Water Heater:

$$\Delta MMBtu = \Delta MMBtu_{SH} + \Delta MMBtu_{DHW}$$

$$\Delta MMBtu_{SH} = units \times \frac{kBtu/h_{in}}{unit} \times \left(\frac{Eff_{ee}}{Eff_{baseline}} - 1\right) \times \frac{EFLH_{heating}}{1{,}000}$$

$$\Delta MMBtu_{SH} = units \times \left[\frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{1{,}000{,}000} \times \left(\frac{1}{E_{t,baseline}} - \frac{1}{E_{t,ee}}\right) + \frac{UA_{baseline}}{E_{t,baseline}} \times \frac{(T_{set} - T_{amb})}{1{,}000{,}000} \times 8760\right]$$

Parameter	Description	Value	Unit	Ref
$\Delta MMBtu_{SH}$	Annual space heating savings associated with installation of a high-efficiency combi-boiler	Calculated	Mmbtu	
$\Delta MMBtu_{DHW}$	Annual domestic hot water savings associated with installation of a high	Calculated	Mmbtu	

Parameter	Description	Value	Unit	Ref
	efficiency combi-boiler			
Units	number of units installed under the program		Each	
$kBTU/h_{in}$	Space heating fuel input rating	150	kBTU/hin	3
Effbaseline	Boiler space heating baseline condition	85%	AFUE	4
Eff_{ee}	Boiler space heating energy efficiency condition	89%	AFUE	17
$E_{t,baseline}$	Water heating baseline thermal efficiency,	80%	Et	5
$E_{t,ee}$	Water heating efficient equipment thermal efficiency	94%	Et	High efficiency requirement
$EFLH_{heating}$	Heating equivalent full-load hours	1,416	Hours	6
GPD	Gallons per day	154	Gallons/day	7
T_{main}	Average temperature of supply water temperature in water main	55.74	°F	8
T_{amb}	Average surrounding ambient air temperature	70	°F	
T_{set}	Average water heater set point temperature	140	°F	9
$UA_{baseline}$	Overall heat loss coefficient (BTU/h-°F) baseline	15.3	Btu/h-°F	10
8.33	Energy required (BTU) to heat one gallon of water by one-degree Fahrenheit	8.33	BTU	
365	Days in one year	365	Days	
1,000	Conversion factor, one MMBtu equals 1,000 kBTU	1,000		
8,760	Hours per year	8,760	Hours	
1,000,000	Conversion factor, one MMBtu equals 1,000,000 Btu	1,000,000		

Combo Furnace/Water Heater:

$$\Delta MMBtu = \Delta MMBtu_{SH} + \Delta MMBtu_{DHW}$$

$$\Delta MMBtu_{SH} = units \times Heating\ Load_{Furnace} \times \left(\frac{1}{AFUE_{baseline}} - \frac{1}{AFUE_{ee}}\right) \times \frac{1}{10}$$

$$\Delta MMBtu_{DHW} = units \times Heating\ Load_{Water\ Heater} \times \left(\frac{1}{UEF_{baseline}} - \frac{1}{UEF_{ee}}\right) \times \frac{1}{10}$$

Where:

Parameter	Description	Value	Unit	Ref
$\Delta MMBtu_{SH}$	Annual space heating savings associated with installation of a high-efficiency combi-furnace	Calculated	Mmbtu	
$\Delta MMBtu_{DHW}$	Annual domestic hot water savings associated with installation of a high efficiency combi-furnace	Calculated	Mmbtu	
Units	number of units installed under the program		Each	
$Heating\ Load_{Furnace}$	Furnace heating load	584	Therms	11
$Heating\ Load_{Water\ Heater}$	Water heating load	139	Therms	12
$AFUE_{baseline}$	Furnace space heating baseline condition	85%	AFUE	2
$AFUE_{ee}$	Furnace space heating energy efficiency condition	97%	AFUE	High efficiency requirement
$UEF_{baseline}$	Water heating baseline uniform energy factor	0.63	UEF	**Error! Bookmark not defined.**
UEF_{ee}	Water heating efficient equipment uniform energy factor	0.9	UEF	High efficiency requirement
10	Conversion factor, one mmbtu equals 10 therms	10		

Measure Life:

Combo Condensing Furnace / Water Heater: The measure life is 18 years[13].

Combo Condensing Boiler/Water Heater: The measure life is 20 years[14].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GC1b012	Combo Condensing Furnace/Water Heater, Gas	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	15
GC2b012	Combo Condensing Furnace/Water Heater, Gas	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	16
GC3b012	Combo Condensing Furnace/Water Heater, Gas	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC1b011	Combo Condensing Boiler/Water Heater, Gas	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC2b011	Combo Condensing Boiler/Water Heater, Gas	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC3b011	Combo Condensing Boiler/Water Heater, Gas	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**

Energy Load Shape:

See Appendix 1.2 Commercial, C&I Load Shapes Table- “Heating and Cooling.

Revision History:

Revision Number	Date	Description
48	1/14/2022	Update baseline. Baseline boiler should be 85% consistent with treatment elsewhere in the TRM. 30.5 MMBtu/unit savings are OK, consistent with MA assumptions:
174	7/1/2023	Updated endnote reference links
283	1/1/2026	Updated RR’s for SBES according to 2025 impact study results.
369	1/1/2027	Calculated deemed savings for combo boiler and combo furnace based on the savings algorithm and references provided.

Endnotes:

1: Values per Residential baseline assumptions informed by negotiations with Residential evaluation stakeholders.

2: Weighted boiler input capacity based on Eversource program data.

3: DNV GL, NMR Group (2017). Gas Boiler Market Characterization https://ma-eeac.org/wp-content/uploads/Gas-Boiler-Market-Characterization-Study-Phase-II-Final-Report.pdf (Last accessed on March 26, 2026)

4: Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Compliance Dates. March 6, 2026; Energy Conservation standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters: Final Rule, Federal Register, 75 FR 20112, April 16, 2010. (Last accessed on March 26, 2026)

5: KEMA (2013). Impact Evaluation of 2011 Prescriptive Gas Measures. Prepared for Massachusetts Energy Efficiency Program Administrators; Page 1-2. https://ma-eeac.org/wp-content/uploads/Impact-Evaluation-of-2011-Prescription-Gas-Measures-6.27.13.pdf (Last accessed on March 26, 2026)

6: DNV GL, Inc (2019) Impact Evaluation of Commercial Water Heaters: Baseline Adjustment Memo Including Consumption Estimates. Table 3. Weighted using 2018 Commercial Buildings Energy Consumption Survey.

7: 2022-05 Final Determination Technical Support Document Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Commercial Prerinse Spray Valves. Table 7.4.1 Weighted Average Annual Main Water Temperature by Census Division and Building Type (Non-education Buildings in New England.) https://downloads.regulations.gov/EERE-2019-BT-STD-0034-0020/content.pdf (Last accessed on March 26, 2026)

8: OSHA notes that water heater temperatures below 140° F may lead to Legionella bacterial growth https://www.osha.gov/legionnaires-disease/control-prevention (Last accessed on March 26, 2026)

9: AHRI Commercial Water Heaters - Average stand by loss for 80 gallon tank at 70 degrees ambient temperature

10: The Cadmus Group (2015). High Efficiency Heating Equipment Impact Evaluation, Table 15. https://neep.org/sites/default/files/resources/High-Efficiency-Heating-Equipment-Impact-Evaluation-Final-Report.pdf (Last accessed on March 26, 2026)

11: Navigant Consulting (2018). Water Heater, Boiler, and Furnace Cost Study, Table 14 https://ma-eeac.org/wp-content/uploads/RES19_Assembled_Report_2018-09-27.pdf (Last accessed on March 26, 2026)

12: Environmental Protection Agency, 2009. Lifecycle Cost Estimate for Energy Star Furnace. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488606996f217b17df75b/view?authToken=aac3217ffb52825b94469ebe6c4de1a0dd05e2633a948c21c2f7234717da20ab09ce09aba4f837dbedd1b7550d

e1250f72ea734e9b32140d69e581516ecad846a3596d19617b58 (Last accessed on March 26, 2026)

13: Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks, GDS Associates, April 2009. https://ma-eeac.org/wp-content/uploads/5_Natural-Gas-EE-Potenial-in-MA.pdf (Last accessed on March 26, 2026)

14: All LBES and Muni assume an ISR and RRs of 100% unless an evaluation finds otherwise.

15: SBES ISRs and RRs are applied per: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 26, 2026)

16: Condensing Boiler Study (2026), Ridgeline Energy Analytics, Table 1.

HVAC Heat Pump Systems

Measure Code	COM-HVAC-HPS
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

This measure includes the installation of single package, ducted split system and ductless mini-split, ground source and water source heat pumps to serve the space heating and space cooling loads in a C&I facility. “Water source” refers to systems that use ground or lake water rather than a boiler as a loop heat source. The savings for this measure are realized through the increased nameplate efficiency between the baseline and installed equipment.

Baseline Efficiency:

For New Construction, the baseline for air source heat pumps is based on a code compliant heat pump unit of the same type as the high efficiency unit, modified for industry standard practice (ISP) as per the 2023 NH Baseline Practices Report by NMR[1]. If the efficiency value is higher in the code than the values from Federal Standards 10CFR Part 431.97[2] are used. The baseline efficiency values for water source and ground source heat pumps are based on the 2018 IECC[3]. Details regarding heat pump baseline efficiencies based on capacity and type are provided in a tabular format along with the savings algorithms.

For Lost Opportunity and Replace on Failure, the baseline is a code compliant heat pump unit of the same type as the high efficiency unit. Lost opportunity baseline heating and cooling efficiencies for air cooled heat pumps are from are from Table 1 to paragraph (b), Table 19 to Paragraph (i) and Table 5 to paragraph (b), and for water source heat pumps are from Table 6 to paragraph (c) of Federal Standards 10CFR Part 431.97[2]. Baseline heating and cooling efficiencies values for ground source heat pumps reference 2018 IECC[3].

All EER values have been converted to EER2 using the CEE crosswalk[13].

New Construction Baseline Values:

Heat Pump Type	Cooling Capacity Range	Baseline Cooling Efficiency	Baseline Heating Efficiency	Baseline EER for kW savings	Ref
Air Source heat pump (split system / DMSHP)	≤65,000 Btu/h	14.30 SEER2	7.50 HSPF2	11.93 EER2	2
Air source heat pump (single package)	≤65,000 Btu/h	13.56 SEER2	6.95 HSPF2	11.42 EER2	1, 2
Air source heat pump (electric resistance heating or no heating)	≥ 65,000 and < 135,000	14.1 IEER	3.4 COP	11.1 EER	1, 2
Air source heat pump (all other types of heating)	≥ 65,000 and < 135,000	13.9 IEER	3.4 COP	10.9 EER	1, 2
Air source heat pump (electric resistance heating or no heating)	≥ 135,000 and < 240,000	13.5 IEER	3.3 COP	10.7 EER	1, 2
Air source heat pump (all other types of heating)	≥ 135,000 and < 240,000	13.3 IEER	3.3 COP	10.5 EER	1, 2
Air source heat pump (electric resistance heating or no heating)	≥240,000 Btu/h < 760,000 Btu/h	12.5 IEER	3.3 COP	9.6 EER	1, 2
Air source heat pump (all other types of heating)	≥240,000 Btu/h < 760,000 Btu/h	12.3 IEER	3.3 COP	9.4 EER	1, 2
Water Source heat pump (water to air - water loop)	<17,000 Btu/h	12.20 EER	4.3 COP	12.20 EER	3
Water Source heat pump (water to air - water loop)	≥17,000 Btu/h < 65,000 Btu/h	13.00 EER	4.3 COP	13.00 EER	3
Water Source heat pump (water to air - water loop)	≥65,000 Btu/h < 135,000 Btu/h	13.00 EER	4.3 COP	13.00 EER	3
Ground Source (open loop - water to air ground water)	< 135,000 Btu/h	18.00 EER	3.7 COP	18.00 EER	3
Ground Source (closed loop - brine to air ground loop)	< 135,000 Btu/h	14.10 EER	3.2 COP	14.10 EER	3

Lost Opportunity Baseline Values:

Heat Pump Type	Cooling Capacity Range	Baseline Cooling Efficiency	Baseline Heating Efficiency	Baseline EER for kW savings	Ref
Air Source heat pump (split system / DMSHP)	≤65,000 Btu/h	14.3 SEER2	7.5 HSPF2	11.93 EER2	2
Air source heat pump (single package)	≤65,000 Btu/h	13.4 SEER2	6.7 HSPF2	11.42 EER2	2
Air source heat pump (electric resistance heating or no heating)	≥ 65,000 and < 135,000	14.1 IEER	3.4 COP	11.00 EER	2
Air source heat pump (all other types of heating)	≥ 65,000 and < 135,000	13.9 IEER	3.4 COP	10.80 EER	2
Air source heat pump (electric resistance heating or no heating)	≥ 135,000 and < 240,000	13.5 IEER	3.3 COP	10.60 EER	2
Air source heat pump (all other types of heating)	≥ 135,000 and < 240,000	13.3 IEER	3.3 COP	10.40 EER	2
Air source heat pump (electric resistance heating or no heating)	≥240,000 Btu/h < 760,000 Btu/h	12.5 IEER	3.2 COP	9.50 EER	2
Air source heat pump (all other types of heating)	≥240,000 Btu/h < 760,000 Btu/h	12.3 IEER	3.2 COP	9.30 EER	2
Water Source heat pump (water to air - water loop)	<17,000 Btu/h	12.20 EER	4.3 COP	12.20 EER	2
Water Source heat pump (water to air - water loop)	≥17,000 Btu/h < 65,000 Btu/h	13.00 EER	4.3 COP	13.00 EER	2
Water Source heat pump (water to air - water loop)	≥65,000 Btu/h < 135,000 Btu/h	13.00 EER	4.3 COP	13.00 EER	2
Ground Source (open loop - water to air ground water)	< 135,000 Btu/h	18.00 EER	3.7 COP	18.00 EER	3
Ground Source (closed loop - brine to air ground loop)	< 135,000 Btu/h	14.10 EER	3.2 COP	14.10 EER	3

High Efficiency:

The high efficiency (or energy efficient) case is the site-specific heat pump unit. The energy efficient heat pump unit is assumed to be of the same type as the baseline unit.

Algorithms for Calculating Primary Energy Impact:

The savings for this measure are attributable to the increase in nameplate efficiency between the baseline and installed units.

Electric Demand Savings:

$$\Delta kW = \max(\Delta kW_{cool} \; or \; \Delta kW_{heat})$$

$$\Delta kW_{cool} = Cap_{cool} \times \left(\frac{1}{EER2_{Base}} - \frac{1}{EER2_{ee}}\right)$$

If unit is a standard air source or mini split heat pump:

$$\Delta kW_{heat} = 0$$

If unit is a cold climate air source or mini split heat pump:

$$\Delta kW_{heat} = Cap_{heat,cc} \times \left(1 - \frac{1}{COP_{ee,cc}}\right) \times \frac{1}{3.412}$$

$Cap_{heat,cc} = Cap_{cool} \times 1.0$ if unit is a cold climate air source or mini split heat pump

$Cap_{heat,cc} = Cap_{cool} \times 0.9$ if unit is a non-cold climate air source or mini split heat pump

If unit is a ground source or water source heat pump

$$\Delta kW_{heat} = Cap_{heat} \times \left(\frac{1}{COP_{Base}} - \frac{1}{COP_{ee}}\right) \times \frac{1}{3.412}$$

$Cap_{heat} = Cap_{cool} \times (COP_{EE} \times 3.412)/EER_{EE}$ if unit is a ground source or water source heat pump

Electric Energy Savings:

$$\Delta kWh = \Delta kWh_{cool} + \Delta kWh_{heat}$$

If unit is an air source and ductless mini split heat pumps < 65 kBtu/hr cooling capacity:

$$\Delta kWh_{cool} = Cap_{cool} \times \left(\frac{1}{SEER2_{Base}} - \frac{1}{SEER2_{ee}}\right) \times EFLH_{cool}$$

$$\Delta kWh_{heat} = Cap_{heat} \times \left(\frac{1}{HSPF2_{Base}} - \frac{1}{HSPF2_{ee}}\right) \times EFLH_{heat}$$

For air source heat pumps >= 65 kBtu/hr cooling capacity:

$$\Delta kWh_{cool} = Cap_{cool} \times \left(\frac{1}{IEER_{Base}} - \frac{1}{IEER_{ee}}\right) \times EFLH_{cool}$$

$$\Delta kWh_{heat} = Cap_{heat} \times \left(\frac{1}{COP_{Base}} - \frac{1}{COP_{ee}}\right) \times \frac{EFLH_{heat}}{3.412}$$

If unit is a water source or ground source heat pump:

$$\Delta kWh_{cool} = Cap_{cool} \times \left(\frac{1}{EER_{Base}} - \frac{1}{EER_{ee}}\right) \times EFLH_{cool}$$

$$\Delta kWh_{heat} = Cap_{heat} \times \left(\frac{1}{COP_{Base}} - \frac{1}{COP_{ee}}\right) \times \frac{EFLH_{heat}}{3.412}$$

Where:

ΔkW = Gross annual demand savings for heat pump unit

ΔkW_{cool} = Gross annual cooling demand savings for heat pump unit

ΔkW_{heat} = Gross annual heating demand savings for heat pump unit. For non cold-climate heat pumps OR for facilities that employ supplemental heating sources (such as fossil fuel or electric resistance heat), $\Delta kW_{heat} = 0$

Cap_{cool} = Cooling capacity (in kBtu/h) of the energy efficient heat pump unit, from equipment specifications

Cap_{heat} = Heating capacity (in kBtu/h) of the energy efficient pump unit, from equipment specifications. Use given equations to convert from cooling capacity value if standard equipment literature does not provide this value

EER_{BASE} = Energy Efficiency Ratio of the baseline heat pump equipment

EER_{EE}= Energy Efficiency Ratio of the energy efficient heat pump unit, from equipment specifications

COP_{BASE} = Heating Coefficient of Performance of baseline heat pump equipment

COP_{EE} = Heating Coefficient of Performance of energy efficient heat pump unit, from equipment specifications

ΔkWh_{cool} = Gross annual cooling savings for heat pump unit

ΔkWh_{heat} = Gross annual heating savings for heat pump unit

$SEER2_{BASE}$ = Seasonal Energy Efficiency Ratio of baseline heat pump equipment

$SEER2_{EE}$ = Seasonal Energy Efficiency Ratio of energy efficient heat pump unit, from equipment specifications

$IEER_{BASE}$ = Integrated Energy Efficiency Ratio of the baseline heat pump equipment

$IEER_{EE}$ = Integrated Energy Efficiency Ratio of the energy efficient heat pump unit, from equipment specifications

$HSPF2_{BASE}$ = Heating Seasonal Performance Factor of baseline heat pump equipment

$HSPF2_{EE}$ = Heating Seasonal Performance Factor of energy efficient heat pump unit, from equipment specifications

$EFLH_{cool}$ = Equivalent Full Load Hours for cooling. See Appendix 2 for inputs.

$EFLH_{heat}$ = Equivalent Full Load Hours for heating. See Appendix 2 for inputs.

0.9 = Conversion factor[12] to convert cooling capacity to heating capacity for non-cold climate, air source or mini split heat pump units not meeting standards similar to NEEP's cold climate air source heat pump (ccASHP) product list. The conversion factor for ccASHPs meeting standards similar to NEEP's is 1.0.

Measure Life:

The measure life is listed below by measure. Due to limitations with the avoided cost calculations in the Benefit/Cost Models, where measure lives are greater than 25 years, the models use a 25-year measure life for ground source heat pumps.

Measure Name	Measure Life
Air Source Heat Pump	20[5]
Ductless Mini Split Heat Pump	20[5]
Water Source Heat Pump	12[6]
Ground Source Heat Pump	25[7]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1d024	Ductless Mini Split Heat Pump	LBES DI	1	0.999	1	1	1	0.342	0	8, 10
EC1c003	Midstream DMSHP Systems	LBES Mid	1	1	1	1	1	0.342	0	10
EC1c006	Midstream Heat Pump Systems	LBES Mid	1	1	1	1	1	0.342	0	10
EC1c009	Midstream Water Source Heat Pump Systems	LBES Mid	1	1	1	1	1	0.342	0.342	10
EC1b050	Water Source Heat Pump	LBES New	1	0.999	1	1	1	0.342	0.342	8, 10
EC1b035	Ground Source Heat Pump	LBES New	1	0.999	1	1	1	0.342	0.342	8, 10
EC1a022	Ductless Mini Split Heat Pump	LBES Retro	1	0.999	1	1	1	0.342	0	8, 10
EC3d037	Ductless Mini Split Heat Pump	Muni DI	1	1	1	1	1	0.342	0	10
EC3b081	Water Source Heat Pump	Muni New	1	1	1	1	1	0.342	0.342	10
EC3b056	Ground Source Heat Pump	Muni New	1	1	1	1	1	0.342	0.342	10
EC3a035	Ductless Mini Split Heat Pump	Muni Retro	1	1	1	1	1	0.342	0	10
EC2d024	Ductless Mini Split Heat Pump	SBES DI	1	0.998	1	1.103	0.885	0.342	0	9, 10
EC2c003	Midstream DMSHP Systems	SBES Mid	1	0.998	1	1.103	0.885	0.342	0	9, 10
EC2c006	Midstream Heat Pump Systems	SBES Mid	1	0.998	1	1.103	0.885	0.342	0	9, 10
EC2c009	Midstream Water Source Heat Pump Systems	SBES Mid	1	0.998	1	1.103	0.885	0.342	0.342	9, 10
EC2b050	Water Source Heat Pump	SBES New	1	0.998	1	1.103	0.885	0.342	0.342	9, 10
EC2b035	Ground Source Heat Pump	SBES New	1	0.998	1	1.103	0.885	0.342	0.342	9, 10

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC2a022	Ductless Mini Split Heat Pump	SBES Retro	1	0.998	1	1.103	0.885	0.342	0	9, 10

Energy Load Shape:

See Appendix 1.2 Commercial – "Heating and Cooling"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):[11]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	2021 NTG
EC1c003 EC2c003	Midstream DMSHP Systems	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.860
EC1c006 EC2c006	Midstream Heat Pump Systems	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.860
EC1c009 EC2c009	Midstream Water Source Heat Pump Systems	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.860

Revision History:

Revision Number	Date	Revision
55	1/14/2022	Updated SEER to EER conversion factor
72	3/1/2022	Added EFLH values
215	1/1/2025	Updated baseline to reflect 2023 NMR NH Baseline Evaluation report recommendation to update the baseline to account for the baseline heat pump efficiency being 1% better for cooling and 3% better for heating, comparing to IECC 2015 Table C403.2.3(2). Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps.
243	1/1/2026	Update measure lives for air source heat pumps. Updated baseline values for heat pumps <65,000 btu/h per 2025 federal code. Added baseline EER values for calculation of demand savings. Updates SBES RR's per new 2025 SBES impact memo.
370	1/1/2027	Added a table for new construction baseline efficiency values.
371	1/1/2027	Updated the baseline lost opportunity and new construction efficiency values as follows: baseline efficiency for lost opportunity uses federal code values for ASHP and WSHP, and IECC values for GSHP. For new construction, baseline efficiency for ASHP is the maximum of the federal code and ISP efficiency values, while GSHP and WSHP use IECC values.
372	1/1/2027	Updated the conversion factors for calculating heating capacity from cooling capacity for ASHPs.

Endnotes:

1: NMR Group and DNV, 2023. New Hampshire Baseline Practices Final Report, Table 32.

2: Apply an adjustment of 1% to cooling efficiency and 3% to heating efficiency. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/27-nh-baseline-practices-report.pdf (Last accessed on March 25, 2026)

3: Title 10 Code of Federal Regulations Chapter II Subchapter D Part 431.97. https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-F/subject-group-ECFR4287065a76436ba/section-431.97 (Last accessed on March 25, 2026)

4: 2018 IECC Table C403.3.2(2) MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS. https://codes.iccsafe.org/s/iecc2018/chapter-4-ce-commercial-energy-efficiency/IECC2018-CE-Ch04-SecC403.3.2 (Last accessed on March 25, 2026)

5: US DOE, 2010. Building America House Simulation Protocols. https://docs.nrel.gov/docs/fy11osti/49246.pdf (Last accessed on March 25, 2026)

6: DNV, 2024. Commercial HVAC and Water Heating Measure Effective Useful Life Study Final Report https://pda.energydataweb.com/api/view/3980/CPUC%20Group%20A%202023%20Commercial%20HVAC%20and%20Water%20Heating%20EUL%20Study%20Final%20Report.pdf (Last accessed on March 25, 2026)

7: DNV GL (2018). Expected Useful Life (EUL) Estimation for Air-Conditioning Equipment from Current Age Distribution Memo. https://ma-eeac.org/wp-content/uploads/Final-memo-on-P73-Track-D-EUL-estimation-results-to-date-v2.pdf (Last accessed on March 25, 2026)

8: GDS Associates Inc., Measure Life Report, Residential and Commercial Industrial Lighting and HVAC Measures, June 2007. https://www.energizect.com/sites/default/files/documents/Measure%20Life%20Report%202007.pdf (Last accessed on March 25, 2026)

9: DNV, 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Impact Evaluation report. Table 3. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on March 25, 2026)

10: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation. Table 7. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 25, 2026)

11: Coincidence Factors are from 2011 NEEP HVAC Loadshape Study Table 0-5 and Table 0-6 (ISO_NE on Peak for NE-North) https://neep.org/sites/default/files/resources/NEEP_HVAC_Load_Shape_Report_Final_August2_0.pdf (Last accessed on March 25, 2026)

12: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. Table 14. https://ma-eeac.org/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf (Last accessed on March 25, 2026)

13: Conversion factor is based on internal ERS analysis of Mass Save and NEEP ccASHP product data.

14: CEE 2023 Converting between Appendices M and M1, https://cee1.my.salesforce.com/sfc/p/#1U0000011m3T/a/7V000000ZkUZ/zsxzP1wnu3GOKk3A_rtXHyIIow6n.fFdRFzUZG2SA94 (Last accessed on March 25, 2026)

HVAC High Efficiency Chiller

Measure Code	COM-HVAC-HEC
Markets	Commercial
Program Types	Lost Opportunity
Categories	Heating, Ventilation and Air Conditioning

Measure Description:

This measure promotes the installation of efficient water-cooled and air-cooled water chilling packages for comfort cooling applications. Eligible chillers include air-cooled, water-cooled rotary screw and scroll, and water-cooled centrifugal chillers for single chiller systems or for the lead chiller only in multi-chiller systems.

There are two paths for chillers, Path A is intended for applications where significant operating time is expected at full load. Path B is intended for applications where significant operating time is expected at part-load. HVAC chiller installations have variable loads therefore savings will be modeled using the path B baseline.

Baseline Efficiency:

The baseline efficiency case assumes compliance with the efficiency requirements as mandated by New Hampshire State Building Code. Energy efficiency must be met via compliance with the International Energy Conservation Code (IECC) 2018 Table C403.3.2[1].

The table below details the specific efficiency requirements by equipment type and capacity. For water cooled ≤300 tons, positive displacement is the baseline. For > 300 tons, centrifugal is the baseline.

Chiller - Minimum Efficiency Requirements (As of 1/1/2015)[1]:

Size Category (Tons)	Units	Path A		Path B	
		Full Load	IPLV	Full Load	IPLV
Air-cooled chillers					
< 150	EER	10.100	13.700	9.700	15.800
≥ 150	EER	10.100	14.000	9.700	16.100
Water cooled, electrically operated, positive displacement (rotary screw and scroll)					
< 75	kW/ton	0.750	0.600	0.780	0.500
≥ 75 and < 150	kW/ton	0.720	0.560	0.750	0.490
≥ 150 and < 300	kW/ton	0.660	0.540	0.680	0.440
≥ 300 and <600	kW/ton	0.610	0.520	0.625	0.410
≥ 600	kW/ton	0.560	0.500	0.585	0.380

Size Category (Tons)	Units	Path A		Path B	
		Full Load	IPLV	Full Load	IPLV
Water cooled, electrically operated, centrifugal					
< 150	kW/ton	0.610	0.550	0.695	0.440
≥ 150 and < 300	kW/ton	0.610	0.550	0.635	0.400
≥ 300 and < 400	kW/ton	0.560	0.520	0.595	0.390
≥ 400 and < 600	kW/ton	0.560	0.500	0.585	0.380
≥ 600	kW/ton	0.560	0.500	0.585	0.380

High Efficiency:

The high efficiency scenario assumes water chilling packages that exceed the efficiency levels required by New Hampshire State Building Code and meet the minimum efficiency requirements as stated in the NHSaves New Construction HVAC energy efficiency rebate forms[8].

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	ΔkWh	ΔkW
EC1b052 EC3b083 EC2b052	Chillers – FL used	N/A	Calculated
EC1b053 EC3b084 EC2b053	Chillers – IPLV used	Calculated	N/A

Energy and demand savings are calculated using the algorithms and inputs below. Please note that consistent efficiency types (FL or IPLV) must be used between the baseline and high efficiency cases. It is required that IPLV be used for kWh savings and FL efficiency be used for kW savings.

All Chillers:[2]

If efficiency is given in kW/ton

$$\Delta kWh = Tons \times \left(\frac{kW}{ton_{Base,IPLV}} - \frac{kW}{ton_{EE,IPLV}}\right) \times Cooling\ EFLH$$

$$\Delta kW = Tons \times \left(\frac{kW}{ton_{Base,FL}} - \frac{kW}{ton_{EE,FL}}\right)$$

If efficiency is given in EER

$$\Delta kWh = Tons \times \left(\frac{12}{EER_{Base,IPLV}} - \frac{12}{EER_{EE,IPLV}}\right) \times Cooling\ EFLH$$

$$\Delta kW = Tons \times \left(\frac{12}{EER_{Base,FL}} - \frac{12}{EER_{EE,FL}}\right)$$

Calculation Parameters Table:

Variable	Description	Value	Units	Ref
Tons	Rated capacity of the cooling equipment		Tons	
Cooling EFLH	Cooling EFLH	Use Large Commercial Cooling Full Load Hours from Appendix 2.* If building, HVAC type and climate zone unknown, use 823[3].	Full Load Hours	
$\frac{kW}{ton_{Base,IPLV}}$	Energy efficiency rating of the baseline equipment at IPLV		kW/ton**	
$\frac{kW}{ton_{Base,FL}}$	Energy efficiency rating of the baseline equipment at FL		kW/ton**	
$\frac{kW}{ton_{EE,IPLV}}$	Energy efficiency rating of the efficient equipment at IPLV		kW/ton**	
$\frac{kW}{ton_{EE,FL}}$	Energy efficiency rating of the efficient equipment at FL		kW/ton**	
$EER_{Base,IPLV}$	Energy efficiency rating of the baseline equipment at IPLV		Btu/watt	
$EER_{Base,FL}$	Energy efficiency rating of the baseline equipment at FL		Btu/watt	
$EER_{EE,IPLV}$	Energy efficiency rating of the efficient equipment at IPLV		Btu/watt	
$EER_{EE,FL}$	Energy efficiency rating of the efficient equipment at FL		Btu/watt	

*Note cooling EFLH may not be appropriate to use for process cooling applications with highly variable loads. Depending on how variable the process load is, a custom approach may be needed.**For Air-cooled units, use the following equation to convert EER to kW/ton:

$$kW/_{ton} = {}^{12}/_{EER}$$

Measure Life:

The measure life is 23 years[4].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1b052	Chillers – FL used	LBES New	1	0.999	n/a	1	1	0.86	0.1	5, 7
EC1b053	Chillers – IPLV used	LBES New	1	0.999	n/a	1	1	0.49	0.06	5, 7
EC3b084	Chillers – IPLV used	Muni New	1	1	n/a	1	1	0.49	0.06	7
EC3b083	Chillers – FL used	Muni New	1	1	n/a	1	1	0.86	0.1	7
EC2b053	Chillers – IPLV used	SBES New	1	0.998	n/a	1.103	0.885	0.49	0.06	6, 7
EC2b052	Chillers – FL used	SBES New	1	0.998	n/a	1.103	0.885	0.86	0.1	6, 7

Energy Load Shape:

See Appendix 1.2 C&I Load Shapes "C&I Electric Chiller (Combined)".

Revision History:

Revision Number	Issue Date	Description
51	1/14/2022	Added EFLH based on 2015 DNV GL study. EFLH value was previously missing.
52	1/14/2022	Fixed error under baseline efficiency, high efficiency, and references section. Document originally labelled the referenced code as "Massachusetts" building code, rather than "New Hampshire". The referenced code, IECC 2015 Energy Conservation, and the values listed were correct but were incorrectly labelled with "Massachusetts". Additionally, the reference to the code was updated as it was not included originally.
99	12/1/2022	Updated methodology to align with latest study, Kema, 2015. Impact of Prescriptive Chiller and Compressed Air Installations. Note, since NH RR is applied under impact factors section, the RR adjustment was removed from the algorithm. Also updated equation to use EFLH from appendix 2, where building type is available. Added conversion factor for kw/ton to EER
244	1/1/2026	Updated cooling equivalent full load hours when building, HVAC and climate zone are unknown based on Commercial Baseline Study weights.
373	1/1/2027	Updated measure description.

Endnotes:

1: 2018 International Energy Conservation Code (IECC) Table C403.3.2(7) https://codes.iccsafe.org/content/IECC2018P5/chapter-4-ce-commercial-energy-efficiency#IECC2018P5_CE_Ch04_SecC403.3 (Last accessed on March 14, 2026)

2: DNV, 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Section 3.7 Recommendations: https://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf (Last accessed on March 14, 2026)

3: Weighted average of cooling full-load hours by building type, climate zone and HVAC type. Weights developed from NH Commercial Baseline Study. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-

documents/sonh/nh_commercial_baseline_final.pdf (Last accessed on March 14, 2026). See Weighting Calculations for Chiller Measure.xlsx

4: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007. https://www.energizect.com/sites/default/files/documents/Measure%20Life%20Report%202007.pdf (Last accessed on March 14, 2026)

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on March 14, 2026)

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation Table 27, Table 28 and Table 29. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 14, 2026)

7: DNV, 2015. Impact Evaluation of Prescriptive Chiller and Compressed Air Installations Table 3-21 and Appendix C https://ma-eeac.org/wp-content/uploads/MA30-Prescriptive-Chiller-and-CAIR-Report_FINAL_151026.pdf (Last accessed on March 14, 2026)

8: NHSave Businesses and Municipalities https://nhsaves.com/businesses-towns/electric/

HVAC Hotel Occupancy Sensor

Measure Code	COM-HVAC-HOS
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The measure is the installation of hotel occupancy sensors (HOS) to control packaged terminal AC units (PTACs) with electric heat, heat pump units and/or fan coil units in hotels that operate all 12 months of the year.

Baseline Efficiency:

The baseline efficiency case assumes the equipment has no occupancy-based controls.

High Efficiency:

The high efficiency case is the installation of controls that include (a) occupancy sensors, (b) window/door switches for rooms that have operable window or patio doors, and (c) set back to 65°F in the heating mode and set forward to 78°F in the cooling mode when occupancy detector is in the unoccupied mode. Sensors controlled by a front desk system are not eligible.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on evaluation results[1]. Deemed savings were calculated by averaging kWh and kW values for self-contained package systems and DX cooling with HW heating coil given in the reference.

BC ID	Measure Name	Program	ΔkWh	ΔkW
EC1a031 EC1d031 EC2a031 EC2d031 EC3a050 EC3d050	Hotel Occupancy Sensor	LBES Retro LBES DI SBES Retro SBES DI Muni Retrofit Muni DI	474	0.105

Measure Life:

The measure life is 9 years[2]. Hotel occupancy sensory measure life assumed to be the same as that for occupancy-based lighting controls.

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1d031	Hotel Occupancy Sensor	LBES DI	1	0.999	n/a	1	1	0.82	0.05	4, 5
EC1a031	Hotel Occupancy Sensor	LBES Retro	1	0.999	n/a	1	1	0.82	0.05	4, 5
EC3d050	Hotel Occupancy Sensor	Muni DI	1	1	n/a	1	1	0.82	0.05	4
EC3a050	Hotel Occupancy Sensor	Muni Retro	1	1	n/a	1	1	0.82	0.05	4
EC2d031	Hotel Occupancy Sensor	SBES DI	1	0.998	n/a	1.103	0.885	0.82	0.05	3, 4
EC2a031	Hotel Occupancy Sensor	SBES Retro	1	0.998	n/a	1.103	0.885	0.82	0.05	3, 4

Energy Load Shape:

See Appendix 1.2 C&I Load Shapes “C&I Heating and Cooling”.

Revision History:

Revision Number	Date	Revision
285	1/1/2026	Updated RR’s for SBES according to 2025 impact study results.
374	1/1/2027	Updated deemed savings by averaging kWh and kW values for self-contained package systems and DX cooling with HW heating coil given in Ref 1.
375	1/1/2027	Updated measure life based on referenced study

Endnotes:

1: MassSave, 2010. Energy Analysis: Hotel Guest Occupancy Sensors. Prepared for National Grid and Eversource (NSTAR). https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488696996f2627a7df77e/view?authToken=095ce06aaba47a2a336205a007e99e3785ff00b8a64833c49b31d254b9df86d3564e3769f809b04ee586d76d90c40d9f2bdb8b866004ad4e906676446a6a6929207d3ce3135b61 (Last accessed on March 6, 2026)

2: Energy and Resource Solutions, November 2005. Measure Life Study. Prepared for MA Joint Utilities. HOS measure life assumed to be the same as that for occupancy-based lighting controls. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488616996f25f6d7df75f/view?authToken=0e4ddf47affefdea3d50fbdb2530c0e4b11fa5eefa624bfe9a5227c6fcff02cc1c597e2db9940a262ab6bbeb9f8f80000061a9bf7bef802f4462b4b8fead390eb825ee81160cd5f (Last accessed on March 6, 2026)

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation Table 7 https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 6, 2026)

4: New Hampshire Common Assumptions.

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on March 14, 2026)

HVAC Infrared Heater

Measure Code	COM-HVAC-IH
Markets	Commercial
Program Types	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

The installation of a gas-fired or propane low intensity infrared heating system in place of unit heater, furnace, or other standard efficiency equipment. Infrared heating uses radiant heat as opposed to warm air to heat buildings. In commercial environments with high air exchange rates, heat loss is minimal because the space's heat comes from surfaces rather than air.

Baseline Efficiency:

The baseline efficiency case is a standard efficiency gas-fired or propane warm air unit heater with combustion efficiency of 80%[1].

High Efficiency:

The high efficiency case is a gas-fired or propane low-intensity infrared heating unit.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Impact Evaluation of 2011 Prescriptive Gas Measures for the Mass Save Program Administrators[2].

BC ID	Measure Name	Fuel Type	Program	ΔMMBtu/unit[7]
GC1b016 GC2b016 GC3b016	Infrared Heater	Gas	LBES New SBES New Muni New	12.0
EC3b064	Infrared Heater	Propane	MES New	12.0

Measure Life:

The measure life is 17 years[3].

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GC1b016	Infrared Heater	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	
GC2b016	Infrared Heater	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	4
GC3b016	Infrared Heater	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a	
EC3b064	Infrared Heater	Propane	MES New	1	n/a	1	n/a	n/a	n/a	n/a	

Energy Load Shape:

See Appendix 1.2 Commercial "C&I Heating & Cooling".

Revision History:

Revision Number	Date	Description
50	1/14/2022	Corrected baseline to reference most current code.
71	3/1/2022	Updated with reference to appendix 2 for new EFLH values based on NH TMY3 Data.
142	12/1/2022	Removed algorithm for calculation. Current program design is prescriptive.
287	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
376	1/1/2027	Added propane to measure and efficiency descriptions
377	1/1/2027	Added RR for "Muni New" program

[7] The typical length of an infrared heater is 4'. If the purchased unit is longer or shorter, adjust the deemed savings value accordingly.

Endnotes:

1: 2024 International Energy Conservation Code, September 2025; Table C403.3.2(5) https://codes.iccsafe.org/content/IECC2024V1.2/chapter-ce-4-commercial-energy-efficiency#IECC2024V1.2_CE_Ch04_SecC403.3.2 (Last accessed on March 24, 2026)

2: KEMA, June 2013. Impact Evaluation of 2011 Prescriptive Gas Measures; Page 1-6 Table ES 5. https://ma-eeac.org/wp-content/uploads/Impact-Evaluation-of-2011-Prescription-Gas-Measures-6.27.13.pdf (Last accessed on March 24, 2026)

3: Nexant, 2006. DSM Market Characterization Report. Prepared for Questar Gas. Appendix E https://pscdocs.utah.gov/gas/05docs/05057T01/Sur%20Test%20McKay%20Ex%201-2%208-15.pdf (Last accessed on March 24, 2026)

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation; Table 6 https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on March 24, 2026)

HVAC Pipe Wrap

Measure Code	COM-HVAC-PW
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Pipe Wrap – Heating: Install insulation on steam pipes located in non-conditioned spaces.

Pipe Wrap – Hot Water: Install insulation on hot water located in non-conditioned spaces.

Baseline Efficiency:

Pipe Wrap – Heating: The baseline efficiency case is un-insulated steam piping in unconditioned space

Pipe Wrap – Hot Water: The baseline efficiency case is un-insulated hot water piping in unconditioned space.

High Efficiency:

Pipe Wrap – Heating: The high efficiency condition is steam piping in unconditioned space with insulation installed.

Pipe Wrap – Hot Water: The high efficiency condition is hot water piping in unconditioned space with insulation installed.

Algorithms for Calculating Primary Energy Impact:

Gas unit savings are deemed based on an average of unit savings for 1.5 inch pipes and 3 inch pipes.[1] kW savings for hot water pipes with electric are calculated using the demand impact model.

Savings for steam pipes with electric heating is calculated as:

$$\Delta kWh = \frac{\left(\left(\frac{UA}{L}\right)_{baseline} - \left(\frac{UA}{L}\right)_{ee}\right)}{E_t \times 3{,}412} \times L \times \Delta T_{amb} \times hrs$$

Where,

$\left(\frac{UA}{L}\right)_{baseline}$= Overall baseline heat transfer coefficient per unit length. 0.97 for 1.5", 1.19 for 2", and 1.70 for 3" copper pipes. For steel pipes, 1.23 for 1.5", 1.51 for 2", and 2.16 for 3".

$\left(\frac{UA}{L}\right)_{ee}$= Overall energy efficient heat transfer coefficient per unit length: 0.12 for all pipe sizes assuming fiber glass insulation of thickness equal to pipe diameter. Use 0.46 for rigid foam/cellular glass insulation of thickness equal to pipe diameter.

L = Length of the pipe insulated.

ΔT_{amb} = 85 °F.1

hrs = Annual operating hours.

E_t = Thermal efficiency of electric heater. Default value of 0.98.

$$\Delta kW = \frac{\Delta kWh}{8760}$$

Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu/ linera foot
GC1a013 GC2a013 GC3a013	Pipe Wrap – Heating	Gas	LBES Retro SBES Retro Muni Retro	n/a	n/a	.29
GC1a008 GC2a008 GC3a008	Pipe Wrap – Hot Water	Gas	LBES Retro SBES Retro Muni Retro	n/a	n/a	.29
EC3a068 E2C3d068	Pipe Wrap – Heating	Gas	Muni Retro Muni DI	n/a	n/a	Calculated
EC3a072 EC3d072	Pipe Wrap – Hot Water	Gas	Muni Retro Muni DI	n/a	n/a	Calculated
EC3a069 EC3d069	Pipe Wrap – Heating	Oil	Muni Retro Muni DI	n/a	n/a	Calculated
EC3a073 EC3d073	Pipe Wrap – Hot Water	Oil	Muni Retro Muni DI	n/a	n/a	Calculated

Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu/ linera foot
E2C3a070 EC3d070	Pipe Wrap – Heating	Propane	Muni Retro Muni DI	n/a	n/a	Calculated
EC3a074 E2C3d074	Pipe Wrap – Hot Water	Propane	Muni Retro Muni DI	n/a	n/a	Calculated
E2C1a038 EC1d038 EC2a038 EC2d038 EC3a067 EC3d067	Pipe Wrap – Heating	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	Calculated	Calculated	n/a
EC1a039 EC1d039 EC2a039 EC2d039 EC3a071 EC3d071	Pipe Wrap – Hot Water	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	Calculated	Calculated	n/a
EC1c061 EC2c061	OMP Pipe Wrap, 7 feet	Electric	LBES Mid SBES Mid	192.5	0.01	
GC1c017 GC2c017	OMP Pipe Wrap, 10 feet	Gas	LBES Mid SBES Mid	n/a	n/a	2.9

Measure Life:

The measure life is 15 years.[2]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d038	Pipe Wrap – Heating	Electric	LBES DI	1	0.999	n/a	1	1	0	0.433
EC1d039	Pipe Wrap – Hot Water	Electric	LBES DI		0.999	n/a	1	1	0.312	0.808
EC1c061	OMP Pipe Wrap, 7 feet	Electric	LBES Mid		1	n/a	1	1	0.312	0.808
GC1c017	OMP Pipe Wrap, 10 feet	Gas	LBES Mid		n/a	1	n/a	n/a	n/a	n/a
EC1a038	Pipe Wrap – Heating	Electric	LBES Retro	1	0.999	n/a	1	1	0	0.433
EC1a039	Pipe Wrap – Hot Water	Electric	LBES Retro	1	0.999	n/a	1	1	0.312	0.808
GC1a008	Pipe Wrap – Hot Water	Gas	LBES Retro – Gas	1	n/a	1	n/a	n/a	n/a	n/a
GC1a013	Pipe Wrap – Heating	Gas	LBES Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3d067	Pipe Wrap – Heating	Electric	Muni DI	1	1	n/a	1	1	0	0.433

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3d071	Pipe Wrap – Hot Water	Electric	Muni DI		1	n/a	1	1	0.312	0.808
EC3d068	Pipe Wrap – Heating	Gas	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d072	Pipe Wrap – Hot Water	Gas	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d069	Pipe Wrap – Heating	Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d073	Pipe Wrap – Hot Water	Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d070	Pipe Wrap – Heating	Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d074	Pipe Wrap – Hot Water	Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3a067	Pipe Wrap – Heating	Electric	Muni Retro	1	1	n/a	1	1	0	0.433
EC3a071	Pipe Wrap – Hot Water	Electric	Muni Retro		1	n/a	1	1	0.312	0.808
EC3a068	Pipe Wrap – Heating	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a072	Pipe Wrap – Hot Water	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC3a008	Pipe Wrap – Hot Water	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC3a013	Pipe Wrap – Heating	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a069	Pipe Wrap – Heating	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a073	Pipe Wrap – Hot Water	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a070	Pipe Wrap – Heating	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a074	Pipe Wrap – Hot Water	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC2d038	Pipe Wrap – Heating	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0	0.433
EC2d039	Pipe Wrap – Hot Water	Electric	SBES DI		0.998	n/a	1.103	0.885	0.312	0.808
EC2c061	OMP Pipe Wrap, 7 feet	Electric	SBES Mid		0.998	n/a	1.103	0.885	0.312	0.808
GC2c017	OMP Pipe Wrap, 10 feet	Gas	SBES Mid		0.956	1	n/a	n/a	n/a	n/a
EC2a038	Pipe Wrap – Heating	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0	0.433
EC2a039	Pipe Wrap – Hot Water	Electric	SBES Retro		0.998	n/a	1.103	0.885	0.312	0.808
GC2a008	Pipe Wrap – Hot Water	Gas	SBES Retro – Gas	1	0.956	1	n/a	n/a	n/a	n/a
GC2a013	Pipe Wrap – Heating	Gas	SBES Retro	1	0.956	1	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% electric realization rate[3]. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.The SBES program uses an electric realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a gas RR of 95.6% from a 2025 Impact study[4].

Coincidence Factors:

A summer coincidence factor of 31.2% and a winter coincidence factor of 80.8% is utilized for insulation of hot water pipes with electric heating. For heating pipes with electric heating, a winter coincidence factor of 43.3% is utilized[5].

Energy Load Shape:

For electric heating measures, see Appendix 1 C&I Load Shapes "Hardwired Electric Heat".

For electric hot water measures, see Appendix 1 C&I Load Shapes "Water Heater – Electric".

For non-electric measures, see Appendix 1 C&I Load Shapes "Non-electric Measures"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1c061 EC2c061	OMP Pipe Wrap, 7 feet	LBES Mid SBES Mid	0.237	0.07	0	0.86
GC1c017 GC2c017	OMP Pipe Wrap, 10 feet	LBES Mid SBES Mid	0.237	0.07	0	0.86

Revision History:

Revision Number	Revision Date	Description
108	12/1/2022	Added new OMP Measures.
268	1/1/2026	Updated SBES RR's based on 2025 impact study

Endnotes:

1: National Grid Staff Calculation, 2010. Pipe insulation for SBS DI measures 2010 Excel Workbook.https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee4885c6996f2d3357df744/view?authToken=7fee5ba9537c0f5f564abd5d10975916a6a377ca27b3db4ab2d14a8fccd27767411a93ba3aeb7bf5b51d488f6bd8d9adc9a2471d1508cd1c7bbaadcb846385e4b40dd3442ba7aa

2: Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks, GDS Associates, April 2009. http://ma-eeac.org/wordpress/wp-content/uploads/5_Natural-Gas-EE-Potenial-inMA.pdf

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wpcontent/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

HVAC Programmable Thermostat

Measure Code	COM-HVAC-PGM
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

Installation of a programmable thermostat, which gives the ability to adjust heating or air-conditioning operating times according to a pre-set schedule.

Baseline Efficiency:

The baseline efficiency case is an HVAC system without a programmable thermostat.

High Efficiency:

The high efficiency case is an HVAC system that has a programmable thermostat installed, purchased through the C&I Online Market Place

Algorithms for Calculating Primary Energy Impact:

Savings are based on the MA Residential Wi-Fi and Programmable Thermostat Impact Evaluation. [1]

BC ID	Measure Name	Energy Type	Program	ΔkWh	ΔkW	ΔMMbtu
GC1c019 GC2c019	OMP Programmable Thermostat, Gas	Gas	LBES Mid SBES Mid	n/a	n/a	2.07

Measure Life:

The measure life is 15 years.[2]

Other Resource Impacts:

No other resource impacts are included.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC1c019	Programmable Thermostat, Gas	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC2c019	Programmable Thermostat, Gas	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC3a015	Programmable Thermostat, Gas	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a

Programmable thermostats that control both cooling and heating equipment should claim both the 27 kWh of electric energy savings associated with the cooling equipment at the impact factors listed above and any heating savings.

In-Service Rates:

All installations have a 100% in-service rate until and evaluation finds otherwise.

Realization Rates:

SBES has a gas relization rate of 95.6% based on 2025 evaluation results[3]. All other programs have a 100% realization rate until an evaluation finds otherwise.

Coincidence Factors:

n/a

Energy Load Shape:

See Appendix 1 “Weighted HVAC- All Homes” and "Central Air Conditioner/Heat Pump (Cooling)"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG[4]
GC1c019 GC2c019	OMP Wifi Thermostat	LBES Mid SBES Mid	0.237	0.07	0	0.86

Revision History:

Revision Number	Issue Date	Description
109	12/1/2022	New Measure Added
269	1/1/2026	Updated SBES RR for 2025 impact study.

Endnotes:

1: Guidehouse Inc (2021) Residential Wi-Fi and Programmable Thermostat Impacts https://ma-eeac.org/wp-content/uploads/MARES24-Final-Report-2021-09-29.pdf

2: Environmental Protection Agency, 2010. Life Cycle Cost Estimate for ENERGY STAR Programmable Thermostat.

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

4: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

HVAC Package Terminal Heat Pump

Measure Code	COM-HVAC-PTHP
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

A package terminal heat pump (PTHP) purchased to replace an end of life package terminal air conditioner (PTAC) with electric resistance heat.

Baseline Efficiency:

The baseline efficiency is a blend between a code compliant package terminal air conditioner (PTAC) with electric resistance heat and a standard efficiency package terminal heat pump (PTHP) reflected by the following COPs:

Capacity	Standard PTHP COP
<=10,000 Btuh	3.0
>10,000 Btuh	2.9

High Efficiency:

The high efficiency case meets the following specifications:

Size Category	EER	COP
< 10,000 BTU/h	12.1	3.5
> 10,000 BTU/h	10.7	3.1

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on a model[1] developed to estimate the savings associated with the displacement of existing heating and cooling systems.

Measure	Core Initiative	Program	Electric Savings (kWh/ton)
EC1b060 EC2b060	C&I New & Replacement Equipment (CI_EQUIP)	LBES SBES	1,126
EC1c065 EC2c065	C&I New & Replacement Equipment (CI_EQUIP)	LBES Mid SBES Mid	1,126

Measure Life:

The measure life is 12 years. [2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RRE	RRNE	RRSP	RRWP	CFSP	CFWP
EC1b060	PTHP	LBES	1.00	0.99	n/a	1.00	1.00	0.34	0.42
EC2b060	PTHP	SBES	1.00	1.00	1.00	1.00	1.00	0.34	0.42
EC1c065	PTHP	LBES-Midstream	1.00	1.00	1.00	1.00	1.00	0.34	0.42
EC2c065	PTHP	SBES Midstream	1.00	1.00	1.00	1.00	1.00	0.34	0.42

In-Service Rates:

The in-service rate is assumed 100% until evaluated.

Realization Rates:

Large Business Energy Solution uses a 99.9% realization rate.[3] All other programs use a 100.0% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors from Vermont TRM LS_114a for PTHP, Hotel[4]

Energy Load Shape:

See Appendix One "C&I Heating & Cooling"

Impact Factors for Calculating Net Savings:

Measure Name	Core Initiative	PA	FR	SO_P	SO_{NP}	NTG	REF
Midstream - PTHP	CI_EQUIP	All	22.5%	8.5%	0.0%	86.0%	5

Revision History:

Revision Number	Date	Revision
209	3/19/2024	New measure added.

Endnotes:

1: Cadeo (2023). Energy Optimization Model Update. 2023_Cadeo_MA22C10_Energy Optimization Model Update

2: DNV GL (2018). Expected Useful Life (EUL) Estimation for Air-Conditioning Equipment from Current Age Distribution Memo. 2018_DNVGL_P73_EUL_Estimation_Results_to_Date

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

4: Vermont Technical Reference Manual 2018. Package Terminal Heat Pump (Hotel Room) pg 23. https://puc.vermont.gov/sites/psbnew/files/doc_library/Vermont%20TRM%20Savings%20Verification%202018%20Version_FINAL.pdf

5: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

HVAC Thermostat - Wi-Fi Communicating

Measure Code	COM-HVAC-WIFI
Markets	Commercial
ProgramTypes	Retrofit
Categories	Heating Ventilation and Air Conditioning

Measure Description:

A Wi-Fi enabled communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling system.

Baseline Efficiency:

The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.

High Efficiency:

The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on residential study results, adjusted for commercial buildings.[1]

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EC1a026 EC1d028 EC2a026 EC2d028 EC3a039	Wi-Fi Thermostat	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro	160.90	0.256	n/a

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EC3d041			Muni DI			
EC3a040 EC3d042 GC1a016 GC2a016	Wi-Fi Thermostat	Gas	Muni Retro Muni DI LBES Retro – Gas SBES Retro – Gas	n/a	n/a	3.11
EC3a041 EC3d043	Wi-Fi Thermostat	Oil	Muni Retro Muni DI	n/a	n/a	3.11
EC3a042 EC3d044	Wi-Fi Thermostat	Propane	Muni Retro Muni DI	n/a	n/a	3.11
GC1c020: GC2c020	OMP Wi-Fi Thermostat	Gas	LBES Mid SBES Mid	n/a	n/a	3.11

Measure Life:

The measure life is 15 years.[2]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d028	Wi-Fi Thermostat	Electric	LBES DI	1	0.999	n/a	1	1	0.346	0
GC1c020	Wi-Fi Thermostat	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
EC1a026	Wi-Fi Thermostat	Electric	LBES Retro	1	0.999	n/a	1	1	0.346	0
GC1a016	Wi-Fi Thermostat	Gas	LBES Retro		n/a	1	n/a	n/a	n/a	n/a
EC3d041	Wi-Fi Thermostat	Electric	Muni DI	1	1	n/a	1	1	0.346	0
EC3d042	Wi-Fi Thermostat	Gas	Muni DI	1	n/a	n/a	n/a	n/a	n/a	n/a
EC3d043	Wi-Fi Thermostat	Oil	Muni DI	1	n/a	n/a	n/a	n/a	n/a	n/a
EC3d044	Wi-Fi Thermostat	Propane	Muni DI	1	n/a	n/a	n/a	n/a	n/a	n/a
EC3a039	Wi-Fi Thermostat	Electric	Muni Retro	1	1	n/a	1	1	0.346	0
EC3a040	Wi-Fi Thermostat	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a041	Wi-Fi Thermostat	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a042	Wi-Fi Thermostat	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC2d028	Wi-Fi Thermostat	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.346	0
GC2c020	Wi-Fi Thermostat	Gas	SBES MID	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2a026	Wi-Fi Thermostat	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.346	0

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC2a016	Wi-Fi Thermostat	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% electric realization rate[3]. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a gas RR of 95.6% from a 2025 Impact study[4]. All other programs use a 100.0% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Summer and winter Coincidence Factors are estimated using demand allocation methodology described the Demand Impact Model.[5]

Energy Load Shape:

See Appendix 1 "Weighted HVAC- All Homes."

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG[5]
GC1c020 GC2c020	OMP Wifi Thermostat	LBES Mid SBES Mid	0.237	0.07	0	0.86

Revision History:

Revision Number	Revision Date	Description
110	12/2/2022	Added new C&I OMP Measures
273	1/1/2026	Updated SBES RRs based on 2025 impact study results.

Endnotes:

1: Navigant Consulting, September 2018. Wi-Fi Thermostat Impact Evaluation--Secondary Research Study Memo. https://ma-eeac.org/wp-content/uploads/Wi-Fi-Thermostat-Impact-Evaluation-Secondary-Literature-Study_FINAL.pdf The residential savings values for Wi-Fi communicating thermostats recommended in the 2018 Secondary Research Study memo are applied to the commercial measures in this chapter as it has not been possible to document savings from commercial Wi-Fi communicating measures. The residential values are not scaled up as the savings from the commercial measures are expected to be very low.

2: Assumed to have the same lifetime as a regular programmable thermostat. Environmental Protection Agency, 2010. Life Cycle Cost Estimate for ENERGY STAR Programmable Thermostat.

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wpcontent/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

6: NMR, DNV-GL, and Tetra-Tech, Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study, Aug. 14, 2018 (Table 48, Table 52)

HVAC Unitary Air Conditioner

Measure Code	COM-HVAC-UAC
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

This measure promotes the installation of high efficiency unitary air conditioning equipment in lost opportunity applications. Air conditioning (AC) systems are a major consumer of electricity and systems that exceed baseline efficiencies can save considerable amounts of energy. This measure applies to air, water, and evaporatively-cooled unitary AC systems, both single-package and split systems.

Baseline Efficiency:

The baseline efficiency is a unit of the same size that meets federal standard as defined in Table 1 to Paragraph (b) and Table 19 to paragraph (i) of CFR 431.97, effecting January 1st, 2023[111]. Baseline EER for units >65,000 btu/h is based on the Michigan Energy Measures Database[112]. Baseline EER for units <65,000 btu/h is calculated using the SEER2 of the unit.

Baseline Efficiency for Units >65,000 btu/h

Cooling capacity	Subcategory	Supplementary heating type	Baseline IEER	Baseline EER
≥65,000 Btu/h and <135,000 Btu/h (>5.4 and <11.3 tons)	AC	Electric Resistance Heating or No Heating	14.8	11.0
≥65,000 Btu/h and <135,000 Btu/h (>5.4 and <11.3 tons)	AC	All Other Types of Heating	14.6	11.0
≥135,000 Btu/h and <240,000 Btu/h (>11.3 and <20 tons)	AC	Electric Resistance Heating or No Heating	14.2	10.8
≥135,000 Btu/h and <240,000 Btu/h (>11.3 and <20 tons)	AC	All Other Types of Heating	14.0	10.8
≥240,000 Btu/h and <760,000 Btu/h (>20 and <63.3 tons)	AC	Electric Resistance Heating or No Heating	13.2	10.0

≥240,000 Btu/h and <760,000 Btu/h (>20 and <63.3 tons)	AC	All Other Types of Heating	13.0	10.0

Baseline Efficiency for Units <65,000 btu/hr

Type	Cooling capacity	Subcategory	Minimum efficiency	Baseline EER2*
Commercial Package Air Conditioning Equipment	<65,000 Btu/h (<5.4 Tons)	Split-System	13.4 SEER2	11.4
Commercial Package Air Conditioning Equipment	<65,000 Btu/h (<5.4 tons)	Single-Package	13.4 SEER2	11.4

* SEER2 to EER2 calculation[113]:

EER=1.12 ×SEER2-(0.02×SEER22)

High Efficiency:

The high efficiency case is the site specific installed equipment that meets the efficiency criteria set by the program, per the application.

Algorithms for Calculating Primary Energy Impact:

Seasonal peak demand savings (summer)

$\Delta kW = (kBtu/h)*(1/EER_{BASE}-1/EER_{EE})$

For units with cooling capacities less than 65 kBtu/h:

$\Delta kWh = (kBtu/h)\ (1/\ SEER2_{BASE} – 1/\ SEER2_{EE})\ (EFLH_{Cool})$

$\Delta kW = kBtu/h)(1/EER_{BASE}-1/EER_{EE})$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$\Delta kWh = (kBtu/h)\ (1/\ IEER_{BASE} – 1/\ IEER_{EE})\ (EFLH_{Cool})$

$\Delta kW = (kBtu/h)\ (1/\ EER_{BASE} – 1/\ EER_{EE})$

Where:

ΔkWh = Gross annual kWh savings from the measure

ΔkW = Gross connected kW savings from the measure

kBtu/h = Capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER2_{BASE}$ = Seasonal Energy Efficiency Ratio of the baseline equipment. See table under "Baseline Efficiency" section.

$SEER2_{EE}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment See table under "High Efficiency" section

$EFLH_{Cool}$ = Cooling equivalent full load hours. If building type is available, use EFLH value from appendix 2. If not, use EFLH value of 755. [4]

$IEER_{BASE}$ = Integrated Energy Efficiency Ratio of the baseline equipment*

$IEER_{EE}$ = Integrated Energy Efficiency Ratio of the energy efficient equipment

$EER_{BASE:}$ Energy Efficiency Ratio of the baseline equipment

$EER_{EE:}$ Energy Efficiency Ratio of the energy efficient equipment

CF_{summer}

If converting from SEER to SEER2 or HSPF to HSPF2, please use the below crosswalk recommended by AHRI. To use, multiple the appendix M rating (SEER, EER, HSPF) by the appropriate number of the corresponding Appendix M1 heading (SEER2, EER2, HSPF2) in the table below. [5]

System Type	SEER2 Conversion Factor	EER2 Conversion Factor	HSPF2 Conversion Factor
Ducted	0.95	0.95	0.85
Ductless	1.00	1.00	0.90
Packaged	0.95	0.95	0.84

Measure Life:

The measure life is 20 years.[6]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1c007	Midstream Unitary Air Conditioners	LBES	1	1	n/a	1	1	0.342	0
E21C1b049	Unitary Air Conditioner	LBES New	1	0.999	n/a	1	1	0.342	0
E21C3b080	Unitary Air Conditioner	Muni New	1	1	n/a	1	1	0.342	0
E21C2c007	Midstream Unitary Air Conditioners	SBES	1	0.998	n/a	1.103	0.885	0.342	0
E21C2b049	Unitary Air Conditioner	SBES New	1	0.998	n/a	1.103	0.885	0.342	0

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solution uses a 99.9% realization rate[7]. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[8]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

A summer coincidence factor of 34.2% is utilized[9].

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Electric Cooling Unitary Equipment".

Impact Factors for Calculating Net Savings:

(Upstream/Midstream Only):[10]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	2021 NTG
EC1c007 EC2c007	Midstream Unitary Air Conditioners	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.86

Revision History:

Revision Number	Date	Revision
54	1/14/2022	Updated baseline table for clarity and to reference most recent code.
69	3/1/2022	Added EFLH reference to Appendix 2
151	12/1/2022	Updated baseline values to align with 2023 Federal Standards update. Added default value for EFLH where building type is not available.
234	3/18/2025	Updated for clarity, no changes to savings values. Added baseline values from 10 CFR 431.97 into baseline efficiency section. Added efficiency criteria from application and fixed broken links.
245	1/1/2026	Updated baselines for units <65,000 btu/h per 2025 federal code update 10 CFR 431.97. Updated measure life. Corrected CF factors in table to align with cited study. Updated broken links. Measure Life updated to 20 years based on new research. Updated SBES RR

Endnotes:

1: Energy Efficiency Standards and Their Compliance Dates 10 CFR Part 431.97 (2025) https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-F/subject-group-ECFR4287065a76436ba/section-431.97

2: Michigan Public Service Commission (2025). Michigan Energy Measures Database (MEMD) Weather Sensitive Measure Documentation https://www.michigan.gov/mpsc/regulatory/energy-optimization/michigan-energy-measures-database

3: US DOE, 2010. Building America House Simulation Protocols. https://docs.nrel.gov/docs/fy11osti/49246.pdf

4: KEMA, August 2011. C&I Unitary HVAC Loadshape Project. https://neep.org/sites/default/files/resources/NEEP_HVAC_Load_Shape_Report_Final_August2_0.pdf

5: CEE, 2023. Converting Between Appendicies M and M1. ,CEE_Crosswalk https://cee1.my.site.com/s/resources?id=a0V2R00000sUQby

6: DNV, 2024. Commercial HVAC and Water Heating Measure Effective Useful Life Study Final Report. https://pda.energydataweb.com/api/view/3980/CPUC%0Group%20A%202023%20Commercial%20HVAC%20and%20Water%20Heating%20EUL%20Study%20Final%20Report.pdf

7: DNV, September 2015. New Hampshire Utilities Large commercial and Industrial Retrofit and New Equipment and construction Final Program Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

8: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

9: KEMA, August 2011. C&I Unitary HVAC Loadshape Project. https://neep.org/sites/default/files/resources/NEEP_HVAC_Load_Shape_Report_Final_August2_0.pdf

10: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

HVAC VRF Systems

Measure Code	COM-HVAC-VRFS2
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Heating Ventilation and Air Conditioning

Measure Description:

This measure includes in the installation of high-efficiency variable flow refrigerant (VRF) heat pumps.

Baseline Efficiency:

The baseline is a code compliant VRF heat pump unit. Details regarding heat pump baseline efficiencies based on capacity and type are provided in a tabular format along with the savings algorithms.

Baseline IEER and COP values for air source VRF units over 65,0000 btu/hr and water source units of all size are from Table 16 to Paragraph (g)(2) of 10CFR 431.97. Baseline SEER2 and HSPF2 values for air cooled units less than 65,000 btu/hr are from Table 19 to Paragraph (i) of 10 CFR 431.97[1]

Baseline EER values are not specified by federal code and are established as follows:

For units <65,000 btu/hr, the following formula is used to calculated baseline EER[2]

$$EER2 = (1.12 \times SEER2) - (0.02 \times SEER2^2)$$

For units > 65,000 btu/hr, the baseline EER values are derived from the s ASHRAE Standard 90.1-2016 as the federal code relies on the ASHRAE standard 90.1[3]. The EER values provided by ASHRAE 90.1 have been converted to EER2 using the CEE crosswalk, assuming a ductless configuration[4].

Equipment type	Size category (btu/hr)	Heating type	Cooling baseline efficiency (IEER, SEER2)	Heating baseline Efficiency (HSPF2, COP)	Baseline EER2
VRF Multi-Split Air Conditioners (Air-Cooled)	<65,000	All	*14.3 SEER2*	*N/A*	*11.9 EER2*
	≥65,000 and <135,000	All	*15.5 IEER,*	*N/A*	11.2 EER2
	≥135,000 and <240,000	All	*14.9 IEER*	*N/A*	*11.0 EER2*
	≥240,000 and <760,000	All	*13.9 IEER*	*N/A*	*10.00 EER2*
VRF Multi-Split Heat Pumps (Air-Cooled)	<65,000		14.3 SEER2	7.5HSPF2	11.9 EER2
	≥65,000 and <135,000	Heat Pump without Heat Recovery	14.6 IEER	3.3 COP_H	11.00 EER2
	≥65,000 and <135,000	Heat Pump with Heat Recovery	14.4 IEER	3.3 COP_H	10.8 EER2
	≥135,000 and <240,000	Heat Pump without Heat Recovery	13.9 IEER	3.2 COP_H	10.6 EER2
	≥135,000 and <240,000	Heat Pump with Heat Recovery	13.7 IEER	3.2 COP_H	10.4 EER2
	≥240,000 and <760,000	Heat Pump without Heat Recovery	12.7 IEER	3.2 COP_H	9.5 EER2

Equipment type	Size category (btu/hr)	Heating type	Cooling baseline efficiency (IEER, SEER2)	Heating baseline Efficiency (HSPF2, COP)	Baseline EER2
	≥240,000 and <760,000	Heat Pump with Heat Recovery	12.5 IEER	3.2 COP_H	9.3 EER2
VRF Multi-Split Heat Pumps (Water-Source)	<65,000	Heat Pump without Heat Recovery	16.0 IEER	4.3 COP	12.0 EER2
	<65,000	Heat Pump with Heat Recovery	15.8 IEER	4.3 COP	11.8 EER2
	≥65,000 and <135,000	Heat Pump without Heat Recovery	16.0 IEER	4.3 COP	12.0 EER2
	≥65,000 and <135,000	Heat Pump with Heat Recovery	15.8 IEER	4.3 COP	11.8 EER2
	≥135,000 and <240,000	Heat Pump without Heat Recovery	14.0 IEER	4.0 COP	10.0 EER2
	≥135,000 and <240,000	Heat Pump with Heat Recovery	13.8 IEER	4.0 COP	9.8 EER2
	≥240,000 and <760,000	Heat Pump without Heat Recovery	12.0 IEER	3.9 COP	10.0 EER2
	≥240,000 and <760,000	Heat Pump with Heat Recovery	11.8 IEER	3.9 COP	9.8 EER2

CEE Crosswalk:

If converting from SEER to SEER2 or HSPF to HSPF2, please use the below crosswalk recommended by AHRI. To use, multiply the appendix M rating (SEER, EER, HSPF) by the appropriate number of the corresponding Appendix M1 heading (SEER2, EER2, HSPF2) in the table below

System Type	SEER2 Conversion Factor	EER2 Conversion Factor	HSPF2 Conversion Factor
Ducted	0.95	0.95	0.85
Ductless	1.00	1.00	0.90
Packaged	0.95	0.95	0.84

High Efficiency:

The high efficiency case is the site-specific VRF heat pump unit.

Algorithms for Calculating Primary Energy Impact:

The savings for this measure are attributable to the increase in nameplate efficiency between the baseline and installed units.

The algorithm for calculating electric demand savings is:

ΔkW=Capcool1EER2Base -1EER2EE

Where:

ΔkW = Gross annual demand savings for VRF unit

ΔkWh_{cool} = Gross annual cooling savings for VRF unit

$EFLH_{cool}$=Where building type is available, refer to appendix 2.

$IEER_{BASE}$ = Integrated Energy Efficiency Ratio of the baseline VRF equipment

$IEER_{EE}$ = Integrated Energy Efficiency Ratio of the energy efficient VRF unit, from equipment specifications

$EER2_{BASE}$ = Energy Efficiency Ratio of the baseline VRF equipment

$EER2_{EE}$ = Energy Efficiency Ratio of the energy efficient VRF unit, from equipment specifications

CF_{summer}: 0.342 Summer coincident factor. See "Impact Factors for Calculating Adjusted Gross Savings" table.

$$\Delta kW = Cap_{cool}\left(\frac{1}{EER2_{Base}} - \frac{1}{EER2_{EE}}\right)$$

The algorithm for calculating annual electric energy savings is:

$$\Delta kWh = \Delta kWh_{cool} + \Delta kWh_{heat}$$

For equipment < 65,000 Btu/hr cooling:

$$\boldsymbol{\Delta kWh_{cool} = CAP_{cool} \times \left(\frac{1}{SEER2_{BASE}} - \frac{1}{SEER2_{EE}}\right) \times EFLH_{cool}}$$

For equipment >= 65,000 Btu/hr cooling:

ΔkWhcool= Capcool × 1IEERbase- 1IEEREE ×EFLHcool

$$\Delta kWh_{cool} = Cap_{cool} \times \left(\frac{1}{IEER_{base}} - \frac{1}{IEER_{EE}}\right) \times EFLH_{cool}$$

For equipment < 65,000 Btu/hr heating

ΔkWhheat= Capheat × 1HSPF2base- 1HSPF2EE ×EFLHheat

$$\Delta kWh_{heat} = Cap_{heat} \times \left(\frac{1}{HSPF2_{base}} - \frac{1}{HSPF2_{EE}}\right) \times EFLH_{heat}$$

For equipment >= 65,000 Btu/hr heating

$$\Delta kWh_{heat} = \frac{Cap_{heat}}{3.412} \times \left(\frac{1}{COP_{BASE}} - \frac{1}{COP_{EE}}\right) \times EFLH_{heat}$$

Where:

ΔkWh_{cool} = Gross annual cooling savings for VRF unit

ΔkWh_{heat} = Gross annual heating savings for VRF unit

Cap_{cool} = Cooling capacity (in kBtu/h) of the energy efficient VRF unit, from equipment specifications

Cap_{heat} = Heating capacity (in kBtu/h) of the energy efficient VRF unit, from equipment specifications.

SEER2$_{BASE}$= Seasonal Energy Efficiency Ratio of baseline VRF unit

SEER2$_{EE}$= Seasonal Energy Efficiency Ratio of energy efficient VRF unit, from equipment specifications

IEER$_{BASE}$ *Integrated* Energy Efficiency Ratio of baseline VRF equipment Energy Efficiency Ratio of energy efficient VRF unit

HSPF2$_{BASE}$= Heating Seasonal Performance Factor of baseline VRF unit

HSPF2$_{EE}$= Heating Seasonal Performance Factor of energy efficient VRF unit, from equipment specifications

COP_{BASE} = Coefficient of performance in heating mode of baseline VRF equipment

COP_{EE} = Coefficient of performance in heating mode of energy efficient VRF unit

EFLH$_{cool}$=Refer to appendix 2.

EFLH$_{heat}$ = Referto appendix 2.

Measure Life:

The measure life is 20 years[5].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1c008	Midstream VRF	LBES Mid	1	1	n/a	1	1	0.342	0
EC2c008	Midstream VRF	SBES Mid	1	0.998	n/a	1.103	0.885	0.342	0

In-Service Rates:

All installations have a 100.0% in-service rate unless an evaluation finds otherwise.

Realization Rates:

All installations have a 100.0% realization rate unless an evaluation finds otherwise. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[6].

Coincidence Factors:

The summer coincidence factor is 34.2% and the winter coincidence factor is 0%[7]

Energy Load Shape:

See Appendix 1 – "Central Heat Pump".

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

(Upstream/Midstream Only)[8]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	2021 NTG
EC1c008 EC2c008	Midstream VRF	LBES Midstream SBES Midstream	0.225	0.085	0.000	0.860

Revision History:

Revision Number	Date	Description
150	12/1/2022	Updated baseline tables to include capacity and subcategory. Update EFLH to refer to appendix 2 where possible and included default values for where building type is not available. Updated algorithms to reference correct performance metrics.
220	1/1/2025	Updated baseline efficiencies based on IECC 2018 and Federal Code.
248	1/1/2026	Reformatted and updated baselines to align per new federal code. Increased measure life from 12 to 20 years based on new research. Updates SBES RR's

Endnotes:

1: 10 CFR 431.97. https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-F/subject-group-ECFR4287065a76436ba/section-431.97

2: US DOE, 2010. Building America House Simulation Protocols. https://docs.nrel.gov/docs/fy11osti/49246.pdf

3: "2023-03-30 Energy Conservation Program: Standards for Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps; Final rule" Federal Register 2023-06178. 2023. https://www.regulations.gov/document/EERE-2018-BT-STD-0003-

4: CEE, 2023. Converting Between Appendicies M and M1. ,CEE_Crosswalk https://cee1.my.site.com/s/resources?id=a0V2R00000sUQby

5: KEMA((2011). C&I Unitary AC Loadshape Project - Final Report. KEMA_2011_CI Unitary HVAC Load Shape Project

6: DNV, 2024. Commercial HVAC and Water Heating Measure Effective UsefulLife Study Final Report https://pda.energydataweb.com/api/view/3980/CPUC%20Group%20A%202023%20Commercial%20HVAC%20and%20Water%20Heating%20EUL%20Study%20Final%20Report.pdf

7: Coincidence Factors are from 2011 NEEP HVAC Loadshape Study Table 0-5 (ISO_NE on Peak for NE-North)

8: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

9: Coincidence Factors are from 2011 NEEP HVAC Loadshape Study Table 0-5 (ISO_NE on Peak for NE-North)

10: NMR, DNV GL, and Tetra Tech, August 2018. Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study. Prepared for Massachusetts Program Administrators. http://ma-eeac.org/wordpress/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

Hot Water Faucet Aerators

Measure Code	COM-HW-FA
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Hot Water

Measure Description:

Installation of a faucet aerator with a flow rate of 1.5 GPM or less on an existing faucet with high flow in a commercial setting.

Baseline Efficiency:

The baseline efficiency case is an existing faucet aerator with Federal Standard flow rate of 2.2 GPM[1]

High Efficiency:

The high efficiency case is a low flow faucet aerator with EPA WaterSense[2] specified maximum flow rate of 1.5 GPM.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated using the Federal Energy Management Program ("FEMP") Energy Cost Calculator[3]. kW savings are calculated using the demand impact model.[4]

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EC1a028 EC1b031 EC1d030 EC2a028 EC2b031 EC2d030 EC3a044 EC3b045 EC3d046	Faucet Aerator	**Electric**	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	309	0.01	n/a
EC1c060 EC2c060	OMP Faucet Aerator	Electric	LBES Mid SBES Mid	309	0.01	n/a
EC3a045 EC3b046 EC3d047 GC1a005 GC1b017 GC2a005 GC2b017	Faucet Aerator	Gas	LBES Retro LBES New LBES DI LBES Retro LBES New SBES DI SBES New	n/a	n/a	1.7
GC1c016 GC1c016	OMP Faucet Aerator	Gas	LBES Mid SBES Mid	n/a	n/a	1.7
GC3b005 GC3b017	Faucet Aerator	Gas	Muni Retro Muni New	n/a	n/a	1.7
EC3a046 EC3b047 EC3d048	Faucet Aerator	Oil	Muni Retro Muni New Muni DI	n/a	n/a	1.7
EC3a047 EC3b048 EC3d049	Faucet Aerator	Propane	Muni Retro Muni New Muni Gas	n/a	n/a	1.7

Measure Life:

The measure life for a faucet aerator is 10 years.[5]

Other Resource Impacts:

There are deemed water savings of 5,460 gallons/unit.[3.]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d030	Faucet Aerator	Electric	LBES DI	1	1	0.99	1	1	0.31	0.81
EC1c060	Faucet Aerator	Electric	LBES Mid	1	1	1	1	1	0.31	0.81
GC1c016	Faucet Aerator	Gas	LBES Mid	1	n/a	1	n/a	n/a	0.31	0.81
GC1b017	Faucet Aerator	Gas	LBES New	1	n/a	1	n/a	n/a	0.31	0.81
GC1a005	Faucet Aerator	Gas	LBES Retro	1	n/a	1	n/a	n/a	0.31	0.81
EC1a028	Faucet Aerator	Electric	LBES Retro	1	0.99	1	1	1	0.31	0.81
EC3d046	Faucet Aerator	Electric	Muni DI	1	1	n/a	1	1	0.31	0.81
EC3d047	Faucet Aerator	Gas	Muni DI	1	n/a	1	n/a	n/a	0.31	0.81
EC3d048	Faucet Aerator	Oil	Muni DI	1	n/a	1	n/a	n/a	0.31	0.81
EC3d049	Faucet Aerator	Propane	Muni DI	1	n/a	1	n/a	n/a	0.31	0.81
EC3b045	Faucet Aerator	Electric	Muni New	1	1	n/a	1	1	0.31	0.81
EC3b046	Faucet Aerator	Gas	Muni New	1	n/a	1	n/a	n/a	0.31	0.81
GC3b017	Faucet Aerator	Gas	Muni New	1	n/a	1	n/a	n/a	0.31	0.81
EC3b047	Faucet Aerator	Oil	Muni New	1	n/a	1	n/a	n/a	0.31	0.81
EC3b048	Faucet Aerator	Propane	Muni New	1	n/a	1	n/a	n/a	0.31	0.81
EC3a044	Faucet Aerator	Electric	Muni Retro	1	1	n/a	1	1	0.31	0.81
GC3b005	Faucet Aerator	Gas	Muni Retro	1	n/a	1	n/a	n/a	0.31	0.81
EC3a045	Faucet Aerator	Gas	Muni Retro	1	n/a	1	n/a	n/a	0.31	0.81
EC3a046	Faucet Aerator	Oil	Muni Retro	1	n/a	1	n/a	n/a	0.31	0.81
EC3a047	Faucet Aerator	Propane	Muni Retro	1	n/a	1	n/a	n/a	0.31	0.81
EC2d030	Faucet Aerator	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2c060	Faucet Aerator	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.31	0.81
GC1c016	Faucet Aerator	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	0.31	0.81
EC1b031	Faucet Aerator	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2b031	Faucet Aerator	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.31	0.81

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC2a028	Faucet Aerator	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.31	0.81
GC2a005	Faucet Aerator	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	0.31	0.81
GC2b017	Faucet Aerator	Gas	SBESNew	1	n/a	0.956	n/a	n/a	0.31	0.81

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs.[6] The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a 95.6% gas RR from a 2025 Impact study[7]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Summer and winter coincidence factors of 31% and 81% have been utilized per the MA demand impact model[4.]

Energy Load Shape:

For electric measures, see Appendix 1 C&I Load Shapes " Water Heater – Electric".

For non-electric measures, see Appendix 1 C&I Load Shapes "Non- Electric Measures."

For non-electric measures, see Appendix 1 C&I Load Shapes "Non- Electric Measures."

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Fuel Type	Program	FR	SO_P	SO_{NP}	NTG
E21C1c060 E21C2c060	OMP Faucet Aerator	**Electric**	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%
G21C1c016 G21C1c016	OMP Faucet Aerator	Gas	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%

Revision History:

Revision Number	Revision Date	Description
106	12/1/22	Added OMP Measures
278	1/1/2026	Updated SBES RR per 2025 impact study

Endnotes:

1: In 1998, the Department of Energy adopted a maximum flow rate standard of 2.2 gpm at 60 psi for all faucets: 63 Federal Register 13307; March 18, 1998. https://www.epa.gov/sites/production/files/2017-02/documents/ws-specification-home-final-suppstatement-v1.0.pdf

2: WaterSense: Bathroom Faucets. https://www.epa.gov/watersense/bathroom-faucets

3: Federal Energy Management Program ("FEMP") Energy Cost Calculator for Faucets and Showerheads. Available at: https://www.energy.gov/eere/femp/energy-cost-calculator-faucets-andshowerheads-0. On average, faucets are assumed to run 30 minutes per day, 260 days per year. Actual usage values should be used, when known, in lieu of default savings values

4: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

5: Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks, GDS Associates, April 2009. http://ma-eeac.org/wordpress/wp-content/uploads/5_Natural-Gas-EE-Potenial-in-MA.pdf

6: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

7: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Hot Water Pre-Rinse Spray Valve

Measure Code	COM-HW-PRSV
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Hot Water

Measure Description:

Pre-Rinse Spray Valve: Retrofitting existing standard spray nozzles in locations where service water is supplied by hot water heater with new low flow pre-rinse spray nozzles with an average flow rate of 1.6 GPM.

Baseline Efficiency:

Pre-Rinse Spray Valve, Gas: The baseline efficiency case is an existing efficiency spray valve.

High Efficiency:

Pre-rinse Spray Valve, Gas: The high efficiency case is a low flow pre-rinse spray valve with an average flow rate of 1.6 GPM. [1]

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on study results. [2] [3]

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔMMBtu
EC1a040 EC1b046 EC1d040 EC2a040 EC2b046 EC2d040 EC3a075 EC3b074 EC3d075	Pre-Rinse Spray Valve	Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	126 kWh for grocery and 957 kWh for non-grocery facility type	0.031 for grocery .233 for non-grocery
EC3a076 EC3b075 EC3d076 GC1a009 GC1b020 GC2a009 GC2b020 GC1c006 GC2c006 GC3a009 GC3b020	Pre-Rinse Spray Valve	Gas	Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New LBES Mid SBES Mid		11.4
EC3a077 EC3b076 EC3d077	Pre-Rinse Spray Valve,	Oil	LBES Retro SBES Retro Muni Retro		11.4
EC3a078 EC3b077 EC3d078	Pre-Rinse Spray Valve	Propane	LBES Retro SBES Retro Muni Retro		11.4
GC1c018 GC2c018	OMP Pre-Rinse Spray Valve	Gas	LBES Mid SBES Mid		11.4
EC1c062 EC2c062	OMP Pre-Rinse Spray Valve	Electric	LBES Mid SBES Mid	126 kWh for grocery and 957 kWh for non-grocery facility type	0.031 for grocery .233 for non-grocery

Measure Life:

The measure life is 8 years.[2]

Other Resource Impacts:

There are water savings of 6,410 gallons per unit.[3]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3d076	Pre-Rinse Spray Valve	Gas	Muni DI	1	1	n/a	1	n/a	n/a	n/a
GC1c018	Pre-Rinse Spray Valve	Gas	LBES Mid	1	1	n/a	1	n/a	n/a	n/a

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC3a009	Pre-Rinse Spray Valve	Gas	LBES New	1	1	n/a	1	n/a	n/a	n/a
GC1a009	Pre-Rinse Spray Valve	Gas	LBES Retro	1	1	n/a	1	n/a	n/a	n/a
EC3d077	Pre-Rinse Spray Valve	Oil	Muni DI	1	1	n/a	1	n/a	n/a	n/a
EC3d078	Pre-Rinse Spray Valve	Propane	Muni DI	1	1	n/a	1	n/a	n/a	n/a
EC3b075	Pre-Rinse Spray Valve	Gas	Muni New	1	1	n/a	1	n/a	n/a	n/a
GC1b020	Pre-Rinse Spray Valve	Gas	Muni New	1	1	n/a	1	n/a	n/a	n/a
EC3a077	Pre-Rinse Spray Valve	Oil	Muni New	1	1	n/a	1	n/a	n/a	n/a
EC3a078	Pre-Rinse Spray Valve	Propane	Muni New	1	1	n/a	1	n/a	n/a	n/a
EC3b076	Pre-Rinse Spray Valve	Oil	Muni Retro	1	1	n/a	1	n/a	n/a	n/a
EC3b077	Pre-Rinse Spray Valve	Propane	Muni Retro	1	1	n/a	1	n/a	n/a	n/a
GC3b020	Pre-Rinse Spray Valve	Gas	Muni Retro	1	1	n/a	1	n/a	n/a	n/a
EC3a076	Pre-Rinse Spray Valve	Gas	Muni Retro	1	1	n/a	1	n/a	n/a	n/a
GC2c018	Pre-Rinse Spray Valve	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2c006	Pre-Rinse Spray Valve	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2b020	Pre-Rinse Spray Valve	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2a009	Pre-Rinse Spray Valve	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a

In-Service Rates:

All installations have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a 95.6% gas RR from a 2025 Impact study[4]. The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs. [5] All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

A summer coincidence factor of 52% and a winter coincidence factor of 100% is utilized.[5]

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF

GC1c006 GC2c006 EC1c062 EC2c062 GC1c018 GC2 c018	Pre Rinse Spray Valve	LBES Mid SBES Mid	0.237	0.07	0	0.83	7
EC1c062 EC2c062 GC1c018 GC2 c018	OMP, Pre-Rinse Spray valve	LBES Mid SBES Mid	0.237	0.07	0	0.86	7

Revision History:

Revision Number	Revision Date	Description
107	12/1/2022	Added new entries for C&I online market place measures:E21C1c062, E21C2c062,G21C1c018, G21C2 c018
290	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Adopted the Massachusetts program administrator internal analysis.

2: Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valves, DNV GL, November 2014. http://ma-eeac.org/wordpress/wp-content/uploads/Prescriptive-Gas-Pre-Rinse-Spray-Valve-Measure-Impact-Evaluation.pdf

3: Connecticut Program Savings Document 2020. Measure 3.2.1: Water-Saving Measures.

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/New%20Hampshire%20Large%20C&I%20Program%20Impact%20Study%20Final%20Report.pdf

6: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wp-content/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

7: NMR Group, Inc. (2018). Massachusetts Sponsors' Commercial and Industrial Free-ridership and Spillover Study. 2018_NMR_CI FR-SO Report

Hot Water Showerhead

Measure Code	COM-HW-SH
Markets	Commercial
ProgramTypes	Retrofit

Categories	Hot Water

Measure Description:

Thermostatic Shut-Off Valve: Installation of a stand-alone thermostatic shut-off valve on standard flow showerhead.

Low-Flow Showerhead, Electric, Gas, Oil, Propane: Installation of a low-flow showerhead with a flow rate of 1.5 GPM or less.

Baseline Efficiency:

Measure Name	Baseline Equipment
Thermostatic Shut-Off Valve, stand alone	Existing standard-flow shower head (2.5 GPM) with no thermostatic shut off valve.
Low-Flow Shower Head with Integrated thermostaticaally actuated valve	Existing standard-flow showerhead (2.5 GPM) with no thermostatic shut-off valve.
Low-Flow Shower Head	The baseline efficiency case is a 2.5 GPM showerhead.

High Efficiency:

Measure	High Efficiency Case
Thermostatic Shut-Off Valve, Stand Alone	The high efficiency case is a standard flow showerhead (2.5 GPM) with the addition of a stand-alone thermostatic shut-off valve. (The "Lady Bug")
Low-Flow Showerhead with Integrated Thermostatic Valve	The high efficiency case is a low-flow showerhead (1.5 GPM) with an integrated thermostatically actuated valve.
Low-Flow Showerhead	The high efficiency case is a low-flow showerhead (1.5 GPM).

Algorithms for Calculating Primary Energy Impact:

Low-Flow Showerhead with Thermostatic Valve: Unit savings are deemed based on the National Grid Shower Start Savings Spreadsheet.[1]

kW savings are calculated using the demand impact model.[2]

Low-Flow Showerhead, Unit savings are deemed.[3]

Low-Flow Showerhead with integrated thermostatic valve, Unit savings are deemed [4]

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
GC1a006 GC1b018 GC2a006 GC2b018	Thermostatic Shut-Off Valve	Gas	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	n/a	n/a	0.33
GC1c013 GC2c013	OMP Thermostatic Shut-Off Valve	Gas	LBES Mid SBES Mid	n/a	n/a	0.34

BC ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
EC1a033 EC1b044 EC1d033 EC2a033 EC2b044 EC2d033 EC3a056 EC3b066 EC3d056	Thermostatic Shut-Off Valve	Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	69	0.02	N/a
EC1c059 EC2c059	OMP Thermostatic Shut-Off Valve	Electric	LBES Mid SBES Mid	69	0.02	n/a
EC3a058 EC3b068 EC3d058	Thermostatic Shut-Off Valve	Oil	Muni Retro Muni New Muni DI	n/a	n/a	0.33
EC3a059 EC3b069 EC3d059	Thermostatic Shut-Off Valve	Propane	Muni Retro Muni New Muni DI	n/a	n/a	0.33
EC1a034 EC1b045 EC1d034 EC2a034 EC2b045 EC2d034 EC3a060 EC3b070 EC3d060	Low-Flow Showerhead	Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	507	0.09	n/a
EC1c057 EC2c057	OMP Low-Flow Showerhead	Electric	LBES Mid SBES Mid	507	0.09	n/a
GC1a007 GC1b019 GC2a007 GC2b019 GC2a007 GC2b019	Low-Flow Showerhead	Gas	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni	n/a	n/a	2.65
GC1c014 GC2c014	OMP Low-Flow Showerhead	Gas	LBES Mid SBES Mid	n/a	n/a	2.65
EC3a062 EC3b072 EC3d062	Low-Flow Showerhead	Oil	Muni Retro Muni New Muni DI	n/a	n/a	2.65
EC3a063 EC3b073 EC3d063	Low-Flow Showerhead	Propane	Muni Retro Muni New Muni DI	n/a	n/a	2.65
GC1c015 GC2c015	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Gas	LBES Mid SBES Mid	N/a	N/a	1.41
EC1c058 EC2c058	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Electric	LBES Mid SBES Mid	183	0.04	n/a

Measure Life:

The measure life for all Showerheads is 10 years.[5]

The measure life for a stand alone thermostatic shut-off valve is 15 years. [6]

Other Resource Impacts:

Low-Flow Showerhead With Thermostatic Valve: Annual water savings of 558 gallons per unit.[1]

Low-Flow Showerhead, Electric, Gas, Oil, Propane: Annual water savings of 7,300 gallons per unit.[3]

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3d063	Low-Flow Showerhead	Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC1d033	Thermostatic Shut-Off Valve	Electric	LBES DI	1	0.99	n/a	1	1	0.31	0.81
EC1d034	Low-Flow Showerhead	Electric	LBES DI	1	0.99	n/a	1	1	0.31	0.81
EC1c057	OMP Low-Flow Showerhead	Electric	LBES Mid	1	1	n/a	1	1	0.31	0.81
EC1c058	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Electric	LBES Mid	1	1	n/a	1	1	0.31	0.81
EC1c059	OMP Thermostatic Shut-Off Valve	Electric	LBES Mid	1	1	n/a	1	1	0.31	0.81
GC1c013	OMP Thermostatic Shut-Off Valve	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC1c014	OMP Low-Flow Showerhead	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
GC1c015	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a
EC1b044	Thermostatic Shut-Off Valve	Electric	LBES New	1	0.99	n/a	1	1	0.31	0.81
EC1b045	Low-Flow Showerhead	Electric	LBES New	1	0.99	n/a	1	1	0.31	0.81
GC1b018	Thermostatic Shut-Off Valve	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
GC1b019	Low-Flow Showerhead	Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a
EC1a033	Thermostatic Shut-Off Valve	Electric	LBES Retro	1	0.99	n/a	1	1	0.31	0.81
EC1a034	Low-Flow Showerhead	Electric	LBES Retro	1	0.99	n/a	1	1	0.31	0.81
GC1a006	Thermostatic Shut-Off Valve	Gas	LBES Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC1a007	Low-Flow Showerhead	Gas	LBES Retro	1	n/a	1	n/a	n/a	n/a	n/a

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC3d056	Thermostatic Shut-Off Valve	Electric	Muni DI	1	1	n/a	1	1	0.31	0.81
EC3d058	Thermostatic Shut-Off Valve	Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d059	Thermostatic Shut-Off Valve	Propane	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3d060	Low-Flow Showerhead	Electric	Muni DI	1	1	n/a	1	1	0.31	0.81
EC3d062	Low-Flow Showerhead	Oil	Muni DI	1	n/a	1	n/a	n/a	n/a	n/a
EC3b066	Thermostatic Shut-Off Valve	Electric	Muni New	1	1	n/a	1	1	0.31	0.81
EC3b068	Thermostatic Shut-Off Valve	Oil	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC3b069	Thermostatic Shut-Off Valve	Propane	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC3b070	Low-Flow Showerhead	Electric	Muni New	1	1	n/a	1	1	0.31	0.81
EC3b072	Low-Flow Showerhead	Oil	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC3b073	Low-Flow Showerhead	Propane	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
GC3b019	Low-Flow Showerhead	Gas	Muni New	1	n/a	1	n/a	n/a	n/a	n/a
EC3a056	Thermostatic Shut-Off Valve	Electric	Muni Retro	1	1	n/a	1	1	0.31	0.81
EC3a058	Thermostatic Shut-Off Valve	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a059	Thermostatic Shut-Off Valve	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a060	Low-Flow Showerhead	Electric	Muni Retro	1	1	n/a	1	1	0.31	0.81
EC3a062	Low-Flow Showerhead	Oil	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC3a063	Low-Flow Showerhead	Propane	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
GC3a007	Low-Flow Showerhead	Gas	Muni Retro	1	n/a	1	n/a	n/a	n/a	n/a
EC2d033	Thermostatic Shut-Off Valve	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2d034	Low-Flow Showerhead	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2c057	OMP Low-Flow Showerhead	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2c058	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2c059	OMP Thermostatic Shut-Off Valve	Electric	SBES Mid	1	0.998	n/a	1.103	0.885	0.31	0.81
GC2c013	OMP Thermostatic Shut-Off Valve	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
GC2c014	OMP Low-Flow Showerhead	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2c015	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2b044	Thermostatic Shut-Off Valve	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2b045	Low-Flow Showerhead	Electric	SBES New	1	0.998	n/a	1.103	0.885	0.31	0.81
GC2b018	Thermostatic Shut-Off Valve	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2b019	Low-Flow Showerhead	Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a
EC2a033	Thermostatic Shut-Off Valve	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.31	0.81
EC2a034	Low-Flow Showerhead	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.31	0.81
GC2a006	Thermostatic Shut-Off Valve	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a
GC2a007	Low-Flow Showerhead	Gas	SBES Retro	1	n/a	0.956	n/a	n/a	n/a	n/a

In-Service Rates:

All programs have a 100% in-service rate unless an evaluation finds otherwise.

Realization Rates:

The LBES program uses a realization rate of 99.9% from a 2015 impact evaluation on commercial and industrial programs[3]. The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's and a 95.6% gas rr from a 2025 Impact study[4]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Summer and winter coincidence factors of 31% and 81% have been utilized per the MA demand impact model[2.]

Energy Load Shape:

For electric measures, see Appendix 1 C&I Load Shapes " Water Heater – Electric".

For non-electric measures, see Appendix 1 C&I Load Shapes "Non- Electric Measures"

Impact Factors for Calculating Net Savings (Upstream/Midstream Only):

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
GC1c015 GC2c015 EC1c058 EC2c058	OMP Low-Flow Shower Head with Integrated Thermostatic Valve	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%

GC1c013 GC2c013 EC1c059 EC2c059	OMP Thermostatic Valve	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%
GC1c014 GC2c014 EC1c057 EC2c057	OMP Low-Flow Shower Head	LBES Mid SBES Mid	22.5%	8.5%	0.0%	86%

Revision History:

Revision Number	Revision Date	Description
105	12/1/2022	Added new LBES Mid and SBES Mid measures for Thermostatic valve, low-flow shower head with integrated thermostatic valve, and low-flow shower head.
111	12/1/2022	Updated measure life for stand alone thermostatic valve
292	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: National_Grid_2014_ShowerStart_Savings_Final_2015-2-9 (1)

2: Navigant Consulting, 2018. RES1 Demand Impact Model Update. http://ma-eeac.org/wordpress/wpcontent/uploads/RES-1-FINAL-Comprehensive-Report-2018-07-27.pdf

3: Federal Energy Management Program ("FEMP") Energy Cost Calculator for Faucets and Showerheads. Available at: https://www.energy.gov/eere/femp/energy-cost-calculator-faucetsandshowerheads-0. On average, showerheads are assumed to run 20 minutes per day, 365 days per year. Actual usage values should be used, when known, in lieu of default savings values.

4: Guidehouse (2020) Comprehensive TRM Review https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/60463491d38ce8bca0795e4b/view?authToken=93e861ad3053d0716f3757b0a5d06f096582c89051d4841798b9efda91a45e2ed41741970a88d6b70e556d22887b967a186d65c834bd4150666dd417f76a0e240d88a664318fe8

5: Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks, GDS Associates, April 2009. http://ma-eeac.org/wordpress/wp-content/uploads/5_Natural-Gas-EE-Potenial-inMA.pdf

6: Guidehouse Inc (2021) Comprehensive TRM Review https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/60463491d38ce8bca0795e4b/view?authToken=93e861ad3053d0716f3757b0a5d06f096582c89051d4841798b9efda91a45e2ed41741970a88d6b70e556d22887b967a186d65c834bd4150666dd417f76a0e240d88a664318fe8

7: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

8: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Hot Water Heaters

Measure Code	COM-HW-WH
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Hot Water

Measure Description*:*

Installation of a heat pump hot water heater, indirect water heater, on demand tankless water heater, volume water heater or condensing water heater.

Baseline Efficiency:

The baseline efficiency case is a code compliant unit of the same size, type and fuel.

BC ID	Measure Name	Baseline	Ref
EC1c044 EC2c044	Midstream 50 Gallon Heat Pump Water Heater	0.95 UEF Electric resistance water heater.	2
EC1c046 EC2c046	Midstream Heat Pump Water Heater, 80 gallons	1.98 UEF Heat Pump water heater	1
EC1c045 EC2c045	Midstream Heat Pump Water Heater, 120 gallons	3 COP	3
GC1c009 GC2c009 GC1b028 GC2b028 GC3b028	Midstream/downstream Indirect Water Heater	Hot water boiler operating at 78% recovery efficiency. Additionally, a baseline storage water heater was assumed for purpose of estimating standby losses.	1
GC1c010 GC2c010 GC1b029 GC2b029 GC3b029	Midstream/downstream on Demand Tankless Water Heater	A code-compliant instantaneous gas fired water heater with TE = 0.80.	1
GC1c011 GC2c011 GC1b030 GC2b030 GC3b030	Midstream/downstream Volume Water Heater	A code specified 80% TE volume water heater > 75,000 Btu/h. Standby loss is a maximum of (Q/800 + 110√V) Btu/h, where Q is the nameplate input rate in Btu/h and V is the rated volume in gallons.	1
GC1c012 GC2c012 GC1b031 GC2b031 GC3b031	Midstream/downstream Condensing Gas Water Heater	A code specified 80% TE water heater water heater > 75,000 Btu/h. Standby loss is a maximum of (Q/800 + 110√V) Btu/h, where Q is the nameplate input rate in Btu/h and V is the rated volume in gallons.	1

High Efficiency:

BC ID	Measure Name	High Efficiency Case
EC1c044 EC2c044	Midstream 50 Gallon Heat Pump Water Heater	UEF 3.2 or greater.
EC1c046 EC2c046	Midstream Heat Pump Water Heater, 80 gallons	UEF 3.2 or greater.
EC1c045 EC2c045	Midstream Heat Pump Water Heater, 120 gallons	COP 3.6 or greater

BC ID	Measure Name	High Efficiency Case
GC1c009 GC2c009 GC1b028 GC2b028 GC3b028	Midstream/Downstream Indirect Water Heater	The high efficiency scenario is an indirect water heater with a Combined Appliance Efficiency (CAE) of 85% or greater.
GC1c010 GC2c010 GC1b029 GC2b029 GC3b029	Midstream/Downstream on Demand Tankless Water Heater	The high efficiency equipment is a gas-fired instantaneous hot water heater with an Thermal Efficiency of at least 0.94.
GC1c011 GC2c011 GC1b030 GC2b030 GC3b030	Midstream/Downstream Volume Water Heater	The high efficiency case is a volume water heater with a 94% TE.
GC1c012 GC2c012 GC1b031 GC2b031 GC3b031	Midstream/Downstream Condensing Gas Water Heater	The high efficiency case is a high efficiency stand alone commercial water heater with a thermal efficiency of 94% or greater and a capacity greater than 75,000 btu/h.

Algorithms for Calculating Primary Energy & Demand Impact:

BC ID	Measure Name	ΔkWh	ΔkW	ΔMMBtu	REF
EC1c044 EC2c044	Midstream 120 Gallon Heat Pump Water Heater	3,429	0.39		4
EC1c046 EC2c046	Midstream Heat Pump Water Heater, 80 gallons	3,004	0.34		3
EC1c045 EC2c045	Midstream Heat Pump Water Heater, 50 gallons	9,354	1.07		3
GC1c009 GC2c009 GC1b028 GC2b028 GC3b028	Midstream/Downstream Indirect Water Heater			10.8	3
GC1c010 GC2c010 GC1b029 GC2b029 GC3b029	Midstream/Downstream on Demand Tankless Water Heater			7.3	3
GC1c011 GC2c011 GC1b030 GC2b030 GC3b030	Midstream/Downstream Volume Water Heater			7.3	3
GC1c012 GC2c012 GC1b031 GC2b031 GC3b031	Midstream/Downstream Condensing Gas Water Heater			7.3	3

Heat Pump Water Heaters

Electric Savings:

$$\Delta kWh = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{3{,}412} \times \left(\frac{F_{eDHW}}{UEF_{baseline}} - \frac{1}{UEF_{ee} \times F_{derate}}\right) + \Delta kWh_{cooling} - \Delta kWh_{heating}$$

Where,

$$\Delta kWh_{cooling} = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{3{,}412} \times \left(\frac{1}{UEF_{ee} \times F_{derate}}\right) \times F_{loc} \times \frac{F_{cool}}{SEER2/3.412}$$

$$\Delta kWh_{heating} = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{3{,}412} \times \left(\frac{1}{UEF_{ee} \times F_{derate}}\right) \times F_{loc} \times F_{ElecHeat} \times \frac{F_{heat}}{HSPF2/3.412}$$

Peak Demand Savings:

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Fossil Fuel Savings:

$$\Delta MMBtu_{fuel} = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{1{,}000{,}000} \times \left(\frac{F_{FF,DHW}}{UEF_{baseline}} + \frac{F_{Boiler,DHW}}{AFUE}\right) - \left(\frac{1}{UEF_{ee} \times F_{derate}} \times F_{loc} \times F_{FuelHeat} \times \frac{F_{heat}}{AFUE}\right)$$

Indirect Water Heaters

$$\Delta MMBtu = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{1{,}000{,}000} \times \left(\frac{1}{Eff_{baseline}} - \frac{1}{Eff_{ee}}\right) + \left(\frac{UA_{baseline}}{Eff_{baseline}} - \frac{UA_{ee}}{Eff_{ee}}\right) \times \frac{(T_{set} - T_{amb})}{1{,}000{,}000} \times 8{,}760$$

Tankless and Storage Water Heaters

$$\Delta MMBtu = units \times \frac{GPD \times 365 \times 8.33 \times (T_{set} - T_{main})}{1{,}000{,}000} \times \left(\frac{1}{UEF_{baseline}} - \frac{1}{UEF_{ee}}\right)$$

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
ΔkW	Peak demand electric savings	Calculated	kW/yr	
$\Delta MMBtu$	Annual fossil fuel energy savings	Calculated	MMBtu/yr	
$\Delta kWh_{cooling}$	Annual electric cooling energy savings as a result of interactivity with the building's HVAC system (electric cooling bonus)	Calculated	kWh/yr	
$\Delta kWh_{heating}$	Annual electric heating energy savings as a result of interactivity with the building's HVAC system (electric heating penalty)	Calculated	kWh/yr	
Units	Number of measures installed under the program			
GPD	Gallons per day	154		2
T_{main}	Average temperature of supply water temperature in water main	55.74	°F	5
T_{amb}	Average surrounding ambient air temperature	70	°F	
T_{set}	Average water heater set point temperature	140		6
F_{eDHW}	Baseline electric factor; used to account for the presence or absence of an electric water heating system in the baseline condition	If baseline system is an electric water heater, set equal to 1. Otherwise, set equal to 0.		
$F_{FF,DHW}$	Baseline fossil fuel factor; used to account for the presence or absence of a fossil fuel water heating system in the baseline condition	If baseline system is a fossil fuel water heater, set equal to 1. Otherwise, set equal to 0.		
$F_{Boiler,DHW}$	Baseline fossil fuel factor; used to account for the presence or absence of a fossil fuel fired boiler-driven indirect water heating system in the baseline condition	If baseline system is a fossil fuel fired boiler driven indirect water heater, set equal to 1. Otherwise, set equal to 0.		
$UEF_{baseline}$	Uniform Energy Factor of the baseline condition	See baseline efficiencies table		1
UEF_{ee}	Uniform Energy Factor of the efficient condition	See high efficiency table		
F_{derate}	Efficiency derating factor used to account for the degradation of heat pump performance present in systems installed in unconditioned spaces	Unconditioned Basement - 0.80 Garage Installation - 0.78		7
F_{loc}	Installation location factor, used to exclude interactive HVAC impacts for systems installed in unconditioned spaces	Use a value of 1.0 if the water heater is installed in a conditioned space. Otherwise, use 0.0.		

Variable	Description	Value	Units	Ref
F_{cool}	Cooling factor, used to account for the percentage of heat extracted from ambient air by the heat pump water heater that reduces space cooling load	0.215		8
F_{heat}	Heating factor, used to account for the percentage of heat extracted from ambient air by the heat pump water heater that increases space heating load	0.73		6
$F_{ElecHeat}$	Electric heating factor, used to exclude electric heating penalty if no electric heating is present	Use a value of 1.0 if the building is electrically heated. Otherwise, use 0.0.		
$F_{FuelHeat}$	Fossil fuel heating factor, used to exclude fossil fuel heating penalty if no fossil fuel heating is present	Use a value of 1.0 if the building is fossil fuel heated. Otherwise, use 0.0.		
SEER2	Seasonal average energy efficiency ratio over the cooling season	3.4 SEER2, assuming a minimally code compliant, 3-ton, split system AC.	BTU/watt-hour	
HSPF2	Heating seasonal performance factor, BTU/watt-hour, total heating output (supply heat) in BTU (including electric heat) during the heating season / total electric energy heat pump consumed (in watt-hour)	7.5 HSPF2, assuming a 3-ton central ASHP system. For electric resistance heating and electric furnaces, use 3.4 HSPF.	BTU/watt-hour	
AFUE	Annual fuel utilization efficiency, seasonal energy efficiency for fuel heating equipment	Lookup from Baseline Efficiencies section based on existing equipment type.		
$Eff_{baseline}$	Boiler space heating baseline condition	Lookup from Baseline Efficiencies section based on existing equipment type.		
Eff_{ee}	Boiler space heating energy efficiency condition	Lookup from High Efficiencies section based on existing equipment type.		
$UA_{baseline}$	Baseline overall heat loss coefficient	15	BTU/h-°F	8
UA_{ee}	Energy efficient overall heat loss coefficient	5	BTU/h-°F	7
365	Days in one year			
8.33	Specific heat of water; energy required (BTU), to heat one gallon of water by one degree Fahrenheit	BTU/gal-F		
3,412	Conversion factor, one kWh equals 3,412 BTU			
3.412	Conversion factor, one watt-hour equals 3.412 BTU			
1,000,000	Conversion factor, one MMBtu equals 1,000,000 BTU			
8,760	Hours per year			

Measure Life:

BC ID	Measure Name	Program	Measure Life	Ref
EC1c044 EC2c044 EC1c045 EC2c045 EC1c046 EC2c046	Midstream Heat Pump Water Heater, 120 gallons Midstream Heat Pump Water Heater, 80 gallons Midstream Heat Pump Water Heater, 50 gallons	LBES Mid SBES Mid	13	9
GC1c009 GC2c009 GC1b028 GC2b028 GC3b028	Midstream/Downstream Indirect Water Heater:	LBES Mid SBES Mid Muni New	15	10
GC1c010 GC2c010 GC1b029 GC2b029 GC3b029	Midstream/Downstream on Demand Tankless Water Heater, Gas:	LBES Mid SBES Mid Muni New	20	11
GC1c011 GC2c011 GC1b030 GC2b030 GC3b030	Midstream/Downstream Volume Water Heater, Gas:	LBES Mid SBES Mid Muni New	15	12
GC1c012 GC2c012 GC1b031 GC2b031 GC3b031	Midstream/Downstream Condensing Gas Water Heater	LBES Mid SBES Mid Muni New	15	13

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1c044	Heat Pump Water Heater, 120 gallons	LBES Mid	1	1	n/a	1	1	0.537	0.563	14,15
EC1c045	Heat Pump Water Heater, 50 gallons	LBES Mid	1	1	n/a	1	1	0.537	0.563	13,14
EC1c046	Heat Pump Water Heater, 80 gallons	LBES Mid	1	1	n/a	1	1	0.537	0.563	13,14

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GC1c010	on Demand Tankless Water Heater, Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a	13
GC1c011	Volume Water Heater, Gas	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a	13
GC1c012	Condensing Gas Water Heater	LBES Mid	1	n/a	1	n/a	n/a	n/a	n/a	13
GC1c009	Indirect Water Heater	LBES Mid	1	1	n/a	1	1	n/a	n/a	13
GC1b029	on Demand Tankless Water Heater, Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	13
GC1b028	Indirect Water Heater	LBES New	1	0.99	1	1	1	n/a	n/a	16
GC1b030	Volume Water Heater, Gas	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	
GC1b031	Condensing Gas Water Heater	LBES New	1	n/a	1	n/a	n/a	n/a	n/a	
EC2c044	Heat Pump Water Heater, 120 gallons	SBES Mid	1	0.998	n/a	1.103	0.885	0.537	0.563	17,14
EC2c045	Heat Pump Water Heater, 50 gallons	SBES Mid	1	0.998	n/a	1.103	0.885	0.537	0.563	15,14
EC2c046	Heat Pump Water Heater, 80 gallons	SBES Mid	1	0.998	n/a	1.103	0.885	0.537	0.563	15,14
GC2c010	on Demand Tankless Water Heater, Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC2c009	Indirect Water Heater	SBES Mid	1	0.998	n/a	n/a	n/a	n/a	n/a	15,14
GC2c011	Volume Water Heater, Gas	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC2c012	Condensing Gas Water Heater	SBES Mid	1	n/a	0.956	n/a	n/a	n/a	n/a	15

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
GC2b028	Indirect Water Heater	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC2b029	on Demand Tankless Water Heater, Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC2b030	Volume Water Heater, Gas	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC2b031	Condensing Gas Water Heater	SBES New	1	n/a	0.956	n/a	n/a	n/a	n/a	15
GC3b031	Condensing Gas Water Heater	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC3b028	Indirect Water Heater, Gas	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC3b029	On Demand Tankless Water Heater, Gas	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**
GC3b030	Volume Water Heater, Gas	Muni New	1	n/a	1.00	n/a	n/a	n/a	n/a	**Error! Bookmark not defined.**

Energy Load Shape:

For heat pump water heaters, see Appendix 1 – " Water Heater - Heat Pump".

For all remaining water heaters, see Appendix 1 – " Water Heater – Natural Gas/Fuel Oil".

Impact Factors for Calculating Net Savings (*Upstream/Midstream Only):*

6,13

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
EC1c044 EC2c044	Midstream Heat Pump Water Heater, 120 gallons	LBES Mid SBES Mid	22.5 %	8.5 %	0.0%	86%	17
EC1c045 EC2c045	Midstream Heat Pump Water Heater, 80 gallons	LBES Mid SBES Mid	22.5 %	8.5 %	0.0%	86%	17
EC1c046 EC2c046	Midstream Heat Pump Water Heater, 50 gallons	LBES Mid SBES Mid	22.5 %	8.5 %	0.0%	86%	17
GC1c009 GC2c009	Midstream Indirect Water Heater	LBES Mid SBES Mid	70.00 %	0.0 %	0.0%	30.00%	19

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG	REF
GC1c010 GC2c010	Midstream on Demand Tankless Water Heater	LBES Mid SBES Mid	40.0 %	0%	0.0%	60.00%	18
GC1c011 GC2c011	Midstream Volume Water Heater	LBES Mid SBES Mid	40.0 %	0%	0.0%	60.00%	18
GC1c012 GC2c012	Midstream Condensing Gas Water Heater	LBES Mid SBES Mid	70.00 %	0%	0.0%	30.00%	18

Revision History:

Revision Number	Revision Date	Description
90	12/1/2022	Added values for midstream heat pump water heaters and updated references to NH building code.
175	7/1/2023	Added measures and IDs for Downstream Indirect, On-Demand, Volume and Condensing water heaters.
294	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
378	1/1/2027	Updated the baseline values for all equipment to be consistent with IECC 2018. Additionally, the baseline equipment for the tankless water heater was updated from gas fired storage water heater ti instantaneous gas fired water heater.
379	1/1/2027	Updated the baseline values for all equipment to be consistent with IECC 2018. Additionally, the baseline equipment for the tankless water heater was updated from gas fired storage water heater ti instantaneous gas fired water heater.
380	1/1/2027	Algorithms and parameter references were added for all equipment type based on MA TRM, NY TRM, CADEO study and NH residential measures. Deemed savings were updated to be based on this. A detailed spreadsheet has been created for the measures.
381	1/1/2027	CF's updated to align with most recent MA loadshape study.
408	10/30/2026	Removed NTG erroneously applied to downstream BC IDs. Corrected RR for gas measure GC2b028 from the electric 0.998 to the correct gas RR of 0.956

Endnotes:

1: 2018 IECC Code Table C404.2 'Minimum Performance of Water-Heating Equipment" https://codes.iccsafe.org/content/iecc2018/chapter-4-ce-commercial-energy-efficiency#IECC2018_CE_Ch04_SecC404, Last accessed January 22, 2026.

2: DNV GL, Inc (2019). "Impact Evaluation of Commercial Water Heaters: Baseline Adjustment Memo". Table 3. Weighted using 2018 Commercial Buildings Energy Consumption Survey. https://ma-eeac.org/wp-content/uploads/MA22C01-B_TRM-Review_FINAL_31OCT2022.pdf, Last accessed April 26, 2026.

3: Deemed savings are calculated using the referenced algorithms and inputs in the chapter. For more detail, see the 2027 C&I Hot Water-Water Heaters Workbook.

4: 2022-05 Final Determination Technical Support Document Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Commercial Prerinse

Spray Valves. Table 7.4.1 Weighted Average Annual Main Water Temperature by Census Division and Building Type (Non-education Buildings in New England.) https://downloads.regulations.gov/EERE-2019-BT-STD-0034-0020/content.pdf, Last accessed April 26, 2026. Based on Burch, J., and C. Christensen. Towards Development of an Algorithm for Mains Water Temperature. 2007. Proceedings of the 2007 ASES Annual Conference: Cleveland, OH.

5: OSHA notes that water heater temperatures below 140° F may lead to Legionella bacterial growth https://www.osha.gov/legionnaires-disease/control-prevention Last accessed April 26, 2026.

6: Based on NYSERDA TRM residential heat pump values for Albany and Binghamton https://ma-eeac.org/wp-content/uploads/Appendix-L-2025-2027-Three-Year-Plan-TRM.pdf, Last accessed January 22, 2026.

7: Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010; Energy Conservation standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters: Final Rule, Federal Register, 75 FR 20112, April 16, 2010 https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430, Last accessed January 22, 2026.

8: Assumes the same measure life as residential HPWH's. Michaels Energy (2022) x2001A CT Measure Life/EUL Update Study- Residential Measures CT, https://www.energizect.com/sites/default/files/2022-07/CT%20X2001A%20EUL%20Res%20Measure%20Report%20FINAL060522.pdf, Last accessed January 25, 2026

9: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks; https://ma-eeac.org/wp-content/uploads/5_Natural-Gas-EE-Potenial-in-MA.pdf, Last accessed January 22, 2026.

10: Hewitt, D. Pratt, J. & Smith, G., December 2005. Tankless Gas Water Heaters: Oregon Market Status. Prepared for the Energy Trust of Oregon. https://www.energytrust.org/wp-content/uploads/2016/11/051206_TanklessGasWaterHeaters0.pdf, Last accessed January 22, 2026.

11: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts; Appendix A-2. GDS_2007_Measure_Life_Report_Residential_and_CI_Lighting_and_HVAC_Measures, Last accessed January 27, 2026

12: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks; Page 2 of Appendix B-2, measure GDS C-WH-4. The GDS study references "ACEEE (2004). Emerging technologies and practices; W1 - pg 46." GDS_2009_Natural_Gas_Energy_Efficiency_Potential_in_MA, Last accessed January 27, 2026.

13: ISR and RR's are assumed to be 100% until evaluated.

14: CFs are applied per DNV (2024). C&I Impact Shape Study. 2024_DNV_C&I_Impact Shape Study

15: ISR and RR is applied per DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inlinedocuments/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf

16: ISR and RRs are applied per Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf

17: NTG is derived from DNV (2018) Massachusetts Commercial and Industrial Upstream HVAC/Heat Pump and Hot Water NTG and Market Effects Indicator Study. https://ma-eeac.org/wp-content/uploads/TXC_49_CI-FR-SO-Report_14Aug2018.pdf

18: NTG is derived from NMR (2018) Massachusetts Sponsors' Commercial and Industrial Programs Free-ridership and Spillover Study https://ma-eeac.org/wp-content/uploads/TXC_35_Report_5Sep2018_FINAL.pdf

Lighting - Controls

Measure Code	COM-LTG-LC
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Lighting

Measure Description:

This measure includes the installation of lighting controls in both lost-opportunity and retrofit applications. Occupancy sensors and daylight dimming controls are both included. Traffic-sensing occupancy sensors that control refrigerated case LEDs are also included as a separate section.

Baseline Efficiency:

The baseline efficiency case for retrofit applications is no controls.

The baseline efficiency case for new construction is code-compliant controls as mandated by the New Hampshire Building Code, which currently reflects IECC 2018 and ASHRAE Standard 90.1-2016.

The baseline efficiency case for refrigerated case LEDs is no controls.

High Efficiency:

The high efficiency case for retrofit applications is lighting fixtures connected to controls that reduce the pre-retrofit hours of operation.

The high efficiency case for new construction applications is lighting fixture controls that reduce the hours of operation further beyond code-compliant controls.

The high efficiency case for refrigerated case LEDs is traffic-sensing controls that are mounted on cases to dim case lighting from a high level to a low-power mode (assumed to be 25% of full power consumption) in less than 2 minutes when traffic is sensed in the aisle.

Algorithms for Calculating Primary Energy Impact:

For retrofit applications:

$$\Delta kWh = Controlled_{kW} \times Hours_{Base} \times Savings\%$$

$$\Delta kW = Controlled_{kW} \times Savings\%$$

Where:

$Controlled_{kW}$ = controlled fixture wattage

$Hours_{Base}$ = Total annual hours that the connected Watts operated in the pre-retrofit case (retrofit installations) or would have operated with code-compliance controls (new construction installations). Use below table for hours only when site specific assumptions do not exist.[1:] Large

business HOU are unadjusted from the MA and CT studies, but SBES HOU have been reduced by 30% per the 2025 SBES impact evaluation.[2:]

Building Type	Hours of Use	Hours of Use SBES
24x7 lighting	8,760	8,760
Automotive	4,056	2,839
Education	2,967	2,077
Grocery	5,468	3,828
Health Care	5,564	3,895
Hotel/Motel	3,064	2,145
Industrial	5,793	4,055
Large Office	4,098	2,869
Other	6,211*	4,348
Parking Lot/ Streetlights	6,887	4,821
Religious Building/ Convention Center	913	639
Restaurant	5,018	3,513
Retail	4,939	3,457
Small Office	3,748	2,624
Warehouse	5,667	3,967
Parking Garage	8,760	8,760

Savings% = percentage of kWh that is saved by utilizing this control measure, as shown in the study-informed deemed savings table below.[3:]

Control Type	% Savings Factor
Lighting Controls – Daylighting Dimming	0.28
Lighting Controls – Occupancy Sensor	0.24
Lighting Controls - Integral Dual Sensor	0.38
Lighting Controls - Integral Dual Sensors with Adaptive, Network-Capable Controls	0.49
Lighting Controls - Exterior Photocell (with dual sensors)	0.38

For lost opportunity applications:

$$\Delta kWh = Controlled_{kW} \times (Hours_{Base} - Hours_{EE})$$

$$\Delta kWh = Controlled_{kW}$$

Where:

$Controlled_{kW}$ = controlled fixture wattage

$Hours_{Base}$ = total annual hours that the connected Watts would have operated with code-compliant controls

$Hours_{EE}$ = total annual hours that the connected kW operates with controls implemented, as determined on a per-application basis.

For refrigerated case LED controls:

$$\Delta kWh = \Delta kWh_{Lights} + \Delta kWh_{Refg}$$

$$\Delta kWh_{Lights} = \Delta kW_{Lights} \times Hours$$

$$\Delta kW_{Lights} = kW_{Hi} - (0.85 \times kW_{Hi} + 0.15 \times kW_{Low})$$

$$\Delta kWh_{Refg} = \Delta kWh_{Lights} \times 0.28 \times Eff_{RS}$$

Where:

ΔkWh_{Lights} = the lighting equipment contribution to savings

ΔkWh_{Refg} = refrigeration interactive effects

ΔkW_{Light} = Lighting demand savings

kW_{Hi} = the high-level lighting power per case, with deemed values shown in the table below

kW_{Low} = the low-level lighting power per case, with deemed values shown in the table below

Hours = the number of operating hours at the site, from application or deemed value shown in table below

0.85 = deemed fraction of time at high power[4:]

0.15 = deemed fraction of time at low power[4:]

0.28 = unit conversion between kW and tons of refrigeration

Eff_{RS} = efficiency of typical refrigeration system, with deemed values based on the CT X1931-5 PSD Commercial Refrigeration Efficiency Study[14:] shown in the table below.

Input	System type	Deemed Value	Unit	Source
kW_hi	5' case side mounted	13	W	4:
	5' case center mounted	26	W	
	6' case side mounted	16	W	
	6' case center mounted	32	W	
kW_lo	5' case side mounted	8.5	W	4:
	5' case center mounted	17	W	
	6' case side mounted	11	W	
	6' case center mounted	21	W	
Hours, if not available from site	All	4,910	Hr/yr	4:

Input	System type	Deemed Value	Unit	Source
Eff_RS	Small business	1.87 for freezer system 1.05 for refrigerator system	kW/ton	Converted from ACOP 1.88 for freezer and 3.35 for refrigerator system.
	Large business	1.87 for freezer system 1.05 for refrigerator system	kW/ton	

Measure Life:

The table below provides measure life for control measures.[5:]

BC ID	Measure Name	Program	Measure Life
EC1a009	Daylight Dimming	LBES Retrofit, LBES DI, SBES Retrofit, SBES DI, MES Retrofit, MES DI	9
EC1d011			
EC2a009			
EC2d011			
EC3a009			
EC3d011			
EC1b009	Daylight Dimming	LBES New, SBES New, MES New	10
EC2b009			
EC3b009			
EC1a014	Lighting Occupancy Sensors	LBES Retrofit, LBES DI, SBES Retrofit, SBES DI, MES Retrofit, MES DI	9
EC1d016			
EC2a014			
EC2d016			
EC3a014			
EC3d016			
EC1b014	Lighting Occupancy Sensors	LBES New, SBES New, MES New	10
EC2b014			
EC3b014			

Other Resource Impacts:

Heating penalties for large C&I occupancy sensors are from a 12-month MA data logging study.[6:] Penalties for small business and municipal programs are from the 2018 MA small business lighting impact evaluation.[7:]

BC ID	Measure Name	Program	MMBtu/kWh
EC1a009	Daylight Dimming	LBES	-0.002728
EC1b009			
EC1d011			
EC2a009	Daylight Dimming	SBES, MES	-0.004080
EC2b009			
EC2d011			
EC3a009			
EC3b009			
EC3d011			

BC ID	Measure Name	Program	MMBtu/kWh
EC1a014	Lighting Occupancy Sensors	LBES	-0.002728
EC1b014			
EC1d016			
EC2a014	Lighting Occupancy Sensors	SBES, MES	-0.004080
EC2b014			
EC2d016			
EC3a014			
EC3b014			
EC3d016			

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d011	Daylight Dimming	LBES DI	1	1	n/a	1	1	0.138	0.134
EC1d016	Lighting Occupancy Sensors	LBES DI	1	1	n/a	1	1	0.138	0.134
EC1a009	Daylight Dimming	LBES New	1	1	n/a	1	1	0.138	0.134
EC1a014	Lighting Occupancy Sensors	LBES New	1	1	n/a	1	1	0.138	0.134
EC1b009	Daylight Dimming	LBES Retro	1	1	n/a	1	1	0.138	0.134
EC1b014	Lighting Occupancy Sensors	LBES Retro	1	1	n/a	1	1	0.138	0.134
EC3d011	Daylight Dimming	Muni DI	1	1	n/a	1	1	0.17	0.13
EC3d016	Lighting Occupancy Sensors	Muni DI	1	1	n/a	1	1	7	0.13
EC3b009	Daylight Dimming	Muni New	1	1	n/a	1	1	0.17	0.13
EC3b014	Lighting Occupancy Sensors	Muni New	1	1	n/a	1	1	0.17	0.13
EC3a009	Daylight Dimming	Muni Retro	1	1	n/a	1	1	0.17	0.13
EC3a014	Lighting Occupancy Sensors	Muni Retro	1	1	n/a	1	1	0.17	0.13
EC2d011	Daylight Dimming	SBES DI	1	0.864	n/a	1.123	0.974	0.63	0.3
EC2d016	Lighting Occupancy Sensors	SBES DI	1	0.864	n/a	1.123	0.974	0.63	0.3
EC2b009	Daylight Dimming	SBES New	1	0.864	n/a	1.123	0.974	0.63	0.3
EC2b014	Lighting Occupancy Sensors	SBES New	1	0.864	n/a	1.123	0.974	0.63	0.3
EC2a009	Daylight Dimming	SBES Retro	1	0.864	n/a	1.123	0.974	0.63	0.3
EC2a014	Lighting Occupancy Sensors	SBES Retro	1	0.864	n/a	1.123	0.974	0.63	0.3

In-Service Rates:

All installations have a 100% in-service-rate unless an evaluation finds otherwise.

Realization Rates:

Realization rates are 100% until evaluated. NH evaluations that have sampled a non-statistically significant number of lighting controls projects produced realization rates slightly greater than 100%, including for Large Business custom electric sites and Small Business and Municipal lighting projects, some of which included controls.[8; 9;] For refrigerated case lighting controls, realization rates are defaulted to 100% as the cited research for savings calculations is a study, and not an evaluation.[4;] SBES measure realization rates are based on the 2025 NHSave SBES Impact Study.[10;]

Coincidence Factors:

Summer and winter coincidence factors for small business program is based on the 2025 NHSave SBES Impact Study.[10:] Municipal programs are based on a MA study of lighting occupancy sensors in small businesses[11:]. For large businesses, coincidence factors are based on an MA impact evaluation of the C&I prescriptive lighting program.[6:]

Energy Load Shape:

Energy load shapes are based on site-level metering of project sites in MA.[12:]

Measure Name	Summer On-peak	Winter On-peak	Summer Off-peak	Winter Off-peak
Lighting Controls	32.10%	31.30%	17.70%	19.00%

Impact Factors for Calculating Net Savings:[13:]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1a009	Daylight Dimming	LBES, SBES, MES	11%	5%	0%	94%
EC1b009						
EC1d011						
EC2a009						
EC2b009						
EC2d011						
EC3a009						
EC3b009						
EC3d011						
EC1a014	Lighting Occupancy Sensors	LBES, SBES, MES	11%	5%	0%	94%
EC1b014						
EC1d016						
EC2a014						
EC2b014						
EC2d016						
EC3a014						
EC3b014						
EC3d016						

Revision History:

Revision Number	Issue Date	Description
59	1/14/2022	Measure life for retrofit lighting occupancy sensors was updated to 9 years from 10, according to the cited ERS study. Original value was incorrect.
154	12/1/2022	Updated refrigeration efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study.

Revision Number	Issue Date	Description
		Added HOU table for where site specific hours are unavailable.
309	1/1/2026	Updated RR's and HOU based on 2025 SBES impact study findings.
382	1/1/2027	Updated the hours for 24x7 facility and parking garage for the SBES program.
383	1/1/2027	Updated the savings factor % for retrofit lighting controls.
384	1/1/2027	Updated the electric realization rates for LBES program.
385	1/1/2027	Updated the summer coincidence factors for municipal lighting occupancy sensor controls.

Endnotes:

1: DNV GL, June 30, 2020. C1635 Impact Evaluation of PY 2016 & 2017 Energy Opportunities Program, Draft Report. Table 5-17. Interior Fixture Hours of Use Results by Building Type. Available at: https://energizect.com/sites/default/files/documents/C1635_FINAL%20Report_Energy%20Opportunities%20Impact%20Evaluation%2008272020.pdf (Last accessed on February 16th, 2026)

2: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

3: CT X1931-4 ALC PSD Phase 2 Memo, 2022 https://www.energizect.com/sites/default/files/documents/CT%20X1931-4%20ALC%20PSD%20Phase%202%20Memo%20Final060822.pdf (Last accessed on February 23rd, 2026)

4: Southern California Edison, January 2016. Refrigerated Case Door Aisle Traffic Sensor. Work paper SCE13CS003, revision 2. https://cedars.cpuc.ca.gov/deer-resources/deemed-measure-packages/measure-package-archive/resource/1563/history/ (Last accessed on February 16th, 2026)

5: ERS, November 17, 2005. Measure Life Study. Prepared for MA Joint Utilities. (Last accessed on February 16th, 2026)

6: DNV KEMA, June 21, 2013. Impact Evaluation of 2010 Prescriptive Lighting Installations. (MA) https://ma-eeac.org/wp-content/uploads/Impact-Evaluation-of-2010-Prescriptive-Lighting-Installations-Final-Report-6-21-13.pdf (Last accessed on February 16th, 2026)

7: DNV GL, ERS, June 7, 2018. Impact Evaluation of PY2016 Small Business Initiative: Phase I https://ma-eeac.org/wp-content/uploads/P69-Impact-Eval-of-MA-Small-Business-Initiative-Phase-I-Lighting_Report_FINAL.pdf (Last accessed on February 16th, 2026)

8: DNV GL, June 21, 2018. Impact Evaluation of 2016 New Hampshire Commercial & Industrial Small Business and Municipal Lighting. See sample projects including controls, which produced an overall realization rate of 106.6%.

https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/8-small-business-municipal-lighting-impact-eval.pdf (Last accessed on February 16th, 2026)

9: DNV GL, September 25, 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. See 100.8% realization rate for custom electric measures in table 16. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on February 16th, 2026)

10: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

11: Cadmus Group, October 23, 2012. Small Business Direct Install Program: Pre/Post Lighting Occupancy Sensor Study. (MA) Available as appendix C-1 in https://ma-eeac.org/wp-content/uploads/Massachusetts-Small-Business-Direct-Install_2010-2012-Impact-Evaluations-1.29.13.pdf (Last accessed on February 16th, 2026)

12: DNV GL, 2018. P72 Prescriptive C&I Loadshapes of Savings.

13: EMI, September 25, 2019. C1644 EO Net-to-Gross Study, Final Report. https://www.energizect.com/sites/default/files/C1644%20-%20EO%20NTG%20Final%20Report_9.25.19.pdf Downstream NTG values are based on Energy Opportunities NTG Study Results for Lighting shown in Table ES-1-1 on p. ES-3. (Last accessed on February 16th, 2026)

14: Connecticut Energy Efficiency Board, X1931-5 PSD Commercial Refrigeration Efficiency Update Study. April 2022 https://www.energizect.com/sites/default/files/documents/CTx1931-5CommercialRefrigerationCOP_Draft%20Report_0.pdf (Last accessed on February 16th, 2026).

Lighting - New Construction and Major Renovation

Measure Code	COM-LTG-NCMR
Markets	Commercial
ProgramTypes	Lost Opportunity
Categories	Lighting

Measure Description:

Advanced lighting design refers to the implementation of various lighting design principles aimed at creating a quality and appropriate lighting experience while reducing unnecessary light usage. This is often done by a professional in a new construction or major renovation situation. Advanced lighting design uses techniques like maximizing task lighting and efficient fixtures to create a system of optimal energy efficiency and functionality.

Baseline Efficiency:

The baseline efficiencies values are derived from the ISP recommendation made in the New Hampshire Baseline Practices Final Report by NMR Group, Inc[11]. The baseline lighting power density (LPD) values presented in Appendix 4 incorporate ISP adjustment factors of 0.60 for interior and 0.67 for exterior lighting applied to IECC 2015 values. These values are all compliant with IECC 2018 requirements, and in some cases exceed code minimums. Therefore, the baseline is compliant with the LPD requirements as mandated by New Hampshire State Building Code, which currently reflects IECC 2018[1 2] with direct reference for compliance to ASHRAE Standard 90.1-2016. These standards specify the maximum lighting power densities (LPDs) by building type (building area method) and interior space type (space-by-space method). LPDs apply to all new construction and major renovation projects.

High Efficiency:

The high efficiency scenario assumes lighting systems that achieve lighting power densities below industry standard practice. Actual site lighting power densities should be determined on a case-by-case basis. Please refer to the current year application form for minimum percentage better than code efficiency requirements.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = \sum_{i=1}^{n}((LPD_{Base,i} - Controlled \times LPD_{Proposed,i}) \times Area_i \times Hours_i /1000)$$

$$\Delta kW_{Fixture} = \sum_{i=1}^{n}((LPD_{Base,i} - LPD_{Proposed,i}) \times Area_i /1000)$$

$$\Delta kW_{Controlled} = \sum_{i=1}^{n} LPD_{Proposed,i} \times Area_i /1000$$

Where:

n = Total number of spaces, or 1 for Building Area Method

$LPD_{Base,i}$ = Baseline lighting power density for building or space type i (Watts/sqft). See Appendix 4

$Area_i$ = Area of building or space i (sqft)

$Hours_i$ = Annual hours of operation of the lighting equipment for space type i, see table below.

$LPD_{proposed,i}$[1: 2:]= Proposed lighting power density for building or space type i (Watts/sqft). See IECC 2018 C405.3.2 Interior lighting power allowance, and C405.4 Exterior lighting power requirements linked in end notes.

Controlled = Min % of controlled lighting above required amounts

1000 = Conversion factor: 1000 watts per 1 kW

Note on HVAC system interaction: Additional Electric savings from cooling system interaction are included in the calculation of adjusted gross savings for Lighting Systems projects. The HVAC interaction adjustment factor is determined from lighting project evaluations and is included in the energy realization rates and demand coincidence factors and realization rates.

Hours of Use:[3:]

Large business HOU are unadjusted from the MA and CT studies, but SBES HOU have been reduced by 30% per the 2025 SBES impact evaluation.[4:]

Building Type	Hours of Use LBES	Hours of Use SBES
24x7 lighting	8,760	8,760
Automotive	4,056	2,839
Education	2,967	2,077
Grocery	5,468	3,828
Health Care	5,564	3,895
Hotel/Motel	3,064	2,145
Industrial	5,793	4,055
Large Office	4,098	2,869
Other	6,211*	4,348
Parking Lot/ Streetlights	6,887	4,821
Religious Building/ Convention Center	913	639
Restaurant	5,018	3,513
Retail	4,939	3,457
Small Office	3,748	2,624
Warehouse	5,667	3,967
Parking Garage	8,760	8,760

Measure Life:

Measure lives are deemed based on study results from MA.[5:]

BC ID	Measure Name	Program	Measure Life
EC1b013 EC2b013 EC3b013	Performance Lighting (Interior)	LBES, SBES, MES	15
EC1b011 EC2b011 EC3b011	Performance Lighting (Exterior)	LBES, SBES, MES	15
EC1b012 EC2b012 EC3b012	Performance Lighting w/ controls (Interior)	LBES, SBES, MES	15
EC1b010 EC2b010 EC3b010	Performance lighting (exterior) w/ controls	LBES, SBES, MES	15

Other Resource Impacts:

Heating penalties are from a lighting program evaluation performed on lighting systems in Massachusetts.[6:]

BC ID	Measure Name	Program	MMBtu/kWh
EC1b012 EC2b012 EC3b012 EC1b013 EC2b013 EC3b013	Performance lighting (interior) w/ and w/out controls	LBES, SBES, MES	-0.000162279
EC1b010 EC2b010 EC3b010 EC1b011 EC2b011 EC3b011	Performance lighting (exterior) w/ and w/out controls	LBES, SBES, MES	n/a

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1b010	Performance Lighting - Exterior w/ Controls	LBES New	1	0.999	1	1	1	0	1
EC1b011	Performance Lighting - Exterior w/o Controls	LBES New	1	0.999	1	1	1	0	1
EC1b012	Performance Lighting - Interior w/ Controls	LBES New	1	0.999	1	1	1	0.504	0.389
EC1b013	Performance Lighting - Interior w/o Controls	LBES New	1	0.999	1	1	1	0.504	0.389
EC3b010	Performance Lighting - Exterior w/o Controls	Muni New	1	1.027	1	1	1	0	1
EC3b011	Performance Lighting - Exterior w/o Controls	Muni New	1	1.027	1	1	1	0	1
EC3b012	Performance Lighting - Interior w/ Controls	Muni New	1	1.066	1	1.135	1	0.504	0.389
EC3b013	Performance Lighting - Interior w/o Controls	Muni New	1	1.066	1	1.135	1	0.504	0.389
EC2b010	Performance Lighting - Exterior w/ Controls	SBES New	1	0.864	1	1	1	0	1
EC2b011	Performance Lighting - Exterior w/ Controls	SBES New	1	0.864	1	1	1	0	1
EC2b012	Performance Lighting - Interior w/ Controls	SBES New	1	0.864	1	1.123	0.974	0.63	0.3
EC2b013	Performance Lighting - Interior w/o Controls	SBES New	1	0.864	1	1.123	0.974	0.63	0.3

In-Service Rates:

All installations have a 100.0% in service rate unless an evaluation finds otherwise.

Realization Rates:

Large Business Energy Solutions uses a 99.9% realization rate. Energy and demand realization rates for Municipal Energy Solutions are based on a NH study of municipal and small business customers.[7:] SBES realization rates are based on 2025 Impact study results.[8:] Realization rates for summer peak demand savings in interior systems reflect a 113.5% HVAC interactive multiplier.

Coincidence Factors:

All coincidence factors are based on a NH study of municipal and small business customers.[7: 8]

Energy Load Shape:

Energy load shapes are based the MA P72 C&I loadshape study.[9:]

Measure Name	Summer On-peak	Winter On-peak	Summer Off-peak	Winter Off-peak
Interior Lighting	33.70%	30.10%	18.40%	17.70%
Exterior Lighting	19.20%	20.10%	29.00%	31.60%

Impact Factors for Calculating Net Savings:[10:]

BC ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
EC1b013 EC2b013 EC3b013	Performance Lighting (Interior)	LBES, SBES, MES	11%	5%	0%	94%
EC1b011 EC2b011 EC3b011	Performance Lighting (Exterior)	LBES, SBES, MES	11%	5%	0%	94%
EC1b012 EC2b012 EC3b012	Performance Lighting w/ controls (Interior)	LBES, SBES, MES	11%	5%	0%	94%
EC1b010 EC2b010 EC3b010	Performance Lighting w/ controls (Exterior)	LBES, SBES, MES	11%	5%	0%	94%

Revision History:

Revision Number	Date	Description
216	1/1/2025	Adjustments are made to the code LPDs to account for industry standard practice (ISP) lighting design, which is more efficient than code requirements.
308	1/1/2026	Updated HOU and RR's based on 2025 SBES impact study findings.
310	2/17/2026	Updated the hours for 24x7 facility and parking garage for the SBES program.
386	1/1/2027	Clarified baseline, correct 24/7 and parking garage hours of use.

Endnotes:

1: IECC (2018) C405.3. Interior lighting power requirements https://codes.iccsafe.org/content/iecc2018/chapter-4-ce-commercial-energy-efficiency#IECC2018_CE_Ch04_SecC405.3 (Last accessed on February 16th, 2026)

2: IECC (2018) C405.4. Exterior lighting power requirements https://codes.iccsafe.org/content/iecc2018/chapter-4-ce-commercial-energy-efficiency#IECC2018_CE_Ch04_SecC405.4 (Last accessed on February 16th, 2026)

3: DNV GL, June 30, 2020. C1635 Impact Evaluation of PY 2016 & 2017 Energy Opportunities Program, Draft Report. Table 5-17. Interior Fixture Hours of Use Results by Building Type. Available at: https://energizect.com/sites/default/files/documents/C1635_FINAL%20Report_Energy%20Opportunities%20Impact%20Evaluation%2008272020.pdf (Last accessed on February 16th, 2026)

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

5: DNV GL, ERS, July 22, 2019. Lighting Outyear Factor and Equivalent Measure Life. https://ma-eeac.org/wp-content/uploads/Lighting-Outyear-Factor-and-Equivalent-Measure-Life-Update_Final.pdf (Last accessed on February 16th, 2026)

6: DNV GL, ERS, NMR, November 22, 2017. Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative https://ma-eeac.org/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf (Last accessed on February 16th, 2026)

7: DNV GL, June 21, 2018. Impact Evaluation of 2016 New Hampshire Commercial & Industrial Small Business and Municipal Lighting https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/8-small-business-municipal-lighting-impact-eval.pdf (Last accessed on February 16th, 2026)

8: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

9: DNV GL, 2018. P72 Prescriptive C&I Loadshapes of Savings

10: EMI, September 25, 2019. C1644 EO Net-to-Gross Study, Final Report. https://www.energizect.com/sites/default/files/C1644%20-%20EO%20NTG%20Final%20Report_9.25.19.pdf Downstream NTG values are based on Energy Opportunities NTG Study Results for Lighting shown in Table ES-1-1 on p. ES-3. (Last accessed on February 16th, 2026)

11: NMR, New Hampshire Baseline Practices Final Report, Prepared for New Hampshire EM&V Working Group, November, 2023.

https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/27-nh-baseline-practices-report.pdf (Last accessed on April 16th, 2026)

Lighting - Retrofit

Measure Code	COM-LTG-LR
Markets	Commercial
ProgramTypes	Retrofit, Lost Opportunity
Categories	Lighting

Measure Description:

This is the retrofit lighting measure, for true new construction lighting savings algorithms, please see the "Lighting- New Construction and Major Renovations" chapter.

This measure includes efficient lighting products including, but not limited to, efficient Light-Emitting Diode (LED) lamps and fixtures, promoted through direct install retrofit programs, and installed in commercial and industrial buildings (C&I).

Midstream measures include efficient lighting products including, but not limited to, efficient Light-Emitting Diode (LED) lamps and fixtures, promoted through point-of-sale (also referred to as midstream) distributors.

Baseline Efficiency:

For C&I lighting retrofit installations, the baseline efficiency case is project-specific and is determined using actual fixture counts and wattages from the existing space.

All midstream measures assume a blend of retrofit and lost opportunity baseline, determined using assumed wattages for each of the replaced lamps or fixtures.[1:]

High Efficiency:

For C&I lighting retrofit installations, the high efficiency case is project-specific and is determined using actual fixture counts and wattages for the project.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = \sum_{i=1}^{n}\left(\left(Count_i \times \frac{Watts_i}{1000}\right)_{Base}\right) - \sum_{j=1}^{m}\left(\left(Count_j \times \frac{Watts_i}{1000}\right)_{EE}\right) \times Hours$$

$$\Delta kW = \sum_{i=1}^{n}\left(\left(Count_i \times \frac{Watts_i}{1000}\right)_{Base}\right) - \sum_{j=1}^{m}\left(\left(Count_j \times \frac{Watts_i}{1000}\right)_{EE}\right)$$

Where:

n = Total number of fixture types in baseline or pre-retrofit case

m = Total number of installed fixture types

$Count_i$ = Quantity of existing fixtures of type i.

$Watts_i$ = Existing fixture or baseline wattage for fixture type i

$Count_j$ = Quantity of efficient fixtures of type j.

$Watts_j$ = Efficient fixture wattage for fixture type j.

1000 = Conversion factor: 1000 watts per kW.

Hours = Lighting annual hours of operation.

For retrofit installations, the annual hours of operation is project-specific and determined using actual building operation data in which the lighting equipment was installed. If site specific hours of operation are unavailable or if vendor estimates of building operating hours are unrealistically different from standard building type operating hours, then refer to the operating hours defined for midstream lighting, which is based on a program evaluation from CT.[2: 6:]

For Midstream:

$$\Delta kWh = n \times \frac{\Delta Watts}{1000} \times Hours$$

$$\Delta kW = n \times \frac{\Delta Watts}{1000}$$

Where:

n = Total number of fixture or lamp types in project.

ΔWatts = Calculated difference between efficient and baseline wattage (see table below)

1000 = Conversion factor: 1000 watts per kW.

Hours = Lighting annual hours of operation.

The following delta watt values are based on MAC1906 Impact Evaluation of the MA C&I Upstream Lighting Initiative[5:] and the CT PSD[3:] and can be viewed in the NH CI Lighting Delta Watts Spreadsheet as well.[4:]

Product (New name)	Product Type	ΔWatts
Low Output (250-5,000 lumens)	Exterior LEDs	88.9
Mid Output (5,000-10,000 lumens)	Exterior LEDs	152.9
High Output (10,000-30,000 lumens)	Exterior LEDs	208.9
Very High Output (>30,000 lumens)	Exterior LEDs	348.5
Low Output w/Occ Sensor (250-5,000 lumens)	Exterior LEDs	88.9
Mid Output w/Occ Sensor (5,000-10,000 lumens)	Exterior LEDs	166.3
High Output w/Occ Sensor (10,000-30,000 lumen)	Exterior LEDs	332
Very High Output w/Occ Sensor (>30,000 lumens)	Exterior LEDs	463.1
Mogul Exterior Low Output (250-5,000 lumens)	Exterior LEDs	213.6
Mogul Exterior Mid Output (5,000-10,000 lumens)	Exterior LEDs	278.4
Mogul Exterior High Output (10,000-30,000 lumens)	Exterior LEDs	426.5

Product (New name)	Product Type	ΔWatts
Mogul Exterior Very High Output (> 30,000 lumens)	Exterior Mogul Lamp	426.5
Parking Garage, >= 200W - Premium	Exterior LEDs	583.1
Parking Garage, >= 200W - Standard	Exterior LEDs	561.6
Parking Garage, 100-199W - Premium	Exterior LEDs	253.9
Parking Garage, 100-199W - Standard	Exterior LEDs	249.4
Parking Garage, 20-99W - Premium	Exterior LEDs	130.5
Parking Garage, 20-99W - Standard	Exterior LEDs	122.9
LED High/Low Bay: High Output (10,000-30,000 lumens) Premium	High Bay/Low Bay	131.2
LED High/Low Bay: High Output (10,000-30,000 lumens) Standard	High Bay/Low Bay	131.2
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Premium	High Bay/Low Bay	99.7
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Standard	High Bay/Low Bay	99.7
LED High/Low Bay: Very High Output (>30,000 lumens) Premium	High Bay/Low Bay	191.4
LED High/Low Bay: Very High Output (>30,000 lumens) Standard	High Bay/Low Bay	191.4
Mogul High Bay	High Bay/Low Bay	162.5
Mogul Low Bay	High Bay/Low Bay	109.4
LED High/Low Bay: High Output (10,000-30,000 lumens) Premium w Dual Sensor	High Bay/Low Bay w Controls	187.46
LED High/Low Bay: High Output (10,000-30,000 lumens) Premium w LLLC	High Bay/Low Bay w Controls	203.72
LED High/Low Bay: High Output (10,000-30,000 lumens) Premium w Occ Sensor	High Bay/Low Bay w Controls	166.72
LED High/Low Bay: High Output (10,000-30,000 lumens) Standard w Dual Sensor	High Bay/Low Bay w Controls	186.6
LED High/Low Bay: High Output (10,000-30,000 lumens) 'Standard w LLLC	High Bay/Low Bay w Controls	202.62
LED High/Low Bay: High Output (10,000-30,000 lumens) Standard w Occ Sensor	High Bay/Low Bay w Controls	166.22
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Premium w Dual Sensor	High Bay/Low Bay w Controls	128.4
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Premium w LLLC	High Bay/Low Bay w Controls	136.7
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Premium w Occ Sensor	High Bay/Low Bay w Controls	117.8
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Standard w Dual Sensor	High Bay/Low Bay w Controls	127.5
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Standard w LLLC	High Bay/Low Bay w Controls	135.5
LED High/Low Bay: Mid Output (5,000-10,000 lumens) Standard w Occ Sensor	High Bay/Low Bay w Controls	117.2
LED High/Low Bay: Very High Output (>30,000 lumens) Premium w Dual Sensor	High Bay/Low Bay w Controls	283.7
LED High/Low Bay: Very High Output (>30,000 lumens) Premium w LLLC	High Bay/Low Bay w Controls	310.5

Product (New name)	Product Type	ΔWatts
LED High/Low Bay: Very High Output (>30,000 lumens) Premium w Occ Sensor	High Bay/Low Bay w Controls	249.7
LED High/Low Bay: Very High Output (>30,000 lumens) Standard w Dual Sensor	High Bay/Low Bay w Controls	284.9
LED High/Low Bay: Very High Output (>30,000 lumens) Standard w LLLC	High Bay/Low Bay w Controls	311.9
LED High/Low Bay: Very High Output (>30,000 lumens) Standard w Occ Sensor	High Bay/Low Bay w Controls	250.4
Stairwell Kit, Low-Output w/sensor	LED Stairwell Kits	19.2
Stairwell Kit, Mid-Output w/sensor	LED Stairwell Kits	40.0
1x4 LED Fixture Premium	Linear LEDs	26.4
1x4 LED Fixture Standard	Linear LEDs	21.1
1x4 LED Troffer Retrofit Kit - Premium	Linear LEDs	49.2
1x4 LED Troffer Retrofit Kit - Standard	Linear LEDs	38.9
2x2 LED Fixture Premium	Linear LEDs	43.5
2x2 LED Fixture Standard	Linear LEDs	38.2
2x2 LED Troffer Retrofit Kit - Premium	Linear LEDs	25.9
2x2 LED Troffer Retrofit Kit - Standard	Linear LEDs	23.9
2x4 LED Fixture Premium	Linear LEDs	48.8
2x4 LED Fixture Standard	Linear LEDs	43.5
2x4 LED Troffer Retrofit Kit - Premium	Linear LEDs	74.1
2x4 LED Troffer Retrofit Kit - Standard	Linear LEDs	70.6
LED Ambient/Strip/Wrap	Linear LEDs	32.8
LED Tubes, 3ft Type A	Linear LEDs	12.0
LED Tubes, 8ft Type A	Linear LEDs	25.1
T5 LED	Linear LEDs	30.1
T8 TLED, 2ft	Linear LEDs	10.4
T8 TLED, 4ft	Linear LEDs	20.8
U-Bend LED	Linear LEDs	35.3
LED 1X4 Troffer Premium Retrofit Kit w Dual Sensor	Linear LEDs w Controls	63.8
LED 1X4 Troffer Premium Retrofit Kit w LLLC	Linear LEDs w Controls	68.1
LED 1X4 Troffer Premium Retrofit Kit w Occ Sensor	Linear LEDs w Controls	58.4
LED 1X4 Troffer Premium w Dual Sensor	Linear LEDs w Controls	38.0
LED 1X4 Troffer Premium w LLLC	Linear LEDs w Controls	41.3
LED 1X4 Troffer Premium w Occ Sensor	Linear LEDs w Controls	33.7
LED 1X4 Troffer Standard Retrofit Kit w Dual Sensor	Linear LEDs w Controls	52.3
LED 1X4 Troffer Standard Retrofit Kit w LLLC	Linear LEDs w Controls	56.2
LED 1X4 Troffer Standard Retrofit Kit w Occ Sensor	Linear LEDs w Controls	47.4
LED 1X4 Troffer Standard w Dual Sensor	Linear LEDs w Controls	34.2
LED 1X4 Troffer Standard w LLLC	Linear LEDs w Controls	38.0
LED 1X4 Troffer Standard W Occ Sensor	Linear LEDs w Controls	29.4
LED 2X2 Troffer Premium Retrofit Kit w Dual Sensor	Linear LEDs w Controls	36.11

Product (New name)	Product Type	ΔWatts
LED 2X2 Troffer Premium Retrofit Kit w LLLC	Linear LEDs w Controls	39.05
LED 2X2 Troffer Premium Retrofit Kit w Occ Sensor	Linear LEDs w Controls	32.4
LED 2X2 Troffer Premium w Dual Sensor	Linear LEDs w Controls	54.9
LED 2X2 Troffer Premium w LLLC	Linear LEDs w Controls	58.20
LED 2X2 Troffer Premium w Occ Sensor	Linear LEDs w Controls	50.70
LED 2X2 Troffer Standard Retrofit Kit w Dual Sensor	Linear LEDs w Controls	33.49
LED 2X2 Troffer Standard Retrofit Kit w LLLC	Linear LEDs w Controls	36.27
LED 2X2 Troffer Standard Retrofit Kit w Occ Sensor	Linear LEDs w Controls	29.97
LED 2X2 Troffer Standard w Dual Sensor	Linear LEDs w Controls	50.68
LED 2X2 Troffer Standard w LLLC	Linear LEDs w Controls	54.25
LED 2X2 Troffer Standard w Occ Sensor	Linear LEDs w Controls	46.05
LED 2X4 Troffer Premium Retrofit Kit w Dual Sensor	Linear LEDs w Controls	84.73
LED 2X4 Troffer Premium Retrofit Kit w LLLC	Linear LEDs w Controls	87.83
LED 2X4 Troffer Premium Retrofit Kit w Occ Sensor	Linear LEDs w Controls	80.83
LED 2X4 Troffer Premium w Dual Sensor	Linear LEDs w Controls	64.23
LED 2X4 Troffer Premium w LLLC	Linear LEDs w Controls	68.70
LED 2X4 Troffer Premium w Occ Sensor	Linear LEDs w Controls	58.50
LED 2X4 Troffer Standard Retrofit Kit w Dual Sensor	Linear LEDs w Controls	80.50
LED 2X4 Troffer Standard Retrofit Kit w LLLC	Linear LEDs w Controls	83.30
LED 2X4 Troffer Standard Retrofit Kit w Occ Sensor	Linear LEDs w Controls	76.80
LED 2X4 Troffer Standard w Dual Sensor	Linear LEDs w Controls	61.01
LED 2X4 Troffer Standard w LLLC	Linear LEDs w Controls	66.00
LED 2X4 Troffer Standard w Occ Sensor	Linear LEDs w Controls	54.50
LED Linear Ambient w/ Dual Sensor	Linear LEDs w Controls	44.40
LED Linear Ambient w/ LLLC	Linear LEDs w Controls	47.70
LED Linear Ambient w/ Occ Sensor	Linear LEDs w Controls	40.10

Midstream lighting measures will calculate gross energy savings using annual hours of operation defined for the building type in which the lamp was installed. These categories and hours of use are defined in the table below.

Midstream Hours of Use by Building Type

The following hours of operation are based on a program evaluation from NH.[6:]

Large business HOU are unadjusted from the NH study, but SBES HOU have been reduced by 30% per the 2025 SBES impact evaluation.[6:] Parking garages are included as an additional building type category that has not yet been evaluated. A review of TRM best practices indicates 8760 hours of use for parking garages.

Building Type	Hours of Use LBES	Hours of Use SBES
24x7 lighting	8,760	8,760
Automotive	4,056	2,839

Building Type	Hours of Use LBES	Hours of Use SBES
Education	2,967	2,077
Grocery	5,468	3,828
Health Care	5,564	3,895
Hotel/Motel	3,064	2,145
Industrial	5,793	4,055
Large Office	4,098	2,869
Other*	6,211	4,348
Parking Lot/ Streetlights	6,887	4,821
Religious Building/ Convention Center	913	639
Restaurant	5,018	3,513
Retail	4,939	3,457
Small Office	3,748	2,624
Warehouse	5,667	3,967
Parking Garage	8,760	8,760

*Other includes recreational and entertainment facilities, service-oriented facilities, and other miscellaneous building types.

Measure Life:

The table below summarizes the adjusted measure lives (AML) for each measure. AML values are estimated based off of historical trajectory for planning purposes.[7:]

Measure Category	Measure	AML
Ambient Linear	TLED	5
Ambient Linear	LED Fixture	5
High/Low Bay	TLED	6
High/Low Bay	LED Fixture	6
High/Low Bay	LED Lamp	6
Exterior/Outdoor	TLED	4
Exterior/Outdoor	LED Fixture	4
Exterior/Outdoor	LED Lamp	4

Other Resource Impacts:

Heating penalties for downstream, interior lighting systems (non-turnkey) are from a 12-month MA data logging study.[20:] Penalties for interior turnkey are from the 2018 MA small business lighting impact evaluation.[8:]

BC ID	Measure Name	Program	MMBtu/kWh
EC1a012	Interior Lighting	LBES, SBES, MES	-0.000691
EC1a013			
EC2a012			
EC2a013			

BC ID	Measure Name	Program	MMBtu/kWh
EC3a012			
EC3a013			
EC1d014	Interior Lighting (turnkey direct-install)	LBES, SBES, MES	-0.004080
EC1d015			
EC2d014			
EC2d015			
EC3d014			
EC3d015			
EC1a010	Exterior Lighting	LBES, SBES, MES	n/a
EC1a011			
EC1d012			
EC1d013			
EC2a010			
EC2a011			
EC2d012			
EC2d013			
EC3a010			
EC3a011			
EC3d012			
EC3d013			

Midstream: The following heating penalties are associated with lighting projects, determined from MA lighting evaluations.[9:]

BC ID	Measure Name	Program	MMBtu/kWh
EC1c010 EC2c010	LED Downlight	LBES Midstream, SBES Midstream	-0.000329
EC1c011 EC2c011	LED Exterior	LBES Midstream, SBES Midstream	N/A
EC1c012 EC2c012	LED High Bay/Low Bay	LBES Midstream, SBES Midstream	-0.000162
EC1c013 EC2c013	LED Linear Fixture	LBES Midstream, SBES Midstream	-0.000162
EC1c014 EC2c014	LED Linear Fixture with Controls	LBES Midstream, SBES Midstream	-0.000162
EC1c015 EC2c015	LED Linear Lamp	LBES Midstream, SBES Midstream	-0.000162
EC1c016 EC2c016	LED Screw In	LBES Midstream, SBES Midstream	-0.000329
EC1c017 EC2c017	LED Stairwell Kit	LBES Midstream, SBES Midstream	N/A

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d012	Exterior Lighting (turnkey direct-install)	LBES DI	1	0.999	n/a	1	1	0	1
EC1d013	Exterior Lighting (turnkey direct-install)	LBES DI	1	0.999	n/a	1	1	0	1
EC1d014	Interior Lighting (turnkey direct-install)	LBES DI	1	0.999	n/a	1	1	0.504	0.389
EC1d015	Interior Lighting (turnkey direct-install)	LBES DI	1	0.999	n/a	1	1	0.504	0.389
EC1c010	LED Downlight	LBES Mid	0.859	1.267	n/a	1	1	0.59	0.52
EC1c011	LED Exterior	LBES Mid	0.955	0.989	n/a	1	1	0	1
EC1c012	LED High Bay/Low Bay	LBES Mid	0.996	0.747	n/a	1	1	0.66	0.56
EC1c013	LED Linear Fixture	LBES Mid	0.971	1.135	n/a	1	1	0.72	0.66
EC1c014	LED Linear Fixture with Controls	LBES Mid	0.971	1.135	n/a	1	1	0.72	0.66
EC1c015	LED Linear Lamp	LBES Mid	0.971	1.135	n/a	1	1	0.72	0.66
EC1c016	LED Screw In	LBES Mid	0.714	1.712	n/a	1	1	0.59	0.52
EC1c017	LED Stairwell Kit	LBES Mid	0.955	0.989	n/a	1	1	0.81	0.82
EC1a010	Exterior Lighting	LBES Retro	1	0.999	n/a	1	1	0	1
EC1a011	Exterior Lighting	LBES Retro	1	0.999	n/a	1	1	0	1
EC1a012	Interior Lighting	LBES Retro	1	0.999	n/a	1	1	0.504	0.389
EC1a013	Interior Lighting	LBES Retro	1	0.999	n/a	1	1	0.504	0.389
EC3d012	Exterior Lighting (turnkey direct-install)	Muni DI	1	1.027	n/a	1	1	0	1
EC3d013	Exterior Lighting (turnkey direct-install)	Muni DI	1	1.027	n/a	1	1	0	1
EC3d014	Interior Lighting (turnkey direct-install)	Muni DI	1	1.066	n/a	1.123	0.974	0.504	0.389
EC3d015	Interior Lighting (turnkey direct-install)	Muni DI	1	1.066	n/a	1.123	0.974	0.504	0.389
EC3a010	Exterior Lighting	Muni Retro	1	1.027	n/a	1	1	0	1
EC3a011	Exterior Lighting	Muni Retro	1	1.027	n/a	1	1	0	1
EC3a012	Interior Lighting	Muni Retro	1	1.066	n/a	1.123	0.974	0.504	0.389
EC3a013	Interior Lighting	Muni Retro	1	1.066	n/a	1.123	0.974	0.504	0.389
EC2d012	Exterior Lighting (turnkey direct-install)	SBES DI	1	0.864	n/a	1	1	0	1
EC2d013	Exterior Lighting (turnkey direct-install)	SBES DI	1	0.864	n/a	1	1	0	1
EC2d014	Interior Lighting (turnkey direct-install)	SBES DI	1	0.864	n/a	1.123	0.974	0.504	0.389
EC2d015	Interior Lighting (turnkey direct-install)	SBES DI	1	0.864	n/a	1.123	0.974	0.504	0.389
EC2c010	LED Downlight	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.59	0.52
EC2c011	LED Exterior	SBES Mid	0.95	1	n/a	1	1	0	1
EC2c012	LED High Bay/Low Bay	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.66	0.56
EC2c013	LED Linear Fixture	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.72	0.66
EC2c014	LED Linear Fixture with Controls	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.72	0.66
EC2c015	LED Linear Lamp	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.72	0.66

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC2c016	LED Screw In	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.59	0.52
EC2c017	LED Stairwell Kit	SBES Mid	0.95	1.034	n/a	1.123	0.974	0.81	0.82
EC2a010	Exterior Lighting	SBES Retro	1	0.864	n/a	1	1	0	1
EC2a011	Exterior Lighting	SBES Retro	1	0.864	n/a	1	1	0	1
EC2a012	Interior Lighting	SBES Retro	1	0.864	n/a	1.123	0.974	0.504	0.389
EC2a013	Interior Lighting	SBES Retro	1	0.864	n/a	1.123	0.974	0.504	0.389

In-Service Rates:

All downstream installations have 100.0% in service rate since programs include verification of equipment installations.

LBES Midstream in-service rates are based on the C1635 Impact Evaluation of PY 2016 and 2017 Energy Opportunities (EO) Program Report.[10:] SBES Midstream in-service rates are based on NHSave SBES 2025 evaluation.[12:]

Realization Rates:

Large Business Energy Solutions (DI and Retro) uses a 99.9% realization rate. Realization rates for Municipal Energy Solutions are based on NH evaluation results for municipal and small business facilities.[16:] They account for operational hours of use adjustments, electric HVAC interactive adjustments for kWh and summer peak kW, and other adjustments. Exterior lighting realization rates account for the same adjustments except the HVAC interactive adjustment. SBES realization rates are from the NHSave SBES 2025 evaluation.[12:]

LBES Midstream realization rates are based on the C1635 Impact Evaluation of PY 2016 and 2017 Energy Opportunities (EO) Program Report.[13:] The HVAC interaction adjustment factor is determined from NHSave SBES 2025 evaluation.[12:]

Non-electric realization rates does not apply to lighting measures.

Coincidence Factors:

Summer and winter coincidence factors are based on NH evaluation results.[16:]

Midstream summer and winter coincidence factors are based on MA 2017 Upstream Lighting Impact evaluation.[17:] LED screw-in coincident factors also applied to LED downlights.

The summer and winter coincidence factor for exterior lighting are 0 and 1 respectively.

Energy Load Shape:

Energy load shapes are based on site-level metering of project sites in MA.[18:]

Measure Name	Summer On-peak	Winter On-peak	Summer Off-peak	Winter Off-peak
Interior Lighting	33.70%	30.10%	18.40%	17.70%
Exterior Lighting	19.20%	20.10%	29.00%	31.60%

Impact Factors for Calculating Net Savings:

Midstream and downstream free-ridership and spillover are based on study results from CT—which is the nearby jurisdiction with programs and markets most similar to those in NH.[19:]

BC ID	Measure Name	Program	FR	SOP	SONP	NTG
EC2d012	Exterior Lighting (turnkey direct-install)	Mid	11%	5%	0%	94%
EC3d012	Exterior Lighting (turnkey direct-install)	Mid	11%	5%	0%	94%
EC2d013	Exterior Lighting (turnkey direct-install)	BES Mid	11%	5%	0%	94%
EC1c010	LED Downlight	LBES Mid	27%	11%	0%	84%
EC1c011	LED Exterior	LBES Mid	27%	11%	0%	84%
EC1c012	LED High Bay/Low Bay	LBES Mid	27%	11%	0%	84%
EC1c013	LED Linear Fixture	LBES Mid	27%	11%	0%	84%
EC1c014	LED Linear Fixture with Controls	LBES Mid	27%	11%	0%	84%
EC1c015	LED Linear Lamp	LBES Mid	27%	11%	0%	84%
EC1c016	LED Screw In	LBES Mid	50%	23%	0%	73%
EC1c017	LED Stairwell Kit	LBES Mid	27%	11%	0%	84%
EC1a012	Interior Lighting	LBES Mid	11%	5%	0%	94%
EC1a013	Interior Lighting	LBES Mid	11%	5%	0%	94%
EC1d014	Interior Lighting (turnkey direct-install)	LBES Mid	11%	5%	0%	94%
EC1d015	Interior Lighting (turnkey direct-install)	LBES Mid	11%	5%	0%	94%
EC1a010	Exterior Lighting	LBES Mid	11%	5%	0%	94%
EC1a011	Exterior Lighting	LBES Mid	11%	5%	0%	94%
EC1d012	Exterior Lighting (turnkey direct-install)	LBES Mid	11%	5%	0%	94%
EC1d013	Exterior Lighting (turnkey direct-install)	LBES Mid	11%	5%	0%	94%
EC3a012	Interior Lighting	Muni Mid	11%	5%	0%	94%
EC3a013	Interior Lighting	Muni Mid	11%	5%	0%	94%
EC3d014	Interior Lighting (turnkey direct-install)	Muni Mid	11%	5%	0%	94%
EC3d015	Interior Lighting (turnkey direct-install)	Muni Mid	11%	5%	0%	94%
EC3a010	Exterior Lighting	Muni Mid	11%	5%	0%	94%
EC3a011	Exterior Lighting	Muni Mid	11%	5%	0%	94%
EC3d013	Exterior Lighting (turnkey direct-install)	Muni Mid	11%	5%	0%	94%
EC2c010	LED Downlight	SBES Mid	72%	11%	0%	39%
EC2c011	LED Exterior	SBES Mid	72%	11%	0%	39%
EC2c012	LED High Bay/Low Bay	SBES Mid	27%	11%	0%	84%
EC2c013	LED Linear Fixture	SBES Mid	27%	11%	0%	84%
EC2c014	LED Linear Fixture with Controls	SBES Mid	27%	11%	0%	84%
EC2c015	LED Linear Lamp	SBES Mid	27%	11%	0%	84%
EC2c016	LED Screw In	SBES Mid	27%	11%	0%	73%
EC2c017	LED Stairwell Kit	SBES Mid	27%	11%	0%	84%
EC2a012	Interior Lighting	SBES Mid	11%	5%	0%	94%

BC ID	Measure Name	Program	FR	SOP	SONP	NTG
EC2a013	Interior Lighting	SBES Mid	11%	5%	0%	94%
EC2d014	Interior Lighting (turnkey direct-install)	SBES Mid	11%	5%	0%	94%
EC2d015	Interior Lighting (turnkey direct-install)	SBES Mid	11%	5%	0%	94%
EC2a010	Exterior Lighting	SBES Mid	11%	5%	0%	94%
EC2a011	Exterior Lighting	SBES Mid	11%	5%	0%	94%

Revision History:

Revision Number	Date	Description
56	1/14/2022	Corrected the three typos resulting from a copy and paste error in the delta watt column of the upstream lighting delta watt value table. Updated line items are LED Retrofit kit, >25 KW, Stairwell kit, low-output w/ sensor and stairwell kit, mid-output w/sensor.
158	12/1/2022	Updated AML's to align with latest MA study.
187	1/1/2024	Updated AML table to remove past year AML's
209	3/1/2024	Added new product types as well as updated naming conventions of existing products to use lumens, rather than watts.
307	1/1/2026	Update SBES RR's, NTG and HOU based on 2025 impact study.
387	1/1/2027	Updated the hours for 24x7 facility and parking garage for the SBES program.
388	1/1/2027	Updated the ΔWatts values for couple of fixtures type for the midstream program

Endnotes:

1: The blend of retrofit and lost opportunity lighting was determined based on MA evaluation results. See DNV GL (2017) Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative, Massachusetts Program Administrators and Energy Efficiency Advisory Council, November 22, 2017 https://ma-eeac.org/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf (Last accessed on February 16th, 2026)

2: DNV (2020) C1635 Impact Evaluation of PY 2016 & 2017 Energy Opportunities (EO) Program. https://energizect.com/sites/default/files/documents/C1635_FINAL%20Report_Energy%20Opportunities%20Impact%20Evaluation%2008272020.pdf (Last accessed on February 16th, 2026)

3: 2022 CT PSD. Chapter 2.1.2 Upstream Lighting. https://energizect.com/sites/default/files/documents/Final%202022%20PSD%20FILED%20110122.pdf (Last accessed on February 16th, 2026)

4: NH Saves (2024) NH CI Retrofit Delta Watts NH CI Lighting Retrofit Delta Watts

5: DNV (2021) Impact Evaluation of PY2019 Massachusetts C&I Upstream Lighting Initiative MAC1906-E-UPLGHT. https://ma-eeac.org/wp-content/uploads/MA19C06-E-UPLGHT_Report_Final_2021.03.05-1.pdf (Last accessed on February 16th, 2026)

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation, Table 30. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

7: 2021_DNV_CI Lighting_Adjusted Measure Life_2021-2022_Memo https://ma-eeac.org/wp-content/uploads/MA-CIEC-Lighting-AML-PY21-PY22_FINAL_20210706.pdf (Last accessed on February 16th, 2026)

8: DNV GL, ERS (2018). Impact Evaluation of PY2016 Small Business Initiative: Phase I 2018_DNVGL_ERS_SBS_Impact https://ma-eeac.org/wp-content/uploads/P69-Impact-Eval-of-MA-Small-Business-Initiative-Phase-I-Lighting_Report_FINAL.pdf (Last accessed on February 16th, 2026)

9: DNV GL (2017). Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative. https://ma-eeac.org/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf (Last accessed on February 16th, 2026)

10: DNV GL, June 30, 2020, C1635 Impact Evaluation of PY 2016 and 2017 Energy Opportunities (EO) Program. Table 6-14: Upstream Lighting In-Service Rate Results. Prepared for Connecticut Energy Efficiency Board (EEB). Available at: https://www.energizect.com/sites/default/files/documents/C1635_FINAL%20Report_Energy%20Opportunities%20Impact%20Evaluation%2008272020_0.pdf (Last accessed on February 16th, 2026)

11: DNV GL, September 25, 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on February 16th, 2026)

12: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation Table 8 and Table 9 https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf (Last accessed on February 16th, 2026)

13: DNV GL, June 30, 2020, C1635 Impact Evaluation of PY 2016 and 2017 Energy Opportunities (EO) Program. Table 6-19: Upstream Lighting kWh Realization Rate Recommendations Without In-Service Rates. Prepared for Connecticut Energy Efficiency Board (EEB). Available at: https://www.energizect.com/sites/default/files/documents/C1635_FINAL%20Report_Energy%20Opportunities%20Impact%20Evaluation%2008272020_0.pdf (Last accessed on February 16th, 2026)

14: DNV GL, November 22, 2017. Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative. https://ma-eeac.org/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf (Last accessed on February 16th, 2026)

15: DNV GL, September 25, 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf (Last accessed on February 16th, 2026)

16: DNV GL, June 21, 2018. Impact Evaluation of 2016 New Hampshire Commercial & Industrial Small Business and Municipal Lighting. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/8-small-business-municipal-lighting-impact-eval.pdf (Last accessed on February 16th, 2026)

17: DNV GL, November 22, 2017. Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative. https://ma-eeac.org/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf (Last accessed on February 16th, 2026)

18: DNV GL, 2018. P72 Prescriptive C&I Loadshapes of Savings.

19: EMI, September 25, 2019. C1644 EO Net-to-Gross Study, Final Report. https://www.energizect.com/sites/default/files/C1644%20-%20EO%20NTG%20Final%20Report_9.25.19.pdf Midstream NTG values are based on Recommendation 2 on p. ES-6 and p. 51. For midstream, screw in values are applied to screw in lights, and linear values are applied to all other light types, which is consistent with the application of screw in and linear NTG values in the MA TRM. Downstream NTG values are based on Energy Opportunities NTG Study Results for Lighting shown in Table ES-1-1 on p. ES-3. (Last accessed on February 16th, 2026)

20: DNV KEMA (2013). Impact Evaluation of 2010 Prescriptive Lighting Installations https://ma-eeac.org/wp-content/uploads/Impact-Evaluation-of-2010-Prescriptive-Lighting-Installations-Final-Report-6-21-13.pdf (Last accessed on February 16th, 2026)

Motors and Drives Variable Frequency Drive

Measure Code	COM-MND-VFD
Markets	Commercial
ProgramTypes	Retrofit/Lost opportunity
Categories	Motors and Drives

Measure Description:

This measure covers the installation of variable speed drives for multiple end use types and building types. The installation of this measure saves energy since the power required to rotate a pump or fan at lower speeds requires less power than when rotated at full speed.

Baseline Efficiency:

The baseline efficiency case measure varies with equipment type. All baselines assume either a constant or 2-speed motor. Air or water volume/temperature is controlled using valves, dampers, and/or reheats.

If the project includes a motor replacement, additional savings may result from improved motor efficiency. Motors controlled by VFDs need to be "inverter rated" or may fail prematurely, thus requiring a simultaneous VFD addition and motor replacement project.

High Efficiency:

In the case of high efficiency, pump flow or fan air volume is directly controlled by the VFD based on input from the system or process controller. The pump or fan will automatically adjust its speed based on input set points, control strategies and the downstream feedback it receives from the system or process controller.

Algorithms for Calculating Primary Energy & Demand Impact:

BC ID	Measure Name	ΔkWh	ΔkW
EC1a043	Variable Frequency Drive	Calculated	Calculated
EC3d088	Variable Frequency Drive with Motor	Calculated	Calculated

Savings Algorithms:

$$\Delta kWh = \frac{HP}{\eta_{motor}} \times \frac{kWh}{HP}$$

$$\Delta kW_{SP} = \frac{HP}{\eta_{motor}} \times \frac{kW_{SP}}{HP}$$

$$\Delta kW_{WP} = \frac{HP}{\eta_{motor}} \times \frac{kW_{WP}}{HP}$$

Calculation Parameters Table:

Variable	Description	Value	Units	Ref
HP	Rated horsepower for the impacted motor	Site specific	HP	
η_{motor}	Motor efficiency	Site-specific		
$kWh/_{HP}$	Annual electric energy reduction based on building and equipment type.	See table below	kWh/HP	1
$kW_{SP}/_{HP}$	Summer demand reduction based on building and equipment type.	See table below	kW/HP	2
$kW_{WP}/_{HP}$	Winter demand reduction based on building and equipment type.	See table below	kW/HP	2

Note: Savings factors below assumes a motor efficiency of 100% and consequently an adjustment is required in the algorithm.

Savings Factors for C&I VFDs without Motor Replacement (kWh/HP[1:] and kW/HP[2:])

Building Type[3:]	Building Exhaust Fan	Cooling Tower Fan	Chilled Water Pump	Boiler Feed Water Pump	Hot Water Circulating Pump	MAF - Make-up Air Fan	Return Fan	Supply Fan	WS Heat Pump
Annual Energy Savings Factors (kWh/HP)									
University/ College	3641	449	745	2316	2344	3220	1067	1023	3061
Elem/High School	3563	365	628	1933	1957	3402	879	840	2561
Multi-Family	3202	889	1374	2340	2400	3082	1374	1319	3713
Hotel/Motel	3151	809	1239	2195	2239	3368	1334	1290	3433
Health	3375	1705	2427	2349	2406	3002	1577	1487	3670
Warehouse	3310	455	816	2002	2087	3229	1253	1205	2818
Restaurant	3440	993	1566	1977	2047	2628	1425	1363	3542
Retail	3092	633	1049	1949	2000	2392	1206	1146	2998
Grocery	3126	918	1632	1653	1681	2230	1408	1297	3285
Offices	3332	950	1370	1866	1896	3346	1135	1076	3235
Summer Demand Savings Factors (kW_{SP}/HP)									
University/ College	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Elem/High School	0.377	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Multi-Family	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Hotel/Motel	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Health	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Warehouse	0.109	-0.023	0.174	0.457	0.091	0.261	0.287	0.274	0.218
Restaurant	0.261	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Retail	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Grocery	0.261	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Offices	0.109	-0.023	0.174	0.457	0.091	0.109	0.287	0.274	0.218
Winter Demand Savings Factors (kW_{WP}/HP)									
University/ College	0.377	-0.006	0.184	0.457	0.21	0.109	0.26	0.252	0.282
Elem/High School	0.457	-0.006	0.184	0.457	0.21	0.109	0.26	0.252	0.282
Multi-Family	0.109	-0.006	0.184	0.355	0.21	0.109	0.26	0.252	0.282
Hotel/Motel	0.109	-0.006	0.184	0.418	0.21	0.109	0.26	0.252	0.282
Health	0.377	-0.006	0.184	0.275	0.21	0.109	0.26	0.252	0.282
Warehouse	0.377	-0.006	0.184	0.178	0.21	0.261	0.26	0.252	0.282
Restaurant	0.109	-0.006	0.184	0.355	0.21	0.109	0.26	0.252	0.282
Retail	0.109	-0.006	0.184	0.275	0.21	0.109	0.26	0.252	0.282
Grocery	0.457	-0.006	0.184	0.418	0.21	0.109	0.26	0.252	0.282
Offices	0.457	-0.006	0.184	0.418	0.21	0.109	0.26	0.252	0.282

Savings Factors for C&I VFDs with Motor Replacement (kWh/HP[1] and kW/HP[2:]):

Building Type[3:]	Building Exhaust Fan	Cooling Tower Fan	Chilled Water Pump	Boiler Feed Water Pump	Hot Water Circulating Pump	MAF - Make-up Air Fan	Return Fan	Supply Fan
Annual Energy Savings Factors (kWh/HP)								
University/College	3,802	486	780	2,415	2,442	3,381	1,143	1,100
Elem/High School	3,721	396	657	2,015	2,040	3,561	941	903
Multi-Family	3,368	954	1,435	2,443	2,504	3,248	1,466	1,412
Hotel/Motel	3,317	866	1,294	2,291	2,335	3,534	1,425	1,381
Health	3,541	1,815	2,535	2,453	2,510	3,168	1,676	1,586
Warehouse	3,476	496	853	2,098	2,183	3,396	1,342	1,294
Restaurant	3,606	1,066	1,636	2,067	2,138	2,794	1,519	1,457
Retail	3,258	685	1,097	2,036	2,087	2,558	1,288	1,229
Grocery	3,292	1,001	1,710	1,724	1,753	2,396	1,498	1,386
Offices	3,498	1,014	1,432	1,947	1,977	3,512	1,210	1,151
Summer Demand Savings Factors (kW_{SP}/HP)								
University/College	0.257	(0.004)	0.465	0.952	0.190	0.257	0.679	0.706
Elem/High School	1.187	(0.006)	0.697	1.428	0.286	0.385	1.019	1.058
Multi-Family	0.385	(0.006)	0.697	1.428	0.286	0.385	1.019	1.058
Hotel/Motel	0.257	(0.004)	0.465	0.952	0.190	0.257	0.679	0.706
Health	0.128	(0.002)	0.232	0.476	0.095	0.128	0.340	0.353
Warehouse	0.770	(0.012)	1.394	2.855	0.571	1.677	2.038	2.117
Restaurant	0.839	(0.006)	0.697	1.428	0.286	0.385	1.019	1.058
Retail	0.514	(0.008)	0.930	1.904	0.381	0.514	1.358	1.411
Grocery	0.280	(0.002)	0.232	0.476	0.095	0.128	0.340	0.353
Offices	0.257	(0.004)	0.465	0.952	0.190	0.257	0.679	0.706
Winter Demand Savings Factors (kW_{WP}/HP)								
University/College	0.791	(0.001)	0.384	0.952	0.437	0.257	0.563	0.544
Elem/High School	1.428	(0.002)	0.575	1.428	0.655	0.385	0.844	0.816
Multi-Family	0.385	(0.002)	0.575	1.123	0.661	0.385	0.844	0.816
Hotel/Motel	0.257	(0.001)	0.384	0.874	0.438	0.257	0.563	0.544
Health	0.396	(0.001)	0.192	0.294	0.223	0.128	0.281	0.272
Warehouse	2.374	(0.003)	1.151	1.181	1.384	1.677	1.688	1.632
Restaurant	0.385	(0.002)	0.575	1.123	0.661	0.385	0.844	0.816
Retail	0.514	(0.002)	0.767	1.178	0.893	0.514	1.125	1.088
Grocery	0.476	(0.001)	0.192	0.437	0.219	0.128	0.281	0.272
Offices	0.952	(0.001)	0.384	0.874	0.438	0.257	0.563	0.544

Measure Life:

The measure life for lost opportunity is 15 years. For retrofit, this measure was determined to be an add on, single baseline measure, so it will leverage the same 15 year life as lost opportunity[4:].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1a043	Variable Frequency Drive	LBES Retro	1	0.99	n/a	1	1	1	1	1	5
EC1d043	Variable Frequency Drive	LBES DI	1	0.99	n/a	1	1	1	1	1	5
EC2a043	Variable Frequency Drive	SBES Retro	1	0.998	n/a	1.103	0.885	1	1	1	6
EC2d043	Variable Frequency Drive	SBES DI	1	0.998	n/a	1.103	0.885	1	1	1	6
EC3a087	Variable Frequency Drive	Muni Retro	1	1	n/a	1	1	1	1	1	
EC3d087	Variable Frequency Drive	Muni DI	1	1	n/a	1	1	1	1	1	
EC1a044	Variable Frequency Drive with Motor	LBES Retro	1	0.99	n/a	1	1	1	1	1	5
EC1d044	Variable Frequency Drive with Motor	LBES DI	1	0.99	n/a	1	1	1	1	1	5
EC2a044	Variable Frequency Drive with Motor	SBES Retro	1	0.998	n/a	1.103	0.885	1	1	1	6
EC2d044	Variable Frequency Drive with Motor	SBES DI	1	0.998	n/a	1.103	0.885	1	1	1	6
EC3a088	Variable Frequency Drive with Motor	Muni Retro	1	1	n/a	1	1	1	1	1	
EC3d088	Variable Frequency Drive with Motor	Muni DI	1	1	n/a	1	1	1	1	1	

Energy Load Shape:

See Appendix 1 C&I Load Shape “C&I VFD (Combined)”.

Revision History:

Revision Number	Date	Description
57	1/14/2022	Changed the formatting of the algorithm for calculating energy impact for clarity.
71	3/1/2022	Included explanations of how project information verbiage and VFD application codes map to the savings values in the TRM.
306	1/1/2026	Updated to reflect NH specific programmatic RR's for 2015 LBES study and 2025 SBES study.
389	1/1/2027	Updated the formatting of the saving algorithms
390	1/1/2027	Updated the reference links
391	1/1/2027	Included NTG values from the MA TRM

Endnotes:

1: Chan, Tumin (2010). Formulation of a Prescriptive Incentive for the VFD and Motors & VFD impact tables at NSTAR (Last accessed January 16, 2026)

2: For Chilled Water Pump, Hot Water Circ. Pump, Return Fan, Supply Fan, and WSHP Circ. Loop: kW/HP estimates derived from Cadmus (2012). Variable Speed Drive Loadshape Project. Prepared for the NEEP Regional Evaluation, Measurement & Verification Forum. Other drive type kW/HP savings estimates based on Chan, Tumin (2010). Formulation of a Prescriptive Incentive for the VFD and Motors & VFD impact tables at NSTAR. Prepared for NSTAR. (Last accessed January 16, 2026)

3: Building types listed in the project information map to the building types listed in the TRM as follows:

TRM Project Info Bldg Type	Matched to TRM Bldg Types for VFD Calc
Elm/H School	Daycare Education - K-12 School
Grocery	Grocery
Health	Exercise center, Gymnasium, Health/Medical – Clinic, Hospital, Sports arena
Hotel/Motel	Hotel/Motel/Lodging, Penitentiary
Multi-Family	Multifamily, Nursing Home
Offices	Convention center, Courthouse Library, Office - Medium/Large (> 20,000 ft²), Office - Small (< 20,000 ft²), Police Station, Religious Worship/Church Town hall
Restaurant	Dining: bar/lounge/leisure, Dining: Cafeteria/Fast Food, Dining: Family
Retail	Motion picture theatre, Museum, Performing arts theatre, Post office, Retail
University/College	Dormitory, Education - College/University, Education - Community College
Warehouse	Automotive facility, Fire station, Industrial/Manufacturing - 1 Shift, Industrial/Manufacturing - 2 Shifts, Industrial/Manufacturing - 3 Shifts, Parking garage, Storage Facility, Transportation, Warehouse - Distribution Center, Warehouse - Inactive Storage, Workshop

4: Energy & Resource Solutions, November (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities. (Last accessed January 16, 2026)

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. (Last accessed January 16, 2026)

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation (Last accessed January 16, 2026)

Refrigeration Case Motor Replacement

Measure Code	COM-REFR-RMCR
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Replacement of shaded-pole (SP) or permanently split capacitor (PSC) motors with electronically commutated motors (ECMs) in the evaporators for multi-deck and freestanding coolers and freezers, typically on the retail floor of convenience stores, liquor stores, and grocery stores.[1]

Baseline Efficiency:

The baseline efficiency case is the existing case motor, either SP or PSC type.

High Efficiency:

The high efficiency case is the replacement of the existing case motor with an ECM.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = \Delta kWh_{Motor} + \Delta kWh_{Heat}$$

$$\Delta kWh_{Motor} = kW_{Motor} \times LRF \times Hours$$

$$\Delta kWh_{Heat} = \Delta kWh_{Motor} \times 0.28 \times Eff_{RS}$$

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Where:

ΔkWh_{Motor} = Energy savings due to increased efficiency of case motor

ΔkWh_{Heat} = Energy savings due to reduced heat from evaporator fans

kW_{Motor} = Rated input power of the existing case motor

LRF = Load reduction factor: 53% when SP motors are replaced, 29% when PSC motors are replaced[2].

.$Hours$ = Average runtime of case motors (8,500 hours)[3]

0.28 = Conversion of kW to tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton.

Eff_{RS} = Efficiency of typical refrigeration system (1.87 kW/ton for freezer system, 1.05 for refrigerator system)[4]

ΔkW = Average demand savings

8,760 = Hours per year

Measure Life:

The measure life is 15 years[5]. This measure is determined to have an add-on single baseline in retrofit scenarios.

This measure is determined to have an add-on single baseline in retrofit scenarios.

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1a016	Case Motor Replacement	Electric	LBES - Retrofit	1	0.999	n/a	1	1	0.9	0.9
EC1d018	Case Motor Replacement	Electric	LBES – Direct Install	1	0.999	n/a	1	1	0.9	0.9
EC2a016	Case Motor Replacement	Electric	SBES - Retrofit	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2d018	Case Motor Replacement	Electric	SBES – Direct Install	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3a016	Case Motor Replacement	Electric	Muni - Retrofit	1	1	n/a	1	1	0.9	0.9
EC3d018	Case Motor Replacement	Electric	Muni – Direct Install	1	1	n/a	1	1	0.9	0.9

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[6]. All programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are representative of C&I Refrigeration.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
C&I Refrigeration	23.30%	26.80%	22.60%	27.30%

Revision History:

Revision Number	Date	Description
169	3/1/2023	Updated refrigeration efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Updated LRF based on MA Refrigeration Load Shape Study.
188	1/1/2024	Updated CF's to align with energy load shape

298	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: The assumptions and algorithms used in this section are specific to NRM products.

2: Load factor is an estimate by NRM based on several pre- and post-meter readings of installations

3: Conservative value based on 15 years of NRM field observations and experience.

4: New efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Converted from ACOP 1.88 for freezer and 3.35 for refrigerator system.

5: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; 15-year measure life for retrofit motor installations.

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Refrigeration Cooler Night Cover

Measure Code	COM-FS-CNC
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of retractable aluminum woven fabric covers for open type refrigerated display cases, where the covers are deployed during the facility unoccupied hours to reduce refrigeration energy consumption.

Baseline Efficiency:

The baseline efficiency case is the annual operation of open-display cooler cases without the use of night covers during unoccupied hours.

High Efficiency:

The high efficiency case is the use of night covers to reduce heat gains through the exposed area of display cooler cases during unoccupied hours.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = (Width)\ x\ (Save)\ x\ (Hours)$

$\Delta\ kW = 0\ kW$

Where:

Δ kWh = Energy Savings

Δ kW = Demand Savings

Width = Width of the opening that the night covers protect (ft)

Save = Savings factor based on the temperature of the case (kW/ft). See table below[1]

Hours = Annual hours that the night covers are in use. If unknown, 2,190 hrs[1]

Cooler Case Temperature	Savings Factor
Low Temperature (-35 F to -5 F)	0.03 kW/ft
Medium Temperature (0 F to 30 F)	0.02 kW/ft
High Temperature (35 F to 55 F)	0.01 kW/ft

Measure Life:

The measure life for refrigeration add-on measures are 5 years[2].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1d019	Cooler Night Covers	LBES DI	1	0.999	n/a	n/a	n/a	0	0	3
EC1a017	Cooler Night Covers	LBES Retro	1	0.999	n/a	n/a	n/a	0	0	3
EC3d025	Cooler Night Covers	Muni DI	1	1	n/a	n/a	n/a	0	0	
EC3a023	Cooler Night Covers	Muni Retro	1	1	n/a	n/a	n/a	0	0	
EC2d019	Cooler Night Covers	SBES DI	1	0.998	n/a	n/a	n/a	0	0	4
EC2a017	Cooler Night Covers	SBES Retro	1	0.998	n/a	n/a	n/a	0	0	4

Energy Load Shape:

See Appendix 1 – "C&I Refrigeration"

Revision History:

Revision Number	Issue Date	Description
217	1/1/2025	Updated measure life from 10 years to five years based on referenced study.
261	1/1/2026	Updated SBES RR based on 2025 Impact Study

392	1/1/2027	Updated measure description; added a default value for Hours

Endnotes:

1: CL&P Program Savings Documentation for 2011 Program Year, 2010. Factors based on Southern California Edison (1997). Effects of the Low Emissive Shields on Performance and Power Use of a Refrigerated Display Case. https://www.econofrost.com/wp-content/uploads/2024/03/Ashrae.pdf

2: Energy & Resource Solutions, November 2005. Measure Life Study. Prepared for The Massachusetts Joint Utilities; Page 4-5 to 4-6. https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488616996f25f6d7df75f/view?authToken=0e4ddf47affefdea3d50fbdb2530c0e4b11fa5eefa624bfe9a5227c6fcff02cc1c597e2db9940a262ab6bbeb9f8f8000061a9bf7bef802f4462b4b8fead390eb825ee81160cd5f

3: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf, Last accessed January 18, 2026

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf, Last accessed January 18, 2026.

Refrigeration Door Heater Controls

Measure Code	COM-RFGN-DHC
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of controls to reduce the run time of door and frame heaters for freezers and walk-in or reach-in coolers. The reduced heating results in a reduced refrigeration load.

Baseline Efficiency:

The baseline efficiency case is a cooler or freezer door or frame heater that operates 8,760 hours per year without any controls.

High Efficiency:

The high efficiency case is a cooler or freezer door heater connected to a heater control system, which controls the door heaters by measuring the ambient humidity and temperature of the store, calculating the dew point, and using pulse width modulation (PWM) or On/Off to control the

anti-sweat heater for freezer and cooler doors. Door temperature is typically maintained about 5°F above the store air dew point temperature.

Algorithms for Calculating Primary Energy Impact:

BC ID	Measure Name	ΔkWh	ΔkW
EC1a019	Door Heater Controls	Calculated	Calculated
EC1d021	Door Heater Controls	Calculated	Calculated
EC2a019	Door Heater Controls	Calculated	Calculated
EC2d021	Door Heater Controls	Calculated	Calculated
EC3a025	Door Heater Controls	Calculated	Calculated
EC3d027	Door Heater Controls	Calculated	Calculated

Energy Savings Algorithms:

$$\Delta kWh = \frac{N \times V \times A \times H}{1000} \times \left[1 + \frac{1}{ACOP}\right]$$

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Calculation Parameters Table:

Variable	Description	Value	Units	Ref
ΔkWh	Annual electricity savings	Calculated	kWh/yr	
ΔkW	Annual summer and winter demand savings	Calculated	kW/yr	
N	Number of heaters		Heaters	
V	Nameplate of door heater voltage		Volts	
A	Nameplate door heat amperage		Amps	
H	Heater Off- Hours	See table below	Hours	1
ACOP	Average Coefficient of Performance (cooler or freezer)	See table below		2

Heater Off-Hours Values[1]	
Control Type	Off-Hours
On/Off	2,786
Micro Pulse	4,196

Cooler and Freezer ACOP Values[2]	
Equipment	ACOP
Cooler	3.35
Freezer	1.88

Measure Life:

The measure life is 10 years.

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1a019	Door Heater Controls	LBES Retro	1	0.999	n/a	1	1	0.9	0.9	4
EC1d021	Door Heater Controls	LBES DI	1	0.999	n/a	1	1	0.9	0.9	4
EC2a019	Door Heater Controls	SBES Retro	1	0.998	n/a	1.103	0.885	0.9	0.9	5
EC2d021	Door Heater Controls	SBES DI	1	0.998	n/a	1.103	0.885	0.9	0.9	5
EC3a025	Door Heater Controls	Muni Retro	1	1	n/a	1	1	0.9	0.9	
EC3d027	Door Heater Controls	Muni DI	1	1	n/a	1	1	0.9	0.9	

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Revision History:

Revision Number	Date	Description
189	1/1/2024	Updated CF's to align with energy load shape
300	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
393	1/1/2027	Updated savings algorithm to account for reduced cooling load and to support multiple door and frame heaters per case.

Endnotes:

1: Cadmus. 2015. "Commercial Refrigeration Load Shape Project." Northeast Energy Efficiency Partnerships https://neep.org/sites/default/files/resources/NEEP%20CRL_Report_FINAL_clean.pdf, Last accessed January 18, 2026.

2: DNV. 2022. "X1931-5 PSD Commercial Refrigeration Efficiency Update Study." Connecticut Energy Efficiency Board. https://www.energizect.com/sites/default/files/documents/X1931-5%20Commercial%20Refrigeration%20ACOP%20Final%20Report_051222.pdf, Last accessed January 18, 2026.

3: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1, , Last accessed January 18, 2026.

4: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH

Electric and Gas Utilities, https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf, , Last accessed January 18, 2026.

5: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf, Last accessed January 18, 2026.

Refrigeration ECM Evaporator Fan Motors for Walk-in Coolers and Freezers

Measure Code	COM-RFGN-ECMFM
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of various sizes of Electronically Commutated (EC) or Permanent Magnet Synchronous (PMS) motors in walk-in/reach-in coolers and freezers to replace existing evaporator fan motors such as Shaded Pole (SP), Permanent Split Capacitor (PSC) or low efficiency Electronically Commutated motors. Interactive refrigeration savings are also achieved due to reduced heat loads resulting from fan power reduction.

Baseline Efficiency:

The baseline efficiency case is an existing evaporator fan motor which is a low efficiency EC or SP or PSC motor.

High Efficiency:

The high efficiency case is the replacement of existing evaporator fan motors with high efficiency EC or PMS motor.

Algorithms for Calculating Primary Energy & Peak Demand Impact:

$$\Delta kWh = \Delta kWh_{Motor} + \Delta kWh_{Ref}$$

$$\Delta kWh_{Motor} = \frac{V \times A \times PF \times \sqrt{Phase}}{1{,}000} \times LRF \times Hours$$

$$\Delta kWh_{Ref} = \Delta kWh_{Motor} \times 0.28 \times Eff_{RS}$$

$$\Delta kW = \frac{\Delta kWh}{8.760}$$

Where:

ΔkWh_{Motor} = Energy savings due to increased efficiency of evaporator motor

ΔkWh_{Ref} = Energy savings due to interactive effects in a refrigeration system

V = Rated fan motor voltage

A = Rated fan motor amperage per phase-to-ground of the existing motor

PF = Typical existing fan motor power factor, 0.55[1]

$Phase$ = Phase of electric power supplying the evaporator motor

LRF = Load reduction factor See table below[2]

$Hours$ = Annual fan operating hours

0.28 = Conversion of kW to tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton.

Eff_{RS} = Efficiency of typical refrigeration system (1.87 kW/ton for freezer system, 1.05 for refrigerator system)[3]

ΔkW = Average demand savings

8,760 = Hours per year

Load Reduction Factor		
Existing Motor	**Replacement Motor**	**LRF**
EC	PMS	0.43
PSC	EC	0.40
PSC	PMS	0.49
SP	EC	0.65
SP	PMS	0.79

Measure Life:

The measure life is 15 years[4].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
EC1a023	ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Electric	LBES Retro	1	0.999	n/a	1	1	0.9	0.9	5
EC1d025	ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Electric	LBES DI	1	0.999	n/a	1	1	0.9	0.9	5
EC2a023	ECM Evaporator Fan Motors for	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.9	0.9	6

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}	Ref
	Walk-in Cooler/Freezer										
EC2d025	ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.9	0.9	6
EC3a036	ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Electric	Muni Retro	1	1	n/a	1	1	0.9	0.9	
EC3d038	ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Electric	Muni DI	1	1	n/a	1	1	0.9	0.9	

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Revision History:

Revision Number	Date	Description
149	12/1/2022	Updated refrigeration efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Updated LRF based on MA Refrigeration Load Shape Study
190	1/1/2024	Updated CF's to align with energy load shape
301	1/1/2026	Updated RR's for SBES according to 2025 impact study results.
394	1/1/2027	Updated the load reduction factor (LRF) for different scenarios
395	1/1/2027	Updated measure, baseline, and high efficiency sections to include all applicable motors

Endnotes:

1: Conservative value based on 15 years of NRM field observations and experience.

2: Becker, B.R, and Fricke B.A. 2019. "Permanent Magnet Synchronous Motors for Commercial Refrigeration: Final Report," Oak Ridge National Laboratory. https://info.ornl.gov/sites/publications/Files/Pub115680.pdf. (Last accessed January 18, 2026)

3: New efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Converted from ACOP 1.88 for freezer and 3.35 for refrigerator system. (Last accessed January 18, 2026)

4: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; 15-year measure life for retrofit motor installations. (Last accessed January 18, 2026)

5: DNV GL, September 2015. New Hampshire Utilities Large Commercial & Industrial (C&I) Retrofit and New Equipment & Construction Program Impact Evaluation. Prepared for NH Electric and Gas Utilities. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-

documents/sonh/1-nh-large-ci-retrofit-new-equip-construction-prog-impact-eval.pdf, Last accessed January 18, 2026.

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-sm-business-energy-solutions-process-and-impact-report-final.pdf, Last accessed January 18, 2026.

Refrigeration Electronic Defrost Control

Measure Code	COM-RFGN-EDC
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Install a controller to activate evaporator defrost only when necessary in a refrigeration system.

Baseline Efficiency:

The baseline efficiency case is an evaporator electric defrost system that uses a time clock to initiate defrost.

High Efficiency:

The high efficiency case is an evaporator electric defrost system with defrost controls based on refrigeration system runtime or load conditions.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = \Delta kWh_{Defrost} + \Delta kWh_{Heat}$$

$$\Delta kWh_{Defrost} = kW_{Defrost} \times Hr/Day \times 365 \times DRF$$

$$\Delta kWh_{Heat} = \Delta kWh_{Defrost} \times 0.28 \times Eff_{RS}$$

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Where:

$\Delta kWh_{Defrost}$ = Energy savings due to reduced runtime of defrost heaters

ΔkWh_{Heat} = Energy savings due to reduced heat from the defrost heaters

$kW_{Defrost}$ = Rated input power of the defrost heater

Hr/Day = Existing scheduled defrost hours per day

DRF = Defrost reduction factor – annual average of 35%[1]

365 = Days per year

0.28 = Conversion of kW to tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton.

Eff_{RS} = Efficiency of typical refrigeration system (1.87 kW/ton for freezer system, 1.05 for refrigerator system)[2]

ΔkW = Average demand savings

8,760 = Hours per year

Measure Life:

The measure life is 10 years[3].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1a024	Electronic Defrost Control	Electric	LBES - Retrofit	1	0.999	n/a	1	1	0.9	0.9
EC1d026	Electronic Defrost Control	Electric	LBES – Direct Install	1	0.999	n/a	1	1	0.9	0.9
EC2a024	Electronic Defrost Control	Electric	SBES - Retrofit	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2d026	Electronic Defrost Control	Electric	SBES – Direct Install	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3a037	Electronic Defrost Control	Electric	Muni - Retrofit	1	1	n/a	1	1	0.9	0.9
EC3d039	Electronic Defrost Control	Electric	Muni – Direct Install	1	1	n/a	1	1	0.9	0.9

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[4]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are representative of C&I Refrigeration.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Revision History:

Revision Number	Date	Description
148	12/1/2022	Updated refrigeration efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study.
191	1/1/2024	Updated CF's to align with energy load shape
302	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Supported by 3rd party evaluation: Independent Testing was performed by Intertek Testing Service on a Walk-in Freezer that was retrofitted with Smart Electric Defrost capability.

2: New efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Converted from ACOP 1.88 for freezer and 3.35 for refrigerator system.

3: Energy & Resource Solutions (2005). Measure Life Study – refrigeration controls for large C&I retrofit. Prepared for The Massachusetts Joint Utilities.

4: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Refrigeration Evaporator Fan Control

Measure Code	COM-RFGN-EFC
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of controls to modulate the evaporator fans based on the temperature in a refrigerated space.

Baseline Efficiency:

The baseline efficiency case is an evaporator fan which runs for 8,760 annual hours.

High Efficiency:

The high efficiency case is an evaporator fan with controls to reduce the fan speed or cycle the fan off when the refrigerated space temperature setpoint is met.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = \Delta kWh_{Fan} + \Delta kWh_{Heat} + \Delta kWh_{Control}$$

$$kW_{Fan} = \frac{V \times A \times PF \times \sqrt{Phase}}{1{,}000}$$

$$\Delta kWh_{Fan} = kW_{Fan} \times \%Off \times 8760$$

$$\Delta kWh_{Heat} = \Delta kWh_{Fan} \times 0.28 \times Eff_{RS}$$

$$\Delta kWh_{Control} = [\mathrm{kW_{CP}} \times Hours_{CP} + kW_{Fan} \times (1 - \%Off) \times 8760] \times 5\%$$

$$\Delta kW = \frac{\Delta kWh}{8760}$$

Where:

ΔkWh_{Fan} = Energy savings due to reduced runtime of evaporator fans

ΔkWh_{Heat} = Energy savings due to reduced heat from the defrost heaters

$\Delta kWh_{Control}$ = Energy savings due to optimized controls, estimated at 5% of compressor and fan energy by consensus estimates used in MA TRM

V = Rated fan motor voltage

A = Rated fan motor amperage per, phase-to-ground

PF = Typical evaporator fan motor power factor, 0.55[1]

$Phase$ = Phase of electric power supplying the evaporator motor

$\%Off$ = Reduction in annual evaporator fan run hours, 33.5%[2].

8760 = Hours per year

kW_{CP} = Nameplate input kW of the compressor

$Hours_{CP}$ = Equivalent full load hours of compressor operations: 4,072 hours[3]

0.28 = Conversion of kW to tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton.

Eff_{RS} = Efficiency of typical refrigeration system (1.87 kW/ton for freezer system, 1.05 for refrigerator system)[4]

ΔkW = Average demand savings

8,760 = Hours per year

Measure Life:

The measure life is 10 years[5].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1a027	Evaporator Fan Control	Electric	LBES Retro	1	0.999	n/a	1	1	1	1
EC1d029	Evaporator Fan Control	Electric	LBES DI	1	0.999	n/a	1	1	1	1
EC2a027	Evaporator Fan Control	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	1	1
EC2d029	Evaporator Fan Control	Electric	SBES DI	1	0.998	n/a	1.103	0.885	1	1
EC3a043	Evaporator Fan Control	Electric	Muni Retro	1	1	n/a	1	1	1	1
EC3d045	Evaporator Fan Control	Electric	Muni DI	1	1	n/a	1	1	1	1

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[6]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

All programs use CF values of 100% since demand savings are average and expected to be consistent.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Revision History:

Revision Number	Date	Description
147	12/1/2022	Updated refrigeration efficiency and %Off based on CT X1931-5 PSD Study adn MA Refrigeratrion Loadshape study.
299	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Conservative value based on 15 years of NRM field observations and experience.

2: The value is based on 2015 MA Commercial Refrigeration Load Shape study

3: Conservative value based on 15 years of NRM field observations and experience. Value supported by Select Energy (2004). Cooler Control Measure Impact Spreadsheet Users' Manual. Prepared for NSTAR.

4: New efficiency based on CT X1931-5 PSD Commercial Refrigeration Efficiency Update Study. Converted from ACOP 1.88 for freezer and 3.35 for refrigerator system.

5: Energy & Resource Solutions (2005). Measure Life Study – fan control retrofit. Prepared for The Massachusetts Joint Utilities.

6: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Refrigeration Novelty Cooler Shutoff

Measure Code	COM-RFGN-NCS
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of controls to shut off a facility's novelty coolers for non-perishable goods based on pre-programmed store hours.

Baseline Efficiency:

The baseline efficiency case a novelty cooler energized for 8,760 annual hours.

High Efficiency:

The high efficiency case is a novelty cooler whose energized hours follow the store's occupied hours, and is de-energized during unoccupied hours.

Algorithms for Calculating Primary Energy Impact:

$$\Delta kWh = kW_{NC} \times \mathrm{DC_{AVG}} \times (Hours_{UNOCC} - 1) \times 365$$

$\Delta kW = \Delta kWh / Hours$ x CF

Where:

kW_{NC} = Rated nameplate input power to the novelty cooler

$\mathrm{DC_{AVG}}$ = Weighted average annual duty cycle: 49%[1]

$Hours_{UNOCC}$ = Daily unoccupied hours of the store

365 = Days per year

CF =.9

Measure Life:

The measure life is 10 years[2].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1a037	Novelty Cooler Shutoff	Electric	LBES Retro	1	0.999	n/a	1	1	0.9	0.9

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d037	Novelty Cooler Shutoff	Electric	LBES DI	1	0.999	n/a	1	1	0.9	0.9
EC2a037	Novelty Cooler Shutoff	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2d037	Novelty Cooler Shutoff	Electric	SBES DI	1	0.998	n/a	1.103	0.885	0.9	0.9
EC3a066	Novelty Cooler Shutoff	Electric	Muni Retro	1	1	n/a	1	1	0.9	0.9
EC3d066	Novelty Cooler Shutoff	Electric	Muni DI	1	1	n/a	1	1	0.9	0.9

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[3]. All other programs use a 100% realization rate unless an evaluation finds otherwise.

Coincidence Factors:

Coincidence factors are representative of C&I Refrigeration.

Energy Load Shape:

See Appendix 1 C&I Load Shapes "C&I Refrigeration".

Revision History:

Revision Number	Date	Description
192	1/1/2024	Updated CF's to align with energy load shape
303	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: Estimated value from NRM experience, supported by Select Energy Services, Inc. (2004). Cooler Control Measure Impact Spreadsheet Users' Manual. Prepared for NSTAR. The study gives a less conservative value than used by NRM.

2: Energy & Resource Solutions (2005). Measure Life Study – cooler shutoff retrofit. Prepared for The Massachusetts Joint Utilities.

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Refrigeration Vending Miser

Measure Code	COM-RFGN-VM
Markets	Commercial
ProgramTypes	Retrofit
Categories	Refrigeration

Measure Description:

Installation of controls intended to reduce the energy consumption of vending machine lighting and refrigeration systems. Qualifying controls must power down these systems during periods of inactivity but, in the case of refrigerated machines, must always maintain a cool product that meets customer expectations. This measure applies to refrigerated beverage vending machines, non-refrigerated snack vending machines, and glass front refrigerated coolers. This measure should not be applied to ENERGY STAR® qualified vending machines, as they already have built-in controls.

Baseline Efficiency:

The baseline efficiency case is a standard efficiency refrigerated beverage vending machine, nonrefrigerated snack vending machine, or glass front refrigerated cooler without a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

High Efficiency:

The high efficiency case is a standard efficiency refrigerated beverage vending machine, non-refrigerated snack vending machine, or glass front refrigerated cooler with a control system capable of powering down lighting and refrigeration systems during periods of inactivity.

Algorithms for Calculating Primary Energy Impact:

ΔkWh = (kWRATED)(Hours)(SAVE)

ΔkW = ΔkWh / Hours

Where:

kW_{rated} = Rated kW of connected equipment; if not available, use default values in table below

$Hours$ = Annual operating hours of connected equipment; if not available, use default value of 8,760

$SAVE$ = Percent savings factor, see table below for values

Vending Machine and Cooler Controls Savings Factors[1]

Equipment Type	kW rated	SAVE
Refrigerated Beverage Vending Machines	0.40	46%
Non-Refrigerated Snack Vending Machines	0.085	46%
Glass Front Refrigerated Coolers	0.46	30%

Measure Life:

The measure life is 5 years[2].

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC ID	Measure Name	Fuel	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
EC1d045	Vending Miser	Electric	LBES DI	1	0.999	n/a	1	1	0.9	0.9
EC2d045	Vending Miser	Electric	LBES DI	1	1	n/a	1	1	0.9	0.9
EC1a045	Vending Miser	Electric	LBES Retro	1	0.999	n/a	1	1	0.9	0.9
EC3d089	Vending Miser	Electric	Muni DI	1	1	n/a	1	1	0.9	0.9
EC3a089	Vending Miser	Electric	Muni Retro	1	0.998	n/a	1.103	0.885	0.9	0.9
EC2a045	Vending Miser	Electric	SBES Retro	1	0.998	n/a	1.103	0.885	0.9	0.9

In-Service Rates:

All installations have a 100% in service rate unless an evaluation finds otherwise.

Realization Rates:

All programs use a 100% realization rate unless an evaluation finds otherwise.The SBES program uses a realization rate of 99.8% kWh RR and 110.3% and 88.5% summer and winter peak RR's from a 2025 Impact study[3].

Coincidence Factors:

Coincidence factors are representative of C&I Refrigeration.

Energy Load Shape:

See Appendix 1 C&I Load Shapes " C&I Refrigeration".

Revision History:

Revision Number	Date	Description
130	12/1/2022	Updated savings factors for snack vending machines and glass front refrigerated coolers to match study.
193	1/1/2024	Updated CF's to align with energy load shape
296	1/1/2026	Updated RR's for SBES according to 2025 impact study results.

Endnotes:

1: USA Technologies Energy Management Product Sheets (2006). https://api-plus.anbetrack.com/etrm-gateway/etrm/api/v1/etrm/documents/5ee488706996f2eb697df798/view?authToken=a922d9227194493fd4df24a36b1bbbf4a87e5da3bb19d4407fdc2db995a43e3e73766bce98d5ab32eaefef84810bdaeb27d49282815e4cc58edac147714d304062a99db42de196

2: Energy & Resource Solutions (2005). Measure Life Study – vending control retrofit. Prepared for The Massachusetts Joint Utilities.

3: Brightline Group, 2025. NHSaves® Small Business Energy Solutions 2023 Process and Impact Evaluation

Commercial New Construction

Measure Code	Com-NC
Markets	Commercial
ProgramTypes	New construction
Categories	Multiple

Measure Description:

This chapter contains the BC ID's and relevant evaluation impact factors for measures offered through the new construction subprograms. Measure savings are applied per the corresponding TRM chapters for each individual installed measure.

Baseline Efficiency:

The baseline efficiency for new construction projects is code or ISP as defined by each TRM chapter entry.

High Efficiency:

For the high efficiency case for new construction projects, refer to the corresponding TRM chapter for each measure installed.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated per the relevant TRM entries.

Measure Life:

The measure life for each measure is applied per the relevant TRM entry.

Other Resource Impacts:

Other resource impacts are applied per the relevant TRM entry.

Impact Factors for Calculating Adjusted Gross Savings:

Measure ID	Measure	Program	ISR	RRee	RRne	RR_{SP}	RR_{WP}
EC1e001	Custom Large Compressed Air New Construction	LBES NC	1	0.88		0.9	0.64
EC1e002	Custom Large Hot Water New Construction	LBES NC	1	0.88		0.9	0.64
EC1e003	Custom Large HVAC New Construction	LBES NC	1	0.88		0.9	0.64
EC1e004	Custom Large Lighting New Construction - Interior	LBES NC	1	1.03		1.27	1.07
EC1e005	Custom Large Lighting New Construction - Exterior	LBES NC	1	1.03		1.27	1.07
EC1e006	Custom Large Lighting New Construction - Controls	LBES NC	1	1.03		1.27	1.07
EC1e007	Custom Large Motors New Construction	LBES NC	1	0.88		0.9	0.64
EC1e008	Custom Large Process New Construction	LBES NC	1	0.88		0.9	0.64
EC1e009	Custom Large Refrigeration New Construction	LBES NC	1	0.88		0.9	0.64
EC1e010	Custom Large Other New Construction	LBES NC	1	0.88		0.9	0.64
EC1e011	Daylight Dimming	LBES NC	1	1.03		1.27	1.07
EC1e012	Performance Lighting - Exterior w/ Controls	LBES NC	1	1.03		1.27	1.07
EC1e013	Performance Lighting - Exterior w/o Controls	LBES NC	1	1.03		1.27	1.07
EC1e014	Performance Lighting - Interior w/ Controls	LBES NC	1	1.03		1.27	1.07
EC1e015	Performance Lighting - Interior w/o Controls	LBES NC	1	1.03		1.27	1.07
EC1e016	Lighting Occupancy Sensors	LBES NC	1	1.03		1.27	1.07
EC1eAUD	CI Audits - Large New Construction	LBES NC	1	0.88		0.9	0.64
EC2e001	Custom Small Compressed Air New Construction	SBES NC	1	0.88		0.9	0.64
EC2e002	Custom Small Hot Water New Construction	SBES NC	1	0.88		0.9	0.64
EC2e003	Custom Small HVAC New Construction	SBES NC	1	0.88		0.9	0.64
EC2e004	Custom Small Lighting New Construction - Interior	SBES NC	1	1.03		1.27	1.07
EC2e005	Custom Small Lighting New Construction - Exterior	SBES NC	1	1.03		1.27	1.07
EC2e006	Custom Small Lighting New Construction - Controls	SBES NC	1	0.88		0.9	0.64
EC2e007	Custom Small Motors New Construction	SBES NC	1	0.88		0.9	0.64
EC2e008	Custom Small Process New Construction	SBES NC	1	0.88		0.9	0.64

EC2e009	Custom Small Refrigeration New Construction	SBES NC	1	0.88		0.9	0.64
EC2e010	Custom Small Other New Construction	SBES NC	1	0.88		0.9	0.64
EC2e011	Daylight Dimming	SBES NC	1	1.03		1.27	1.07
EC2e012	Performance Lighting - Exterior w/ Controls	SBES NC	1	1.03		1.27	1.07
EC2e013	Performance Lighting - Exterior w/o Controls	SBES NC	1	1.03		1.27	1.07
EC2e014	Performance Lighting - Interior w/ Controls	SBES NC	1	1.03		1.27	1.07
EC2e015	Performance Lighting - Interior w/o Controls	SBES NC	1	1.03		1.27	1.07
EC2e016	Lighting Occupancy Sensors	SBES NC	1	0.88		0.9	0.64
EC2eAUD	CI Audits - Small New Construction	SBES NC	1	0.88		0.9	0.64
EC3e001	Custom Muni Compressed Air New Construction	Muni NC	1	0.88		0.9	0.64
EC3e002	Custom Muni Hot Water New Construction	Muni NC	1	0.88		0.9	0.64
EC3e003	Custom Muni HVAC New Construction	Muni NC	1	0.88		0.9	0.64
EC3e004	Custom Muni Lighting New Construction - Interior	Muni NC	1	1.03		1.27	1.07
EC3e005	Custom Muni Lighting New Construction - Exterior	Muni NC	1	1.03		1.27	1.07
EC3e006	Custom Muni Lighting New Construction - Controls	Muni NC	1	1.03		1.27	1.07
EC3e007	Custom Muni Motors New Construction	Muni NC	1	0.88		0.9	0.64
EC3e008	Custom Muni Process New Construction	Muni NC	1	0.88		0.9	0.64
EC3e009	Custom Muni Refrigeration New Construction	Muni NC	1	0.88		0.9	0.64
EC3e010	Custom Muni Other New Construction	Muni NC	1	0.88		0.9	0.64
EC3e011	Daylight Dimming	Muni NC	1	1.03		1.27	1.07
EC3e012	Performance Lighting - Exterior w/ Controls	Muni NC	1	1.03		1.27	1.07
EC3e013	Performance Lighting - Exterior w/o Controls	Muni NC	1	1.03		1.27	1.07
EC3e014	Performance Lighting - Interior w/ Controls	Muni NC	1	1.03		1.27	1.07
EC3e015	Performance Lighting - Interior w/o Controls	Muni NC	1	1.03		1.27	1.07
EC3e016	Lighting Occupancy Sensors	Muni NC	1	1.03		1.27	1.07
EC3eAUD	CI Audits - Muni New Construction	Muni NC	1	0.88		0.9	0.64
GC1e001	Custom Large Hot Water New	LBES NC	1		0.949		
GC1e002	Custom Large HVAC New	LBES NC	1		0.949		

GC1e003	Custom Large Other New	LBES NC	1		0.949		
GC1e004	Custom Large Process New	LBES NC	1		0.949		
GC1NES08	CI Audits - Large New Construction	LBES NC	1		0.949		
GC1e005	Custom Whole Building (Path 1 & 2)	LBES NC	1		0.949		
GC1e006	Prescriptive Building Shell	LBES NC	1		0.949		
GC1e007	Prescriptive Food Services	LBES NC	1		0.949		
GC1e008	Prescriptive HVAC	LBES NC	1		0.949		
GC1e009	Prescriptive DHW	LBES NC	1		0.949		
GC2e001	Custom Small Hot Water New Construction	SBES NC	1		0.949		
GC2e002	Custom Small HVAC New Construction	SBES NC	1		0.949		
GC2e003	Custom Small Other New Construction	SBES NC	1		0.949		
GC2e004	Custom Small Process New Construction	SBES NC	1		0.949		
GC2NES08	CI Audits - Small New Construction	SBES NC	1		0.949		
GC2e005	Custom Whole Building (Path 1 & 2)	SBES NC	1		0.949		
GC2e006	Prescriptive Building Shell	SBES NC	1		0.949		
GC2e007	Prescriptive Food Services	SBES NC	1		0.949		
GC2e008	Prescriptive HVAC	SBES NC	1		0.949		
GC2e009	Prescriptive DHW	SBES NC	1		0.949		
GC3e001	Custom Small Hot Water New Construction	Muni NC	1		0.949		
GC3e002	Custom Small HVAC New Construction	Muni NC	1		0.949		
GC3e003	Custom Small Other New Construction	Muni NC	1		0.949		
GC3e004	Custom Small Process New Construction	Muni NC	1		0.949		
GC3e0051	C&I Small New Construction Code Compliance	Muni NC	1		0.949		
GC3NES07	CI Audits - Muni New Construction	Muni NC	1		0.949		
GC3e005	Custom Whole Building (Path 1 & 2)	Muni NC	1		0.949		
GC3e006	Prescriptive Building Shell	Muni NC	1		0.949		
GC3e007	Prescriptive Food Services	Muni NC	1		0.949		
GC3e008	Prescriptive HVAC	Muni NC	1		0.949		

GC3e009	Prescriptive DHW	Muni NC	1		0.949		

In-Service Rates:

All measures have an ISR of 100% per evaluation results. [1]

Realization Rates:

Realization rates are applied per evaluation results and only differ within each saving component depending on whether the measure is a lighting or a non-lighting measure.[1]

Coincidence Factors:

Coincidence factors are specific to the measure installed. See the relevant TRM entry for each measure.

Energy Load Shape:

See relevant TRM entry for the measure installed.

Revision History:

Revision Number	Date	Description
396	1/1/2027	Chapter added. CI NC measures split out from New Equipment
407	10/30/2026	Increased decimal places for realization rates to 3 to align with BC model.

Endnotes:

1: Demand Side Analytics (2026) NHSaves® C&I New Construction Study 2023-2024. https://www.energy.nh.gov/sites/g/files/ehbemt551/files/inline-documents/sonh/nhsaves-2023-2024-new-construction-study.pdf

Appendix 1: Energy Load Shapes

The section includes a table or reference with the time-of-use pattern of a typical customer's electrical energy consumption for each segment and end use. Because the value of avoided energy varies throughout the year, load shapes are used to allocate energy savings into specific time periods to better reflect its time-dependent value. Load shapes are defined as follows based on ISO-NE definitions:

- Summer On-Peak: 7 am to 11 pm, weekdays, during the months of June through September, except ISO-NE holidays.
- Summer Off-Peak: All other hours during the months of June through September (includes weekends and holidays).
- Winter On-Peak: 7 am to 11 pm, weekdays, during the months of October through May, except ISO-NE holidays; and
- Winter Off-Peak: All other hours during the months of October through May (includes weekends and holidays).

Table A1.1. Residential Energy Load Shapes

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
Non-Electric Measures	0.0%	0.0%	0.0%	0.0%
Clothes Washer	18.3%	15.4%	36.4%	29.9%
24-hour operation	15.2%	18.3%	30.5%	36.1%
Clothes Dryer - Electric	16.9%	14.2%	38.9%	30.0%
Clothes Dryer - Natural Gas	15.9%	16.4%	37.6%	30.1%
Hardwired Electric Heat	0.0%	0.0%	43.1%	56.9%
Lighting	19.0%	15.1%	35.1%	30.7%
Primary TV and Peripherals	15.4%	17.6%	32.2%	34.8%
Primary Desktop Computer	17.5%	17.3%	33.5%	31.7%
Primary Refrigerator	18.2%	20.9%	29.0%	31.9%
Secondary Refrigerator	19.9%	23.6%	26.3%	30.2%
Freezer	17.1%	20.7%	28.7%	33.6%
Dehumidifier	24.9%	29.7%	22.0%	23.3%

Pool Pump	54.5%	38.2%	4.9%	2.4%
Dishwasher	14.8%	16.3%	34.1%	34.8%
Water Heater - Electric	15.2%	11.9%	41.5%	31.4%
Water Heater - Heat Pump	14.9%	13.0%	39.1%	33.0%
Water Heater - Natural Gas/Fuel Oil	13.3%	11.6%	40.9%	34.2%
Central Air Conditioner/Heat Pump (Cooling)	47.3%	42.2%	6.6%	3.8%
Room or Window Air Conditioner	47.5%	47.4%	2.9%	2.2%
Mini-Split Air Conditioner/Heat Pump (Cooling)	43.4%	40.2%	7.4%	9.0%
Mini-Split Heat Pump (Heating)	0.0%	0.0%	42.9%	57.1%
Furnace Fan	0.0%	0.0%	44.6%	55.4%
Boiler Distribution	0.0%	0.0%	45.0%	55.0%
Weighted HVAC - All Homes	23.2%	21.7%	25.4%	29.7%
Weighted HVAC - Multi-family	25.2%	23.7%	23.2%	27.9%
Weighted HVAC - Multi-family Low Income	22.4%	21.6%	25.4%	30.6%
Weighted HVAC - Single Family	22.5%	20.8%	26.1%	30.5%
Weighted HVAC - Single Family Low Income	23.1%	21.7%	25.3%	29.9%
Central Heat Pump	10.1%	9.0%	35.1%	45.7%
DMSHP	8.0%	7.4%	36.4%	48.2%
Electric Resistance with AC	6.0%	5.0%	45.0%	44.0%

Source: Navigant (2018). RES1 Demand Impact Model Update

Table A1.2. Commercial and Industrial Energy Load Shapes

C&I energy load shapes, except where noted in the chapters, are derived from site-level metering of project sites in MA. See DNV GL, 2018. P72 Prescriptive C&I Load shapes of Savings.

Load Shape Description	Total Energy			
	Summer		Winter	
	On Peak	Off Peak	On Peak	Off Peak
C&I Compressed Air - VFD Compressor	26.5%	23.7%	25.9%	23.9%
C&I Compressed Air - Air Dryer	22.4%	27.7%	21.7%	28.1%
C&I Electric Chiller (Combined)	39.4%	38.5%	11.3%	10.8%
C&I Electric Cooling Unitary Equipment	52.7%	34.1%	8.6%	4.6%
C&I Exterior Lighting	19.2%	29.0%	20.1%	31.6%
C&I Interior Lighting - Prescriptive	34.3%	18.1%	30.3%	17.4%
C&I Interior Lighting - Custom	32.3%	19.4%	29.8%	18.6%
C&I Lighting Controls	32.1%	17.7%	31.3%	19.0%
C&I Refrigeration	23.3%	26.8%	22.6%	27.3%
C&I VFDs (Combined)	23.8%	25.3%	23.7%	27.2%
C&I Food Services	16.0%	17.0%	32.0%	35.0%
C&I Heating & Cooling	34.9%	22.1%	26.4%	16.6%

Appendix 2: Equivalent Full Load Hours

Equivalent full load hours (EFLH) are the number of hours a heating or cooling system would have to operate at full load to equal the amount of heating or cooling delivered by the system. Heating and cooling EFLH are tabulated for 21 standard building types and three representative cities in New Hampshire. The EFLH values are based on building energy simulations of prototypical buildings.[8] TMY3 long term average weather data for the three New Hampshire cities were used to drive the simulation models.

Zone	**Representative Cities**
Zone 1- South	Manchester, Portsmouth
Zone 2 - Central	Concord, Keene, Laconia, Lebanon
Zone 3- North	Berlin

The building types are described as follows:

Building Type	*Description*
Assembly	Public buildings that include community centers, libraries, performance and movie theaters, auditoria, police and fire stations, gymnasia, sports arenas, and transportation terminals
Auto	Repair shops and auto dealerships, including parking lots and parking structures.
Big Box	Single story, high-bay retail stores with ceiling heights of 25 feet or more. Majority of floor space is dedicated to non-food items but could include refrigerated and non-refrigerated food sales areas.
Community College	Community college campus and post-secondary technical and vocational education buildings, including classroom, computer labs, dining, and office. Conditioned by packaged HVAC systems
Dormitory	College or University dormitories
Fast Food	Self-service restaurants with primarily disposable plates, utensils etc.
Full-Service Restaurant	Full-service restaurants with full dishwashing facilities

[8] Prototypical building models are described in the New York Technical Reference Manual v. 8 Appendix A.

Building Type	*Description*
Grocery	Refrigerated and non-refrigerated food sales, including convenience stores and specialty food sales
Hospital	Inpatient and outpatient care facility conditioned by built-up HVAC systems. Excludes medical offices
Hotel	Multifunction lodging facility with guest rooms, meeting space, foodservice conditioned by built-up HVAC system
Large Office	Office space in buildings greater than 3 stories conditioned by built-up HVAC system.
Light Industrial	Single story workspace with heating and air-conditioning; conditioned by packaged HVAC systems
Motel	Lodging facilities with primarily guest room space served by packaged HVAC systems
Large Retail	Retail building with 2 or more stories served by built-up HVAC system
Primary School	K-8 school
Religious	Religious worship
Secondary School	9-12 school
Small Office	Office occupancy in buildings 3 stories or less served by packaged HVAC systems; includes Medical offices
Small Retail	Single story retail with ceiling height of less than 25 feet; primarily non-food retail and storage areas served by packaged HVAC systems. Includes service businesses, post offices, Laundromats, and exercise facilities.
University	University campus buildings, including classroom, computer labs, biological and/or chemical labs, workshop space, dining, and office. Conditioned by built-up HVAC systems
Warehouse	Primarily non-refrigerated storage space could include attached offices served by packaged HVAC system.
Other	Use these values if building type is not known

EFLH data for large commercial buildings with built-up HVAC systems are broken out by HVAC system type:

- CV noecon Constant volume reheat system without an airside economizer
- CV econ Constant volume reheat system with an airside economizer
- VAV Variable air volume system with an airside economizer
- Unknown Weighted average of the three HVAC types above used if HVAC system type is not known

Small Commercial Cooling Full Load Hours

Building Type	Berlin	Concord	Manchester
Assembly	448	538	492
Auto Repair	186	304	341
Big Box Retail	734	841	786
Dormitory	638	698	705
Fast Food Restaurant	427	539	521
Full-Service Restaurant	391	512	479
Grocery	2,143	2,188	2,028
Light Industrial	350	435	419
Motel	670	900	909
Primary School	167	304	278
Religious	171	220	261
Small Office	563	786	758
Small Retail	575	716	685
Warehouse	172	249	275
Other	545	659	638

Small Commercial Heating Full Load Hours

Building Type	Berlin	Concord	Manchester
Assembly	1,234	960	908
Auto Repair	4,173	3,370	3,379
Big Box Retail	744	602	474
Dormitory	686	544	452
Fast Food Restaurant	1,837	1,400	1,249
Full-Service Restaurant	1,886	1,303	1,275
Grocery	951	1,064	988

Light Industrial	1,379	1,265	949
Motel	736	626	499
Primary School	1,551	1,309	1,094
Religious	1,129	1,012	928
Small Office	894	760	588
Small Retail	1,264	1,052	795
Warehouse	1,172	920	829
Other	1,403	1,156	1,029

Large Commercial Cooling Full Load Hours

Building Type	HVAC Type	Berlin	Concord	Manchester
Community College	CV econ	412	627	581
	CV noecon	612	874	789
	VAV	299	489	460
	Unknown	365	570	530
High School	CV econ	252	398	330
	CV noecon	707	837	741
	VAV	148	255	196
	Unknown	251	368	301
Hospital	CV econ	1,037	1,132	1,115
	CV noecon	2,248	2,117	1,865
	VAV	1,014	1,089	1,079
	Unknown	1,115	1,175	1,145
Hotel	CV econ	2,838	3,033	2,763
	CV noecon	3,035	3,219	2,983
	VAV	2,811	3,014	2,726
	Unknown	2,937	3,126	2,873
Large Office	CV econ	885	1,095	1,002
	CV noecon	2,500	2,541	2,276
	VAV	584	758	675
	Unknown	739	906	810
Large Retail	CV econ	701	848	832
	CV noecon	1,695	1,654	1,665
	VAV	560	662	656
	Unknown	662	756	750
University	CV econ	566	722	760
	CV noecon	1,334	1,543	1,689

	VAV	413	592	619
	Unknown	579	760	807
Other	CV econ	727	870	837
	CV noecon	1,660	1,695	1,543
	VAV	625	747	720
	Unknown	737	856	819

Large Commercial Heating Full Load Hours

Building Type	HVAC Type	Berlin	Concord	Manchester
Community College	CV econ	1,103	1,098	939
	CV noecon	982	1,014	863
	VAV	704	462	642
	Unknown	809	646	723
High School	CV econ	806	744	724
	CV noecon	721	699	652
	VAV	383	289	274
	Unknown	501	423	402
Hospital	CV econ	1,140	1,052	703
	CV noecon	1,068	971	641
	VAV	738	781	437
	Unknown	797	818	474
Hotel	CV econ	1,111	955	909
	CV noecon	917	771	671
	VAV	571	432	350
	Unknown	1,014	863	790
Large Office	CV econ	2,140	2,046	1,683
	CV noecon	2,046	1,985	1,620
	VAV	518	428	309
	Unknown	739	651	497
Large Retail	CV econ	1,878	1,827	1,735
	CV noecon	1,755	1,728	1,620
	VAV	775	681	549
	Unknown	942	856	729
University	CV econ	1,515	1,404	1,342
	CV noecon	1,279	1,195	1,135

	VAV	615	852	797
	Unknown	858	991	933
Other	CV econ	1,097	1,039	855
	CV noecon	1,017	976	793
	VAV	438	414	327
	Unknown	551	522	415

Appendix 3: UDRH

UDRH is based on 2018 IECC code per the 2026 New Hampshire Energy Star Homes UDRH Update memo [9]

Measure	Unit	SF Value	MF Value
Building Envelope[b]			
Above Grade Wall	R-value	20	17
Above Grade Wall	U-value	0.06	0.07
Frame Floor	R-value	30	28
Frame Floor	U-value	0.033	0.035
Rim Joist	R-value	20	20
Rim Joist	U-value	0.06	0.06
Flat Ceiling	R-value	49	48
Flat Ceiling	U-value	0.026	0.026
Flat Ceiling (raised heel or energy truss)[c]	R-value	38	37
Flat Ceiling (raised heel or energy truss)	U-value	0.030	0.030
Vaulted Ceiling	R-value	49	48
Vaulted Ceiling	U-value	0.026	0.027
Vaulted Ceiling (<500 sq. ft. or 20% of ceiling area)[d]	R-value	30	29
Vaulted Ceiling (<500 sq. ft. or 20% of ceiling area)	U-value	0.035	0.036
Conditioned Foundation Wall	R-value	15/19[e]	6.4/8.1
Conditioned Foundation Wall	U-value	0.050	0.118
Unconditioned Foundation Wall	R-value	0	0
Unconditioned Foundation Wall	U-value	0.360	0.847
Slab Edge (Heated or Unheated)	R-value	10, 2ft[f]	10, 2ft

[9] NMR (2026) New Hampshire Energy Star Homes UDRH Update Memo

Under Slab (Unheated)		R-value	0	0
Under Slab (Heated)		R-value	5	5
Windows		U-value	0.30	0.31
Air Infiltration		ACH50	5.0	7.5
Duct Leakage		CFM25/CFA	0.08	0.12
Heating and Cooling				
Cooling	Central AC	SEER/SEER2	13.0/12.4	12.5/11.9
	Heat Pump	SEER/SEER2	13.0/13.0	12.5/12.5
Furnace	NG or LP	AFUE	90	89.4
	Oil	AFUE	85	85
Boiler	NG or LP	AFUE	90	89.9
	Oil	AFUE	87	87
Heat Pump		HSPF/HSPF2	8.5/7.7	8.6/7.7
Water Heating (SF and In-Unit MF)				
Standalone Tank	NG or LP	UEF	0.59	0.61
	Oil	UEF	0.59	0.59
	Electric resistance	UEF	0.92	0.92
	HPWH	UEF	0.92	0.92
Instantaneous	NG or LP	UEF	0.62	0.64
	Electric	UEF	0.92	0.92
Indirect	NG or LP	UEF	0.75	0.75
	Oil	UEF	0.69	0.69
	Electric	UEF	0.92	0.92
Water Heating (Central System, MF Only)[g]				
Standalone Tank	NG or LP	EF/TE	-	0.72/80
	Oil	EF/TE	-	0.59/80
	Electric Resistance	EF	-	0.89
	HPWH	EF	-	0.89
Instantaneous	NG or LP	EF/TE	-	0.82/80
	Oil	EF/TE	-	0.59/80

Boiler	NG or LP	TE	-	80
	Oil	TE	-	78

[b] Building envelope values are directly from Chapter 4: Residential Energy Efficiency in New Hampshire energy code based on 2018 IECC as linked to above. Specifically, R values come from Table R402.1.2, and associated U values from Table R402.1.4.

[c] Section R402.2.1 includes an exception stating R38 may be installed if "uncompressed insulation extends over the wall top plate at the eaves", such as raised heel or energy truss construction.

[d] Section R402.2.2 includes an exception stating that R30 may be installed if there is not sufficient space for more insulation in the assembly, but this reduction in insulation "shall be limited to 500 square feet or 20 percent of total insulated ceiling area, whichever is less".

[e] "15/19" means R15 continuous on either the exterior or the interior of the home or R19 cavity insulation on the interior.

[f] All slabs require R10 at the perimeter (slab edge), extending 2ft below grade. For heated slabs, "R5 insulation shall be provided under the full slab area… in addition to the required slab edge insulation".

[g] Central water heater values for MF buildings were derived from the Commercial Provisions of the New Hampshire energy code, Section C404: https://up.codes/viewer/new_hampshire/iecc-2018/chapter/CE_4/ce-commercial-energy-efficiency#C404.

Appendix 4: New Construction Lighting Power Density

Table A3-1 New Construction Interior Lighting Baseline Values (Building Area Method)

Building Type	**NH ISP**
Automotive facility	0.48
Convention center	0.61
Courthouse	0.61
Dining: bar lounge/leisure	0.61
Dining: cafeteria/fast food	0.54
Dining: family	0.57
Dormitory	0.34
Exercise center	0.5
Fire station	0.4
Gymnasium	0.56
Health care clinic	0.54
Hospital	0.63
Hotel/Motel	0.52
Library	0.71
Manufacturing facility	0.7
Motion picture theater	0.46
Multifamily	0.31
Museum	0.61
Office	0.49
Parking garage	0.13
Penitentiary	0.49
Performance arts theater	0.83
Police Station	0.52
Post office	0.52

Religious building	0.6
Retail	0.76
School/university	0.52
Sports arena	0.55
Town hall	0.53
Transportation	0.42
Warehouse	0.4
Workshop	0.71

Table A3-2 New Construction Interior Lighting Baseline Values (Space-by-Space Method)

Common/Building Specific	Space Type	NH ISP
Common Space types	Audience seating area - In a convention center	0.49
Common Space types	Audience seating area - In a gymnasium	0.39
Common Space types	Audience seating area - In a motion picture theater	0.68
Common Space types	Audience seating area - In a penitentiary	0.17
Common Space types	Audience seating area - In a performing arts theater	1.46
Common Space types	Audience seating area - In a religious building	0.92
Common Space types	Audience seating area - In a sports arena	0.26
Common Space types	Audience seating area - In an auditorium	0.38
Common Space types	Audience seating area - OTHERWISE	0.26
Common Space types	Banking activity area	0.61
Common Space types	Classroom/lecture hall/ training room - In a penitentiary	0.8
Common Space types	Classroom/lecture hall/ training room - OTHERWISE	0.74
Common Space types	Computer Room	1.03
Common Space types	Conference/meeting/multipurpose room	0.74
Common Space types	Copy/Print Room	0.43

Common Space types	Corridor - facility for visually impaired (not primarily used by staff)	0.55
Common Space types	Corridor - In a hospital	0.47
Common Space types	Corridor - In a manufacturing facility	0.25
Common Space types	Corridor - OTHERWISE	0.4
Common Space types	Courtroom	1.03
Common Space types	Dining area - facility for visually impaired (not primarily used by staff)	1.14
Common Space types	Dining area - In a penitentiary	0.58
Common Space types	Dining area - In bar/lounge or leisure dining	0.64
Common Space types	Dining area - In cafeteria or fast food dining	0.39
Common Space types	Dining area - In family dining	0.53
Common Space types	Dining area - OTHERWISE	0.39
Common Space types	Electrical/mechanical	0.57
Common Space types	Emergency vehicle parking	0.34
Common Space types	Food preparation	0.73
Common Space types	Guest room	0.28
Common Space types	Laboratory - In or as classrooms	0.86
Common Space types	Laboratory - OTHERWISE	1.09
Common Space types	Laundry/washing area	0.36
Common Space types	Loading dock, interior	0.28
Common Space types	Lobby - facility for visually impaired (not primarily used by staff)	1.08
Common Space types	Lobby - for an elevator	0.38
Common Space types	Lobby - In a hotel	0.64
Common Space types	Lobby - In a motion picture theater	0.35
Common Space types	Lobby - In a performing arts theater	1.2
Common Space types	Lobby - OTHERWISE	0.54
Common Space types	Locker room	0.45

Common Space types	Lounge/breakroom - In a healthcare facility	0.55
Common Space types	Lounge/breakroom - OTHERWISE	0.44
Common Space types	Office - enclosed (<=250 sqft)	0.67
Common Space types	Office - enclosed (>250 sqft)	0.67
Common Space types	Office - open plan	0.59
Common Space types	Parking area, interior	0.11
Common Space types	Pharmacy area	1.01
Common Space types	Restroom - facility for visually impaired (not primarily used by staff)	0.73
Common Space types	Restroom - OTHERWISE	0.59
Common Space types	Sales area	0.95
Common Space types	Seating area, general	0.32
Common Space types	Stairwell	0.41
Common Space types	Storage room	0.38
Common Space types	Vehicular Maintenance area	0.4
Building Specific Space Types	Convention center - exhibit space	0.87
Building Specific Space Types	Dormitory - living quarters	0.23
Building Specific Space Types	Facility for visually impaired - In a Chapel (not primarily used by staff)	1.33
Building Specific Space Types	Facility for visually impaired - In a rec room (not primarily used by staff)	1.45
Building Specific Space Types	Fire Station - sleeping quarters	0.13
Building Specific Space Types	Gymnasium/fitness center - In a playing area	0.72
Building Specific Space Types	Gymnasium/fitness center - In an exercise area	0.43
Building Specific Space Types	Healthcare Facility - In a medical supply room	0.44
Building Specific Space Types	Healthcare Facility - In a nursery	0.53
Building Specific Space Types	Healthcare Facility - In a patient room	0.37
Building Specific Space Types	Healthcare Facility - In a physical therapy room	0.55
Building Specific Space Types	Healthcare Facility - In an exam/treatment room	1

Building Specific Space Types	Healthcare Facility - In an imaging room	0.91
Building Specific Space Types	Healthcare Facility - In a nurse's station	0.43
Building Specific Space Types	Healthcare Facility - In an operating room	1.49
Building Specific Space Types	Healthcare Facility - In a recovery room	0.69
Building Specific Space Types	Library - In a reading area	0.64
Building Specific Space Types	Library - In the stacks	1.03
Building Specific Space Types	Manufacturing - In a detailed manufacturing area	0.77
Building Specific Space Types	Manufacturing - In a high bay area (25-50-foot floor-ceiling height)	0.74
Building Specific Space Types	Manufacturing - In a low bay area (<25-foot floor-ceiling height)	0.71
Building Specific Space Types	Manufacturing - In an equipment room	0.44
Building Specific Space Types	Manufacturing - In an extra high bay area (>50-foot floor-ceiling height)	0.63
Building Specific Space Types	Museum - In a general exhibition area	0.63
Building Specific Space Types	Museum - In a restoration room	0.61
Building Specific Space Types	Performing arts theater - dressing room	0.37
Building Specific Space Types	Post office - sorting area	0.56
Building Specific Space Types	Religious building - In a fellowship hall	0.38
Building Specific Space Types	Religious building - In a worship/pulpit/choir area	0.92
Building Specific Space Types	Retail - In a dressing/fitting area	0.43
Building Specific Space Types	Retail - In a mall concourse	0.66
Building Specific Space Types	Sports arena - playing area - For a Class I facility	2.21
Building Specific Space Types	Sports arena - playing area - For a Class II facility	1.44
Building Specific Space Types	Sports arena - playing area - For a Class III facility	1.08
Building Specific Space Types	Sports arena - playing area - For a Class IV facility	0.72
Building Specific Space Types	Transportation facility - At a terminal ticket counter	0.48
Building Specific Space Types	Transportation facility - In a baggage/carousel area	0.32
Building Specific Space Types	Transportation facility - In an airport concourse	0.22

Building Specific Space Types	Warehouse - storage area - For medium to bulky, palletized items	0.35

Table A3-3 New Construction Exterior Lighting Baseline Values

	Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)	500 W	600 W	750 W	1300 W
Uncovered Parking Areas				
Parking areas and drives	0.03 W/ft2	0.04 W/ft2	0.07 W/ft2	0.09 W/ft2
Building Grounds				
Walkways less than 10 ft wide	0.5 W/linear foot	0.5 W/linear foot	0.5 W/linear foot	0.7 W/linear foot
Walkways 10 ft wide or greater, plaza areas Special feature areas	0.09 W/ft2	0.09 W/ft2	0.11 W/ft2	0.13 W/ft2
Stairways	0.50 W/ft2	0.67 W/ft2	0.67 W/ft2	0.67 W/ft2
Pedestrian tunnels	0.10 W/ft2	0.10 W/ft2	0.13 W/ft2	0.20 W/ft2
Building Entrances, Exits, and Loading Docks				
Main entries	13 W/linear foot of door width	13 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
Other doors	13 W/linear foot of door width	13 W/linear foot of door width	13 W/linear foot of door width	13 W/linear foot of door width
Entry canopies	0.17 W/ft2	0.17 W/ft2	0.27 W/ft2	0.27 W/ft2
Sales Canopies				
Free standing and attached	0.40 W/ft2	0.40 W/ft2	0.54 W/ft2	0.67 W/ft2
Outdoor Sales				
Open areas (including vehicle sales lots)	0.17 W/ft2	0.17 W/ft2	0.34 W/ft2	0.47 W/ft2
Street frontage for vehicle sales lots in addition to "open area" allowance	7 W/linear foot	7 W/linear foot	7 W/linear foot	20 W/linear foot

Appendix 5: Revision Log

Revision Number	Date	Chapter	Description
1 -169	12022-2023		Filed with previous TRMs
170	1/1/2024	1.13 Duct Sealing	corrected table headers for kW and MMBTU savings; added gas measure ID G21B1a020
171	1/1/2024	2.30 Boilers	Removed Efficiency Table (not relevant); updated endnote reference links
172	1/1/2024	2.32 Condensing Unit Heaters	Updated endnote reference links
173	1/1/2024	2.33 Demand Control Ventilation	Updated endnote reference links
174	1/1/2024	2.40 Heat and Hot Water Combo Systems	Updated endnote reference links
175	1/1/2024	2.53 Water Heaters	Added measures and IDs for Downstream Indirect, On-Demand, Volume and Condensing water heaters.
176	1/1/2024	1.21 Resi Ductless Mini Split Heat Pump	Updated verbiage to show the offering is specific to cold climate heat pumps
177	1/1/2024	1.22 ENERGY STAR Central Air Conditioning	Updated SEERee to most recent available annual average of rebated units, 2020-2021
178	1/1/2024	1.38 Pool Pump	Updated baseline to align with new federal standard and savings.
179	1/1/2024	1.38 Pool Pump	Updated measure life to reflect most recent study
180	1/1/2024	2.5 Clothes Washer, High Speed	Added New Measure

Revision Number	Date	Chapter	Description
181	1/1/2024	2.10 Compressed Air Leak Detection	Added New Measure
182	1/1/2024	2.20 Pasta Cooker	Added New Measure
183	1/1/2024	2.25 Ice Machine	Updated usage of H for Harvest Rate to IHR for clarity and consistency
184	1/1/2024	2.29 Steam Cooker	Updated end notes for high efficiency section and added table from Energy Star Requirements documentation
185	1/1/2024	2.30. Ultra Low Temp Freezer	Changed name of measure from Ultra Low Temp Freezer to Cold Storage Suggest changing the name of this chapter to "Cold Storage" as there are a number of lab grade freezers and refrigerators that are available under the offering.
186	1/1/2024	2.32 Induction Cooktop	New Measure Added
187	1/1/2024	2.60. Lighting - Retrofit	Updated AML table to remove past year AML's
188	1/1/2024	2.62 Case Motor Replacement	Updated CF's to align with energy load shape
189	1/1/2024	2.64 Door Heater Controls	Updated CF's to align with energy load shape
190	1/1/2024	2.65 ECM Evaporator Fan Motors for Walk-in Coolers and Freezers	Updated CF's to align with energy load shape
191	1/1/2024	2.66 Electronic Defrost Control	Updated CF's to align with energy load shape
192	1/1/2024	2.68 Novelty Cooler Shutoff	Updated CF's to align with energy load shape
193	1/1/2024	2.69 Vending Miser	Updated CF's to align with energy load shape

Revision Number	Date	Chapter	Description
194	1/1/2024	2.37 Demand Control Ventilation	Updated savings algorithm to use a temperature BIN spreadsheet that uses the reduction of outside air to calculate the energy saved by not having to condition that air with NH specific TMY3 data
195	1/1/2024	2.40 Commercial Duct sealing	Updated section based on NY TRM v. 10.
196	1/1/2024	TBD Ultra Low Temp Freezer	Added deemed kW savings from CT PSD.
197	1/1/2024	Measure Characterization Structure (intro)	Under the "Primary Granite State Test" description, updated the measure life of weatherization projects to a weighted average of 21 years from a 15 year measure life.
198	1/1/2024	Multiple chapters	Home Performance with Energy Star
199	1/1/2024	1.11 Air Sealing	Corrected HVAC loads shape CF for electric homes and added cooling CF for FF heated homes.
200	1/1/2024	1.36 Lighting-Fixture	Added Home Performance Multifamily BC ID's
201	1/1/2024	1.36 Lighting-LED bulb	Added Home Performance Multifamily BC ID's
202	1/1/2024	1.25 HVAC Repair and Cleaning	Added heat pump clean and repair BC ID's that are offered in HEA
203	1/1/2024	1.12 Door Replacement	Corrected CF’s
204	1/1/2024	1.12 Door Replacement	Corrected load shape
205	1/1/2024	1.13 Duct Sealing	Corrected CF’s and load shape
206	1/1/2024	1.13 Insulation	Corrected CF’s and load shape
207	1/1/2024	1.13 Window Insert	Corrected CF’s and load shape

Revision Number	Date	Chapter	Description
208	1/1/2024	1.16 Window Replacement	Corrected CF's and load shape
209	3/19/2024	2.42 Packaged Terminal Heat Pump	New Measure Added
210	3/1/2024	2.61 Lighting-Retrofit	Added new product types as well as updated naming conventions of existing products to use lumens, rather than watts.
211	1/1/2025	2.61 Lighting-Retrofit	Delta Watt Values Updated to align with most recent MA Study, C1906
212	1/1/2025	2.8 Air Compressor	A separate savings value has been added for units of 75 HP. Previously all size units used the same kw reduction per HP (.189).
213	1/1/2025	2.34 Boilers	Baseline updated based on NMR baseline study, new deemed values provided.
214	1/1/2025	2.1 Active Demand Response	Updated RR based on 2024 C&I tristate ADR Study. Removed measures not being offered by NH Saves
215	1/1/2025	2.44 Heat Pump Systems	Updated baseline to reflect 2023 NMR NH Baseline Evaluation report recommendation to update the baseline to account for the the baseline heat pump efficiency being 1% better for cooling and 3% better for heating, comparing to IECC 2015 Table C403.2.3(2) Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps.
216	1/1/2025	2.60 Lighting - New Construction and Major Renovation	Per the 2023 NMR baseline study, An LPD factor has been applied to the baseline to account for the existence of LED's in the baseline.
217	1/1/2025	2.64 Cooler Night Cover	Updated measure life from 10 years to five years based on referenced study.
218	1/1/2025	2.26 Oven	Updated savings to align with updated Energy Star CFS calculator (updated March 2024). Added

Revision Number	Date	Chapter	Description
			equations embedded in the Energy Star and CA Energywise calculators
219	1/1/2025	2.62 Variable Frequency Drive	RR's for LBES and Muni programs had been omitted in the previous version. They have been added in.
220	1/1/2025	2.54 VRF Systems	Updated baseline efficiencies based on IECC 2018 and Federal Code.
221	1/1/2025	1.21 Ductless Mini-split Heat Pumps	Removed references to measures no longer offered and clarified baseline values.
222	1/1/2025	1.24 Furnace	Bifurcated baseline from NMR Baseline Practices report adopted
223	1/1/2025	1.35 LED Bulb	Updated delta watts to align with most recent MA study. Removed references to measures no longer offered by program.
224	1/1/2025	1.9 Recycling	Dehumidifier recycling measure savings corrected to align with other recycling measures to use gross savings from study.
225	1/1/2025	1.8 Refrigerator	Updated CF Factors
226	1/1/2025	1.18 Boiler	Bifurcated baseline from NMR Baseline Practices report adopted
228	1/1/2025	1.39 Whole Home New Construction	UDRH reference home definitions updated to 2018 IECC and recent federal code and added as an appendix. Baseline verbiage updated.
229	1/1/2025	1.4 Clothes Washer	Corrected ES products savings values based on referenced source which was already used in planning models.
230	1/1/2025	1.30 Heat Pump Water Heater	Updated deemed savings based on recommendation from 2023 New Hampshire Baseline Practices Report by NMR to update baseline for direct install HPWHs to align with a baseline of federal minimum efficiency standards
231	1/1/2025	1.28 Wi-fi Communicating Thermostat	Update Savings for ES Products measures based on recent MA results, adjusted for NH HDD and CDDD.

Revision Number	Date	Chapter	Description
232	3/17/2025	Residential Whole Home New Construction	The UDRH originally included in the 2025 TRM has been reverted to the version used in the 2024 TRM due to issues uncovered with multifamily versus single family code updates. A study is being planned to provide updated, separate SF and MF UDRH inputs and is expected to inform the 2027 TRM.
233	3/17/2025	1. Residential Heat Pump Water Heater	Updated baseline verbiage for clarity, added new BC ID's for the 120v HPWHs.
234	4/1/2025	Residential and Commercial Various Chapters	The TRM was updated to include omitted BC ID's for measures offered through the municipal gas program.
235	1/1/2026	1. Residential Furnace	Updated HEA Impact factors for 2025 NMR results. Corrected references for ES products/ kwh savings.
236	3/18/2025	2. C&I Unitary Air Conditioner	Updated for clarity, no changes to savings values. Added baseline values from 10 CFR 431.97 into baseline efficiency section. Added efficiency criteria from application and fixed broken links.
237	6/27/2025	2. C&I Air compressor	Added savings value for 15-24 HP compressor.
238	1/1/2026	2. C&I High Effiency Condensing Unit	Fixed measure code (was FS, should be HVAC). Updated SBES RR and fixed references. Updated CF.
239	1/1/2026	2. C&I Air compressor	Baseline updated per new federal code. Savings values adjusted to account for increased efficiency of baseline. Updated RR's for SBES according to 2025 impact somitudy results.
240	1/1/2026	2. C&I Boilers	Added efficiency adjustment factors as a function of return water temperature and revised heating EFLH based on commercial baseline study. Updated SBES RR's based on 2025 SBES Impact study
241	1/1/2026	2. C&I Boiler Reset Control	Updated SBES RRs based on 2025 Impact memo

Revision Number	Date	Chapter	Description
242	1/1/2026	2. C&I Compressed air leak detection	Updated SBES RRs based on 2025 Impact memo
243	1/1/2026	2. C&I Dishwasher	Updated savings to align with new energy star calculator idle energy rates. Resulted in updated savings for all measures and updated water savings for high temp pots and pans also updated. Measure life updated to align with recent study results. SBES RR's updated to align with 2025 SBES impact Study
244	1/1/2026	2. C&I Dual Enthalpy Economizer	Updated measure description. Updated SBES RRs based on 2025 SBES impact memo.
245	1/1/2026	2. C&I Heat Pump Systems	Update measure lives for air source heat pumps. Updated baseline values for heat pumps <65,000 btu/h per 2025 federal code. Added baseline EER values for calculation of demand savings. Updates SBES RR's per new 2025 SBES impact memo.
246	1/1/2026	2. C&I High effiency chiller	Updated cooling equivalent full load hours when building, HVAC and climate zone are unknown based on Commercial Baseline Study weights.
247	1/1/2026	2. C&I Unitary Air Conditioner	Updated baselines for units <65,000 btu/h per 2025 federal code update 10 CFR 431.97. Updated measure life. Corrected CF factors in table to align with cited study. Updated broken links. Measure Life updated to 20 years based on new research.
248	1/1/2026	2. C&I VRF	Reformatted and updated baselines to align per new federal code. Increased measure life from 12 to 20 years based on new research. Updates SBES RRs.
249	1/1/2026	2. C&I Zero loss condensate drain	Corrected ML citation

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250	1/1/2026	2. C&I Zero loss condensate drain	Updated SBES RR's for 2025 SBES impact memo results.
251	1/1/2026	2. C&I Custom	Updated realization rates for electric and gas measures in the LBES program per 'Impact Evaluation of 2020 and 2021 PY Large Business Energy Solutions Program Custom Measures' by DNV, 2024. Added in missing references for SBES and MES lighting and non lighting realization rates and coincidence factors. Updated CF's for LBES and hot water measures. Updated SBES RRs for 2025 impact results.
252	1/1/2026	1. Residential Faucet Aerator	Updated realization rates according to 2025 HEA and HEP final impact memos.
253	1/1/2026	1. Residential Air sealing	Updated realization rates according to 2025 HEA and HEP final impact memos.
254	1/1/2026	1. Residential Boiler	Updated high efficiency program requirements to align with application. Updated HEA RR's based on 2025 impact memo.
255	1/1/2026	1. Residential Insulation	Adjustments to realization rates for 2025 NMR HEA/HEP impact memos, modify HEP to HP
256	1/1/2026	1. Residential Pipe Insulation	Updated realization rates according to 2025 HEA and HEP impact memo results.
257	1/1/2026	1. Residential Programmable Thermostat	Updated RR's based on new NH HEA/HEP study results.
258	1/1/2026	1. Residential Refrigerator	Updated RR's for HEA based on new impact memo.
259	1/1/2026	1. Residential Showerhead	Savings algorithm edited for clarity. Updated RR's based on new NH HEA/HEP study results.
260	1/1/2026	1. Residential Wi-Fi Thermostat	Updated HEP RR's based on 2025 impact results.
261	1/1/2026	2 Refrigerated Air Dryer	Updated SBES RR's based on 2025 impact study
262	1/1/2026	2. C&I Oven	Updated SBES RR's based on 2025 impact study

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263	1/1/2026	2. C&I Cooler night cover	Updated SBES RR's based on 2025 impact study
264	1/1/2026	2. C&I Adding Compressor Capaty and/or Storage	Updated SBES RR's based on 2025 impact study
265	1/1/2026	2. C&I Air nozzle	Updated SBES RR's based on 2025 impact study
266	1/1/2026	2. C&I rculator pump	Updated SBES RR's based on 2025 impact study
267	1/1/2026	2. C&I Furnaces	Updated SBES RR's based on 2025 impact study
268	1/1/2026	2. C&I Induction Cooktop	Updated SBES RR's based on 2025 impact study
269	1/1/2026	2. C&I Low Pressure Drop Filter	Fixed references for LBES realization rates. Updates SBES RR's based on 2025 impact study.
270	1/1/2026	2. C&I Pipe wrap	Updated SBES RR's based on 2025 impact study
271	1/1/2026	2. C&I Programmable thermostat	Updated SBES RR for 2025 impact study.
272	1/1/2026	2. C&I Steam traps	Updated SBES RR's for 2025 impact study results.
273	1/1/2026	2. C&I Refrigerated Chef Base	Updated SBES RR's for 2025 impact study results.
274	1/1/2026	2. C&I Underfired Broiler	Updates SBES gas RR per 2025 evaluation results.
275	1/1/2026	2. C&I Thermostat Wi-Fi___33 Communicating	Updated SBES RR's for 2025 impact study results.

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276	1/1/2026	2. C&I Condensing Unit Heater	Updated SBES RR's for 2025 impact study results.
277	1/1/2026	2. C&I Deck Oven	Updated SBES RR's for 2025 impact study results.
278	1/1/2026	2. C&I Demand Control Ventilation	Updated SBES RR's for 2025 impact study results.
279	1/1/2026	2. C&I Duct sealing	Updated SBES RR's for 2025 impact study results.
280	1/1/2026	2. C&I Faucet aerator	Updated SBES RR's for 2025 impact study results.
281	1/1/2026	2. C&I Freezer	Updated SBES RR's for 2025 impact study results.
282	1/1/2026	2. C&I Fryer	Updated RR’s for SBES according to 2025 impact study results.
283	1/1/2026	2. C&I Griddle	Updated RR’s for SBES according to 2025 impact study results.
284	1/1/2026	2. C&I Hand-Wrap Machine	Updated RR’s for SBES according to 2025 impact study results.
285	1/1/2026	2. C&I Heat and Hot Water Combo Condensing Systems	Updated RR’s for SBES according to 2025 impact study results.
286	1/1/2026	2. C&I Holding Cabinet	Updated RR’s for SBES according to 2025 impact study results.
287	1/1/2026	2. C&I Hotel Occupancy sensor	Updated RR’s for SBES according to 2025 impact study results.
288	1/1/2026	2. C&I Ice Machine	Updated RR’s for SBES according to 2025 impact study results.
289	1/1/2026	2. C&I Infrared heater	Updated RR’s for SBES according to 2025 impact study results.

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290	1/1/2026	2. C&I Laboratory Grad Cold Storage	Updated RR's for SBES according to 2025 impact study results.
291	1/1/2026	2. C&I Pasta Cooker	Updated RR's for SBES according to 2025 impact study results.
292	1/1/2026	2. C&I Pre-Rinse Spray Valve	Updated RR's for SBES according to 2025 impact study results.
293	1/1/2026	2. C&I Refrigerator	Updated RR's for SBES according to 2025 impact study results.
294	1/1/2026	2. C&I Showerhead	Updated RR's for SBES according to 2025 impact study results.
295	1/1/2026	2. C&I Steam Cooker	Updated RR's for SBES according to 2025 impact study results.
296	1/1/2026	2. C&I Water heater	Updated RR's for SBES according to 2025 impact study results.
297	1/1/2026	2. C&I Conveyor Broiler	Updated RR's for SBES according to 2025 impact study results.
298	1/1/2026	2. C&I Vending Miser	Updated RR's for SBES according to 2025 impact study results.
299	1/1/2026	2. C&I Advanced Power Strip	Updated RR's for SBES according to 2025 impact study results.
300	1/1/2026	2. C&I Case motor replacement	Updated RR's for SBES according to 2025 impact study results.
301	1/1/2026	2. C&I Evaporator Fan Control	Updated RR's for SBES according to 2025 impact study results.
302	1/1/2026	2. C&I Door Heater Controls	Updated RR's for SBES according to 2025 impact study results.
303	1/1/2026	2. C&I ECM Evaporator Fan	Updated RR's for SBES according to 2025 impact study results.

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		Motors for Walk-in Coolers	
304	1/1/2026	2. C&I Electronic Defrost Control	Updated RR's for SBES according to 2025 impact study results.
305	1/1/2026	2. C&I Novelty Cooler Shutoff	Updated RR's for SBES according to 2025 impact study results.
306	1/1/2026	2. C&I Dehumidifier	Updated RR's for SBES according to 2025 impact study results.
307	1/1/2026	2. C&I Room Air Purifier	Updated RR's for SBES according to 2025 impact study results.
308	1/1/2026	2. C&I Variable Frequency Drive	Updated to reflect NH specific programmatic RR's for 2015 LBES study and 2025 SBES study.
309	1/1/2026	2. C&I Lighting Retrofit	Update SBES RR's, NTG and HOU based on 2025 impact study.
310	1/1/2026	2. C&I Lighting- New Construction and Major Renovation	Updated HOU and RR's based on 2025 impact study findings.
311	1/1/2026	2. C&I Lighting- Controls	Updated HOU and RR's based on 2025 impact study findings.
312	8/29/2025	Appendix 5 Revision Log	Fixed numbering issue in the revision log. Revission 233 and 234 in this quarterly report were not included in the filed 2026 TRM. They have been added to the 2026 TRM and as revisions 233 and 234 and subsequent revision numbers have been adjusted accordingly.
313	8/29/2025	Residential Motors and Drives ECM Pump	Added new measure for HEA circulator pump.
314	8/29/2025	Table of Contents	Added active chapter links to table of contents in 2026 TRM.

Revision Number	Date	Chapter	Description
315	8/29/2025	C&I Lighting-Retrofit	Corrected error in DW values for midstream lighting fixtures and controls that resulted from a naming convention issue.
316	8/29/2025	Residential Advanced Power Strips	Added APS measures for HEA and HEP programs
318	1/1/2027	Residential Energy Kits	Added chapter to reflect kit-specific ISR.
319	1/1/2027	Residential Appliance Recycling	Incorporated updates on deemed savings values and NTG per the 2026 ES Products Study
320	1/1/2027	Residential Air Sealing	Updated realization rates for delivered fuels, demand savings and ancillary savings according to final HEA/ HEP reports.
321	1/1/2027	Residential Duct Sealing	Updated Realization Rates for the Home Energy Performance Program
322	1/1/2027	Residential Door replacement	Updated RR's based on study results
323	1/1/2027	Residential Insulation	Updated Weatherization RRs and ML's of ancillary savings.
324	1/1/2027	Residential Window Inserts	Updated RR's per evaluation results
325	1/1/2027	Residential Window Replacement	Updated RR's per evaluation results
326	1/1/2027	Residential HVAC Boilers	Included the deemed ΔMMBtu/unit and NTG values for HEP and ES programs based on the reference provided. Corrected existing RR values based on evaluation results
327	1/1/2027	Residential Boiler Reset Control	Updated energy savings based on a 2024 Massachusetts Evaluation
328	1/1/2027	Residential Central Air Source Heat Pump	Updated CF's for all measures and added NTG for lost opportunity heat pumps.
329	1/1/2027	Residential Ductless Minisplit Heat Pump	Updated CF's for all measures and added NTG for lost opportunity heat pumps.
330	1/1/2027	Residential Energy Star Central Air Conditioning	Updated all efficiencies to SEER2
331	1/1/2027	Residential Energy Star Room Central Conditioning	Updated the baseline and high efficiency and savings value based on the code and Energy Star V7 requirements. Updated summer coincidence factor based on the reference provided

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332	1/1/2027	Residential HVAC Furnace	Included deemed savings value for HEP and ES products based on the references provided. Updated the impact factors table to include only gas impacts
333	1/1/2027	Residential Heat Recovery Ventilator	Updated energy savings and demand savings to match source values.
334	1/1/2027	Residential Programmable Thermostat	Updated the deemed kWh, kW and MMBtu values based on recent studies.
335	1/1/2027	Residential Programmable Thermostat	Updated the measure life based on the latest study.
336	1/1/2027	Residential Programmable Thermostat	Updated the summer and winter coincidence factors.
337	1/1/2027	Residential HVAC Repair and Cleaning	Updated single family area default values
338	1/1/2027	Residential HVAC Repair and Cleaning	Removed example calculations to ensure consistency with the rest of the TRM.
339	1/1/2027	Residential HVAC Repair and Cleaning	Added a deemed savings table
340	1/1/2027	Residential Room Air Purifier	Updated the baseline case to align with federal code requirements
341	1/1/2027	Residential Room Air Purifier	Updated the efficient case based on the latest Energy Star Version 3.0 Air Cleaner specifications
342	1/1/2027	Residential Room Air Purifier	Added savings algorithms and updated the deemed savings values
343	1/1/2027	Residential Wifi Thermostat	Updated the measure life based on the latest study.
344	1/1/2027	Residential Wifi Thermostat	Updated the summer and winter coincidence factors.
345	1/1/2027	Residential Hot Water Heat Pump Water Heater	Updated baseline efficiency values, savings values and NTG for Energy Star Products Measures per the 2026 NH ES Products study.
346	1/1/2027	Residential Pipe Insulation	Adopted deemed savings. Updated RR’s to 100%. Corrected savings values that were interchanged for domestic and heating hot water pipes

Revision Number	Date	Chapter	Description
347	1/1/2027	Residential Hot Water Heater	Added baseline efficiencies table and updated efficiencies based on federal standards Added high efficiencies table Updated deemed savings values Added underlying equations Updated realization rates
348	1/1/2027	Residential ECM Motor for FWH Circulating Pump	Updated the program types and included Retrofit
349	1/1/2027	Residential ECM Motor for FWH Circulating Pump	Updated the deemed savings values
350	1/1/2027	Residential ECM Motor for FWH Circulating Pump	Updated the winter coincidence factor values
351	1/1/2027	Residential ECM Motor for FWH Circulating Pump	Updated the reference links
352	1/1/2027	Residential ECM Motor for FWH Circulating Pump	Added algorithms that were used to calculate deemed savings; Updated deemed savings
353	1/1/2027	Residential Pool Pump	Updated kW savings, ISR, CFSP and NTG per the 2026 NH ES Products memo.
354	1/1/2027	Whole Home New Construction	Updated baseline verbiage to reflect new UDRH results. Removed references to old software in measure description
355	1/1/2027	C&I Air Sealing and Insulation	Updated algorithm to include simplified kWh/sf approach
356	1/1/2027	C&I Air Sealing and Insulation	Updated algorithm to use factors Fvent,c and Fvent,h. pdated to NH specific values for HDD, CDD and LM
357	1/1/2027	C&I Compressed Air Air Compressor	Baseline updated per the 2025 ISP: Compressed Air study
358	1/1/2027	C&I Custom Measures	Updated CF verbiage to reflect they are custom calculated for each project. Correct application of SBES and Muni RR's.
359	1/1/2027	C&I Food Service Hot Food Holding Cabinet	Fixed deemed savings to align with referenced size inputs
360	1/1/2027	C&I HVAC Boiler	Updated high efficiency values per new evaluation
361	1/1/2027	C&I HVAC Boiler Reset Controls	Updated savings based on a more recent study

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362	1/1/2027	C&I Condensing Unit Heater	Updated measure description. Added savings algorithms
363	1/1/2027	C&I Demand Control Ventilation	Updated the measure life based on the most recent source.
364	1/1/2027	C&I Demand Control Ventilation	Updated baseline efficiency and high efficiency description
365	1/1/2027	C&I Demand Control Ventilation	Added location and equipment specific savings factors using NH Degree Days
366	1/1/2027	C&I Demand Control Ventilation	Updated savings algorithms
367	1/1/2027	C&I Duct Insulation	Included deemed savings value and savings algorithm for different fuel types.
368	1/1/2027	C&I Duct Sealing	Added a description for the constants 400 cfm/tn and 17 cfm/kBtu/h. Updated the non-electric RR for LBES program based on the reference provided
369	1/1/2027	C&I HVAC Heat and Hot Water Combo Systems	Calculated deemed savings for combo boiler and combo furnace based on the savings algorithm and references provided
370	1/1/2027	C&I Heat Pump Systems	Added a table for new construction baseline efficiency values.
371	1/1/2027	C&I Heat Pump Systems	Updated the baseline lost opportunity and new construction efficiency values as follows: baseline efficiency for lost opportunity uses federal code values for ASHP and WSHP, and IECC values for GSHP. For new construction, baseline efficiency for ASHP is the maximum of the federal code and ISP efficiency values, while GSHP and WSHP use IECC values.
372	1/1/2027	C&I Heat Pump Systems	Updated the conversion factors for calculating heating capacity from cooling capacity for ASHPs.
373	1/1/2027	C&I High Efficiency Chiller	Updated measure description
374	1/1/2027	C&I HVAC Hotel Occupancy Sensor	Updated deemed savings by averaging kWh and kW values for self-contained package systems and DX cooling with HW heating coil given in Ref 1.
375	1/1/2027	C&I HVAC Hotel Occupancy Sensor	Updated measure life based on referenced study
376	1/1/2027	C&I Infrared heater	Added propane to measure and efficiency descriptions
377	1/1/2027	C&I Infrared heater	Added RR for “Muni New” program
378	1/1/2027	C&I Hot Water Heater	Updated the baseline values for all equipment to be consistent with IECC 2018. Additionally, the baseline equipment for the

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			tankless water heater was updated from gas fired storage water heater ti instantaneous gas fired water heater.
379	1/1/2027	C&I Hot Water Heater	Updated the baseline values for all equipment to be consistent with IECC 2018. Additionally, the baseline equipment for the tankless water heater was updated from gas fired storage water heater ti instantaneous gas fired water heater.
380	1/1/2027	C&I Hot Water Heater	Algorithms and parameter references were added for all equipment type based on MA TRM, NY TRM, CADEO study and NH residential measures. Deemed savings were updated to be based on this. A detailed spreadsheet has been created for the measures.
381	1/1/2027	C&I Hot Water Heater	CF's updated to align with most recent MA loadshape study.
382	1/1/2027	C&I Lighting Controls	Updated the hours for 24x7 facility and parking garage for the SBES program.
383	1/1/2027	C&I Lighting Controls	Updated the savings factor % for retrofit lighting controls.
384	1/1/2027	C&I Lighting Controls	Updated the electric realization rates for LBES program.
385	1/1/2027	C&I Lighting Controls	Updated the summer coincidence factors for municipal lighting occupancy sensor controls.
386	1/1/2027	C&I Lighting- New Construction and Major Renovation	Clarified baseline, correct 24/7 and parking garage hours of use.
387	1/1/2027	C&I Lighting Retrofit	Updated the hours for 24x7 facility and parking garage for the SBES program.
388	1/1/2027	C&I Lighting Retrofit	Updated the ΔWatts values for couple of fixtures type for the midstream program
389	1/1/2027	C&I Variable Frequency Drive	Updated the formatting of the saving algorithms
390	1/1/2027	C&I Variable Frequency Drive	Updated the reference links
391	1/1/2027	C&I Variable Frequency Drive	Included NTG values from the MA TRM
392	1/1/2027	C&I Refrigeration Cooler Night Cover	Updated measure description; added a default value for Hours
393	1/1/2027	C&I Refrigeration Door Heater Controls	Updated savings algorithm to account for reduced cooling load and to support multiple door and frame heaters per case.

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394	1/1/2027	C&I Refrigeration ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Updated the load reduction factor (LRF) for different scenarios
395	1/1/2027	C&I Refrigeration ECM Evaporator Fan Motors for Walk-in Cooler/Freezer	Updated measure, baseline, and high efficiency sections to include all applicable motors
396	1/1/2027	Commercial New Construction	Chapter added. CI NC measures split out from New Equipment
397	10/30/2026	Res Building Shell HVAC Duct Sealing	Added BC ID GB1a020 which had been omitted.
398	10/30/2026	Res Building Shell Insulation	Corrected the RR for BC ID GB1a018, a gas measure, from the 0.61 delivered fuel RR to the correct gas RR of 0.58.
399	10/30/2026	Res Window Insert	Corrected the RR for BC ID GB1a017 from the delivered fuel RR of 0.61 to the correct gas RR of 0.58
400	10/30/2026	Res Hot Water Water Heater	Corrected impact factors for EA2a082 EA2a083, GB1b011 to reflect the accurate RRs from the HEP and HEA studies,
401	10/30/2026	Res Whole Home New Construction	Added in omitted gas BC ID's GA1a001 through GA1a009
402	10/30/2026	C&I Custom	Extended RR's to three decimal places to resolve inconsistencies between TRM and BC Models
403	10/30/2026	C&I Food Service High Efficiency Condensing Unit	Added omitted BC ID's EC3b033 and EC3b034
404	10/30/2026	C&I Food Service Ovens	Fixed misprint issue with chapter. 2025 updates are now included again.
405	10/30/2026	C&I Food Service Deck Ovens	Add in omitted chapter
406	10/30/2026	C&I Condensing Unit Heater	Added omitted BC ID GC3b013
407	10/30/2026	C&I New Construction	Increased decimal places for realization rates to 3 to align with BC model.
408	10/30/2026	C&I Hot Water Water Heater	Removed NTG erroneously applied to downstream BC IDs. Corrected RR for gas measure GC2b028 from the electric 0.998 to the correct gas RR of 0.956