NEW HAMPSHIRE TECHNICAL REFERENCE MANUAL

for Estimating Savings from Energy Efficiency Measures, 2021 Program Year

WORKING DRAFT

Submitted April 1, 2020 by the New Hampshire Utilities

NHsaves Your Source for Energy Efficiency | EVERSOURCE | Liberty Utilities | New Hampshire Electric Co-op | Unitil

Table of Contents

0. 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.

Each measure is presented in its own section as a measure characterization. The 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 parameters for calculating savings are listed in the same order for each measure.

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). Data inputs and assumptions are based on New Hampshire utilities' data where available, and where not available are based on sources including 1) manufacturer and industry data, 2) a combination of the best available data from jurisdictions in the same region, 3) data from government agencies such as the U.S. Department of Energy or Environmental Protection Agency, or 4) 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.

0.1. Reference Tables

PROGRAM ABBREVIATIONS

Commercial	
Energy Rewards RFP Program	RFP
Large Business Energy Solutions	LBES
Municipal Energy Solutions	Muni
Small Business Energy Solutions	SBES
Residential	
ENERGY STAR Homes	ES Homes
ENERGY STAR Products	ES Products
Home Energy Assistance	HEA
Home Energy Reports	HER
Home Performance with ENERGY STAR	HPwES

CATEGORIES

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

0.2. Measure Characterization Structure

This section describes the common entries or inputs that make up each measure characterization. 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.

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.

Description:

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

Baseline Efficiency:

This section will include a statement of the assumed equipment/operation efficiency in the absence of program intervention. Multiple baselines will be 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 will describe 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 will describe the method for calculating electric savings and electric demand savings in appropriate units.

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.

This section will, as appropriate, summarize electric and non-electric savings in a table that contains the following information:

Measure Name: <Name used in utilities' Benefit-Cost models >
Program: <Defined by utilities, also referred to as Program Name>
Savings: <Measure savings in units of kWh, kW, MMBtu, or other as applicable; this information may be contained in multiple fields>

Measure Life:

This section will provide the measure life for each measure and describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML). It will note any adjustments made, such as for LED market trends.

BC Measure 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. Further descriptions of the impact factors and the sources on which they are based are described below.

ISR	=	In-Service Rate
CF_{SP}	=	Peak Coincidence Factor (summer peak)
CF_{WP}	=	Peak Coincidence Factor (winter peak)
RR_{E}	=	Realization Rate, electric(kWh)
RR_{NE}	=	Realization Rate, non-electric (MMBtu)
RR_{SP}	=	Realization Rate for summer peak kW
RR_{WP}	=	Realization Rate for winter peak kW

Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
[Measure Name]	[Program abbreviation]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

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:

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. Depending on the impact evaluation study, there may be separate Realization Rates for electric energy (kWh), peak demand (kW), or non-electric energy (MMBtu).

Coincidence Factors:

Adjusts 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.

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:

The amount of savings attributable to a program or measure. Net savings differs from "Gross Savings" because it includes adjustments from impact factors, such as free-ridership or spillover. The ratio of net savings to gross savings in known as the Net-to-Gross ratio and is usually expressed as a percent.

This section would only apply to midstream and upstream offerings, which are known to have greater levels of free-ridership than other programs as an inherent part of their program design. For other programs, the utilities will prioritize designing programs and putting mechanisms in place to minimize free-riders, in line with precedent from the 1999 NH EE Working Group report, which stated that "program designs should attempt to minimize free-riders" but "the methodological challenges and associated costs of accurately assessing free-riders no longer justifies the effort required".

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

0.3. Impact Factors for Calculating Adjusted Gross and Net Savings

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.

This section describes the types of impact factors used to make such adjustments, and how those impacts are applied to gross savings estimates.

Types of Impact Factors

The impact factors used to adjust savings fall into one of two categories:

Impact factors used to adjust gross savings:
- In-Service Rate ("ISR")
- Realization Rate ("RR")
- Summer and Winter Peak Demand Coincidence Factors ("CF")

Impact factors used to calculate net savings:
- Free-Ridership ("FR") and Spillover ("SO") Rates
- Net-to-Gross Ratios ("NTG")

The **in-service rate** is the 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.

The **realization rate** is 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. Depending on the impact evaluation study, there may be separate Realization Rates for electric energy (kWh), peak demand (kW), or non-electric energy (MMBtu).

A **coincidence factor** adjusts 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:

- 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:

- 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 loadshape model.

The **net savings** value is the final value of savings that is attributable to a measure or program. Net savings differs from gross savings because it includes the effects of the free-ridership and/or spillover rates. Net savings currently apply to midstream and upstream offerings, which are known to have greater levels of free-ridership than other programs as an inherent part of their program design. For other programs, the utilities will prioritize designing programs and putting mechanisms in place to minimize free-riders, in line with precedent from the 1999 NH EE Working Group report, which stated that "program designs should attempt to minimize free-riders" but "the methodological challenges and associated costs of accurately assessing free-riders no longer justifies the effort required".

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).

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.

1. Residential

1.1. Active Demand Response

Measure Code	[To Be Defined in ANB system],
Market	Residential
Program Type	Custom
Category	Behavior

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings]

Measure Life:

The measure life is [XX] years. [Source needed]

BC Measure ID	Measure Name	Program	Measure Life
	[Measure Name]	[Abbr]	XX

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in service rate since all programs include verification of equipment installations.

Realization Rates:

All programs use 100% energy realization rates.

Coincidence Factors:

Summer and winter coincidence factors are estimated using XXXX.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.2. Appliances - Advanced Power Strip

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	Appliances

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 refenced study results.[1]

BC Measure ID	BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b001	E---	Advanced Power Strip, Tier I	ES Products	117.0	0.011
E21A3b002	E---	Advanced Power Strip, Tier II	ES Products	174.0	0.018

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21A3b001	Advanced Power Strip, Tier I	ES Products	0.86	0.92	n/a	0.92	0.92	0.58	0.86
E21A3b002	Advanced Power Strip, Tier II	ES Products	0.75	0.92	n/a	0.92	0.92	0.58	0.86

In-Service Rates:

In-service rates are based on consumer surveys, as found in the referenced study.[1]

Realization Rates:

Realization rates account for the savings lost due to improper customer set-up/use of devices, as found in the referenced study.[3]

Coincidence Factors:

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

Energy Load Shape

See Appendix X – "Primary TV and Peripherals".[4]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] NMR Group, Inc. (2018). Advanced Power Strip Metering Study.
[2] Massachusetts common assumption.
[3] NMR Group, Inc. (2018). Advanced Power Strip Metering Study.
[4] Navigant (2018). RES1 Demand Impact Model Update.

1.3. Appliances - Clothes Dryer

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Appliances

Description:

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

Baseline Efficiency:

The baseline efficiency case is a new electric resistance dryer that meets the federal standard as of January 1, 2015 which is an Energy Factor (EF) of 3.73 for a vented standard dryer. 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).

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.

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:

Unit savings 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.

$$\boldsymbol{\Delta kWh} = (\boldsymbol{lbs/YEAR} \div \boldsymbol{CEF_{BASE}}) - (\boldsymbol{lbs/YEAR} \div \boldsymbol{CEF_{EFF}})$$

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)

Unit savings [1,2,3]

BC Measure Id	Measure Name	Program	ΔkWh	ΔkW	ΔGas MMBtu
E21B1a052	Clothes Dryer (Retrofit)	HEA	Calculated	Calculated	n/a
E21A2a055	Clothes Dryer (Retrofit)	HPwES	Calculated	Calculated	n/a
E21A1a027	Clothes Dryer (New Construction)	ES Homes	160.4	0.047	n/a
G---	Clothes Dryer (New Construction)	ES Homes			
E21A3b010	Clothes Dryer (ENERGY STAR)	ES Products	160.4	0.047	n/a
E21A3b012	Clothes Dryer (ENERGY STAR + Hybrid technology)	ES Products	213.3	0.063	n/a
E21A3b011	Clothes Dryer (ENERGY STAR + Heat Pump technology)	ES Products	421.1	0.124	n/a
G---	Clothes Dryer (Energy Star) - Gas	ES Products			

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21B1a052	Clothes Dryer (Retrofit)	HEA	1.00	0.87	n/a	0.87	0.87		
E21A2a055	Clothes Dryer (Retrofit)	HPwES	1.00	1.00	n/a	1.00	1.00		
E21A1a027	Clothes Dryer (New Construction)	ES Homes	1.00	1.00	n/a	1.00	1.00		
G---	Clothes Dryer (ENERGY STAR)	ES Products	1.00	1.00	n/a	1.00	1.00		
E21A3b010	Clothes Dryer (ENERGY STAR + Hybrid technology)	ES Products	1.00	1.00	n/a	1.00	1.00		
E21A3b012	Clothes Dryer (ENERGY STAR + Heat Pump technology)	ES Products	1.00	1.00	n/a	1.00	1.00		

In-Service Rate Source:

All installations have 100% in service rate.

Realization Rate Sources:

Programs use 100% energy realization rates for lost opportunity and retrofit HPwES clothes dryers.
Programs use 86.9% energy realization rates for retrofit HEA clothes dryers.

BC Measure ID	Measure Name	Program	CF_{SP}	CF_{WP}
E21B1a052 E21A2a055	Clothes Dryer (Retrofit)	HEA/HPwES	0.45	0.58
E21A3b010	Clothes Dryer (ENERGY STAR)	Products	0.45	0.58
E21A3b012	Clothes Dryer (ENERGY STAR + Hybrid technology)	Products	0.45	0.58
E21A3b011	Clothes Dryer (ENERGY STAR + Heat Pump technology)	Products	0.45	0.58
G---	Clothes Dryer (ENERGY STAR) - Gas	Products		

Coincidence Factors:

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

Energy Load Shape

See Appendix AX – "Clothes Dryer – Electric". [5]

Source:

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten

percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Northwest Energy Efficiency Alliance (2019). Dryers - QPL October 2019.
2: Department of Energy (2015). 10 CFR Part 431 March 27, 2015. Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers. Table II.7.
3: 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.

4: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances.
5: Navigant (2018). RES1 Demand Impact Model Update.

1.4. Appliances - Clothes Washer

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	New
Category	Appliances

Description:

Clothes washers exceeding minimum qualifying efficiency standards established as ENERGY STAR® or Most Efficient.

Baseline Efficiency:

The baseline 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.

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:

Unit savings are based on weighted averages by efficiency class presented in the 2015 Efficiency Vermont TRM. Demand savings are derived from the Navigant Demand Impact Model.

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu
E21B1a051	Clothes Washer (Retrofit)	HEA	Calculated	Calculated	Calculated	Calculated	Calculated
E21A2a054	Clothes Washer (Retrofit)	HPwES	Calculated	Calculated	Calculated	Calculated	Calculated
E21A1a026	Clothes Washer (New Construction)	ES Homes	88.7	0.02	0.093	0.163	0.013
G---	Clothes Washer (New Construction) – Gas	ES Homes	123.9	0.02	3.000	0.000	0.000
E21A3b017	Clothes Washer (ENERGY STAR)	Products	88.7	0.02	0.093	0.163	0.013

G---	Clothes Washer (ENERGY STAR) – Gas	Products					
E21A3b018	Clothes Washer (ENERGY STAR Most Efficient)	Products	155.9	0.04	0.152	0.267	0.022
G---	Clothes Washer (ENERGY STAR Most Efficient) – Gas	Products					

Source:

Measure Life:

The measure life is 11 years.[2]

Other Resource Impacts:

Annual water savings are deemed.

Measure Name	Program	Annual Water Savings (gallons)
Clothes Washer (Retrofit)	HEA/HPwES	
Clothes Washer (New Construction)	ES Homes	2,244
Clothes Washer (ENERGY STAR)	ES Products	2,244
Clothes Washer (ENERGY STAR Most Efficient)	ES Products	3,940

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}
E21B1a051	Clothes Washer (Retrofit)	HEA	1.00	0.87	0.98	0.87	0.87		
E21A2a054	Clothes Washer (Retrofit)	HPwES	1.00	1.00	1.00	1.00	1.00	0.49	0.52
E21A1a026	Clothes Washer (New Construction)	ES Homes	1.00	1.00	1.00	1.00	1.00	1.00	0.94
G---	Clothes Washer (New Construction) – Gas	ES Homes	1.00	1.00	1.00	1.00	1.00	0.49	0.52
E21A3b017	Clothes Washer (ENERGY STAR)	Products	1.00	1.00	1.00	1.00	1.00		
G---	Clothes Washer (ENERGY STAR) – Gas	Products						0.49	0.52
E21A3b018	Clothes Washer (ENERGY STAR Most Efficient)	Products	1.00	1.00	1.00	1.00	1.00		
G---	Clothes Washer (ENERGY STAR Most Efficient) – Gas	Products							

In-Service Rates Sources:

All installations have 100% in service rate.

Realization Rates Sources:

Programs use 100% energy realization rates for lost opportunity and retrofit HPwES clothes washers. All programs use 86.9% energy realization rates for retrofit HEA clothes washers.

Coincidence Factors:

All electric programs use a summer coincidence factor of 49% and a winter coincidence factor of 52%. All gas programs use a summer coincidence factor of 100% and a winter coincidence factor of 94%.

Energy Load Shape

See Appendix X – "Clothes Washer".[3]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Energy Efficiency Vermont (2015) Technical Reference User Manual
2: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
3: Navigant (2018). RES1 Demand Impact Model Update.

1.5. Appliances - Dehumidifier

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Appliances

Description:

Dehumidifiers exceeding minimum qualifying efficiency standards established as ENERGY STAR.

Baseline Efficiency:

The 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).

High Efficiency:

The high efficiency case is a dehumidifier that meets the ENERGY STAR standard as of October 31, 2019. 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:

Unit savings are calculated based on the EPA ENERGY STAR appliance calculator. Demand savings are derived from the Navigant Demand Impact Model.

$$\boldsymbol{\Delta kWh = Capacity \times (0.473 \div 24) \times ((1 \div Eff_{BASE}) - (1 \div Eff_{ES})) \times Hours}$$

Where:
Capacity = Average capacity of dehumidifier in Pints/24 Hours: 35 pints/day
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
0.473 = Conversion factor: 0.473 Liters/Pint
24 = Conversion factor: 24 Hours/Day

Table: Measure Energy Impact[1]

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21B1a053	Dehumidifier (Retrofit)	HEA	Calculated	Calculated
E21A2a056	Dehumidifier (Retrofit)	HPwES	Calculated	Calculated
E21A3b019	Dehumidifier (ENERGY STAR)	Products	144.5	0.034

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21B1a053	Dehumidifier (Retrofit)	HEA	All	1.00	0.87	n/a	0.87	0.87	E21B1a053
E21A2a056	Dehumidifier (Retrofit)	HPwES	All	1.00	1.00	n/a	1.00	1.00	E21A2a056
E21A3b019	Dehumidifier (ENERGY STAR)	Products	All	1.00	1.00	n/a	1.00	1.00	E21A3b019

In-Service Rates:

All installations have 100% in service.

Realization Rates:

All programs use 100% energy realization rates for lost opportunity and retrofit HPwES dehumidifiers.
All programs use 86.9% energy realization rates for retrofit HEA dehumidifiers.

Coincidence Factors:

All PAs use a summer coincidence factor of 82% and a winter coincidence factor of 17%.

Energy Load Shape

See Appendix X – "Dehumidifier".[3]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1,2: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx **3:** Navigant (2018). RES1 Demand Impact Model Update.

1.6. Appliances - Dishwasher

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	Appliances

Description:

The installation of a high efficiency ENERGY STAR residential dishwasher.

Baseline Efficiency:

The baseline efficiency case is a dishwasher that meets the federal standard effective May 30, 2013. Standard size dishwashers shall not exceed 307 kwh/year and 5.0 gallons per cycle.

High Efficiency:

The high efficiency case is a dishwasher that meets the ENERGY STAR standard as of January 29, 2016. Standard size dishwashers shall not exceed 270 kwh/year and 3.5 gallons per cycle.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated based on the EPA ENERGY STAR appliance calculator. Demand savings are derived from the Navigant Demand Impact Model.

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

Where:
kWh_{BASE} = Average usage of a baseline dishwasher
kWh_{ES} = Average usage of a new dishwasher meeting ENERGY STAR® standards

Table: Measure Energy Impact[1]

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b020	ES Dishwasher	ES Products	37.0	0.011

Measure Life:

The measure life is 11 years.

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b020	ES Dishwasher	ES Products	1.00	1.00	n/a	1.00	1.00	0.28	0.48

In-Service Rates:

[ ]

Realization Rates:

[ ]

Coincidence Factors:

Programs use a summer coincidence factor of 28% and a winter coincidence factor of 48%.

Energy Load Shape

See Appendix X – "Dishwasher".[2]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] Environmental Protection Agency (2016). Savings Calculator for Energy Star Qualified Appliances.
[2] Navigant (2018). RES1 Demand Impact Model Update.

1.7. Appliances - Freezer

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Appliances

Description:

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

Baseline Efficiency:

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).

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:

Unit savings are based on consumption estimates from a 2011 Efficiency Vermont analysis of incentivized units. Demand savings are derived from the Navigant Demand Impact Model.

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

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

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21B1a050	Freezer (Retrofit)	HEA	Calculated	Calculated
E21A2a053	Freezer (Retrofit)	HPwES	Calculated	Calculated
E21A3b021	Freezer (ENERGY STAR®)	Products	52.5	0.01

Measure Life:

The measure life is 12 years.

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21B1a050	Freezer (Retrofit)	HEA	1.00	0.87	n/a	0.87	0.87		
E21A2a053	Freezer (Retrofit)	HPwES	1.00	1.00	n/a	1.00	1.00	0.91	0.68
E21A3b021	Freezer (ENERGY STAR®)	ES Products	1.00	1.00	n/a	1.00	1.00	0.91	0.68

In-Service Rates:

All installations have 100% in service rate.

Realization Rates:

Programs use 100% energy realization rates

Coincidence Factors:

All installations have 100% in service rate since programs include verification of equipment installations.

Energy Load Shape

See Appendix X – "Freezer".

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx

1.8. Appliances - Refrigerator

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Appliances

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:

Unit savings are deemed based on the EPA ENERGY STAR appliance calculator. Demand savings are derived from the Navigant Demand Impact Model.

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

Where:
kWh_{BASE} = Average usage of a new refrigerator meeting federal standards, average energy consumption assumed to be 413 kWh
kWh_{ES} = Average usage of a new refrigerator meeting ENERGY STAR® Most Efficient standards.

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21B1a049	Refrigerator (Retrofit)	HEA	Calculated	Calculated
E21A2a049	Refrigerator (Retrofit)	HPwES	Calculated	Calculated

E21A1a025	Refrigerator (New Construction)	ES Homes	41.0	0.01
E21A3b022	Refrigerator (ENERGY STAR®)	ES Products	41.0	0.01
E21A3b023	Refrigerator (Most Efficient)	ES Products	96.4	0.02

Measure Life:

The measure life is 12 years.[1]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21B1a049	Refrigerator (Retrofit)	HEA	1.00	0.87	n/a	0.87	0.87	0.79	0.65
E21A2a049	Refrigerator (Retrofit)	HPwES	1	1.00	n/a	1.00	1.00	0.79	0.65
E21A1a025	Refrigerator (New Construction)	ES Homes	1.00	1.00	n/a	1.00	1.00	0.79	0.65
E21A3b022	Refrigerator (ENERGY STAR®)	ES Products	1.00	1.00	n/a	1.00	1.00	0.79	0.65
E21A3b023	Refrigerator (Most Efficient)	ES Products	1.00	1.00	n/a	1.00	1.00	CF_{SP}	CF_{WP}

In-Service Rates:

All installations have 100% in service rate since all PA programs include verification of equipment installations.

Realization Rates:

All PAs use 100% energy realization rates for lost opportunity and retrofit HPwES refrigerators. All PAs use 86.9% energy realization rates for retrofit HEA refrigerators].

Coincidence Factors:

A summer coincidence factor of 79% and a winter coincidence factor of 65% are utilized

Energy Load Shape

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

Source:

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
2: Navigant (2018). RES1 Demand Impact Model Update.

1.9. Appliances – Recycling

Measure Code	[To Be Defined in ANB system],
Market	Residential
Program Type	Retrofit
Category	Appliances

Description:

The retirement of old, inefficient refrigerators, freezers and room air conditioners.

Baseline Efficiency:

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

High Efficiency:

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

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b027	Primary Refrigerator Recycling	ES Products	491.6	0.087
E21A3b028	Secondary Refrigerator Recycling	ES Products	755.0	0.137
E21A3b029	Secondary Freezer Recycling	ES Products	658.0	0.095
E21A3b030	Room Air Conditioner Recycling	ES Products	16.2	0.026

Source: [ ]

Measure Life:

The measure life is 8 years for refrigerators and freezers and 5 years for room air conditioners.

Source: [ ]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b027	Primary Refrigerator Recycling	ES Products	1.00	1.00	n/a	1.00	1.00	0.79	0.65
E21A3b028	Secondary Refrigerator Recycling	ES Products	1.00	1.00	n/a	1.00	1.00	0.86	0.52
E21A3b029	Secondary Freezer Recycling	ES Products	1.00	1.00	n/a	1.00	1.00	0.91	0.68
E21A3b030	Room Air Conditioner Recycling	ES Products	1.00	1.00	n/a	1.00	1.00	0.33	0.00

In-Service Rates:

In-service rate is based on evaluation results.

Realization Rates:

Realization rates are set to 100% since unit savings are deemed.

Source: [ ]

Coincidence Factors:

All programs use a summer coincidence factor of 79% and a winter coincidence factor of 65% for primary refrigerator recycling, a summer coincidence factor of 86% and a winter coincidence factor of 52% for secondary refrigerator recycling, a summer coincidence factor of 91% and a winter coincidence factor of 68% for secondary freezer recycling, a summer coincidence factor of 33% and a winter coincidence factor of 0% for room air conditioner recycling.

Energy Load Shape

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

Source: Navigant (2018). RES1 Demand Impact Model Update.

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: SOURCES/NOTES

1.10. Appliances - Room Air Purifier

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	New
Category	Appliances

Description:

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

Baseline Efficiency:

The baseline efficiency case is a room air purifier that does not meet ENERGY STAR® efficiency requirements.

High Efficiency:

The high efficiency case is a room air purifier that meets the ENERGY STAR® standard as of July 1, 2004. A new room air purifier must produce a minimum Clean Air Delivery Rate (CADR)* of 50, and minimum performance of 2.0 CADR per watt.
*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).

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the EPA ENERGY STAR® appliance calculator. Demand savings are derived from the Navigant Demand Impact Model.

$$\boldsymbol{\Delta kWh} = \left(\frac{\boldsymbol{CADR \div CADR/W_{Conv}}}{\boldsymbol{1000}}\right) \times \boldsymbol{Hours} - \left(\frac{\boldsymbol{CADR \div CADR/W_{ES}}}{\boldsymbol{1000}}\right) \times \boldsymbol{Hours}$$

Where:
CADR = Clean Air Delivery Rate, a measure of capacity, assumed to be 100
$CADR/W_{Conv}$ = Clean Air Delivery Rate per watt for the conventional unit, a measure of efficiency, assumed to be 3.0
$CADR/W_{ES}$ = Clean Air Deliver Rate per watt for the ENERGY STAR® unit, a measure of efficiency
Hours = Assumption that the unit runs continuously, 5,840 hours/year

Table: Measure Energy Impacts[1]

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b025	Room Air Purifier	ES Products	391.0	0.045

Measure Life:

The measure life is 9 years.[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b025	Room Air Purifier	ES Products	0.97	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

In-service rate is based on evaluation results.

Realization Rates:

Realization rates are set to 100% since unit savings are deemed.[3]

Coincidence Factors:

All installations have 100% in service rate since programs include verification of equipment installations.

Energy Load Shape

See Appendix X – "24 hour operation".[4]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Environmental Protection Agency (2016). Savings Calculator for ENERGY STAR Qualified Appliances. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
2: Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division (2007). 2008 Status Report: Savings Estimates for the ENERGY STAR Voluntary Labeling Program.
3: NMR Group, Inc. (2018). Products Impact Evaluation of In-Service and Short Term Retention Rates Study.
4: Navigant (2018). RES1 Demand Impact Model Update.

1.11. Motors- ECM Circulator Pump

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	New
Category	Motors and Drives

Description:

Installation of high efficiency residential boiler circulator pumps, including electronically commutated variable speed air supply motors.

Baseline Efficiency:

The baseline efficiency case is the installation of a standard circulator pump.

High Efficiency:

The high efficiency case is the installation of an ECM circulator pump.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on evaluation results.

Table: Measure Energy Impacts[1]

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b013	ECM Motor for FWH Circulating Pump	ES Products	68.0	0.024

Measure Life:

The measure life is 18 years.

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b013	ECM Motor for FWH Circulating Pump	ES Products	1.00	1.00	n/a	1.00	1.00	0.00	0.54

In-Service Rates:

All installations are assumed to have 100% in service rate.

Realization Rates:

Realization rates are set to 100% since deemed savings are based on evaluation results.

Coincidence Factors:

Programs use a summer coincidence factor of 0% and a winter coincidence factor of 54%.

Energy Load Shape

See Appendix X – "Boiler Distribution".[2]

Impact Factors for Calculating Net Savings (Upstream/Midstream Only)[3]:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21A3b013	ECM Motor for FWH Circulating Pump	ES Products	0.40	0.09	0.00	0.69

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] West Hill Energy and Computing (2018). CT HVAC and Water Heater Process and Impact Evaluation and CT Heat Pump Water Heater Impact Evaluation.

[2] Navigant (2018). RES1 Demand Impact Model Update.
[3] West Hill Energy and Computing (2018). CT HVAC and Water Heater Process and Impact Evaluation and CT Heat Pump Water Heater Impact Evaluation.

1.12. Motors- Furnace Fan Motor

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	Motors and Drives

Description:

Installation of high efficiency motors on residential furnace fans, including electronically commutated variable speed air supply motors.

Baseline Efficiency:

The baseline efficiency case is the installation of a standard furnace fan motor.

High Efficiency:

The high efficiency case is the installation of an ECM motor for FHA furnace fans.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on evaluation results.

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b014---	ECM Motors for FHA Furnace Fans	ES Products	168.0	.093

Source: [ ]

Measure Life:

The measure life is 15 years.

Source: [ ]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b014	ECM Motors for FHA Furnace Fans	ES Products	1.00	1.00	n/a	1.00	1.00	0.00	0.54

In-Service Rates:

All installations have 100% in service rate since programs include verification of equipment installations.

Realization Rates:

Realization rates are set to 100% since deemed savings are based on evaluation results.

Coincidence Factors:

Programs use a summer coincidence factor of 0% and a winter coincidence factor of 54%.

Energy Load Shape

See Appendix X – "Boiler Distribution".[1]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] Navigant (2018). RES1 Demand Impact Model Update.

1.13. Motors - Pool Pump

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	Motors and Drives

Description:

The installation of a variable-speed drive pool pump. 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 single speed 1.5 horsepower pump that pumps 64 gallons per minute (gpm) and runs 8.5 hours per day for 91 days a year. It has an Energy Factor (EF) = 2.1 and cycles 32,640 gallons per day.

High Efficiency:

The high efficiency case is a variable-speed pump that meets the ENERGY STAR® Version 2.0 Energy Efficiency Requirements as of January 2, 2019. For a variable-speed pump the high efficiency case is a pump rated at 50 gpm high speed. It has a 4.0 EF at high speed, an 8.8 EF at low speed and runs 2 hr/day at high speed for filter & cleaning and 18 hr/day for filtering alone.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on averaged results from the ENERGY STAR pool pump calculator. Demand savings are derived from the Navigant Demand Impact Model.

$$\boldsymbol{\Delta kWh} =$$

Where:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E21A3b024	Pool Pump (Variable Speed)	ES Products	1,062.0	1.118

Measure Life:

The measure life is 10 years.[1]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3b024	Pool Pump (Variable Speed)	ES Products	1.00	1.00	n/a	1.00	1.00	0.55	0.00

In-Service Rates:

In-service rates are set to 100% based on the assumption that all purchased units are installed.

Realization Rates:

Realization rates are set to 100% since unit savings are deemed.

Coincidence Factors:

Programs use a summer coincidence factor of 55% and a winter coincidence factor of 0%.

Energy Load Shape

See Appendix X – "Pool Pump".[2]

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Davis Energy Group (2008). Proposal Information Template for Residential Pool Pump Measure Revisions. Prepared for Pacific Gas and Electric Company.

2: Navigant (2018). RES1 Demand Impact Model Update

1.14. Building Shell – Air Sealing

Measure Code	[To Be Defined in ANB system],
Market	Residential
Program Type	Retrofit
Category	Building Shell

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.

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:

The programs use vendor-calculated energy savings for air sealing measures in the Residential Home Performance with ENERGY STAR and Home Energy Assistance programs. These savings values are calculated using vendor proprietary software where 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.

Should the vendor software be unavailable or unable to estimate a home's energy savings from air sealing, the following savings algorithm should be used.

$\Delta MMBtu = \Delta CFM * (MMBtu/CFM_{heating} + CFM_{cooling})$

Where:
ΔCFM = Reduced air loss, in Cubic Feet per Minute (CFM) in a treated home.
MMBtu/CFM = Deemed savings per reduced CFM of 0.012934 MMBtu per CFM. This represents a blended savings value, applicable for all heating fuel types and cooling equipment scenarios in HPwES, based on evaluation results.[1]

In addition to heating fuel savings, the following deemed values are applied to reflect ancillary electric savings for heating load reductions, depending on the home heating equipment. 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):[5]

Equipment	kWh Savings	Description of Impact
Furnace fan	86.0	Per home value reflecting reduced fan operation based on heating load reduction from weatherization measures
HW boiler circulation pump(s)	9.0	Per circulator pump value reflecting reduced pump operation based on heating load reduction from weatherization measures

Measure Life:

The table below includes the effective useful life (EUL) for air sealing which assumes retrofit installation.

BC Measure ID	Measure Name	Program	Measure Life
	Air Sealing	HPwES/ HEA	15[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21B1a001	Air Sealing	Cord Wood	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a001	Air Sealing	Cord Wood	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
E21B1a002	Air Sealing	Electric	HEA	1.00	.89	n/a	.89	.89	0.34	0.21
E21A2a002	Air Sealing	Electric	HPwES	.99	1.00	n/a	1.00	1.00	0.34	0.21
E21B1a003	Air Sealing	Gas	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a003	Air Sealing	Gas	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
E21B1a004	Air Sealing	Kerosene	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a004	Air Sealing	Kerosene	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
E21B1a005	Air Sealing	Oil	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a005	Air Sealing	Oil	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
E21B1a006	Air Sealing	Propane	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a006	Air Sealing	Propane	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
E21B1a007	Air Sealing	Wood Pellets	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
E21A2a007	Air Sealing	Wood Pellets	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

All HPwES measures have a 99% in-service-rate based on evaluation results.[1] In-service-rates for HEA measures are set to 100%, as realization rates reflect any uninstalled measures, per evaluation results.[3]

Realization Rates:

For HPwES measures, realization rates are set to 100% to reflect new modeling software for 2021, until evaluation research provides updated estimates. Should the vendor software be unavailable or unable to estimate a home's energy savings from air sealing, and the deemed savings approach referenced above is used, a realization rate of 109% will be applied based on evaluation results.[1]

For HEA measures, realization rates are based on evaluation results, and are inclusive of in-service rates.[3]

Coincidence Factors:

Summer and winter coincidence factors are estimated using the RES1 Demand Impact Model Update. Set to "Weighted HVAC - Single Family".[4]

Energy Load Shape:

See RES1 Demand Impact Model Update in Appendix X

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Opinion Dynamics, December 24, 2019, Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT. **2:** 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

3: Opinion Dynamics, February 10, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – DRAFT.**4:** Navigant Consulting, 2018. RES1 Demand Impact Model Update.**5:** Cadmus, April 5, 2013, New Hampshire HVAC Load and Savings Research, Final Report, table 19.

1.15. Building Shell – Insulation

Measure Code	[To Be Defined in ANB system],
Market	Residential
Program Type	Retrofit
Category	Building Shell

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:

The programs currently use vendor calculated energy savings for these measures in the Residential Home Performance with ENERGY STAR and Home Energy Assistance programs. These savings values are calculated using vendor proprietary software where 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 proprietary building model is based on thermal transfer, building gains, and a variable-based heating/cooling degree day/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. Savings from shell measures use standard U-value, area, and degree day algorithms. 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.

Should the vendor software be unavailable or unable to estimate a home's energy savings from insulation, the following savings algorithm should be used.[1]

$\Delta MMBtu = HSqFt * (MMBtu_{heating} + MMBtu_{cooling})$

Where:
HSqFt = Hundred square feet of installed insulation in a treated home (represented by installed sq ft / 100 sq ft).
$MMBtu_{heating}$ = Deemed savings per square foot of installed insulation, using appropriate value for basements, walls, or attics in the tables developed by Opinion Dynamics and program implementers.[1]
$MMBtu_{cooling}$ = If cooling is present in treated home, use appropriate value for basements, walls, or attics the table developed by Opinion Dynamics and program implementers. Otherwise set to 0.[1]

In addition to heating fuel savings, the following deemed values are applied to reflect ancillary electric savings for heating load reductions, depending on the home heating equipment. 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):[5]

Equipment	kWh Savings	Description of Impact
Furnace fan	86.0	Per home value reflecting reduced fan operation based on heating load reduction from weatherization measures
HW boiler circulation pump(s)	9.0	Per circulator pump value reflecting reduced pump operation based on heating load reduction from weatherization measures

Measure Life:

The table below includes the effective useful life (EUL) for insulation which assumes retrofit installation.

BC Measure ID	Measure Name	Program	Measure Life
	Insulation	HPwES, HEA	25[2]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
	Insulation	Cord Wood	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Cord Wood	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
	Insulation	Electric	HEA	1.00	.89	n/a	.89	.89	0.34	0.21
	Insulation	Electric	HPwES	.99	1.00	n/a	1.00	1.00	0.34	0.21
	Insulation	Gas	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Gas	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
	Insulation	Kerosene	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Kerosene	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
	Insulation	Oil	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Oil	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
	Insulation	Propane	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Propane	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a
	Insulation	Wood Pellets	HEA	1.00	n/a	.89	n/a	n/a	n/a	n/a
	Insulation	Wood Pellets	HPwES	.99	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

All HPwES measures have a 99% in-service-rate based on evaluation results.[1] In-service-rates for HEA measures are set to 100%, as realization rates reflect any uninstalled measures, per evaluation results.[3]

Realization Rates:

For HPwES measures, realization rates are set to 100% to reflect new modeling software for 2021, until evaluation research provides updated estimates. Should the vendor software be unavailable or unable to estimate a home's energy savings from insulation, and the deemed savings approach referenced above is used, a realization rate of 109% will be applied based on evaluation results.[1]

For HEA measures, realization rates are based on evaluation results, and are inclusive of in-service rates.[3]

Coincidence Factors:

Summer and winter coincidence factors are estimated using the RES1 Demand Impact Model Update, based on the "Weighted HVAC – Single Family" measure.[4]

Energy Load Shape:

See RES1 Demand Impact Model Update in Appendix X.

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Opinion Dynamics, December 24, 2019, Home Performance with Energy Star Program Evaluation Report 2016-2017. Excel file associated with report with calculations, "*2019 NHSaves HPwES Deemed Savings_2020-02-25_FM adjustments*"

2: 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

3: Opinion Dynamics, February 10, 2020, New Hampshire Utilities, Home Energy Assistance Program Evaluation Report, 2016-2017 – DRAFT.

4: Navigant (2018). RES1 Demand Impact Model Update

5: Cadmus, April 5, 2013, New Hampshire HVAC Load and Savings Research, Final Report, table 19.

1.16. Hot Water – Faucet Aerator

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Energy Type	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu
	Faucet Aerator,	Electric	HEA/HPwES					
	Faucet Aerator	Gas	HEA/HPwES					
	Faucet Aerator	Kerosene	HEA/HPwES					
	Faucet Aerator	Oil	HEA/HPwES					
	Faucet Aerator	Propane	HEA/HPwES					

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	Measure Life
	Faucet Aerator,	Electric	HEA/HPwES	XX
	Faucet Aerator	Gas	HEA/HPwES	
	Faucet Aerator	Kerosene	HEA/HPwES	
	Faucet Aerator	Oil	HEA/HPwES	
	Faucet Aerator	Propane	HEA/HPwES	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.17. Hot Water – Heat Pump Water Heater

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Heat Pump Water Heater	HEA/ HPwES	XX
	Heat Pump Water Heater	ES Homes	
	Heat Pump Water Heater 50 gal	ES Products	XX
	Heat Pump Water Heater 80 gal	ES Products	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.18. Hot Water – Pipe Insulation

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu
	Pipe insulation – Hot Water	Gas	HPwES/ HEA					
	Pipe insulation – Hot Water	Kerosene	HPwES/ HEA					
	Pipe insulation – Hot Water	Oil	HPwES/ HEA					
	Pipe insulation – Hot Water	Propane	HPwES/ HEA					

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	Measure Life
	Pipe insulation – Hot Water	Gas	HPwES/ HEA	XX
	Pipe insulation – Hot Water	Kerosene	HPwES/ HEA	
	Pipe insulation – Hot Water	Oil	HPwES/ HEA	
	Pipe insulation – Hot Water	Propane	HPwES/ HEA	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.19. Hot Water - Setback

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit
Category	Hot Water

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:

Unit savings are deemed based on an engineering calculation.

$\Delta MMBtu$ = Density of Water (lbs/gallon) x Annual Water Usage (gallons) x ($Temp_{PRE}$-$Temp_{POST}$) / Water Heater Energy Factor

$\Delta MMBtu_{Elec}$ = 8.3 x 2065.8 x (140 – 125) / 0.95 = 0.271

$\Delta MMBtu_{FF}$ = 8.3 x 2065.8 x (140 – 125) / 0.62 = 0.415

Savings are adjusted assuming the presence of an electric dishwasher, which requires additional energy to heat water under the new water temperature.

$\Delta MMBtu_{DW}$ = 8.3 x 933.1 x (140 – 125) / 1.00 = 0.116

BC Measure ID	Measure Name	Program	Fuel Type	ΔMMBtu/unit
	Hot Water Setback	HPwES	Electricity	0.155
	Hot Water Setback	HPwES	Propane	0.299
	Hot Water Setback	HPwES	Gas	0.299
	Hot Water Setback	HPwES	Oil	0.299

Measure Life:

The table below includes the measure life for existing units and new equipment.

BC Measure ID	Measure Name	Fuel Type	Program	Measure Life
	Hot Water Setback		HPwES	4

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
	Hot Water Setback	HPwES	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.20. Hot Water - Showerhead

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu
	Hand Held Showerhead	Electric	HEA/HPwES					
	Hand Held Showerhead	Gas	HEA/HPwES					
	Hand Held Showerhead	Kerosene	HEA/HPwES					
	Hand Held Showerhead	Oil	HEA/HPwES					
	Hand Held Showerhead	Propane	HEA/HPwES					
	Low-Flow Showerhead	Electric	HEA/HPwES					
	Low-Flow Showerhead	Gas	HEA/HPwES					
	Low-Flow Showerhead	Kerosene	HEA/HPwES					
	Low-Flow Showerhead	Oil	HEA/HPwES					

	Low-Flow Showerhead	Propoane	HEA/HPwES					

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	Measure Life
	Hand Held Showerhead	Electric	HEA/HPwES	XX
	Hand Held Showerhead	Gas	HEA/HPwES	
	Hand Held Showerhead	Kerosene	HEA/HPwES	
	Hand Held Showerhead	Oil	HEA/HPwES	
	Hand Held Showerhead	Propane	HEA/HPwES	
	Low-Flow Showerhead	Electric	HEA/HPwES	
	Low-Flow Showerhead	Gas	HEA/HPwES	
	Low-Flow Showerhead	Kerosene	HEA/HPwES	
	Low-Flow Showerhead	Oil	HEA/HPwES	
	Low-Flow Showerhead	Propane	HEA/HPwES	

Other Resource

Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.21. Hot Water – Water Heater

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Water Heater - Indirect (attached to ES FHW Boiler; Combined eff rating >=85% (EF=.82)	ES Products	XX
	Water Heater - Integrated w/Condensing Boiler >= 90% AFUE	ES Products	
	Water Heater - Integrated w/Condensing Boiler >= 95% AFUE	ES Products	
	Water Heater - Tankless, On-Demand >=.94 New Construction	ES Homes	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.22. HVAC – Boiler

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit
Category	HVAC

Description:

Installation of a new, high efficiency forced hot water boiler, replacing an existing lower efficiency boiler.

Baseline Efficiency

For the retirement savings over the remaining life of existing boiler, the baseline is the existing inefficient boiler estimated to be 75% AFUE for a forced hot water boiler. For the high efficiency unit savings over lifetime of the new boiler, the baseline for gas and propane boilers is a code-compliant boiler (AFUE = 82%) adjusted by a degradation factor (0.967) to account for its metered efficiency (AFUE=79.3%)[225]. For oil boilers the baseline is a code-compliant 84% AFUE boiler.

High Efficiency

For the retirement savings over the remaining life of existing boiler, the efficient case for gas and propane boilers is a code-compliant boiler (AFUE = 82%) adjusted by a degradation factor (0.967) to account for its metered efficiency (AFUE = 79.3%). For oil boilers the efficient case is a code-compliant 84% AFUE boiler. For the high efficiency savings over lifetime of the new boiler, the efficient case for gas and propane boilers is a new high efficiency boiler AFUE >= 93%) adjusted by a degradation factor (0.941) to account for its metered efficiency (AFUE >= 87.5%)[226]. For oil the efficient case is an 86% AFUE boiler.

Algorithms for Calculating Primary Energy Impact:

Unit savings for the early replacement of an existing boiler with a high efficiency boiler are counted in two parts: (1) early retirement savings for a code-compliant boiler compared to the existing boiler over the remaining lifetime of the existing boiler, and (2) efficiency savings for the high efficiency boiler compared to a code-compliant boiler for the full life of the new high efficiency boiler:

$\Delta MMBtu = \Delta MMBtu_{RETIRE} + \Delta MMBtu_{EE}$

$\Delta MMBtu_{RETIRE}$ = *heating load MMBTUs * (1/AFUE base – 1/AFUEee)*

$\Delta MMBtu_{EE}$ = *heating load MMBTUs * (1/AFUE base – 1/AFUEee)*

Where:
Unit = Removal of existing inefficient boiler and installation of new high efficiency boiler
$\Delta MMBtu_{RETIRE}$ = Annual MMBtu savings of code-compliant boiler compared to existing boiler
$\Delta MMBtu_{EE}$ = Annual MMBtu savings of high efficiency boiler

BC Measure ID	Measure Name	Fuel Type	Program	ΔMMBtu/unit
	Early Retirement Boiler, Forced Hot Water (EE)	Gas		11.4
	Early Retirement Boiler, Forced Hot Water (Retire)	Gas		7.0
	Early Retirement Boiler, Forced Hot Water (EE), Oil	Oil		2.7
	Early Retirement Boiler, Forced Hot Water (Retire), Oil	Oil		13.8
	Early Retirement Boiler, Forced Hot Water (EE), Other	Propane/Kerosene		11.4
	Early Retirement Boiler, Forced Hot Water (Retire), Other	Propane/Kerosene		7.0

Measure Life:

The table below includes the measure life for existing units and new equipment. The remaining life for the existing unit is 10 years, and the measure life of new equipment is 20 years.

BC Measure ID	Measure Name	Program	Measure Life
	Boiler	[Abbr]	20

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.23. HVAC – Boiler Reset Control

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit
Category	HVAC

Description:

Installation of a device to automatically control boiler water temperature.

Baseline Efficiency

The baseline efficiency case is a boiler with automatically controlled water temperature.

High Efficiency

The high efficiency case is a boiler with automatically controlled water temperature.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on study results.

BC Measure ID	Measure Name	Fuel Type	Program	ΔMMBtu/unit
	Boiler Reset Control	Oil	HPwES	4.7
	Boiler Reset Control	Propane	HPwES	4.5
	Boiler Reset Control	Gas	ES Appliances	4.5
	Boiler Reset Control	Oil	HEA	4.4

Measure Life:

The table below includes the measure life for existing units and new equipment.

BC Measure ID	Measure Name	Program	Measure Life
	Boiler Reset Control	[Abbr]	15

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.24. HVAC – Condensing Boilers

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Early Retirement/Replacement
Category	HVAC

Description:

Installation of a new, high efficiency combined water heating and boiler unit.

Baseline Efficiency

The baseline is a code-compliant boiler (AFUE = 82%) adjusted by a degradation factor (0.967) to account for its metered efficiency (AFUE=79.3%)[225]. The water heating baseline is a 0.6 EF water heater.

High Efficiency

The efficient case is an integrated water heater/boiler unit with either an AFUE 90 boiler (AFUE = 90%, EF = 0.90) or an AFUE 95 boiler (AFUE = 95%, EF = 0.95).

Algorithms for Calculating Primary Energy Impact:

Unit savings for the early replacement of an existing boiler with a high efficiency boiler are counted in two parts: (1) early retirement savings for a code-compliant boiler compared to the existing boiler over the remaining lifetime of the existing boiler, and (2) efficiency savings for the high efficiency boiler compared to a code-compliant boiler for the full life of the new high efficiency boiler:

$\Delta MMBtu = \Delta MMBtu_{RETIRE} + \Delta MMBtu_{EE}$

$\Delta MMBtu_{RETIRE}$ = *heating load MMBTUs * (1/AFUE base – 1/AFUEee)*

$\Delta MMBtu_{EE}$ = *heating load MMBTUs * (1/AFUE base – 1/AFUEee)*

Where:
Unit = Removal of existing inefficient boiler and installation of new high efficiency boiler
$\Delta MMBtu_{RETIRE}$ = Annual MMBtu savings of code-compliant boiler compared to existing boiler
$\Delta MMBtu_{EE}$ = Annual MMBtu savings of high efficiency boiler

BC Measure ID	Measure Name	Fuel Type	**Program**	ΔMMBtu/unit
	Early Retirement Boiler, Forced Hot Water (EE)	Gas		11.4
	Early Retirement Boiler, Forced Hot Water (Retire)	Gas		7.0

	Early Retirement Boiler, Forced Hot Water (EE), Oil	Oil		2.7
	Early Retirement Boiler, Forced Hot Water (Retire), Oil	Oil		13.8
	Early Retirement Boiler, Forced Hot Water (EE), Other	Propane/Kerosene		11.4
	Early Retirement Boiler, Forced Hot Water (Retire), Other	Propane/Kerosene		7.0

Measure Life:

The table below includes the measure life for existing units and new equipment. The remaining life for the existing unit is 10 years, and the measure life of new equipment is 20 years.

BC Measure ID	Measure Name	Program	Measure Life
	Boiler	[Abbr]	20

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.25. HVAC – ENERGY STAR Central Air Conditioning

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost opportunity
Category	HVAC

Description:

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

Baseline Efficiency:

For lost opportunity and replace on failure retrofit, the baseline efficiency case is a Seasonal Energy Efficiency Ratio (SEER) 13 central air-conditioning unit (meets federal standards). For early retirement, if values are known, then baseline is the existing air-conditioning unit SEER over its remaining life, and a code-compliant, SEER 13 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 qualified ENERGY STAR central air-conditioning unit, based on the reported capacity and efficiency levels of units rebated in the previous calendar year. The minimum ENERGY STAR Seasonal Energy Efficiency Ratio (SEER) requirement for the program is 15.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = Tons \times 12\ kBtu/hr / Ton \times (1/SEER_{BASE} - 1/SEER_{EE}) \times Hours$
$\Delta kW = \Delta kWh \times Annual\ Maximum\ Demand\ Factor$

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).[1]
SEER$_{BASE}$ = Seasonal Energy Efficiency Ratio (SEER).

- For lost opportunity and replace on failure retrofit installation, baseline AC equipment should be the federal standard of 13 SEER.
- For early replacement retrofit, baseline AC equipment is divided into two components:
  - For the remaining useful life of the replaced AC equipment:
    - if known, use the replaced (old) AC SEER value.
    - if unknown, assume previous calendar year average of the replaced (old) AC SEER value (for 2019 was SEER 10).
  - For the remaining useful life of the new AC equipment:
    - baseline AC equipment should be the federal standard of 13 SEER

SEER$_{EE}$ = Seasonal Energy Efficiency Ratio (SEER) of new efficient AC equipment. Use actual rebated SEER, or if unknown, assume previous calendar year average (for 2019 was 17.1 SEER). [2]
Hours = Equivalent Full Load Hours (EFLH). Assume 385 for New Hampshire based on the ENERGY STAR calculator.[3]

Savings Assumptions for Calculating Residential Central Air Conditioners:

BC Measure ID	Measure Name	Program	Tons	SEER$_{BASE}$	SEER$_{EE}$	Hours	ΔkWh	Annual Max Demand Factor[6]	ΔkW
	ENERGY STAR Central AC	ENERGY STAR Products	Use actual, if unknown use 2.85	13	Use actual, if unknown use 17.1	385	243 kWh	0.001594	0.3871
	ENERGY STAR Central AC, Early Retirement	HPwES/HEA	Use actual, if unknown use 2.85	Use actual, if unknown use 10	Use actual, if unknown use 17.1	385	547 kWh	0.001594	0.8714

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. 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)
	ENERGY STAR Central AC	ES Products	18[4]	n/a
	ENERGY STAR Central AC, Early Retirement	HPwES/HEA	18	6[5]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
	ENERGY STAR Central AC	ES Products	1.00	1.00	n/a	1.00	1.00	0.35	0.00
	ENERGY STAR Central AC, Early Retirement	HPwES/HEA	1.00	1.00	n/a	1.00	1.00	0.35	0.00

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations.

Realization Rates:

Realization rates are set to 100% until evaluation research provides updated estimates.

Coincidence Factors:

Summer coincidence factors are estimated using the RES1 Demand Impact Model Update.[6] The winter coincidence factor is assumed to be zero.

Energy Load Shape:

See RES1 Demand Impact Model Update in Appendix X.

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Average tonnage for Eversource 2019 rebated ENERGY STAR central AC according to tracking database summary report. Pulled February 10, 2020.
2: Average SEER for Eversource 2019 rebated ENERGY STAR central AC according to tracking database summary report. Pulled February 10, 2020.
3: ENERGY STAR Central AC calculator. Assumptions worksheet. Usage: Full Load Cooling Hours. Concord NH location. Based on 2002 EPA study.
https://www.energystar.gov/sites/default/uploads/buildings/old/files/CentralAC_Calculator.xls
EFLH Calculator tab in the EVT_CCHP MOP and Retrofit_2018_.xlsx.). Previous VT TRM was 375. Cadmus study showed much lower for heat pumps:
https://publicservice.vermont.gov/sites/dps/files/documents/2017%20Evaluation%20of%20Cold%20Climate%20Heat%20Pumps%20in%20Vermont.pdf
4: Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS, June 2007.
https://library.cee1.org/system/files/library/8842/CEE_Eval_MeasureLifeStudyLights%2526HVACGDS_1Jun2007.pdf

5: 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.
6: MA RES1 Demand Impact Model Update, Navigant Consulting, August 15, 2018.
https://etrm.anbetrack.com/etrm/api/v1/etrm/documents/5d4d6bd1863b1c1b6f82942f/view?authToken=847dee4d59da9810925b541fc87c4b95bc0affbb470b721516b94c85f74c93ad4c1b3f1dd2735e51e70940

1.26. HVAC – ENERGY STAR Room Air Conditioning

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost opportunity
Category	HVAC

Description:

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

Baseline Efficiency:

The baseline efficiency case is a room AC unit meeting current federal standard.

High Efficiency:

The high efficiency case is a program-qualified ENERGY STAR room AC unit.

Algorithms for Calculating Primary Energy Impact:

Electric energy savings for a program-qualified ENERGY STAR room air-conditioning unit are deemed at 33 kWh per unit. Unit savings are based on the Massachusetts eTRM value (36 kWh) adjusted[1] to account for the cooling load differential between Massachusetts[2] and New Hampshire.[3]
Savings Assumptions for Calculating Residential ENERGY STAR Room Air Conditioners:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
	ENERGY STAR Room AC	ES Products	33 kWh	0.06

Measure Life:

The table below includes the effective useful life (EUL) for room air-conditioning units which assumes lost opportunity installation.

BC Measure ID	Measure Name	Program	Measure Life
	ENERGY STAR Room AC	ES Products	8[4]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
	ENERGY STAR Room AC	ES Products	1.00	1.00	n/a	1.00	1.00	0.33	0.00

In-Service Rates:

All installations are assumed to have 100% in-service-rates.

Realization Rates:

Realization rates are set to 100% since unit savings are deemed.

Coincidence Factors:

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

Energy Load Shape:

See RES1 Demand Impact Model Update in Appendix X

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: Common cooling savings algorithms used in the Connecticut PSD[2] show a directly proportional relationship between savings and cooling operational hours. We assume a similar directly proportional relationship between cooling operational hours (EFLH), cooling savings, and cooling degree days. The New Hampshire CDD of 518 is based on the HPwES evaluation[3] and the MA CDD is assumed to be the average of New Hampshire and Connecticut (603).
2: Connecticut's 2019 Program Savings Document, March 1, 2019.
https://www.energizect.com/sites/default/files/2019%20PSD%20%283-1-19%29.pdf
3: Opinion Dynamics, New Hampshire Utilities Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT, December 24, 2019.
RES1 Demand Impact Model Update, "*Navigant Demand Impact Model Update (MA) 2018-08-15 (Summary Only).xlsx*" Navigant Consulting, August 15, 2018.
4: Energy Star (2018). Savings Calculator for Energy Star Appliances.
5: Navigant (2018). RES1 Demand Impact Model Update.

1.27. HVAC - Furnace

Measure Code	[To Be Defined in ANB system]
Market	Commercial/Residential
Program Type	Retrofit/Lost Opportunity
Category	HVAC

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Energy Type	Program	ΔkWh	ΔkW	ΔGas MMBtu	ΔOil MMBtu	ΔPropane MMBtu
E---	Ancillary Savings Cooler		HPwES					
E---	Furnace Replacement	Gas	HEA	88.7	0.02	0.093	0.163	0.013
G---	Furnace Replacement	Gas	HPwES	123.9	0.02	3.000	0.000	0.000
E---	Furnace Replacement	Kerosene	HEA	88.7	0.02	0.093	0.163	0.013
E---	Furnace Replacement	Kerosene	HPwES	155.9	0.04	0.152	0.267	0.022
	Furnace Replacement	Propane	HEA					
	Furnace Replacement	Propane	HPwES					

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Fuel Type	Program	Measure Life
	Ancillary Savings Cooler		HPwES	XX
	Furnace Replacement	Gas	HEA/ HPwES	
	Furnace Replacement	Kersone	HEA/ HPwES	
	Furnace Replacement	Propane	HEA/ HPwES	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

1.28. HVAC – Heat Pump, Air Source

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	HVAC

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings]

Measure Life:

The measure life is [XX] years. [Source needed]

BC Measure ID	Measure Name	Program	Measure Life
[Measure Name]	[Abbr]	XX	

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in service rate since all programs include verification of equipment installations.

Realization Rates:

All programs s use 100% energy realization rates.

Coincidence Factors:

Summer and winter coincidence factors are estimated using XXXX.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: SOURCES/NOTES

1.29. HVAC – Heat Pump, Ductless

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	HVAC

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings]

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

Measure Life:

The measure life is [XX] years. [Source needed]

BC Measure ID	Measure Name	Program	Measure Life
[Measure Name]	[Abbr]	XX	

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in service rate since all programs include verification of equipment installations.

Realization Rates:

All programs use 100% energy realization rates.

Coincidence Factors:

Summer and winter coincidence factors are estimated using XXXX.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: SOURCES/NOTES

1.30. HVAC – Heat Recovery Ventilator

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	HVAC

Description:

Heat Recovery Ventilators (HRV) can help make mechanical ventilation more cost effective by reclaiming energy 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[2]

BC Measure ID	Measure Name	Program	Δmmbtu
TBD	ES Appliances (HVAC Systems) - Heat Recovery Ventilator (-133 kWh penalty)	ES Products	7.7

Measure Life:

The measure life is 20 years.

Other Resource Impacts:

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

BC Measure ID	Measure Name	Fuel Type	Program	ΔkWh/Unit	ΔkW/Unit
TBD	ES Appliances (HVAC Systems) - Heat Recovery Ventilator (-133 kWh penalty)	Electric	ES Products	-133.0	-0.07

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}
TBD	ES Appliances (HVAC Systems) - Heat Recovery Ventilator (-133 kWh penalty)	ES Products	1.00	1.00	1.00	1.00	1.00	0.00	1.00

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations.

Realization Rates:

Realization rates are based on 100% [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using demand allocation methodology described the Cadmus Demand Impact Model (2012) prepared for MA Program Administrators.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes: **1:** MA TRM 2016 – 2018**2:** GDS Associates, Inc. (2009). *Natural Gas Energy Efficiency Potential in Massachusetts*. Prepared for GasNetworks.

1.31. HVAC- Swimming Pool Heater

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	New
Category	Custom

Description:

The installation of a high efficiency heat pump or gas swimming pool heater.

Baseline Efficiency:

[ ]

High Efficiency:

[ ]

Algorithms for Calculating Primary Energy Impact:

[ ]

$$\Delta kWh =$$

Where:

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW
E---	Heat Pump Swimming Pool Heater	ES Products		
G---	Gas Swimming Pool Heater	ES Products		

Source: [ ]

Measure Life:

The measure life is [ ] years.

Source: [ ]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E---	Heat Pump Swimming Pool Heater	ES Products							
G---	Gas Swimming Pool Heater	ES Products							

In-Service Rates:

[ ]

Realization Rates:

[ ]

Source: [ ]

Coincidence Factors:

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

Energy Load Shape

See Appendix X – "[ ]".

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1.32. Lighting - Fixture

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Lighting

Description:

Removal of existing inefficient fixtures with the installation of new efficient fixtures.

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:

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:

$\Delta kWh = ((WattsINEFF - WattsEE) \times HOU)))/1000 \times \#Bulbs \times 365$

$\Delta kW = \Delta kWh \times kW/kWh$

WattsINEFF = Rated watts of inefficient bulbs (either removed, through retrofit, or assumed to have been installed, through lost opportunity)

WattsEE = Rated watts of efficient bulbs installed

#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 with ENERGY STAR 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

(HPwES) 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 of use:[1]

- 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 HPwES LEDs (all installed in residential applications): 3.0 hours/day
- Retrofit HEA LEDs: Vendor calculated

Delta watts (WattsINEFF – WattsEE) are broken out by delivery strategy, and reflect a mix of program fixture wattages (for the efficient wattage) and a blended mix of incandescents, halogens, and CFLs that would have been purchased in absence of the program measure.[2]

BC Measure ID	Measure Name	Program	Delta Watts per Fixture	Daily HOU	Number of Bulbs	ΔkWh	ΔkW
E21A3a009	LED Fixture	ES Products	34.2	2.1	1	26.4	0.03
E21A2a048	LED Fixture	HPwES	34.2	3	1	37.4	0.02
E21B1a048	LED Fixture	HEA	Vendor Calculated				
E21A3a010	LED Fixture (Hard to Reach)	ES Products	34.2	2.1	1	26.4	0.02
E21A1a024	LED Fixture	ES Homes	8.55	1.75	1	5.5	0.01

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]

BC Measure ID	Measure Name	Program	Adjusted Measure Life
E21A3a009	LED Fixture	ES Products	3
E21A2a048 E21B1a048	LED Fixture	HPwES/HEA	2
E21A3a010	LED Fixture (Hard to Reach)	ES Products	3
E21A1a024	LED Fixture	ES Homes	3

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:[4]

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21A3a009	LED Fixture	ES Products	100%	100%	100%	100%	100%	0.55	0.85
E21A2a048 E21B1a048	LED Fixture	HPwES/HEA	98%	100%	100%	100%	100%	0.55	0.85
E21A3a010	LED Fixture (Hard to Reach)	ES Products	100%	100%	100%	100%	100%	0.55	0.85
E21A1a024	LED Fixture	ES Homes	100%	100%	100%	100%	100%	0.55	0.85

In-Service Rates:

In-service rates are based off of MA assumptions, and for HPwES and HEA are based off of NH evaluation results.[5]

Realization Rates:

Realization rates are set to 100%.

Coincidence Factors:

Coincidence factors are based on prescriptive loadshapes from the updated Navigant Massachusetts Demand Impact Model.[6]

Energy Load Shape

See Appendix X – "Lighting".[7]

Impact Factors for Calculating Net Savings:[8]

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21A3a009	LED Fixture	ES Products	67%	n/a	n/a	33%
E21A3a010	LED Fixture (Hard to Reach)	ES Products	47%	n/a	n/a	53%

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Hard to Reach channel, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-

income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: 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. 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 "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019.

2: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).

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/wordpress/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: 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 "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019.

5: "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019.

6: Navigant Consulting. (2018). Res 1 Baseline Study: Demand Impact Model.

7: Navigant (2018). RES1 Demand Impact Model Update.

8: "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).

1.33. Lighting - LED Bulb

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit/Lost Opportunity
Category	Lighting

Description:

The installation of Light-Emitting Diode (LED) screw-in bulbs and linear LEDs. LEDs offer comparable luminosity to incandescent and halogen bulbs at significantly less wattage and significantly longer lamp lifetimes.

Baseline Efficiency:

The baseline efficiency case lost opportunity is a combination of an incandescent bulb, halogen bulb, and a compact fluorescent bulb. The baseline efficiency case for retrofit LED Bulbs is a combination of an incandescent bulb and halogen bulb

High Efficiency:

The high efficiency case is an ENERGY STAR ® rated LED bulb.

Algorithms for Calculating Primary Energy Impact:

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:[1]

$\Delta kWh = ((WattsINEFF\text{-}WattssEE) \times HOU)/1000 \times 365$

$\Delta kW = \Delta kWh \times kW/kWh$

WattsINEFF = Rated watts of inefficient bulbs (either removed, through retrofit, or assumed to have been installed in lieu of the program bulbs, through lost opportunity)

WattsEE = Rated watts of efficient bulbs installed

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 with ENERGY STAR 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 lamps). The direct installation delivery strategies (HPwES, HEA) are based on residential hours only but reflect higher hours of use since the programs direct

contractors to only replace lamps that are used for at least three hours per day. The following summarizes the key assumptions for daily hours of use:[2]

- Lost opportunity LEDs installed in residential applications: 1.75 hours/day
- Lost opportunity LEDs installed in commercial applications (7% of all lost opportunity lamps): 7 hours/day
- Retrofit HPwES LEDs (all installed in residential applications): 3.0 hours/day
- Retrofit HEA LEDs: Vendor calculated

Delta watts (WattsINEFF – WattsEE) 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).[3]

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.[4] 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.[5]

BC Measure ID	Measure Name	Program	Delta Watts	Daily HOU	ΔkWh	ΔkW
E21A3a001	General Service Lamps	ES Products	37.7	2.1	29.1	0.04
E21A3a004	Reflector	ES Products	45.7	2.1	35.3	0.05
E21A3a003	Other Specialty	ES Products	41.3	2.1	31.9	0.04
E21A3a002	Linear	ES Products	15.5	1.6	9.3	0.02
E21A2a044	General Service Lamps	HPwES	32.2	3.0	35.3	0.03
E21A2a047	Reflector	HPwES	46.2	3.0	50.6	0.05
E21A2a046	Other Specialty	HPwES	46.2	3.0	50.6	0.05
E21A2a045	Linear	HPwES	15.5	3.0	17.0	0.02
E21B1a044	General Service Lamps	HEA	Vendor Calculated			
E21B1a047	Reflector	HEA	Vendor Calculated			
E21B1a046	Other Specialty	HEA	Vendor Calculated			
E21B1a045	Linear	HEA	Vendor Calculated			
E21A3a005	General Service Lamps (Hard to Reach)	ES Products	37.7	2.1	29.1	0.04
E21A3a008	Reflector (Hard to Reach)	ES Products	45.7	2.1	35.3	0.05

1

E21A3a007	Other Specialty (Hard to Reach)	ES Products	41.3	2.1	31.9	0.04
E21A3a006	Linear (Hard to Reach)	ES Products	15.5	1.6	9.3	0.02
E21A1a023	ES Homes Lighting	ES Homes	10.2	1.75	6.5	0.01
	General Service Lamps	Drop Ship	37.7	1.75	24.1	0.04
	Reflector	Drop Ship	45.7	1.75	29.2	0.05
	Other Specialty	Drop Ship	41.3	1.75	26.4	0.04

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 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.[6]

BC Measure ID	Measure Name	Program	Adjusted Measure Life
E21A3a001	General Service Lamps	ES Products/Drop Ship	3
E21A3a004	Reflector	ES Products/Drop Ship	2
E21A3a003	Other Specialty	ES Products/Drop Ship	3
E21A3a002	Linear	ES Products	10
E21A2a044 E21B1a044	General Service Lamps	HPwES/HEA	2
E21A2a047 E21B1a047	Reflector	HPwES/HEA	2
E21A2a046 E21B1a046	Other Specialty	HPwES/HEA	2
E21A2a045 E21B1a045	Linear	HPwES/HEA	10
E21A3a005	General Service Lamps (Hard to Reach)	ES Products	3
E21A3a008	Reflector (Hard to Reach)	ES Products	2
E21A3a007	Other Specialty (Hard to Reach)	ES Products	3

E21A3a006	Linear (Hard to Reach)	ES Products	10
E21A1a023	ES Homes Lighting	ES Homes	3

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21A3a001	General Service Lamps	ES Products	89%	100%	100%	100%	100%	0.55	0.85
E21A3a004	Reflector	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A3a003	Other Specialty	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A3a002	Linear	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A2a044 E21B1a044	General Service Lamps	HPwES/HEA	98%	100%	100%	100%	100%	0.55	0.85
E21A2a047 E21B1a047	Reflector	HPwES/HEA	98%	100%	100%	100%	100%	0.55	0.85
E21A2a046 E21B1a046	Other Specialty	HPwES/HEA	98%	100%	100%	100%	100%	0.55	0.85
E21A2a045 E21B1a045	Linear	HPwES/HEA	98%	100%	100%	100%	100%	0.55	0.85
E21A3a005	General Service Lamps (Hard to Reach)	ES Products	89%	100%	100%	100%	100%	0.55	0.85
E21A3a008	Reflector (Hard to Reach)	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A3a007	Other Specialty (Hard to Reach)	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A3a006	Linear (Hard to Reach)	ES Products	91%	100%	100%	100%	100%	0.55	0.85
E21A1a023	ES Homes Lighting	ES Homes	98%	100%	100%	100%	100%	0.55	0.85
	General Service Lamps	Drop Ship	50%	100%	100%	100%	100%	0.55	0.85
	Reflector	Drop Ship	50%	100%	100%	100%	100%	0.55	0.85
	Other Specialty	Drop Ship	50%	100%	100%	100%	100%	0.55	0.85

In-Service Rates:

In-service rates are based on results from NH evaluations where available, and MA evaluations elsewhere.[7]

Realization Rates:

Realization rates are set to 100%.

Coincidence Factors:

Coincidence factors are based on prescriptive loadshapes from the updated Navigant Massachusetts Demand Impact Model.[8]

Energy Load Shape:

See Appendix X – "Lighting".[9]

Impact Factors for Calculating Net Savings:[10]

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21A3a001	General Service Lamps	ES Products	67%	n/a	n/a	33%
E21A3a004	Reflector	ES Products	67%	n/a	n/a	33%
E21A3a003	Other Specialty	ES Products	67%	n/a	n/a	33%
E21A3a002	Linear	ES Products	67%	n/a	n/a	33%
E21A3a005	General Service Lamps (Hard to Reach)	ES Products	47%	n/a	n/a	53%
E21A3a008	Reflector (Hard to Reach)	ES Products	47%	n/a	n/a	53%
E21A3a007	Other Specialty (Hard to Reach)	ES Products	47%	n/a	n/a	53%
E21A3a006	Linear (Hard to Reach)	ES Products	47%	n/a	n/a	53%

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Hard to Reach channels and the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: 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.

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. 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, and on "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019.

3: Delta watts for ES Products and HTR are based on both historical lamps sales in Massachusetts and the most recently available market adoption model (for PY2021). See http://ma-eeac.org/wordpress/wp-content/uploads/MA19R02-E-DeltaWattReport-Final-2019.04.10.pdf. 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://www.energycodes.gov/sites/default/files/becu/2015_IECC_residential_requirements.pdf).Delta watts for HPwES and HEA are based on "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019.

4: 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.

5: RLPNC 18-7: TLED Product Impact Factor Estimation, Memo from NMR Group, Inc. to the Massachusetts Program Administrators, August 3, 2018.

6: 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/wordpress/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.

7:In-service rates for ES Products and HTR channel are based on the MA study "RLPNC 179: 2019—21 Planning Assumptions: Lighting Hours-of-Use and In-Service Rate," 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. In-service rates for HPwES and HEA are based on "Home Performance with Energy Star Program Evaluation Report 2016-2017 – DRAFT," Prepared by Opinion Dynamics Corporation, December 24, 2019. The ENERGY STAR Homes assumptions are set to the same values as HPwES and HEA. The ISR for Drop Ship is estimated based on program experience with lighting kits, and will be evaluated.

8: Navigant Consulting (2018). RES1 Demand Impact Model Update.

9: Navigant Consulting (2018). RES1 Demand Impact Model Update.

10: "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).

1.34. Thermostat - Communicating

Measure Code	TBD
Market	Residential
Program Type	Retrofit
Category	HVAC

Description:

A 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 systems

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 study results[2]

BC Measure ID	Measure Name	Energy Type	Program	ΔkWh	ΔkW	ΔMMbtu
TBD	WiFi Thermostat (Cooling & Heating)	Gas	ES Products	104	0.23	6.6
	WiFi Thermostat (Heating Only)	Gas	ES Products			6.6
	WiFi Thermostat	Electric	HEA/ HPwES	74.8	0.155	0.00
	Wi-Fi Thermostat	Oil	HEA/HPwES			4.7
	Wi-Fi Thermostat	Kerosene	HEA/HPwES			
	WiFi Thermostat	Propane	HEA/HPwES			

	WiFi Thermostat	Wood Pellets	HEA/HPwES			

Measure Life:

The measure life is 15 years.[3]

Other Resource Impacts:

When the thermostat also controls the cooling system the electric savings are 104 kWh[4] and 0.231 kW[5] in Single-Family and 74.8 kWh and 0.155 kW in Multi-Family.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
TBD	WiFi Thermostat (Cooling & Heating)		ES Products	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	WiFi Thermostat (Heating Only)		ES Products	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat,	Electric	HEA/HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Oil	HEA/HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Kerosene	HEA/HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Propane	HEA/HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Wood Pellets	HEA/HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00

In-Service Rates:

All installations have 100% in-service-rates.

Realization Rates:

Realization rates are based on 100% since deemed savings are based on evaluation results. [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using demand allocation methodology described the Cadmus Demand Impact Model (2012) prepared for MA Program Administrators.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes: **1:**MA TRM 2016 – 2018
2: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis. Prepared for **K**eith Miller and Whitney Domigan, National Grid.
[3]Environmental Protection Agency (2010). *Life Cycle Cost Estimate for ENERGY STAR Programmable Thermostat*.
4: Electric savings based on staff analysis with savings assumptions from Cadmus.
5: Estimated using demand allocation methodology described in: Cadmus Demand Impact Model (2012). Prepared for Massachusetts Program Administrators

1.35. Thermostat - Programmable

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Retrofit
Category	HVAC

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:

Unit savings are deemed based on study results[2]

BC Measure ID	Measure Name	Energy Type	Program	ΔkWh	ΔkW	ΔMMbtu
TBD	Thermostat – Standard, 7- Day Programmable	Gas	ES Products			3.2
	Programmable Thermostat	Electric	HEA/HPwES	330	0.18	0.00
	Programmable Thermostat	Oil	HEA/HPwES			3.1
	Programmable Thermostat	Kerosene	HEA/HPwES			
	Programmable Thermostat	Propane	HEA/HPwES			3.2
	Programmable Thermostat	Wood Pellets	HEA/HPwES			

Measure Life:

The measure life is 15 years.[3]

Other Resource Impacts:

For Gas - Residential Multi-Family Retrofit:

If facility has central cooling then also calculate air conditioning savings.
$\Delta kWh = kWh_{cool} \times \%s$
Where:
kWhcool = Average kWh consumption of the air conditioning system: 397 kWh
%savings = Energy savings percent from installation of programmable thermostats, deemed at 6.2%

BC Measure ID	Measure Name	Program	Energy Type	kWh/Unit	ΔkW/Unit
TBD	ES Appliances (HVAC Systems) – Thermostat – Standard, 7- Day Programmable (also controls elec cooling)	ESP	Electric	25	0.05

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
TBD	Thermostat – Standard, 7- Day Programmable		ES Products	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat,	Electric	HEA/ HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Oil	HEA/ HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Kerosene	HEA/ HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Propane	HEA/ HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Programmable Thermostat	Wood Pellets	HEA/ HPwES	1.00	1.00	1.00	1.00	1.00	1.00	1.00

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations.

Realization Rates:

Realization rates are based on 100% since deemed savings are based on evaluation results. [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using demand allocation methodology described the Cadmus Demand Impact Model (2012) prepared for MA Program Administrators.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] MA TRM 2016 – 2018

[2] The Cadmus Group, Inc. (2012). *Home Energy Services Impact Evaluation.* Prepared for the Electric and Gas Program Administrators of Massachusetts.

[3]Environmental Protection Agency (2010). *Life Cycle Cost Estimate for ENERGY STAR Programmable Thermostat*.

1.36. Whole Home - New Construction

Measure Code	[To Be Defined in ANB system]
Market	Residential
Program Type	Lost Opportunity
Category	Whole Home

Description:

The Program Administrators currently use vendor calculated energy savings using a RESNET accredited Rating Software Tool (REM/Rate) 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), which was updated in 2019 to reflect the IECC 2015 code, with amendments as adopted by the state of NH[2, 3], UDRH heating system efficiencies and air infiltration rates remain more stringent than code to reflect the results of the 2017 NH Energy Star Homes evaluation.[4]

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 heating, cooling, and water heating. Demand savings are derived from the Navigant Demand Impact Model. As noted below, because the values are custom generated they are not shown in the table below.

BC Measure ID	Measure Name	Fuel Type	Program	
	Cooling,	Electric	ES Homes	
	Heating	Electric	ES Homes	
	Heating	Gas	ES Homes	
	Heating	Oil	ES Homes	
	Heating	Propane	ES Homes	

	HeatingPellets	Wood Pellets	ES Homes	
	Hot Water	Wood Pellets	ES Homes	
	Hot Water	Gas	ES Homes	
	Hot Water	Oil	ES Homes	
	Hot Water	Propane	ES Homes	
	Hot Water	Wood Pellets	ES Homes	

Measure Life:

The measure life is shown below and varies by end use.[5]

BC Measure ID	Measure Name	Program	Measure Life
	Heating	ES Homes	25
	Cooling	ES Homes	25
	Water Heating	ES Homes	15

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
	Cooling	Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.35	0.00
	Heating	Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.00	0.43
	Heating	Gas	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Heating	Oil	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Heating	Propane	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Heating	Wood Pellets	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Hot Water	Electric	ES Homes	1.00	1.00	1.00	1.00	1.00	0.31	0.81
	Hot Water	Gas	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Hot Water	Oil	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Hot Water	Propane	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a
	Hot Water	Wood Pellets	ES Homes	1.00	1.00	1.00	1.00	1.00	n/a	n/a

In-Service Rates:

All installations have 100% in service rate since all programs include verification of equipment installations.

Realization Rates:

All energy realization rates are 100% because energy and demand savings are custom-calculated based on project specific detail.

Coincidence Factors:

Coincidence factors are based on prescriptive load shapes from the updated Navigant Demand Impact Model for Massachusetts.[6]

Energy Load Shape

See Appendix X (By End Use)

Non-Energy Impacts for Secondary Cost Test

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing

to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

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"

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: "New Hampshire ENERGY STAR Homes Program Impact Evaluation," Prepared by ERS for the NH Program Administrators, December 7, 2017.

5: See MA electronic Technical Reference Manual "Whole Home New Construction" section, accessed on February 14, 2020, and GDS Associates Inc. *Measure Life Report, Residential and Commercial Industrial Lighting and HVAC Measures,* Jun. 2007.

6: Navigant Consulting. (2018). Res 1 Baseline Study: Demand Impact Model.

1.37. Whole Home – Energy Reports

Measure Code	[To Be Defined in ANB system]]
Market	Residential
Program Type	Custom
Category	Behavior

Home Energy Reports – Behavioral Savings

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Home Energy Reports – Behavioral Savings	[Abbr]	XX

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

2. Commercial

2.1. C&I Active Demand Response

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Custom
Category	Active Demand Response

Description:

Active Demand Reduction includes C&I Interruptible Load Curtailment and Storage Performance. The Interruptible 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, comfort, 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. The Program Administrators also incentivize active demand reduction strategies during winter. The goal is to help promote winter resiliency by finding customers that can reduce electric usage during times of high winter system load.

The C&I Storage Performance offering provides increased performance incentives for C&I storage performance. Since storage does not impact customer comfort or operations, storage resources are expected to be available for daily dispatch to maximize their value.

Baseline Efficiency:

Baseline conditions will be determined on a site-specific basis.

High Efficiency:

N/A, Active Demand Reduction does not directly increase efficiency. Interruptible Load does reduce energy consumption by curtailing use, but does not increase efficiency per se.

Algorithms for Calculating Primary Energy Impact:

The Active Demand Reduction measure generates site-specific demand savings. Savings estimates for these projects are calculated using engineering analysis with project-specific details.

Measure Life:

Because Active Demand Reduction is a behavior measure, measure life is one year.

BC Measure ID	Measure Name	Program	Measure Life
	Interruptible Load		1

	Storage System and Performance		1
	Storage Targeted Dispatch		1

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
	Interruptible Load								
	Winter Interruptible Load								
	Storage System and Performance, discharge (savings) Summer								
	Storage System and Performance, charge (consumption) Summer								
	Storage System and Performance, discharge (savings) Winter								
	Storage System and Performance, charge (consumption) Winter								
	Storage Daily Dispatch, discharge (savings)								
	Storage Daily Dispatch, charge (consumption)								
	Storage Targeted Dispatch, discharge (savings) Summer								
	Storage Targeted Dispatch, charge (consumption) Summer								
	Storage Targeted Dispatch, discharge (savings) Winter								
	Storage Targeted Dispatch, charge (consumption) Winter								

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

2.2. Building Envelope- Air Sealing and Insulation

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	**Building Shell**

Description:

Air Sealing: Air sealing will decrease the infiltration of outside air through cracks and leaks in the building.

Insulation: The installation of high efficiency insulation in an existing structure

Baseline Efficiency:

Air Sealing: The baseline efficiency case is the existing building before the air sealing measure is implemented. The baseline building is characterized by the existing air changes per hour (ACHPRE) for multi-family facilities, which is measured prior to the implementation of the air sealing measure. This will typically be a default value of a baseline/pre-retrofit ACH =0.5.
Insulation:

High Efficiency:

Air Sealing: The baseline efficiency case is the existing building after the air sealing measure is implemented. The high efficiency building is characterized by the new air changes per hour (ACHPOST) for multi-family facilities, which is measured after the air sealing measure is implemented. This will typically be a default value of a baseline/pre-retrofit ACH =0.4.
Insulation:

Algorithms for Calculating Primary Energy Impact:

Air Sealing:
Unit savings are calculated using the following algorithms and assumptions:

kWh = (Vol x ACH x 0.018 x HDD x 24/ ηheating) / 3,413
MMBtu = (Vol x ACH x 0.018 x HDD x 24/ ηheating) / 1,000,000
kW = kWh x kW/kWh

Where:
Vol = [ft^3] This is the air volume of the treated space, calculated from the dimensions of the space, which could include the number of floors, the floor area per floor, and the floor-to-ceiling height, or the dwelling floor area and number of dwellings. The treated space can be the entire building including the common areas, or just the individual dwelling units. (Auditor Input)
Δ ACH = [ºF-day] Infiltration reduction in Air Changes per Hour, natural infiltration basis. This will typically be a default value, but the source of the assumption should be transparent and traceable, or it could come from a blower door test. (Stipulated Value or Blower Door Test)

HDD60 = Heating degree-days, base 60 from TMY3 weather data. See table below.
ηheating = [AFUE, COP, thermal efficiency (%)] Efficiency of the heating system, as determined on site (Auditor Input)
24 = Conversion factor: 24 hours per day
0.018 = [Btu / ft^3- ºF] Air heat capacity: The specific heat of air (0.24 Btu / ºF.lb) times the density of air (0.075 lb / ft^3)
1,000,000 = Conversion factor: 1,000,000 Btu per MMBtu
3,413 = Conversion factor: 3,413 Btu / kWh
kW / kWh = Average kW reduction per kWh reduction: 0.00073 kW / kWh[1]

Insulation:

Measure Life:

The measure life is 15 years. [2]

BC Measure ID	Measure Name	Program	Measure Life
E21C3a015 E21C3a016 E21C3a017 E21C3a018 E21C3d017 E21C3d018 E21C3d019 E21C3d020	Air Sealing	Municipal Retrofit Municipal Direct Install	15

Other Resource Impacts:

There are no other resource impacts identified for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C3a015 E21C3d017	Air Sealing	Electric	Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0	0.433
E21C3a016 E21C3d018	Air Sealing	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a017 E21C3d019	Air Sealing	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a018 E21C3d020	Air Sealing	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a051 E21C3d051	Insulation	Electric	Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0	0.433
E21C3a052 E21C3d052	Insulation	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a053 E21C3d053	Insulation	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a054 E21C3d054	Insulation	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Summer and winter Coincidence Factors are estimated using demand allocation methodology described in the Demand Impact Model. [3]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

25

1: Navigant Consulting (2018). Demand Impact Model Update.
2: GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for The New England State Program Working Group.
3: Navigant Consulting (2018). Demand Impact Model Update.

2.3. Compressed Air - Air Compressor

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Compressed Air

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.

Baseline Efficiency:

The baseline efficiency case is a typical load/unload compressor.

High Efficiency:

The high efficient 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.

Algorithms for Calculating Primary Energy Impact:

Δ kWh = (HP $_{COMPRESSOR}$) x (Save) x (Hours)
Δ kW = (HP $_{COMPRESSOR}$) x (Save)

Where:

HP $_{COMPRESSOR}$ = Nominal rated horsepower of high efficiency air compressor.
Save = Air compressor kW reduction per HP: 0.189. [1]
Hours = Annual operating hours of the air compressor.

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1b016 E21C2b016 E21C3b016	Air Compressor	LBES New SBES New Muni New	1.00	1.39	1.39	1.00	1.00	1.17	0.98

In-Service Rates:

Realization Rates:

RR from the prospective results of the 2015 study of prescriptive compressed air. The RR adjusts for differences in operating hours between PA tracking assumptions and on site findings. The RR must be coupled with the updated kW / HP results from the same study, referenced in the Algorithm section above.[3]

Coincidence Factors:

CFs from the prospective results of the 2015 study of prescriptive compressed air.[4]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations. Prepared for the MA PAs and EEAC. Result for VSD 25-75 HP used since "All" result includes savings from load/unload compressors, which are now baseline.
2:ERS (2005). Measure Life Study.
3: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations.

2.4. Compressed Air - Air Nozzle

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Compressed Air

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 is a standard nozzle on a compressed air system.

High Efficiency:

The high efficient case is the same air compressor with an engineered nozzle.

Algorithms for Calculating Primary Energy Impact:

Savings are calculated in a spreadsheet tool per the following:

Delta_kW = Delta_kWh / hr
Delta_kWh = (FLOW_base - FLOW_eng) x kW_SCFM x USE x hr

Where:
FLOW_base = open nozzle flow at 100 psi (site specific)
FLOW_eng = engineered nozzle flow at 100 psi (site specific)
hr = annual operating hours
kW_SCFM = 0.29 (site specific if available)
USE = 0.05 (site specific if available)

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1b017 E21C2b017 E21C3b017	Air Nozzle	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.80	0.54

In-Service Rates:

Realization Rates:

Coincidence Factors:

Summer and winter coincidence factors are from 2016 DMI impact evaluation of CAIR.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

2.5. Compressed Air - Compressor Storage

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Compressed Air

Description:

Compressor Storage [Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Compressor Storage	LBES	XX
	Compressor Storage	SBES	
	Compressor Storage	MES	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: SOURCES/NOTES

2.6. Compressed Air - Low Pressure Drop Filter

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Compressed Air

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 higher efficiencies.

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:

ΔkWh = (Quantity) x (HPcomp) x (0.7457) x (%sav) x (Hours)
ΔkW = (Quantity) x (HPcomp) x (0.7457) x (%sav)

Where:
ΔkWh = Energy savings
ΔkW = Demand savings
Quantity = Number of filters installed. Site specific.
HPCOMP = Average compressor load. Site specific.
0.7457 = Conversion from HP to kW
% Savings = Percent change in pressure drop. Site specific.
Hours = Annual operating hours of the lower pressure drop filter. Site specific.

Measure Life:

The measure life is 5 years.[1]

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21C1a032	Low Pressure Drop Filter	LBES Retro	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C1b043	Low Pressure Drop Filter	LBES New	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C1d032	Low Pressure Drop Filter	LBES DI	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C2a032	Low Pressure Drop Filter	SBES Retro	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C2b043	Low Pressure Drop Filter	SBES New	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C2d032	Low Pressure Drop Filter	SBES DI	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C3a055	Low Pressure Drop Filter	Muni Retro	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C3b065	Low Pressure Drop Filter	Muni New	1.00	1.00	n/a	1.00	1.00	0.80	0.54
E21C3d055	Low Pressure Drop Filter	Muni DI	1.00	1.00	n/a	1.00	1.00	0.80	0.54

In-Service Rates:

Realization Rates:

Realization rates are based on impact evaluation of PY 2004 compressed air installations. [2a]

Realization rates are based on impact evaluation of NSTAR 2006 compressed air installations. [2b]

Coincidence Factors:

Summer and winter coincidence factors are CFs based on impact evaluation of PY 2004 compressed air installations. [3]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: ERS

2a: 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.
2b: LW Analytics (2008). Business & Construction Solutions (BS/BC) Programs Measurement & Verification - 2006 Final Report.
3: 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.

2.7. Compressed Air - Refrigerated Air Dryer

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Compressed Air

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:

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). Obtain 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.

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1b047	Refrigerated Air Dryers	LBES New	1.00	1.56	n/a	1.00	1.00	1.17	0.98
E21C2b047	Refrigerated Air Dryers	SBES New	1.00	1.56	n/a	1.00	1.00	1.17	0.98
E21C3b078	Refrigerated Air Dryers	Muni New	1.00	1.56	n/a	1.00	1.00	1.17	0.98

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations.

Realization Rates:

Realization rates are from the prospective results of the 2015 study of prescriptive compressed air. The realization rates adjust for differences in operating hours between PA tracking assumptions and on site findings. The realization rates must be coupled with the updated kW/CFM results from the same study.[3]

Coincidence Factors:

Summer and winter coincidence factors are from the prospective results of the 2015 study of prescriptive compressed air.[4]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations.
2: Energy & Resource Solutions (2005). Measure Life Study.
3,4: DNV GL (2015). Impact Evaluation of Prescriptive Chiller and Compressed Air Installations.

2.8. Compressed Air - Zero Loss Condensate Drain

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Compressed Air

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 greater efficiency

Baseline Efficiency:

The baseline efficiency case is installation of 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:

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. Site specific.
CFMsaved = Average CFM saved per CFM of piping capacity: 0.049
Save = Average savings per CFM: 0.241 kW/CFM [1]
Hours = Annual operating hours of the zero loss condensate drain.

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a046	Zero Loss Condensate Drains	LBES Retro	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C1b051	Zero Loss Condensate Drains	LBES New	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C1d046	Zero Loss Condensate Drains	LBES DI	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C2a046	Zero Loss Condensate Drains	SBES Retro	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C2b051	Zero Loss Condensate Drains	SBES New	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C2d046	Zero Loss Condensate Drains	SBES DI	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C3a090	Zero Loss Condensate Drains	Muni Retro	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C3b082	Zero Loss Condensate Drains	Muni New	1.00	1.00	1.00	1.00	1.00	0.80	0.54
E21C3d090	Zero Loss Condensate Drains	Muni DI	1.00	1.00	1.00	1.00	1.00	0.80	0.54

In-Service Rates:

Realization Rates:

RRs based on impact evaluation of PY 2004 compressed air installations.[3a]
RRs from impact evaluation of NSTAR 2006 compressed air installations.[3b]

Coincidence Factors:

Summer and winter coincidence factors are based on impact evaluation of PY 2004 compressed air installations.[4]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet.. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
3a: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid; results analysed in RLW Analytics (2006). Sample Design and Impact Evaluation Analysis for

Prescriptive Compressed Air Measures in the Energy Initiative and Design 2000 Programs. Prepared for National Grid

3b: RLW Analytics (2008). Business & Construction Solutions (BS/CS) Programs Measurement & Verification - 2006 Final Report. Prepared for NSTAR Electric and Gas; Table 17

4: DMI (2006). Impact Evaluation of 2004 Compressed Air Prescriptive Rebates. Prepared for National Grid; results analysed in RLW Analytics (2006). Sample Design and Impact Evaluation Analysis for Prescriptive Compressed Air Measures in the Energy Initiative and Design 2000 Programs. Prepared for National Grid.

2.9. Custom

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	**Custom**

Description:

Custom projects will be categorized as:

- new or retro
- large, small, or muni
- compressed air, hot water, HVAC lighting, motors, other, process, refrigeration

Baseline Efficiency:

High Efficiency:

Algorithms for Calculating Primary Energy Impact:

Measure Life:

Other Resource Impacts:

Impact Factors for Calculating Adjusted Gross Savings:

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

41

1:

2.10. **Food Service - Dishwasher**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Dishwasher High Temp: 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 Temp: 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:

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption (gal/rack)
High Temp Under Counter Dishwasher	0.76	1.09
High Temp Door Type Dishwasher	0.87	1.29
High Temp Single Tank Conveyer Dishwasher	1.93	0.87
High Temp Multi Tank Conveyer Dishwasher	2.59	0.97
High Temp Pots & Pans Dishwasher	1.20	0.70
Low Temp Under Counter Dishwasher	0.50	1.73
Low Temp Door Type Dishwasher	0.60	2.10
Low Temp Single Tank Conveyor Dishwasher	1.60	1.31
Low Temp Multi Tank Conveyor Dishwasher	2.00	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 as follows:

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption (gal/rack)
High Temp Under Counter Dishwasher	0.50	0.86
High Temp Door Type Dishwasher	0.70	0.89
High Temp Single Tank Conveyer Dishwasher	1.50	0.70
High Temp Multi Tank Conveyer Dishwasher	2.25	0.54
High Temp Pots & Pans Dishwasher	1.20	0.58
Low Temp Under Counter Dishwasher	0.50	1.19
Low Temp Door Type Dishwasher	0.60	1.18
Low Temp Single Tank Conveyor Dishwasher	1.60	0.79
Low Temp Multi Tank Conveyor Dishwasher	2.00	0.54

Algorithms for Calculating Primary Energy Impact:

Dishwasher High Temp: Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator:
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 = Average annual equipment operating hours, see Hours section below.

BC Measure ID	Measure	Program	ΔkW	ΔkWh
E21C1b026 E21C2b026 E21C3b040	High Temp Under Counter Dishwasher	LBES New SBES New Muni New	0.32	1,791
E21C1b022 E21C2b022 E21C3b036	High Temp Door Type Dishwasher	LBES New SBES New Muni New	0.74	4,151
E21C1b025 E21C2b025 E21C3b039	High Temp Single Tank Conveyer Dishwasher	LBES New SBES New Muni New	0.75	4,243
E21C1b023 E21C2b023 E21C3b037	High Temp Multi Tank Conveyer Dishwasher	LBES New SBES New Muni New	1.71	9,630
E21C1b024 E21C2b024	High Temp Pots & Pans Dishwasher	LBES New SBES New	0.18	1,032

E21C3b038		Muni New		
E21C1b030 E21C2b030 E21C3b044	Low Temp Under Counter Dishwasher	LBES New SBES New Muni New	0.39	2,178
E21C1b027 E21C2b027 E21C3b041	Low Temp Door Type Dishwasher	LBES New SBES New Muni New	2.46	13,851
E21C1b029 E21C2b029 E21C3b043	Low Temp Single Tank Conveyor Dishwasher	LBES New SBES New Muni New	2.07	11,685
E21C1b028 E21C2b028 E21C3b042	Low Temp Multi Tank Conveyor Dishwasher	LBES New SBES New Muni New	2.86	16,131

Measure Life:

The measure life for a new high temperature dishwasher is given by type below [2.]:

BC Measure ID	Measure Name	Program	Measure Life
E21C1b026 E21C2b026 E21C3b040	High Temp Under Counter Dishwasher	LBES New SBES New Muni New	10
E21C1b022 E21C2b022 E21C3b036	High Temp Door Type Dishwasher	LBES New SBES New Muni New	15
E21C1b025 E21C2b025 E21C3b039	High Temp Single Tank Conveyer Dishwasher	LBES New SBES New Muni New	20
E21C1b023 E21C2b023 E21C3b037	High Temp Multi Tank Conveyer Dishwasher	LBES New SBES New Muni New	20
E21C1b024 E21C2b024 E21C3b038	High Temp Pots & Pans Dishwasher	LBES New SBES New Muni New	10
E21C1b030 E21C2b030 E21C3b044	Low Temp Under Counter Dishwasher	LBES New SBES New Muni New	10
E21C1b027 E21C2b027 E21C3b041	Low Temp Door Type Dishwasher	LBES New SBES New Muni New	15
E21C1b029 E21C2b029 E21C3b043	Low Temp Single Tank Conveyor Dishwasher	LBES New SBES New Muni New	20

E21C1b028 E21C2b028 E21C3b042	Low Temp Multi Tank Conveyor Dishwasher	LBES New SBES New Muni New	20

Other Resource Impacts:

Dishwasher high temp: There are water savings associated with this measure. [3]

Dishwasher Type	Annual water savings (gal/unit)
High Temp Under Counter Dishwasher	5,399
High Temp Door Type Dishwasher	35,056
High Temp Single Tank Conveyer Dishwasher	21,284
High Temp Multi Tank Conveyer Dishwasher	80,754
High Temp Pots & Pans Dishwasher	10,517
Low Temp Under Counter Dishwasher	12,677
Low Temp Door Type Dishwasher	80,629
Low Temp Single Tank Conveyor Dishwasher	65,104
Low Temp Multi Tank Conveyor Dishwasher	93,900

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}
E21C1b026 E21C2b026 E21C3b040	High Temp Under Counter Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b022 E21C2b022 E21C3b036	High Temp Door Type Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b025 E21C2b025 E21C3b039	High Temp Single Tank Conveyer Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b023 E21C2b023 E21C3b037	High Temp Multi Tank Conveyer Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b024 E21C2b024 E21C3b038	High Temp Pots & Pans Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b030 E21C2b030 E21C3b044	Low Temp Under Counter Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1b027 E21C2b027 E21C3b041	Low Temp Door Type Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b029 E21C2b029 E21C3b043	Low Temp Single Tank Conveyor Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b028 E21C2b028 E21C3b042	Low Temp Multi Tank Conveyor Dishwasher	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

2.11. Food Service - Fryer

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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 a standard sized fryer is a deep-fat fryer with a cooking energy efficiency of 75%, shortening capacity of up to 65 pounds, and idle energy rate of 1.05 kW. The baseline efficiency case for a large sized fryer is a deep-fat fryer with a cooking energy efficiency of 70%, shortening capacity of up to 100 pounds, and idle energy rate of 1.35 kW.

Gas Fryer: The baseline efficiency case is a non-Energy Star qualified fryer.

High Efficiency:

Electric Fryer: The high efficiency case for a standard sized fryer is a deep-fat fryer with a cooking energy efficiency of 80%, shortening capacity of up to 70 pounds, and idle energy rate of no more than 1.0 kW. For large capacity fryers (shortening capacity exceeds 70 pounds), the idle energy rate may be up to 1.1 kW.

Gas Fryer: The high efficiency case is an Energy Star qualified fryer.

Algorithms for Calculating Primary Energy Impact:

Electric Fryer: Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator:
$\Delta kWh = \Delta kWh$
$\Delta kW = \Delta kW / Hours$
Where:
ΔkWh = gross annual kWh savings from the measure per table below
ΔkW = gross average kW savings from the measure per table below
Hours = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Fryer [1, 2]

BC Measure ID	Measure Name	Program	ΔkW	ΔkWh	ΔMMBtu
E21C1b033 E21C2b033 E21C3b050	Electric Fryer, Standard Vat	LBES New SBES New Muni	0.50	2,976	
E21C1b032 E21C2b032 E21C3b049	Electric Fryer, Large Vat	LBES New SBES New Muni	0.50	2,841	
G21C1b024 G21C2b024	Gas Fryer	LBES New SBES New			78.3

Measure Life:

The measure life for a new commercial fryer is 12 years. [2]

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}
E21C1b033 E21C2b033 E21C3b050	Electric Fryer, Standard Vat	LBES New SBES New Muni	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b032 E21C2b032 E21C3b049	Electric Fryer, Large Vat	LBES New SBES New Muni	1.00	1.00	n/a	1.00	1.00	0.90	0.90
G21C1b024 G21C2b024	Gas Fryer	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

100% Realization Rates are assumed because savings are based on researched assumptions by ENERGY STAR®.

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:

2.12. **Food Service - Griddle**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Electric Griddle: Installation of a qualified ENERGY STAR® griddle. ENERGY STAR® griddles save energy cooking and idle times due to improved cooking efficiency and idle energy rates.

Gas Griddle: Installation of a gas griddle with efficiency of 38%.

Baseline Efficiency:

Electric Griddle: The baseline efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 65%, production capacity of 35 pounds per hour, and idle energy rate of 400 W/sq. ft.

Gas Griddle: The baseline efficiency case is a standard efficiency (32% efficient) gas griddle.

High Efficiency:

Electric Griddle: The high efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 70%, production capacity of 40 pounds per hour, and idle energy rate of 320 W/sq. ft.

Gas Griddle: The high efficiency case is a gas griddle with an efficiency of 38%.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	ΔMMBtu
E21C1b034 E21C2b034 E21C3b055	Commercial Electric Griddle		3,965	0.90	
G21C1b025 G21C2b025	Commercial Gas Griddle				37.9

delkWh = SAVE x Width x Hours
delkW = SAVE x Width

Where:
ΔkWh = gross annual kWh savings from the measure. With default Width, average savings are 3,965 kWh.
ΔkW = gross average kW savings from the measure. With default Width, average savings are 0.90 kW.
SAVE = Savings per foot of griddle width: 0.15 kW/ft [1]
Width = Width of griddle in feet. Default of 3 feet.
Hours = Griddles are assumed to operate 313 days per year. The average griddle is assumed to operate 12 hours per day, or 3,756 hours per year. [2]

Measure Life:

The measure life for a new commercial griddle 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}
E21C1b034 E21C2b034 E21C3b055	Electric Griddle	LBES New SBES New Muni New	1.00	1.00	1.00	1.00	1.00	1.00	1.00
G21C1b025 G21C2b025	Gas Griddle	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: ENERGY STAR Commercial Kitchen Equipment Savings Calculator: Griddle Calcs.< http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >. Tool downloaded August 10, 2015.
2: The Energy Star Calculator default value of 365 days per year seems excessive. Though many or most restaurants operate 7 days per week, many institutional kitchens do not. 6 day operation is assumed. 365 * 6/7 = 313 days/yr for 12 hours per day, or 3,756 hours.
3: PG&E calculator: http://www.fishnick.com/saveenergy/tools/calculators/egridcalc.php

2.13. **Food Service - Holding Cabinet**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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 half size HFHC.

Baseline Efficiency:

The baseline efficiency idle energy rate for a HFHC is 40 W for all sizes.

High Efficiency:

The high efficiency idle energy rate for HFHC is 294 W for full size, 258 W for 3/4 size, and 172 W for 1/2 size.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the FSTC Life Cycle Kitchen Equipment Savings Calculator:

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 = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Hot Food Holding Cabinets [1]

BC Measure ID	Measure Name	Program	ΔkW	ΔkWh

E21C1b037 E21C2b037 E21C3b058	Full Size – 20 cu.ft.	LBES New SBES New Muni	0.50	2,737
E21C1b036 E21C2b036 E21C3b057	3/4 Size – 12 cu.ft.	LBES New SBES New Muni	0.20	1,095
E21C1b038 E21C2b038 E21C3b059	1/2 Size – 8 cu.ft.	LBES New SBES New Muni	0.20	1,095

Measure Life:

The measure life for a new commercial griddle is 12 years. [2]

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}
E21C1b037 E21C2b037 E21C3b058	Hot Food Holding Cabinet Full Size	LBES New SBES New Muni	1.00	1.00	1.00	1.00	1.00	0.90	0.90
E21C1b036 E21C2b036 E21C3b057	Hot Food Holding Cabinet 3/4 Size	LBES New SBES New Muni	1.00	1.00	1.00	1.00	1.00	0.90	0.90
E21C1b038 E21C2b038 E21C3b059	Hot Food Holding Cabinet Half Size	LBES New SBES New Muni	1.00	1.00	1.00	1.00	1.00	0.90	0.90

In-Service Rates:

Realization Rates:

100% Realization Rates are assumed because savings are based on researched assumptions by ENERGY STAR®.

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
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2.14. **Food Service - Ice Machine**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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.

High Efficiency:

The high efficiency case is a commercial ice machine meeting the ENERGY STAR® Efficiency Requirements.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Fishnick Commercial Kitchen Equipment Savings Calculator

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 = Average annual equipment operating hours, see Hours section below.

Energy Savings for Commercial Ice Machine [1:]

BC Measure ID	Equipment Type	Program	ΔkW	ΔkWh

E21C1b039 E21C2b039 E21C3b060	Ice Making Head	LBES New SBES New Muni New	0.30	1,117
E21C1b040 E21C2b040 E21C3b061	Self Contained Unit	LBES New SBES New Muni New	0.30	805
E21C1b041 E21C2b041 E21C3b062	Remote Condensing Unit (Batch)	LBES New SBES New Muni New	0.30	2,601
E21C1b042 E21C2b042 E21C3b063	Remote Condensing Unit (Continuous)	LBES New SBES New Muni New	0.30	3,641

Measure Life:

The measure life for a new ice making machine is 8 years. [2]

Other Resource Impacts:

There are water savings associated with this measure [3]:

Dishwasher Type	Annual water savings (gal/unit)
Ice Making Head	3,322
Self Contained Unit	3,526
Remote Condensing Unit (Batch)	2,631
Remote Condensing Unit (Continuous)	0

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}
E21C1b039 E21C2b039 E21C3b060	Ice Machine - Ice Making Head	LBES New SBES New Muni New	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1b040 E21C2b040 E21C3b061	Ice Machine - Remote Cond./Split Unit - Batch	LBES New SBES New Muni New	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1b041 E21C2b041 E21C3b062	Ice Machine - Remote Cond./Split Unit - Continuous	LBES New SBES New Muni New	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1b042 E21C2b042 E21C3b063	Ice Machine - Self Contained	LBES New SBES New Muni New	1.00	1.00	1.00	1.00	1.00	0.9	0.9

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
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3:

2.15. **Food Service - Oven**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Combination Oven, Electric Convection Oven, 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.

Combination Oven, Gas Convection Oven, Gas Conveyor Oven, Gas Rack Oven, Gas	Installation of High Efficiency Gas Ovens

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Baseline Efficiency:

Combination Oven, Electric Convection Oven, Electric	The baseline efficiency case is a convection oven with a cooking energy efficiency of 65%, production capacity of 90 pounds per hour, and idle energy rate of 2.0 kW. The baseline efficiency case for a combination oven is a commercial combination oven with a convection cooking energy efficiency of 72% with a production capacity of 79 pounds per hour for convection mode and 49% steam cooking energy efficiency, with a production capacity of 126 pounds per hour for steammode. Idle energy is assumed to be 1.3 kW for convection mode and 5.3 kW for steam mode.

Gas Ovens: The baseline efficiency case is a standard efficiency oven as follows.

Measure Name	Baseline Efficiency
Convection Oven, Gas	44%
Combination Oven, Gas	35%
Conveyor Oven, Gas	20% Heavy Load
Rack Oven, Gas	30%

High Efficiency:

Combination Oven, Electric Convection Oven, Electric	The high efficiency case is a convection oven with a cooking energy efficiency of 71%, production capacity of 90 pounds per hour, and idle energy rate of 1.6 kW. The high efficiency case for a combination oven is a commercial combination oven with a cooking energy efficiency of 76% with a production capacity of 119 pounds per hour for convection mode, and 55% cooking energy efficiency with a production capacity of 177 pounds per hour for steam mode, and idle energy rate of 1.3 kW for convection mode and 2.0 kW for steam mode.

Gas Ovens: High efficiency case is an oven that meets or exceeds the high efficiency ratings per oven type shown in table below.

Measure Name	Efficiency Requirement
Convection Oven	>= 46%
Combination Oven	>= 44%
Conveyer Oven	>= 42%
Rack Oven	>= 50%

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator and the Food Services Technology Center Life Cycle Cost Calculator:
ΔkWh = kWh
ΔkW = KWh / hours

Where:
ΔkWh = gross annual kWh savings from the measure. See table below.
ΔkW = gross average kW savings from the measure. See table below.
Hours = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Ovens [1]

BC Measure ID	Equipment Type	Programs	ΔkW	ΔkWh	Δmmbtu
E21C1b021 E21C2b021 E21C3b035	Electric Full Size Convection Oven	LBES New SBES New Muni New	0.70	2,787	
E21C1b019 E21C2b019 E21C3b031	Electric Combination Oven	LBES New SBES New Muni New	3.50	15,095	
G21C1b022 G21C2b022	Gas Convection Oven	LBES New SBES New			35.7 [2]
G21C1b021 G21C2b021	Gas Combination Oven	LBES New SBES New			110.3 [3]
G21C1b023 G21C2b023	Gas Conveyer Oven	LBES New SBES New			88.4 [4]
G21C1b026 G21C2b026	Gas Rack Oven	LBES New SBES New			211.3 [5]

Measure Life:

The measure life for a new commercial oven is 12 years. [6]

Other Resource Impacts:

Electric Ovens: There are no other resource impacts for these measures.

Combination Oven, Gas: Annual water savings of 65,700 gallons per unit.
There are no other resource impacts for the other gas oven 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}
E21C1b021 E21C2b021 E21C3b035	Electric Convection Oven	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
E21C1b019 E21C2b019 E21C3b031	Electric Combination Oven	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
G21C1b022 G21C2b022	Gas Convection Oven	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b021 G21C2b021	Gas Combination Oven	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b023 G21C2b023	Gas Conveyer Oven	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b026 G21C2b026	Gas Rack Oven	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

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2.16. **Food Service - Steam Cooker**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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, with heavy-load cooking efficiency of at least 38%. 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 of 30%, pan production capacity of 23.3 pounds per hour, preheat energy of 1.5 kWh, and idle energy rate of 1.2 kW
Gas Steam Cooker: The baseline efficiency case is a non-energy star steamer.

High Efficiency:

Electric Steam Cooker: The High Efficiency case is an ENERGY STAR® electric steam cooker with a cooking energy efficiency of 50%, pan production capacity of 16.7 pounds per hour, preheat energy of 1.5 kWh, and an idle energy rate of 0.4 kW.

Gas Steam Cooker: The high efficiency case is an ENERGY STAR® qualified gas-fired steamer.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Fishnick Energy Star Commercial Kitchen Equipment Savings Calculator: [1]

BC Measure ID	Measure Name	Programs	ΔkWH	ΔkW	ΔMmbtu
E21C1b048 E21C2b048 E21C3b079	Electric Steam Cooker	LBES New SBES New Muni New	30,156	6.89	
G21C1b027 G21C2b027	Gas Steam Cooker	LBES New SBES New			370.7

Quantity = Number of pans. Default of 3 pans.
Hours = Average annual equipment operating hours. See Hours section below.

Measure Life:

The measure life for a new steamer is 12 years. [2]

Other Resource Impacts:

Electric Steam Cooker: Per unit annual water savings of 139 gallons due to the improved cooking efficiency of the high efficiency equipment.

Gas Steam Cooker: Deemed annual water savings of 162,060 gallons per unit.

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}
E21C1b048 E21C2b048 E21C3b079	Electric Steam Cooker	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	0.90	0.90
G21C1b027 G21C2b027	Gas Steam Cooker	LBES New SBES New	1.00	n/a	1.00	1.00	1.00	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
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2.17. **Hot Water - Faucet Aerators**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Faucet Aerator: 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 with service water heated by natural gas.

Baseline Efficiency:

Gas Faucet Aerator: The baseline efficiency case is a 2.2 GPM faucet.

High Efficiency:

Gas Faucet Aerator: The high efficiency case is a faucet with 1.5 GPM or less aerator installed.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔkW	ΔMMBtu
E21C1a028 E21C1b031 E21C1d030 E21C2a028 E21C2b031 E21C2d030 E21C3a044 E21C3b045 E21C3d046	Faucet Aerator	**Electric**	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	97	0.024	
E21C3a045 E21C3b046 E21C3d047 G21C1a005 G21C1b017 G21C2a005 G21C2b017	Faucet Aerator	Gas	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI			1.7
E21C3a046 E21C3b047 E21C3d048	Faucet Aerator	Oil	Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New			0.22
E21C3a047 E21C3b048 E21C3d049	Faucet Aerator	Propane	LBES Retro SBES Retro Muni Retro			0.21

Measure Life:

The measure life for a faucet aerator is 7 years. [2]

Other Resource Impacts:

There are deemed water savings of 5,460 gallons/unit. [3]

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a028 E21C1b031 E21C1d030 E21C2a028 E21C2b031 E21C2d030 E21C3a044 E21C3b045 E21C3d046	Faucet Aerator	**Electric**	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	1.00	0.99	1.00	1.00	1.00	0.312	0.808
E21C3a045 E21C3b046 E21C3d047 G21C1a005 G21C1b017 G21C2a005 G21C2b017	Faucet Aerator	Gas	Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a046 E21C3b047 E21C3d048	Faucet Aerator	Oil	LBES Retro SBES Retro Muni Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a047 E21C3b048 E21C3d049	Faucet Aerator	Propane	LBES Retro SBES Retro Muni Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Coincidence Factors are

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:

2.18. **Hot Water - Pre Rinse Spray Valve**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Hot Water

Description:

Pre Rinse Spray Valve, Gas: Retrofitting existing standard spray nozzles in locations where service water is supplied by natural gas fired 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 and based on study results.[2]

BC Measure ID	Measure Name	Fuel Type	Program	ΔkWh	ΔMMBtu
E21C1a040 E21C1b046 E21C1d040 E21C2a040 E21C2b046 E21C2d040 E21C3a075 E21C3b074 E21C3d075	Pre Rinse Spray Valve	Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI		
E21C3a076 E21C3b075 E21C3d076 G21C1a009 G21C1b020 G21C2a009 G21C2b020	Pre Rinse Spray Valve	Gas	Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New		11.4
E21C3a077 E21C3b076 E21C3d077	Pre Rinse Spray Valve,	Oil	LBES Retro SBES Retro Muni Retro		11.4
E21C3a078 E21C3b077 E21C3d078	Pre Rinse Spray Valve	Propane	LBES Retro SBES Retro Muni Retro		11.4

Measure Life:

The measure life steamer is 8 years. [3]

Other Resource Impacts:

There are water savings of 6,410 gallons per unit.[4]

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a040 E21C1b046 E21C1d040 E21C2a040 E21C2b046 E21C2d040 E21C3a075 E21C3b074 E21C3d075	Pre Rinse Spray Valve	Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI	1.00	0.99	1.00	1.00	1.00		
E21C3a076 E21C3b075 E21C3d076 G21C1a009 G21C1b020 G21C2a009 G21C2b020	Pre Rinse Spray Valve	Gas	Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a077 E21C3b076 E21C3d077	Pre Rinse Spray Valve,	Oil	LBES Retro SBES Retro Muni Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a078 E21C3b077 E21C3d078	Pre Rinse Spray Valve	Propane	LBES Retro SBES Retro Muni Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2, 3, 4: DNV GL (2014). Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valves.

2.19. Hot Water - Showerheads

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Hot Water

Description:

Low-Flow Showerhead with Thermostatic Valve: Installation of a stand-alone thermostatic shut-off valve on stand flow showerhead.

Low-Flow Showerhead, Electric: Installation of a low-flow showerhead with thermostatic shut-off valve.

Low-Flow Showerhead, Gas: Installation of a low flow showerhead with a flow rate of 1.5 GPM or less in a commercial setting with service water heated by natural gas.

Baseline Efficiency:

Low-Flow Showerhead with Thermostatic Valve: The baseline efficiency is an existing standard-flow showerhead (2.5 GPM) with no thermostatic shut-off valve.

Low-Flow Showerhead, Electric: The baseline efficiency is an existing standard-flow showerhead (2.5 GPM) with no thermostatic shut-off valve.

Low-Flow Showerhead, Gas: The baseline efficiency case is a 2.5 GPM showerhead.

High Efficiency:

Low-Flow Showerhead with Thermostatic Valve: The high efficiency case is a standard flow showerhead (2.5 GPM) with the addition of a stand-alone thermostatic shut-off valve.

Low-Flow Showerhead, Electric: The high efficiency case is a low-flow showerhead (1.75 GPM) with the addition of a thermostatic shut-off valve.

Low-Flow Showerhead, Gas: The high efficiency case is a 1.5 GPM showerhead.

Algorithms for Calculating Primary Energy Impact:

Low-Flow Showerhead with Thermostatic Valve: Unit savings are deemed. [1] kW savings are calculated using the demand impact model.[2]

Low-Flow Showerhead, Electric and Low-Flow Showerhead, Gas: Unit savings are deemed.[3]

BC Measure ID	Measure Name	Fuel Type	ΔkWh	ΔkW	ΔMMBtu
E21C1a033 E21C1b044 E21C1d033 E21C2a033 E21C2b044 E21C2d033 E21C3a056 E21C3b066 E21C3d056 G21C1a006 G21C1b018 G21C2a006 G21C2b018	Low-Flow Showerhead With Thermostatic Valve		69	0.01	
E21C3a057 E21C3b067 E21C3d057	Low-Flow Showerhead	Electric	513	0.09	
E21C3a058 E21C3b068 E21C3d058	Low-Flow Showerhead	Gas			2.65
E21C3a059 E21C3b069 E21C3d059	Low-Flow Showerhead	Oil			
E21C1a034 E21C1b045 E21C1d034 E21C2a034 E21C2b045 E21C2d034 E21C3a060 E21C3b070 E21C3d060 G21C1a007 G21C1b019 G21C2a007 G21C2b019	Low-Flow Showerhead	Propane			

Measure Life:

The measure life for all Showerheads is 10 years. [4]

Other Resource Impacts:

Low-Flow Showerhead With Thermostatic Valve: Annual water savings of 558 gallons per unit.[5]

Low-Flow Showerhead, Electric and Low-Flow Showerhead, Gas: Annual water savings of 7,300 gallons per unit.[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}
E21C1a033 E21C1b044 E21C1d033 E21C2a033 E21C2b044 E21C2d033 E21C3a056 E21C3b066 E21C3d056 G21C1a006 G21C1b018 G21C2a006 G21C2b018	Low-Flow Showerhead With Thermostatic Valve, Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New	1.00	1.00	n/a	1.00	1.00	0.52	1.00
E21C3a057 E21C3b067 E21C3d057	Low-Flow Showerhead With Thermostatic Valve, Gas	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a058 E21C3b068 E21C3d058	Low-Flow Showerhead With Thermostatic Valve, Oil	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a059 E21C3b069 E21C3d059	Low-Flow Showerhead With Thermostatic Valve, Propane	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C1a034 E21C1b045 E21C1d034 E21C2a034 E21C2b045 E21C2d034 E21C3a060 E21C3b070 E21C3d060 G21C1a007 G21C1b019 G21C2a007 G21C2b019	Low-Flow Showerhead, Electric	LBES Retro LBES New LBES DI SBES Retro SBES New SBES DI Muni Retro Muni New Muni DI LBES Retro LBES New SBES Retro SBES New	1.00	1.00	n/a	1.00	1.00	0.52	1.00
E21C3a061 E21C3b071 E21C3d061	Low-Flow Showerhead, Gas	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a062 E21C3b072 E21C3d062	Low-Flow Showerhead, Oil	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a063 E21C3b073 E21C3d063	Low-Flow Showerhead, Propane	Muni Retro Muni New Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: National Grid (2014). Review of ShowerStart evolve
2:
3:
4: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks; Table B-2a, measure C-WH-15.
5: National Grid (2014). Review of ShowerStart evolve
6: Federal Energy Management Program (2011). Energy Cost Calculator for Faucets and Showerheads.

2.20. **HVAC - Boiler Reset Controls**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

Boiler Reset Controls: Boiler Reset Controls are devices that automatically control boiler water 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 without reset controls.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Fuel Type	Program	ΔMMBtu
E21C1a015 E21C1d017 E21C2a015 E21C2d017	Boiler Reset Control	Electric	LBES Retro LBES DI SBES Retro SBES DI	
E21C3a019 E21C3d021 G21C1a010 G21C2a010	Boiler Reset Controls	Gas	Muni Retro Muni DI LBES Retro SBES Retro	35.5
E21C3a020 E21C3d022	Boiler Reset Control	Oil	Muni Retro Muni DI	
E21C3a021 E21C3d023	Boiler Reset Control	Propane	Muni Retro Muni DI	

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 Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a015 E21C1d017 E21C2a015 E21C2d017	Boiler Reset Control	Electric	LBES Retro LBES DI SBES Retro SBES DI	1.00	1.00	1.00	1.00	1.00		
E21C3a019 E21C3d021 G21C1a010 G21C2a010	Boiler Reset Controls	Gas	Muni Retro Muni DI LBES Retro SBES Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a020 E21C3d022	Boiler Reset Control	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a021 E21C3d023	Boiler Reset Control	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Study assumes 710.46 MMBTU base use with 5% savings factor.
2: ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls.

2.21. HVAC - Circulator Pump

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Description:

Circulator Pump: Single-phase circulator pumps up 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 depend on application and pump size as described in table below. [1]

Size	Type	kW	kWh
<= 1 HP	Hydronic Heating	$\Delta kW = 0.245 * HP_{rated} + 0.02$	$\Delta kWh = 1,325 * HP_{rated} + 111$
	Service Hot Water	$\Delta kW = 0.245 * HP_{rated} + 0.02$	$\Delta kWh = 2,780 * HP_{rated} + 233$
> 1 HP	Hydronic Heating	$\Delta kW = 0.265$	$\Delta kWh = 1,436$
	Service Hot Water	$\Delta kW = 0.265$	$\Delta kWh = 3,013$

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1b018 E21C2b018 E21C3b030	Circulator Pump	LBES New SBES New Muni New	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The Cadmus Group (2017). Circulator Pump Technical Memo. Prepared for National Grid and Eversource engineers.
2: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

2.22. **HVAC – Cooler Night Cover**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

Installation of retractable aluminum woven fabric covers for open-type refrigerated display cases, where the covers are deployed during the facility unoccupied hours in order to reduce refrigeration energy consumption.

Baseline Efficiency:

The baseline efficiency case is the annual operation of open-display cooler cases.

High Efficiency:

The high efficiency case is the use of night covers to protect the exposed area of display cooler cases during unoccupied hours.

Algorithms for Calculating Primary Energy Impact:

ΔkWh = (Width) x (Save) x (Hours)
Δ kW = (Width) x (Save)

Where:
Δ kWh = Energy Savings
Δ kW = Connected load reduction
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

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 is determined to be an add-on single baseline measure. [2, 3]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a017 E21C1d019 E21C2a017 E21C2d019 E21C3a023 E21C3d025	Cooler Night Covers	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

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.
2: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
3: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Page 4-5 to 4-6.

2.23. HVAC - Demand Control Ventilation

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

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.

Baseline Efficiency:

The baseline efficiency case assumes the relevant HVAC equipment has no ventilation control.

High Efficiency:

The high efficiency case is the installation of an outside air intake control based on CO_2 sensors.

Algorithms for Calculating Primary Energy Impact:

Gross energy and demand savings for implementation of demand control ventilation are custom calculated using the PA's DCV savings calculation tools. These tools are used to calculate energy and demand savings based on site-specific project details including hours of operation, HVAC system efficiency and total air flow, and enthalpy and temperature set points. [1] Alternatively, the energy and demand savings may be calculated using the following algorithms and inputs:

kWh = kBtuh * (1 Ton/12 kBtu/h) * SAVEkWh
kW = kBtuh * (1 Ton/12 kBtu/h) * SAVEkW

Where:
kBtu/h = Capacity of the cooling equipment in kBtu per hour
SAVEkWh = Average annual kWh reduction per ton of cooling capacity: 170 kWh/ton [2]
SAVEkW = Average kW reduction per ton of cooling capacity: 0.15 kW/ton [3]

Measure Life:

The measure life is 10 years. [4]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a018 E21C1d020 E21C2a018 E21C2d020 E21C3a024 E21C3d026	Demand Control Ventilation	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.01	n/a	1.09	1.57	0.82	0.05

In-Service Rates:

All installations have 100% in service rate.

Realization Rates:

Realization Rates are from an impact evaluation 2006 HVAC installations and impact evaluation of 2007/2008 installations. [5]

Coincidence Factors:

CFs based on standard assumptions.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Detailed descriptions of the DCV Savings Calculation Tools are included in the TRM Library under the "C&I Spreadsheet Tools" folder.
2: Keena, Kevin (2008). Analysis of CO2 Control Energy Savings on Unitary HVAC Units. Prepared for National Grid.
3: Keena, Kevin (2008). Analysis of CO2 Control Energy Savings on Unitary HVAC Units. Prepared for National Grid.
4: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1. Measure life is assumed to be the same as Enthalpy Economizer.
5: RLW Analytics (2008). Business & Construction Solutions (BS/CS) Programs Measurement & Verification 2006 Final Report. Prepared for NSTAR; Table 17.

2.24. **HVAC - Dual Enthalpy Economizer Controls**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

The measure is to upgrade the outside-air dry-bulb economizer to a dual enthalpy economizer. 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.

Baseline Efficiency:

The baseline efficiency case for this measure assumes the relevant HVAC equipment is operating with a fixed dry-bulb 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:

ΔkWh = (kBtu/h) * (1 Ton / 12 kBtu/h) * (SAVEkW)

Where:
kBtu/h = Capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h)
SAVEkWh = Average annual kWh reduction per ton of cooling capacity: 289 kWh/ton [1]
SAVEkW = Average kW reduction per ton of cooling capacity: 0.289 kW/ton [2]

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a020 E21C3a026 E21C3d028	Dual Enthalpy Economizer Controls	LBES SBES MES	1.00	1.00	n/a	1.00	1.00	0.33	0.00

In-Service Rates:

Realization Rates:

Realization Rates same as Unitary AC.

Coincidence Factors:

All PAs on-peak CFs based 2011 NEEP C&I Unitary AC Loadshape Project [4]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1, 2: Patel, Dinesh (2001). Energy Analysis: Dual Enthalpy Control. Prepared for Eversource (NSTAR).
3: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1
4: KEMA (2011). C&I Unitary HVAC Loadshape Project - Final Report. Prepared for the Regional Evaluation, Measurement & Verification Forum.

2.25. HVAC - Duct Insulation

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

For existing ductwork in non-conditioned spaces, insulate ductwork. This could include replacing un-insulated 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 (e.g. attic or basement).

High Efficiency:

The high efficiency condition is insulated ductwork in unconditioned spaces.

Algorithms for Calculating Primary Energy Impact:

Deemed average annual MMBtu savings of 0.13 [1] are assumed per unit.

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 Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C3a027 E21C3d029	Duct Insulation	Electric	Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0.336	0.173
E21C3a028 E21C3d030	Duct Insulation	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a029 E21C3d031	Duct Insulation	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a030 E21C3d032	Duct Insulation	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:

2.26. **HVAC - Duct Sealing**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

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 (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:
Δ MMBtu = MMBtu x Units

Where:
Unit = Number of square feet of ductwork treated
MMBtu = Average annual MMBtu savings per unit: 0.13 [1]

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 Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a021 E21C1d023 E21C2a021 E21C2d023 E21C3a031 E21C3d033	Duct Sealing	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	n/a	n/a
E21C3a032 E21C3d034	Duct Sealing	Gas	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a033 E21C3d035	Duct Sealing	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a034 E21C3d036	Duct Sealing	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1, 2: National Grid Staff Estimate (2010). MA SBS-DI Duct Sealing and Insulation Scenario and Deemed Savings.

2.27. **HVAC - Energy Management System**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

The measure is the installation of a new building energy management system (EMS) or the expansion of an existing energy management system for control of non-lighting electric and gas end-uses in an existing building on existing equipment.

Baseline Efficiency:

The baseline for this measure assumes the relevant HVAC equipment has no control.

High Efficiency:

The high efficiency case is the installation of a new EMS or the expansion of an existing EMS to control additional non-lighting electric or gas equipment. The EMS must be installed in an existing building on existing equipment.

Algorithms for Calculating Primary Energy Impact:

Gross energy and demand savings for energy management systems (EMS) are custom calculated using the PA's EMS savings calculation tools. These tools are used to calculate energy and demand savings based on project-specific details including hours of operation, HVAC system equipment and efficiency and points controlled.

BC Measure ID	Measure Name	Fuel Type	Program	MMbtu/kWh
	Energy Management System	Gas		0.001277
	Energy Management System	Oil		0.002496

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a025 E21C1d027 E21C2a025 E21C2d027 E21C3a038 E21C3d040	Energy Management System	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0.95	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Descriptions of the EMS savings calculation tools are included in the TRM Library "C&I Spreadsheet Tools" folder.
2: The Fleming Group (1994). Persistence of Commercial/Industrial Non-Lighting Measures, Volume 3, Energy Management Control Systems. Prepared for New England Power Service Company.

2.28. HVAC - Heat and Hot Water Combo Systems

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Description:

Combo Condensing Furnace / Water Heater: Installation of a combination furnace.

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 [1] and a separate high draw gas fired storage water heater with an efficiency rating of 0.63 UEF.

Combo Condensing Boiler / Water Heater: The baseline efficiency case is a standard efficiency gas-fired storage tank hot water heater with a separate standard efficiency boiler for space heating purposes.

High Efficiency:

Combo Condensing Furnace / Water Heater: A new combination 97% AFUE furnace and 0.90 tankless water heater.

Combo Condensing Boiler / Water Heater: The high efficiency case is either a condensing, integrated water heater/boiler with an AFUE of >=90% or AFUE>=95%.

Algorithms for Calculating Primary Energy Impact:

Combo Condensing Furnace / Water Heater: The heating load for furnaces is 584 therms. This is based on an evaluation of heating equipment installed through the HEHE program and assumed to be representative of single family homes. [2]

Δ Therms = heating load * (1/AFUEbase – 1/AFUEee) = 584 *(1/0.85 – 1/0.97) = 85 therms
The water heating load is 139 therms [3]
Δ Therms = water heating load * (1/UEFbase – 1/UEFee) = 139 *(1/0.63 – 1/0.90) = 66 therms

Combo Condensing Boiler / Water Heater: Unit savings are deemed based on study results.[4]

BC Measure ID	Measure Name	ΔMMBtu
G21C1b012 G21C2b012	Combo Condensing Furnace/Water Heater, Gas	15.1
G21C1b011 G21C2b011	Combo Condensing Boiler/Water Heater, Gas	30.5

Measure Life:

Combo Condensing Furnace / Water Heater: The measure life is 18 years. [5]
Combo Condensing Boiler/Water Heater: 20 years.[6]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
G21C1b012 G21C2b012	Combo Condensing Furnace/Water Heater, Gas	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b011 G21C2b011	Combo Condensing Boiler/Water Heater, Gas	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Negotiated value
2: The Cadmus Group (2015). High Efficiency Heating Equipment Impact Evaluation
3: Navigant Consulting (2018). RES19_Task7_WaterHeater_Characterization_v10, tab (001)
4: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts
5: Environmental Protection Agency (2009). Lifecycle Cost Estimate for Energy Star Furnace
6: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts

2.29. **HVAC - Heating Systems - Boilers**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	HVAC

Boiler 1701 to 2000 MBH 85 AFUE, Oil
Boiler 1000 to 1700 MBH 90 AFUE, Oil
Boiler 500 to 999 MBH 85 AFUE, Oil
Boiler 301 to 499 MBH 85 AFUE, Oil
Boiler to 300 MBH 85 AFUE, Oil
Boiler to 300 MBH 87 AFUE, Oil

Boiler 1701 to 2000 MBH 90 AFUE, Propane
Boiler 1000 to 1700 MBH 90 AFUE, Propane
Boiler 500 to 999 MBH 90 AFUE, Propane
Boiler 301 to 499 MBH 90 AFUE, Propane
Boiler to 300 MBH 90 AFUE, Propane
Boiler to 300 MBH 95 AFUE, Propane

Boiler Tune-Ups

Description:

The installation of a high efficiency natural gas fired condensing hot water boiler. High-efficiency condensing boilers can take advantage of improved design, sealed combustion and condensing flue gases in a second heat exchanger to achieve improved efficiency.

Baseline Efficiency:

Baseline efficiency is an 85% AFUE boiler.

High Efficiency:

High efficiency is per table of efficiency thresholds below.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Program	ΔMMBtu
G21C1b010 G21C2b010	<= 300 mbh (0.95 TE)	LBES New SBES New	17.7
G21C1b009 G21C2b009	<= 300 mbh (0.90 TE)	LBES New SBES New	14.7
G21C1b008 G21C2b008	301-499 mbh (0.90 TE)	LBES New SBES New	28.0
G21C1b007 G21C2b007	500-999 mbh (0.90 TE)	LBES New SBES New	51.4
G21C1b006 G21C2b006	1000-1700 mbh (0.90 TE)	LBES New SBES New	94.5
G21C1b005 G21C2b005	1701+ mbh (0.90 TE)	LBES New SBES New	165.3

Measure Life:

The measure life is 25 years. [2]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
G21C1b010 G21C2b010	<= 300 mbh (0.95 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b009 G21C2b009	<= 300 mbh (0.90 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b008 G21C2b008	301-499 mbh (0.90 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b007 G21C2b007	500-999 mbh (0.90 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b006 G21C2b006	1000-1700 mbh (0.90 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1b005 G21C2b005	1701+ mbh (0.90 TE)	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: DNV GL, NMR (2017). Gas Boiler Market Characterization Study Phase II
2: ASHRAE Applications Handbook (2003); Page 36.3.

2.30. HVAC - Heating Systems - Condensing Unit Heaters

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Description:

Installation of a condensing gas-fired unit heater for space heating with capacity up to 300 MBH and minimum combustion efficiency of 90%.

Baseline Efficiency:

The baseline efficiency case is a standard efficiency gas fired unit heater with minimum combustion efficiency of 80%, interrupted or intermittent ignition device (IID), and either power venting or an automatic flue damper. [1] As a note, the baseline efficiency referenced applies to 2016. Baseline requirements for 2017 and on have not been finalized.

High Efficiency:

The high efficiency case is a condensing gas unit heater with 90% AFUE or greater.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Program	ΔMMBtu
	Condensing Unit Heater (<= 300 mbh)		40.9

Measure Life:

The measure life is 18 years. [3]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
G21C1b013 G21C2b013	Condensing Unit Heater	LBES New LBES New	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: 2012 International Energy Conservation Code
2: NYSERDA Deemed Savings Database (Rev 11); Measure Name: A.UNIT-HEATER-COND.
3: Ecotrope, Inc. (2003). Natural Gas Efficiency and Conservation Measure Resource Assessment for the Residential and Commercial Sectors. Prepared for the Energy Trust of Oregon.

2.31. HVAC - Heating Systems - Furnaces

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Furnace w/ ECM 85 AFUE up to 150 MBH, Oil
Furnace w/ ECM 87 AFUE up to 150 MBH, Oil
Furnace w/ ECM 95 AFUE up to 150 MBH, Propane
Furnace w/ ECM 97 AFUE up to 150 MBH, Propane

Description:

Furnace w/ ECM 95 AFUE, Gas Furnace w/ ECM 97 AFUE, Gas	The installation of a high efficiency natural gas warm air furnace with an electronically commutated motor (ECM) for the fan. High efficiency furnaces are better at converting fuel into direct heat and better insulated to reduce heat loss. ECM fan motors significantly reduce fan motor electric consumption as compared to both shaped-pole and permanent split capacitor motors.

Baseline Efficiency:

The baseline efficiency in an 85% AFUE furnace.

High Efficiency:

The high efficiency scenario assumes either a gas-fired furnace equal or higher than 95% AFUE or 97% AFUE.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	ΔMMBtu	ΔkWh	ΔkW
G21C1b014 G21C2b014	Furnace, 95%	5.7	168	0.124
G21C1b015 G21C2b015	Furnace, 97%	6.7	168	0.124

Measure Life:

The measure life is 18 years. [2]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
G21C1b014 G21C2b014	Furnace, 95%	LBES New SBES New	1.00	1.00	1.00	n/a	n/a	0.00	0.16
G21C1b015 G21C2b015	Furnace, 97%	LBES New SBES New	1.00	1.00	1.00	n/a	n/a	0.00	0.16

In-Service Rates:

Realization Rates:

Coincidence Factors:

Values pertain to other resource impacts for the EC motors.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2: ASHRAE Applications Handbook (2003); Page 36.3

2.32. **HVAC - Heating Systems - Infrared Heater**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Description:

The installation of a gas-fired 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 unit heater with combustion efficiency of 80%.

High Efficiency:

The high efficiency case is a gas-fired low-intensity infrared heating unit.

Algorithms for Calculating Primary Energy Impact:

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

BC Measure ID	Measure Name	Fuel Type	Program	ΔMMBtu
G21C1b016 G21C2b016	Infrared Heaters	Gas		12.0

Measure Life:

The measure life is 17 years. [2]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}
G21C1b016 G21C2b016	Infrared Heaters	Gas	LBES New SBES New	1.00	n/a	1.00	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: KEMA (2013). Impact Evaluation of 2011 Prescriptive Gas Measures; Page 1-5.
2: Nexant (2006). DSM Market Characterization Report. Prepared for Questar Gas.

2.33. **HVAC - High Efficiency Chiller**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

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.

Baseline Efficiency:

The baseline efficiency case assumes compliance with the efficiency requirements as mandated by Massachusetts State Building Code. As described in Chapter 13 of the aforementioned document, energy efficiency must be met via compliance with the International Energy Conservation Code (IECC) 2015.

The table below details the specific efficiency requirements by equipment type and capacity.

Chiller - Minimum Efficiency Requirements [1:]

	Size Category (Tons)	Units	Path A	Path A	Path B	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
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

	Size Category (Tons)	Units	Path A	Path A	Path B	Path B
			Full Load	IPLV	Full Load	IPLV
	≥ 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

Note: Compliance with this standard may be obtained by meeting the minimum requirements of Path A or B, however, both the Full Load and IPLV must be met to fulfill the requirements of Path A or B.

High Efficiency:

The high efficiency scenario assumes water chilling packages that exceed the efficiency levels required by Massachusetts State Building Code and meet the minimum efficiency requirements as stated in the New Construction HVAC energy efficiency rebate forms.

Algorithms for Calculating Primary Energy Impact:

Gross energy and demand savings for chiller installations may be custom calculated using the PA's Chillers savings calculation tool. These tools are used to calculated energy and demand savings based on site-specific chiller plant details including specific chiller plan equipment, operational staging, operating load profile and load profile. [2]

Alternatively, the energy and demand savings may be 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 recommended that IPLV be used over FL efficiency types when possible.

Air-Cooled Chillers:
$kWh = Tons * (12/ EER_{BASE} - 12/ EER_{EE}) * Hours$
$kW = Tons * (12/ EER_{BASE} - 12/ EER_{EE})$

Water-Cooled Chillers:
$kWh = Tons * (kW/ ton_{BASE} - kW/ ton_{EE}) * Hours$
$kW = Tons * (kW/ ton_{BASE} - kW/ ton_{EE}) * (LF/100)$

Where:
Tons = Rated capacity of the cooling equipment
EER_{BASE} = Energy Efficiency Ratio of the baseline equipment. See table below for values.
EER_{EE} = Energy Efficiency Ratio of the efficient equipment. Site-specific.
kW/ton_{BASE} = Energy efficiency rating of the baseline equipment. See table below for values.
kW/ton_{EE} = Energy efficiency rating of the efficient equipment. Site-specific.
Hours = Equivalent full load hours for chiller operation

Measure Life:

The measure life is 23 years. [3]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
	Chillers – IPLV used	LBES New SBES New Muni New	All	1.00	1.00	1.00	1.00	0. 49	0.06
	Chillers – FL used	LBES New SBES New Muni New	All	1.00	1.00	1.00	1.00	0.86	0.10

In-Service Rates:

Realization Rates:

RRs based on Massachusetts prospective results from 2015 prescriptive chiller study.[4] Prospective results are to be used in parallel with updated savings factors, as described above, from the same study.

Coincidence Factors:

CFs based on prospective statewide results from 2015 prescriptive chiller study. [5]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:
4:
5:

2.34. **HVAC - Hotel Occupancy Sensor**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

The measure is to 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:
delkWh = $SAVE_{kWh}$
delkW = $SAVE_{kW}$

Where:
Unit = Installed hotel room occupancy sensor
$SAVE_{kWh}$ = Average annual kWh reduction per unit: 438 kWh [1]
$SAVE_{kW}$ = Average annual kWh reduction per unit: 0.09 kW [2]

Measure Life:

The measure life is 10 years. [3] This measure was determined to be an add-on single baseline.

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a031 E21C1d031 E21C2a031 E21C2d031 E21C3a050 E21C3d050	Hotel Occupancy Sensor	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	All	1.00	1.00	1.00	1.00	0.82	0.05

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: MassSave (2010). Energy Analysis: Hotel Guest Occupancy Sensors. Prepared for National Grid and Eversource (NSTAR).
2: MassSave (2010). Energy Analysis: Hotel Guest Occupancy Sensors. Prepared for National Grid and Eversource (NSTAR).
3:

2.35. **HVAC - Pipe Wrap**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

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:

BC Measure ID	Measure Name	Program	ΔMMBtu per linear foot
	Pipe Insulation - Heating, Gas, <= 1.5”		0.21
	Pipe Insulation - Heating, Gas, 3”		0.37

Measure Life:

The measure life is 15 years. [1]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a038 E21C1d038 E21C2d038 E21C3a067 E21C3d067	Pipe Insulation – Heating	Electric	LBES Retro SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0	0.433
G21C1a013 G21C2a013 E21C3a068 E21C3d068	Pipe Insulation – Heating	Gas	LBES Retro SBES Retro Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a
E21C3a069 E21C3d069	Pipe Insulation – Heating	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a
E21C3a070 E21C3d070	Pipe Insulation – Heating	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a
E21C1a039 E21C1d039 E21C2a039 E21C2d039 E21C3a071 E21C3d071	Pipe Insulation – Water Heating	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	1.00	1.00	1.00	0.312	0.808
G21C1a008 G21C2a008 E21C3a072 E21C3d072	Pipe Insulation – Water Heating	Gas	LBES Retro SBES Retro Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a
E21C3a073 E21C3d073	Pipe Insulation – Water Heating	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a
E21C3a074 E21C3d074	Pipe Insulation – Water Heating	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: GDS Associates, Inc (2009). Natural Gas Energy Efficiency Potential in Massachusetts. Prepared for GasNetworks; table B-2a

2.36. **HVAC - Steam Traps**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

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:

BC Measure ID	Measure Name	ΔMMBtu
G21C1a014 G21C2a014	Steam Trap	12.2

Measure Life:

The measure life is 6 years. [1]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
G21C1a014 G21C2a014	Steam Trap	LBES Retro SBES Retro	1.00	1.00	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: DNV GL (2015) Massachusetts 2013 Prescriptive Gas Impact Evaluation – Steam Trap Evaluation Phase I.

2.37. **HVAC - Thermostat - Programmable**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

This measure involves the installation of a programmable thermostat for cooling and/or heating systems in spaces with either no or erratic existing control.

Baseline Efficiency:

Programmable Thermostat, Electric: The baseline efficiency case includes spaces with either no or erratic heating and/or cooling control as indicated in the equipment type selection.

Programmable Thermostat, Gas: The baseline efficiency case is an HVAC system using natural gas to provide space heating without a programmable thermostat.

High Efficiency:

Programmable Thermostat, Electric: The high efficiency case includes control of the space cooling and/or heating system as indicated in the equipment type selection.

Programmable Thermostat, Gas: The high efficiency case is an HVAC system using natural gas to provide space heating with a 7-day programmable thermostat installed.

Algorithms for Calculating Primary Energy Impact:

kWh = (**Δ** kWh)
kW = (**Δ** kW)

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	ΔMMBtu
E21C1a041 E21C1d041 E21C2a041 E21C2d041 E21C3a079 E21C3d079	Programmable Thermostat, Electric[1]		278	0.204	
G21C1a015 G21C2a015 E21C3a080 E21C3d080	Programmable Thermostat, Gas[2]				3.5
E21C3a081 E21C3d081	Programmable Thermostat, Oil[3]		27	0.043	3.5
E21C3a082 E21C3d082	Programmable Thermostat, Propane[4]		27	0.043	3.11

Measure Life:

BC Measure ID	Measure Name	Program	Years
	Programmable Thermostats		15[5]

Other Resource Impacts:

There are no other resource impacts for this measure.

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a041 E21C1d041 E21C2a041 E21C2d041 E21C3a079 E21C3d079	Programmable Thermostats	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	0.00	0.00
G21C1a015 G21C2a015 E21C3a080 E21C3d080	Programmable Thermostats	Gas	LBES Retro SBES Retro Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a081 E21C3d081	Programmable Thermostats	Oil	Muni Retro Muni DI							
E21C3a082 E21C3d082	Programmable Thermostats	Propane	Muni Retro Muni DI							

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:
4:
5:

2.38. **HVAC - Thermostat – Wi-Fi**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	HVAC

Description:

A 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 systems.

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 study results. [1] The total cooling savings of 64 kWh were adjusted to reflect the percent of homes that have cooling which is 28 % based on the Residential Baseline study.

BC Measure ID	Measure Name	Fuel Type	Program	Δ kWh	Δ kW	Δ MMBtu
E21C1a026 E21C1d028 E21C2a026 E21C2d028 E21C3a039 E21C3d041	Wi-Fi Thermostat	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	278	0.443	
E21C3a040 E21C3d042 G21C1a016 G21C2a016	Wi-Fi Thermostat	Gas	Muni Retro Muni DI LBES Retro SBES Retro			3.11
E21C3a041 E21C3d043	Wi-Fi Thermostat	Oil	Muni Retro Muni DI			3.11
E21C3a042 E21C3d044	Wi-Fi Thermostat	Propane	Muni Retro Muni DI			3.11

Measure Life:

121

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 Measure ID	Measure Name	Fuel Type	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1a026 E21C1d028 E21C2a026 E21C2d028 E21C3a039 E21C3d041	Wi-Fi Thermostat	Electric	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	0.346	0.0
E21C3a040 E21C3d042 G21C1a016 G21C2a016	Wi-Fi Thermostat	Gas	Muni Retro Muni DI LBES Retro SBES Retro	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a041 E21C3d043	Wi-Fi Thermostat	Oil	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a
E21C3a042 E21C3d044	Wi-Fi Thermostat	Propane	Muni Retro Muni DI	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

.

Coincidence Factors:

Summer and winter Coincidence Factors are estimated using demand allocation methodology described the Demand Impact Model. [3]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Navigant Consulting (2018). Wi-Fi Thermostat Impact Evaluation--Secondary Research Study Memo
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: Navigant Consulting (2018). Demand Impact Model Update.

2.39. **HVAC – Unitary Air Conditioner**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

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 case for new installations assumes compliance with the efficiency requirements as mandated by Massachusetts State Building Code.

High Efficiency:

The high efficiency case assumes the HVAC equipment meets or exceeds the Consortium for Energy Efficiency's (CEE) specification. This specification results in cost-effective energy savings by specifying higher efficiency HVAC equipment while ensuring that several manufacturers produce compliant equipment. The CEE specification is reviewed and updated annually to reflect changes to the ASHRAE and IECC energy code baseline as well as improvements in the HVAC equipment technology. Equipment efficiency is the rated efficiency of the installed equipment for each project.

Algorithms for Calculating Primary Energy Impact:

For units with cooling capacities less than 65 kBtu/h:
$\Delta kWh = (kBtu/h)\ (1/\ SEER_{BASE} - 1/\ SEER_{EE})\ (EFLH_{Cool})$
$\Delta kW = (kBtu/h)\ (1/\ EER_{BASE} - 1/\ EER_{EE})$

For units with cooling capacities equal to or greater than 65 kBtu/h and EER available:
$\Delta kWh = (kBtu/h)\ (1/\ EER_{BASE} - 1/\ EER_{EE})\ (EFLH_{Cool})$
$\Delta kW = (kBtu/h)\ (1/\ EER_{BASE} - 1/\ EER_{EE})$

For units with cooling capacities equal to or greater than 65 kBtu/h and IEER available:
$\Delta kWh = (kBtu/h)\ (1/\ IEER_{BASE} - 1/\ IEER_{EE})\ (HoursCool)\ (Capadj)$
$\Delta kWh = (kBtu/h)\ (1/\ IEER_{BASE} - 1/\ IEER_{EE})$

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)

$SEER_{BASE}$ = Seasonal Energy Efficiency Ratio of the baseline equipment
$SEER_{EE}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment
$EFLH_{Cool}$ = Cooling equivalent full load hours
EER_{BASE} = Energy Efficiency Ratio of the baseline equipment
EER_{EE} = Energy Efficiency Ratio of the energy efficient equipment
$IEER_{BASE}$ = Integrated Energy Efficiency Ratio of the baseline equipment
$IEER_{EE}$ = Integrated Energy Efficiency Ratio of the energy efficient equipment
HoursCool = Annual Cooling Hours
Capadj = Capacity Adjustment Factor

Measure Life:

The measure life is 12 years. [1]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
	Unitary Air Conditioner		1.00	1.00	1.00	1.00	1.00	0.33	0.00

In-Service Rates:

Realization Rates:

Energy RRs set to 1.00 based 2011 NEEP C&I Unitary HVAC Loadshape Project. [2]

Coincidence Factors:

CFs based 2011 NEEP C&I Unitary HVAC Loadshape Project. [3]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2: 2011 NEEP C&I Unitary HVAC Loadshape Project
3: 2011 NEEP C&I Unitary HVAC Loadshape Project

2.40. **Lighting - Controls**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Lighting

Freezer/Cooler LEDs

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Daylight Dimming	C1 - Large Business Energy Solutions	XX
	Lighting Occupancy Sensors	C1 - Large Business Energy Solutions	
	Daylight Dimming	C2 - Small Business Energy Solutions	
	Lighting Occupancy Sensors	C2 - Small Business Energy Solutions	
	Daylight Dimming	C3 - Municipal Energy Solutions	
	Lighting Occupancy Sensors	C3 - Municipal Energy Solutions	
	Daylight Dimming	C4 - Energy Rewards RFP Program	

	Lighting Occupancy Sensors	C4 - Energy Rewards RFP Program	
	Freezer/Cooler LEDs		

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

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

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
	Daylight Dimming	C1 - Large Business Energy Solutions				
	Lighting Occupancy Sensors	C1 - Large Business Energy Solutions				
	Daylight Dimming	C2 - Small Business Energy Solutions				
	Lighting Occupancy Sensors	C2 - Small Business Energy Solutions				
	Daylight Dimming	C3 - Municipal Energy Solutions				
	Lighting Occupancy Sensors	C3 - Municipal Energy Solutions				
	Daylight Dimming	C4 - Energy Rewards RFP Program				

	Lighting Occupancy Sensors	C4 - Energy Rewards RFP Program				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

2.41. Lighting - Exterior

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Lighting

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Lighting Fixture - Exterior w/ Controls	C1 - Large Business Energy Solutions	XX
	Lighting Fixture - Exterior w/o Controls	C1 - Large Business Energy Solutions	
	Lighting Fixture - Exterior w/ Controls	C2 - Small Business Energy Solutions	
	Lighting Fixture - Exterior w/o Controls	C2 - Small Business Energy Solutions	
	Lighting Fixture - Exterior w/ Controls	C3 - Municipal Energy Solutions	
	Lighting Fixture - Exterior w/o Controls	C3 - Municipal Energy Solutions	
	Lighting Fixture - Exterior w/ Controls	C4 - Energy Rewards RFP Program	
	Lighting Fixture - Exterior w/o Controls	C4 - Energy Rewards RFP Program	

	Lighting Fixture - Interior w/ Controls	C1 - Large Business Energy Solutions	
	Lighting Fixture - Interior w/o Controls	C1 - Large Business Energy Solutions	
	Lighting Fixture - Interior w/ Controls	C2 - Small Business Energy Solutions	
	Lighting Fixture - Interior w/o Controls	C2 - Small Business Energy Solutions	
	Lighting Fixture - Interior w/ Controls	C3 - Municipal Energy Solutions	
	Lighting Fixture - Interior w/o Controls	C3 - Municipal Energy Solutions	
	Lighting Fixture - Interior w/ Controls	C4 - Energy Rewards RFP Program	
	Lighting Fixture - Interior w/o Controls	C4 - Energy Rewards RFP Program	
	Parking Lot Lighting		
	Street Lights		

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

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

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

2.42. **Lighting - Interior**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Lighting

Lighting Fixture - Interior w/ Controls
Lighting Fixture - Interior w/o Controls
Lighting Interior Bulb

2.43. **Lighting – Retrofit**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Lighting

Description:

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).

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.

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:

$\Delta kWh = (\text{Summation } i=1 \text{ to } n(\text{Count}_i * \text{Watts}_i / 1000)_{BASE} - \text{Summation } j=1 \text{ to } n(\text{Count}_j * \text{Watts}_j / 1000)_{EE}) (\text{Hours})$

$\Delta kW = \text{Summation } i=1 \text{ to } n(\text{Count}_i * \text{Watts}_i / 1000)_{BASE} - \text{Summation } j=1 \text{ to } n(\text{Count}_j * \text{Watts}_j / 1000)_{EE}$

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 secondary research from MA.[1]

Measure Life:

The table below summarizes the adjusted measure lives (AML) for each measure. Note these AML values account for the estimated fraction of program lighting measures that are assumed to be lost opportunity (replace on failure) vs. retrofit (early replacement) based on MA evaluation research, as well as an outyear factor (accounting for future, naturally occurring adoption of LEDs) that calculates the second-period savings of early replacement dual baseline measures.[2]

BC Measure ID	Measure Category	Measure	AML
	Ambient Linear	TLED	10.53
	Ambient Linear	LED Fixture	10.99
	High/Low Bay	TLED	12.81
	High/Low Bay	LED Fixture	12.84
	High/Low Bay	LED Lamp	12.56
	Exterior/Outdoor	TLED	10.12
	Exterior/Outdoor	LED Fixture	10.18
	Exterior/Outdoor	LED Lamp	9.74
	Screw-Based	A-Line	4.69
	Screw-Based	Downlight/Track	5.86
	Screw-Based	Decorative	3.78

Other Resource Impacts:

Heating penalties for downstream, interior lighting systems (non-turnkey) are from a 12-month MA data logging study.[3] Penalties for interior turnkey are from the 2018 MA small business lighting impact evaluation.[4]

BC Measure ID	Measure Name	Program	MMBtu/kWh
	Interior lighting	RFP, LBES, MES, SBES	-0.000691
	Interior lighting (turnkey)	MES, SBES	-0.004080
	Exterior lighting (both non-turnkey and turnkey)	RFP, LBES, MES, SBES	n/a

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
	Lighting Systems - Interior	RFP, LBES, MES, SBES	1.00	0.998	0.977	0.977	0.827	0.843
	Lighting Systems - Exterior	RFP, LBES, MES, SBES	1.00	0.998	1.00	1.00	0.00	1.00
	Lighting Systems - Interior (Turnkey)	MES, SBES	1.00	1.066	1.135	1.00	0.504	0.389
	Lighting Systems - Exterior (Turnkey)	MES, SBES	1.00	1.027	1.00	1.00	0.00	1.00

In-Service Rates:

All downstream installations have 100% in service rate since programs include verification of equipment installations.

Realization Rates:

Turnkey realization rates are based on NH evaluation results.[5] They account for operational hours of use adjustments, electric HVAC interactive adjustments, and other adjustments. Exterior lighting realization rates account for the same adjustments except the electric HVAC adjustment. Non-turnkey realization rates are based on NH evaluation results.[6]

Coincidence Factors:

Summer and winter coincidence factors are based on NH evaluation results.[5, 6]

Energy Load Shape:

Energy load shapes are based on site-level metering of project sites in MA.[7]

Measure Name	Summer On-peak	Winter On-peak	Summer Off-peak	Winter Off-peak
Interior Lighting	33.7%	30.1%	18.4%	17.7%
Exterior Lighting	19.2%	20.1%	29.0%	31.6%

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

[1] See Lighting – Midstream chapter, hours of use based on DNV GL (2018). Massachusetts C&I Lighting Hours of Use by Building Type - Quick Hit Study. http://ma-eeac.org/wordpress/wp-content/uploads/MA-CIEC-stage-5-report-P86-Lighting-HOU-Study-FINAL.pdf
[2] DNV GL (2020) MA19C14-E-LGHTMKT: Market Model Forecast and Updated AML Values, Presented by DNV GL to the Massachusetts Program Administrators. Report forthcoming.
[3] DNV KEMA (2013). Impact Evaluation of 2010 Prescriptive Lighting Installations. http://ma-eeac.org/wordpress/wp-content/uploads/Impact-Evaluation-of-2010-Prescriptive-Lighting-Installations-Final-Report-6-21-13.pdf
[4] DNV GL, ERS (2018). Impact Evaluation of PY2016 Small Business Initiative: Phase I http://ma-eeac.org/wordpress/wp-content/uploads/P69-Impact-Eval-of-MA-Small-Business-Initiative-Phase-I-Lighting_Report_FINAL.pdf
[5] DNV GL (2018) Impact Evaluation of 2016 New Hampshire Commercial & Industrial Small Business and Municipal Lighting. https://puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/small-business-and-municipal-lighting-impact-evaluation.pdf
[6] DNV GL (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
[7] DNV GL (2018). P72 Prescriptive C&I Loadshapes of Savings.

Still need to identify a source for C&I lighting loadshapes. NEEP has a catalogue I can pull in lighting values from based on DNV/KEMA research from 2011…

2.44. Motors & Drives - Variable Frequency Drive

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	Motors and Drives

Description:

This measure covers the installation of variable speed drives according to the terms and conditions stated on the statewide worksheet. The measure covers 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, air or water volume/temperature is controlled using valves, dampers, and/or reheats.

High Efficiency:

In the high efficiency case, pump flow or fan air volume is directly controlled using downstream information. The pump or fan will automatically adjust its speed based on inputted set points and the downstream feedback it receives.

Algorithms for Calculating Primary Energy Impact:

Δ kWh = (HP) * (kWh/HP)
Δ kW = (HP) * (kW/HP_{SP})

Where:
HP = Rated horsepower for the impacted motor
kWh/HP = Annual electric energy reduction based on building and equipment type. See table below.
kW/HP_{SP} = Summer demand reduction based on building and equipment type. See table below.
kW/HP_{WP} = Winter demand reduction based on building and equipment type. See table below.

Savings factors below already account for motor efficiency and consequently an adjustment is not required in the algorithm.

Savings Factors for C&I VFDs without Motor Replacement (kWh/HP [1] and kW/HP) [2]

Building Type	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/HP$_{SP}$)									
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/HP$_{WP}$)									
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 [3] and kW/HP [4]) :

Building Type	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/HP_{SP})								
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/HP_{WP})								
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:

For lost-opportunity installations, the lifetime is 15 years. [5] This measure has been determined to be an add-on single baseline measure for retrofit scenarios. [6]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a043 E21C1d043 E21C2a043 E21C2d043 E21C3a087 E21C3d087	Variable Frequency Drive	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	0.94	n/a	1.00	1.00	1.00	1.00
E21C1a044 E21C1d044 E21C2a044 E21C2d044 E21C3a088 E21C3d088	Variable Frequency Drive with Motor	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	0.94	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Energy RRs for for all PAs based on impact evaluation of 2011-2012 prescriptive VSD projects. [7] Demand RRs from study not used due to low precision of demand results. Demand RRs for Chilled Water Pump, Hot Water Circ. Pump, Return Fan, Supply Fan, and WSHP Circ. Loop set to 1 since savings based on NEEP VSD Loadshape study.

Energy RRs for residential end use installations based on an evaluation of multi-family projects. [8]

Coincidence Factors:

CFs for all PAs set to 1.0 since summer and winter demand savings are based on evaluation results.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: Chan, Tumin (2010). Formulation of a Prescriptive Incentive for the VFD and Motors & VFD impact tables at NSTAR.
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.
3: Chan, Tumin (2010). Formulation of a Prescriptive Incentive for the VFD and Motors & VFD impact tables at Eversource (NSTAR). Prepared for NSTAR.
4: 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.
5: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1
6: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
7: KEMA, Inc. and DMI, Inc. (2013). 2011-2012 Massachusetts Prescriptive VSD Impact Evaluation. Prepared for the Massachusetts Program Administrators and the Massachusetts Energy Efficiency Advisory Council.
8: Navigant Consulting (2018). Multi-Family Program Impact and Net-to-Gross Evaluation.

2.45. Plug Load - Advanced Power Strip

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Appliances

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' 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 study results. [1]

BC Measure ID	Measure Name	Program	kWh	kW
	Smart Strip		117	0.009

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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
	Smart Strip		0.76	0.92	n/a	0.92	0.92	0.58	0.86

In-Service Rates:

In-Service Rates are based on consumer surveys, as found in the referenced study. [3]

Realization Rates:

Realization Rates account for the savings lost due to improper customer set-up/use of devices, as found in the referenced study. [4]

Coincidence Factors:

Summer and winter Coincidence Factors are estimated using demand allocation methodology described in the Navigant Demand Impact Model. [5]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: NMR Group, Inc. (2018). Advanced Power Strip Metering Study.
2: Massachusetts Common Assumption
3: NMR Group, Inc. (2018). Products Impact Evaluation of In-service and Short-Term Retention Rates Study.
4: NMR Group, Inc. (2018). Advanced Power Strip Metering Study.
5: Navigant Consulting (2018). Demand Impact Model Update.

2.46. Refrigeration - Case Motor Replacement

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

Installation of electronically commutated motors (ECMs) in 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.

High Efficiency:

The high efficiency case is the replacement of the existing case motor with an ECM.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = \Delta kWh_{Motor} + \Delta kWh_{Heat}$
$\Delta kWh_{Motor} = kW_{Motor} \times LRF \times Hours$
$\Delta kWh_{Heat} = \Delta kWh_{Motor} \times 0.28 \times Eff_{rs}$
$\Delta kW = \Delta kWh/8760$

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} = Metered load of case motor
LRF = Load reduction factor: 53% when shaded pole 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 (1.6 kW/ton) [4]
ΔkW = Average demand savings
8,760 = Hours per year

Measure Life:

The measure life is 15 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [5] [6]

Other Resource Impacts:

There are no other resource impacts for this measure.
145

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}
E21C1a016 E21C1d018 E21C2a016 E21C2d018 E21C3a022 E21C3d024	Case Motor Replacement	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

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: Assumed average refrigeration efficiency for typical installations. 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.
5: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
6: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; 15-year measure life for retrofit motor installations.

2.47. **Refrigeration - Door Heater Controls**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

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 cooling load. [1]

Baseline Efficiency:

The baseline efficiency case is a cooler or freezer door 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) to control the anti-sweat heater based on specific algorithms for freezer and cooler doors. Door temperature is typically maintained about 5ºF above the store air dew point temperature. [2]

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = kW_{DH} * \%OFF * 8{,}760$
$\Delta kW = kW_{DH} * \%OFF$

Where:
kW_{DH} = Total demand of the door heater, calculated as Volts * Amps / 1,000
8,760 = Door heater annual run hours before controls
%OFF Door heater Off-time: 46% for freezer door heaters or 74% for cooler door heaters) [3]

Measure Life:

The measure life is 10 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [4, 5]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a019 E21C1d021 E21C2a019 E21C2d021 E21C3a025 E21C3d027	Door Heater Controls	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	0.50	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

All PAs: on-peak CFs from the 1995 HEC study of walk-in cooler anti-sweat door heater controls. [6]

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The assumptions and algorithms used in this section are specific to NRM products.
2: Select Energy Services, Inc. (2004). Analysis of Cooler Control Energy Conservation Measures. Prepared for NSTAR.
3: The value is an estimate by NRM based on hundreds of downloads of hours of use data from Door Heater controllers. These values are also supported by Select Energy Services, Inc. (2004). Cooler Control Measure Impact Spreadsheet User's Manual. Prepared for NSTAR.
4: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
5: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1.
6: HEC, Inc. (1995). Analysis of Door Master Walk-In Cooler Anti-Sweat Door Heater Controls Installed at Ten Sites in Massachusetts. Prepared for New England Power Service Company; Table 9. Adjusted to account for updated RR.

2.48. **Refrigeration - Electronic Defrost Control**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

A control mechanism to skip defrost cycles when defrost is unnecessary. [1]

Baseline Efficiency:

The baseline efficiency case is an evaporator fan electric defrost system that uses a time clock mechanism to initiate defrost.

High Efficiency:

The high efficiency case is an evaporator fan defrost system with electric defrost controls.

Algorithms for Calculating Primary Energy Impact:

Δ kWh $_{Defrost}$ = kW $_{Defrost}$ x Hours x DRF
ΔkWh $_{Heat}$ = ΔkWh $_{Defrost}$ x0.28 xEff $_{RS}$
ΔkWh = ΔkWh $_{Defrost}$ + ΔkWh $_{Heat}$
Δ kW = Δ kWh/8760

Where:
ΔkWh $_{Defrost}$ = Energy savings resulting from an increase in operating efficiency due to the addition of electronic defrost controls.
ΔkWh $_{Heat}$ = Energy savings due to reduced heat from reduced number of defrosts.
kW $_{Defrost}$ = Load of electric defrost.
Hours = Number of hours defrost occurs over a year without the defrost controls.
DRF = Defrost reduction factor- percent reduction in defrosts required per year (35%) [2]
0.28 = Conversion of kW to tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton.
Eff $_{RS}$ = Efficiency of typical refrigeration system (1.6 kW/ton) [3]
ΔkW = Average demand savings
8,760 = Hours per year

Measure Life:

The measure life is 10 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [4, 5]

Other Resource Impacts:

There are no other resource impacts for this measure.
149

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}
E21C1a024 E21C1d026 E21C2a024 E21C2d026 E21C3a037 E21C3d039	Electronic Defrost Control	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The assumptions and algorithms used in this section are specific to NRM products.
2: 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.
3: Assumed average refrigeration efficiency for typical installations. 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: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
5: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities.

2.49. **Refrigeration - Evaporator Fan Control**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

Installation of controls to modulate the evaporator fans based on temperature control. Energy savings include: fan energy savings from reduced fan operating hours, refrigeration energy savings from reduced waste heat, and compressor energy savings resulting from the electronic temperature control. Electronic controls allow less fluctuation in temperature, thereby creating savings. [1]

Baseline Efficiency:

The baseline efficiency case assumes evaporator fans that run 8,760 annual hours with no temperature control.

High Efficiency:

The high efficiency case is the use of an energy management system to control evaporator fan and compressor operation based on temperature.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = \Delta kWh_{Fan} + \Delta kWh_{Heat} + \Delta kWh_{Control}$
$\Delta kWh_{Fan} = kW_{Fan} * 8760 * \%OFF$
$\Delta kWh_{Heat} = \Delta kWh_{Fan} * 0.28 * Eff_{RS}$
$\Delta kWh_{Control} = [kW_{CP} * Hours_{CP} + kW_{Fan} * 8760 * (1-\%OFF)] * 5\%$
$\Delta kW = \Delta kWh/8760$

Where:
ΔkWh_{Fan} = Energy savings due to evaporator being shut off
ΔkWh_{Heat} = Energy savings due to reduced heat from the evaporator fans
$\Delta kWh_{Control}$ = Energy savings due to the electronic controls on compressor and evaporator
kW_{Fan} = Power demand of evaporator fan calculated from equipment nameplate data and estimated 0.55 power factor/ adjustment [2:] Amps x Voltage x PF x √Phase
%OFF = Percent of annual hours that the evaporator is turned off: 46% [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: 1.6 kW/ton [4]
kW_{CP} = Total power demand of compressor motor and condenser fan calculated from equipment nameplate data and estimated 0.85 power factor [5] Amps x Voltage x PF x √Phase
$Hours_{CP}$ = Equivalent annual full load hours of compressor operation: 4,072 hours [6]
5% = Reduced run-time of compressor and evaporator due to electronic temperature controls [7]
ΔkW = Average demand savings
8,760 = Hours per year

Measure Life:

The measure life is 10 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [8, 9]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a027 E21C1d029 E21C2a027 E21C2d029 E21C3a043 E21C3d045	Evaporator Fan Controls	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The assumptions and algorithms used in this section are specific to NRM products.
2: Conservative value based on 15 years of NRM field observations and experience.
3: The value is an estimate by NRM based on hundreds of downloads of hours of use data. These values are also supported by Select Energy Services, Inc. (2004). Cooler Control Measure Impact Spreadsheet User's Manual. Prepared for NSTAR
4: Assumed average refrigeration efficiency for typical installations. 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.
5: This value is an estimate by NRM based on hundreds of downloads of hours of use data from the electronic controller.
6: Conservative value based on 15 years of NRM field observations and experience.

7: Conservative estimate supported by less conservative values given by several utility-sponsored 3rd Party studies including: Select Energy Services, Inc. (2004). Analysis of Cooler Control Energy Conservation Measures. Prepared for NSTAR.
8: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
9: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities;

2.50. **Refrigeration - Novelty Cooler Shutoff**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

Installation of controls to shut off a facility's novelty coolers for non-perishable goods based on pre-programmed store hours. Energy savings occur as coolers cycle off during facility unoccupied hours. [1]

Baseline Efficiency:

The baseline efficiency case is the novelty coolers operating 8,760 hours per year.

High Efficiency:

The high efficiency case is the novelty coolers operating fewer than 8,760 hours per year since they are controlled to cycle each night based on pre-programmed facility unoccupied hours.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = kW_{NC} * DC_{AVG} * Hours_{OFF}$
$\Delta kW = 0$

Where:
$\Delta kW = 0$ since savings are assumed to occur during evening hours and are therefore not coincident with either summer or winter peak periods.
kW_{NC} = Power demand of novelty cooler calculated from equipment nameplate data and estimated 0.85 power factor [2]
DC_{AVG} = Weighted average annual duty cycle: 48.75% [3]
$Hours_{OFF}$ = Potential hours off every night per year, estimated as one less than the number of hours the store is closed per day

Measure Life:

The measure life is 10 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [4,5]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a037 E21C1d037 E21C2a037 E21C2d037 E21C3a066 E21C3d066	Novelty Cooler Shutoff	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	0.00	0.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The assumptions and algorithms used in this section are specific to NRM products.
2: Conservative value based on 15 years of NRM field observations and experience.
3: The estimated duty cycles for Novelty Coolers are 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.
4: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
5: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1.

2.51. **Refrigeration - Vending Miser**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

Controls can significantly 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, non-refrigerated 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:

$\Delta kWh = (kW_{rated})(Hours)(SAVE)$
$\Delta kW = \Delta kWh / Hours$

Where:
kW_{rated} = Rated kW of connected equipment. See table below for default rated kW by connected equipment type
Hours = Operating hours of the connected equipment: default of 8,760 hours
SAVE = Percent savings factor for the connected equipment. See table below for values

Vending Machine and Cooler Controls Savings Factors [1]

BC Measure ID	**Equipment Type**	**P**rogram	**kW rated**	**SAVE (%)**	**ΔkW**	**ΔkWh**
	Refrigerated Beverage Vending		0.40	46	0.184	1612
	Non-Refrigerated Snack Vending		0.085	46	0.0	343
	Glass Front Refrigerated Coolers		0.46	30	0.1	1208

Measure Life:

The measure life is 5 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [2]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1a045 E21C1d045 E21C2a045 E21C2d045 E21C3a089 E21C3d089	Vending Misers	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	0.00	0.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Coincidence Factors are set to zero since demand savings typically occur during off-peak hours.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: USA Technologies Energy Management Product Sheets (2006). http://www.usatech.com/energy_management/energy_productsheets.php. Accessed 9/1/09.
2: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet.. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.

2.52. **Refrigeration - ECM Evaporator Fan Motors for Walk-in Coolers and Freezers**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit
Category	Refrigeration

Description:

Installation of various sizes of electronically commutated motors (ECMs) in walk-in coolers and freezers to replace existing evaporator fan motors. [1]

Baseline Efficiency:

The baseline efficiency case is an existing evaporator fan motor.

High Efficiency:

The high efficiency case is the replacement of existing evaporator fan motors with ECMs.

Algorithms for Calculating Primary Energy Impact:

$\Delta kWh = \Delta kWh_{Fan} + \Delta kWh_{Heat}$
$\Delta kWh_{Fan} = kW_{Fan} * LRF * Hours$
$\Delta kWh_{Heat} = \Delta kWh_{Fan} * 0.28 * Eff_{RS}$
$\Delta kW = \Delta kWh / 8{,}760$

Where:
ΔkWh_{Fan} = Energy savings due to increased efficiency of evaporator fan motor
ΔkWh_{Heat} = Energy savings due to reduced heat from the evaporator fans
kW_{Fan} = Power demand of evaporator fan calculated from equipment nameplate data and estimated 0.55 power factor/adjustment [2] Amps x Voltage x PF x √Phase
LRF = Load reduction factor for motor replacement (65%) [3]
Hours = Annual fan operating hours.
0.28 = Conversion factor between kW and tons: 3,413 Btuh/kW divided by 12,000 Btuh/ton
Eff_{RS} = Efficiency of typical refrigeration system: 1.6 kW/ton [4]
ΔkW = Average demand savings
8,760 = Hours per year

Measure Life:

The measure life is 15 years. This measure is determined to have an add-on single baseline in retrofit scenarios. [5, 6]

Other Resource Impacts:

158

There are no other resource impacts for this measure.

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}
E21C1a023 E21C1d025 E21C2a023 E21C2d025 E21C3a036 E21C3d038	ECM Evaporator Fan Motors for Walk-in Coolers/Freezers	LBES Retro LBES DI SBES Retro SBES DI Muni Retro Muni DI	1.00	1.00	n/a	1.00	1.00	1.00	1.00

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: USA Technologies Energy Management Product Sheets (2006). http://www.usatech.com/energy_management/energy_productsheets.php. Accessed 9/1/09.
2: Baseline Categories and preliminary Out Year Factors are described at a high level in DNV GL, ERS (2018). Portfolio Model Companion Sheet. Additional background on the baseline categorization given in DNV GL, ERS (2018). Portfolio Model Methods and Assumptions – Electric and Natural Gas Memo.
3:
4:
5:
6:

2.53. **Midstream Hot Water - Water Heaters**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	**Hot Water**

Description:

- Midstream Heat Pump Water Heater 120:
- Midstream Heat Pump Water Heater 80:
- Midstream Heat Pump Water Heater 50:
- Midstream Indirect Water Heater, Gas: Indirect water heaters use a storage tank that is heated by the main boiler. The energy stored by the water tank allows the boiler to turn off and on less often, saving considerable energy.
- Midstream On Demand Tankless Water Heater, Gas: Tankless water heaters circulate water through a heat exchanger to be heated for immediate use, eliminating the standby heat loss associated with a storage tank.
- Midstream Volume Water Heater, Gas: Installation of a high-efficiency gas-fired water heater.

Baseline Efficiency:

All Water Heaters: The baseline efficiency case assumes compliance with the efficiency requirements as mandated by Massachusetts State Building Code. As described in the MA State Building Code, energy efficiency must be met via compliance with the relevant International Energy Conservation Code (IECC).

- Midstream Heat Pump Water Heater
- Midstream Indirect Water Heater: For indirect water heaters the baseline is a hot water boiler operating at 78% recovery efficiency. Additionally a baseline storage water heater was assumed for purposed of estimating standby losses. [1]
- Midstream On Demand Tankless Water Heater, Gas: For on-demand tankless water heaters the baseline is a code-compliant gas-fired storage water heater with EF = 0.61. [2]
- Midstream Volume Water Heater, Gas: The assumed baseline is a code specified 80% TE volume water heater.

High Efficiency:

- Midstream Heat Pump Water Heater
- Midstream Indirect Water Heater: The high efficiency scenario is an indirect water heater with a Combined Appliance Efficiency (CAE) of 85% or greater.
- Midstream On Demand Tankless Water Heater, Gas: The high efficiency equipment is either a gas-fired instantaneous hot water heater with an Energy Factor of at least 0.90.
- Midstream Volume Water Heater, Gas: The high efficiency case is a volume water heater with a 94% TE

Algorithms for Calculating Primary Energy Impact:

BC Measure ID	Measure Name	Program	ΔkWh	ΔMMBtu	ΔMMBtu / Mbtuh
	Midstream Heat Pump Water Heater, 120 gallons				
	Midstream Heat Pump Water Heater, 80 gallons				
	Midstream Heat Pump Water Heater, 50 gallons				
	Midstream Indirect Water Heater			19.0	
	Midstream On Demand Tankless Water Heater			8.9	
	Midstream Volume Water Heater				0.6077

Measure Life:

BC Measure ID	Measure Name	Program	Measure Life
	Midstream Heat Pump Water Heater		
	Midstream Indirect Water Heater:		15 [3]
	Midstream On Demand Tankless Water Heater, Gas:		20 [4]
	Midstream Volume Water Heater, Gas:		15

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1c044 E21C2c044	Midstream Heat Pump Water Heater, 120	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.431	0.747
E21C1c046 E21C2c046	Midstream Heat Pump Water Heater, 80	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.431	0.747
E21C1c045 E21C2c045	Midstream Heat Pump Water Heater, 50	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.431	0.747
G21C1c009 G21C2c009	Midstream Indirect Water Heater	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1c010 G21C2c010	Midstream On Demand Tankless Water Heater, Gas	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1c011 G21C2c011	Midstream Volume Water Heater, Gas	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

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

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
	Midstream Heat Pump Water Heater					
	Midstream Indirect Water Heater					
	Midstream On Demand Tankless Water Heater					
	Midstream Volume Water Heater					

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing

to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1, 2: 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

3: GDS Associates, Inc. (2009). Natural Gas Energy Efficiency Potential in Massachusetts; Appendix A-2.

4: Hewitt, D. Pratt, J. & Smith, G. (2005). Tankless Gas Water Heaters: Oregon Market Status. Prepared for the Energy Trust of Oregon

2.54. **Midstream Lighting**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity/Retrofit
Category	Lighting

Description:

This measure includes 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:

All midstream measures assume a blend of retrofit and lost opportunity baseline,[1] determined using assumed wattages for each of the replaced lamps or fixtures.

High Efficiency:

The high efficiency case is project-specific and is determined using actual fixture counts for the project and the NHSaves Wattage Tables.[2]

Algorithms for Calculating Primary Energy Impact:

ΔkWh = n * (DeltaWatts/1000) * Hours

ΔkW = n * DeltaWatts /1000

Where:
n = Total number of fixture or bulb types in project.
DeltaWatts = Calculated difference between efficient and baseline wattage (see NHSaves Wattage Tables for delta watts assumptions)[3].
1000 = Conversion factor: 1000 watts per kW.
Hours = Lighting annual hours of operation.

Midstream lighting measures will calculate gross energy savings using annual hours of operation defined for the particular 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 secondary research from MA.[4] 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
College & University	4,839
Grocery/Food Sales	5,468
Hospital	5,413
Industrial/Manufacturing	4,988
K-12 School	2,788
Lodging	4,026
Medical Office	3,673
Office Building	4,181
Other*	4,332
Restaurant/Food Service	5,018
Retail	4,939
Warehouse and Storage	6,512
Parking Garages	8,760

*Other includes recreational and entertainment facilities, service-oriented facilities, religious facilities.

Measure Life:

The table below summarizes the adjusted measure lives (AML) for each of the midstream measures. Note these AML values account for the estimated fraction of program lighting measures that are assumed to be lost opportunity (replace on failure) vs. retrofit (early replacement) based on MA evaluation research, as well as an outyear factor (accounting for future, naturally occurring adoption of LEDs) that calculates the second-period savings of early replacement dual baseline measures.[5]

BC Measure ID	Measure Category	Measure	Program	AML
	Ambient Linear	TLED		10.53
	Ambient Linear	LED Fixture		10.99
	High/Low Bay	TLED		12.81
	High/Low Bay	LED Fixture		12.84
	High/Low Bay	LED Lamp		12.56
	Exterior/Outdoor	TLED		10.12
	Exterior/Outdoor	LED Fixture		10.18
	Exterior/Outdoor	LED Lamp		9.74
	Screw-Based	A-Line		4.69
	Screw-Based	Downlight/Track		5.86
	Screw-Based	Decorative		3.78

Other Resource Impacts:

165

The following heating penalties are associated with lighting projects, determined from MA lighting evaluations.[6]

BC Measure ID	Measure Name	Program	MMBtu/kWh
	LED Downlight	Midstream	-0.000329
	LED Exterior	Midstream	N/A
	LED High Bay/Low Bay	Midstream	-0.000162
	LED Linear Fixture	Midstream	-0.000162
	LED Linear Fixture with Controls	Midstream	-0.000162
	LED Linear Lamp	Midstream	-0.000162
	LED Screw In	Midstream	-0.000329
	LED Stairwell Kit	Midstream	N/A

Impact Factors for Calculating Adjusted Gross Savings:

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
	LED Downlight	Midstream	84.6%	103.07%	118.49%	94.12%	59.0%	52.1%
	LED Exterior	Midstream	100%	100.00%	100.00%	100.00%	0%	100%
	LED High Bay/Low Bay	Midstream	100%	101.86%	115.36%	98.87%	72.11%	65.93%
	LED Linear Fixture	Midstream	100%	101.86%	115.36%	98.87%	72.11%	65.93%
	LED Linear Fixture with Controls	Midstream	100%	101.86%	115.36%	98.87%	72.11%	65.93%
	LED Linear Lamp	Midstream	84.6%	101.86%	115.36%	98.87%	72.11%	65.93%
	LED Screw In	Midstream	84.6%	103.07%	118.49%	94.12%	59.0%	52.1%
	LED Stairwell Kit	Midstream	84.6%	100.00%	101.62%	100.00%	81.01%	82.28%

In-Service Rates:

In-service rates are based on MA evaluation results reflecting a comparable level of project inspections as used in the NH program.[7]

Realization Rates:

Realization rates reflect HVAC savings from cooling system interaction, which are included in the calculation of adjusted gross savings for Lighting Systems projects. The HVAC interaction adjustment factor is determined from MA lighting project evaluations.[8]

Coincidence Factors:

166

Summer and winter coincidence factors are based on MA 2017 Upstream Lighting Impact evaluation.[9]

Energy Load Shape:

Energy load shapes are based on site-level metering of project sites in MA.[10]

Measure Name	Summer On-peak	Winter On-peak	Summer Off-peak	Winter Off-peak
Interior Lighting	33.7%	30.1%	18.4%	17.7%
Exterior Lighting	19.2%	20.1%	29.0%	31.6%

Impact Factors for Calculating Net Savings:

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.[11]

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
	LED Downlight	Midstream	50%	23%	0%	73%
	LED Exterior	Midstream	27%	11%	0%	84%
	LED High Bay/Low Bay	Midstream	27%	11%	0%	84%
	LED Linear Fixture	Midstream	27%	11%	0%	84%
	LED Linear Fixture with Controls	Midstream	27%	11%	0%	84%
	LED Linear Lamp	Midstream	27%	11%	0%	84%
	LED Screw In	Midstream	50%	23%	0%	73%
	LED Stairwell Kit	Midstream	27%	11%	0%	84%

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes

1: The blend of retrofit and lost opportunity lighting was determined based on MA evaluation results. See DNV GL (2015) Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative, Massachusetts Program Administrators and Energy Efficiency Advisory Council, November 22, 2017 http://ma-eeac.org/wordpress/wp-content/uploads/Upstream-Lighting-Initiative-Impact-Evaluation-PY2015.pdf

2: Delta watts are based on a Massachusetts study of midstream lighting baseline and efficiency wattages. The delta watts for measures with integrated controls reflect a 30% savings adder and should not include additional control savings.

DeltaWatts Table for Appendix.xlsx

3: DNV GL (2018). Massachusetts C&I Lighting Hours of Use by Building Type - Quick Hit Study. http://ma-eeac.org/wordpress/wp-content/uploads/MA-CIEC-stage-5-report-P86-Lighting-HOU-Study-FINAL.pdf
4: DNV GL (2020) MA19C14-E-LGHTMKT: Market Model Forecast and Updated AML Values, Presented by DNV GL to the Massachusetts Program Administrators. Report forthcoming.
5: DNV-GL (2015). Massachusetts Commercial and Industrial Upstream Lighting Program: "In Storage" Lamps Follow-Up Study, Final Report, Mar. 27, 2015.
6: DNV GL (2018). P81 MA C&I Upstream Lighting In-Service Rate (ISR) Analysis Summary
7: DNV GL (2017). Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative
8: DNV GL (2017). Impact Evaluation of PY2015 Massachusetts Commercial and Industrial Upstream Lighting Initiative
9: DNV GL (2018). P72 Prescriptive C&I Loadshapes of Savings.
10: DNV GL (2018). P72 Prescriptive C&I Loadshapes of Savings.
11: EMI (2019). C1644 EO Net-to-Gross Study, Draft Report, Sep. 25, 2019 (Table ES-1-1, and Recommendation 1 on p. 49). To separate the contribution of free-ridership and spillover to these NTG values, we used a proportion equivalent to the levels of free-ridership and spillover found for screw-based LEDs in 2020.

2.55. **Midstream HVAC**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	HVAC

Description:

- Midstream Heat Pump Systems
- Midstream ECM Fan Motors
- Midstream VRF
- Midstream Circulator Pump: Single-phase circulator pumps up used in C&I buildings used for hydronic heating and system hot water.
- Midstream Demand Control Ventilation (DCV): The measure controls the quantity of outside air to an air handling system based on detected space CO2 levels. The installed systems monitor the CO2 in the spaces or return air and reduce the outside air use when possible to save energy while meeting indoor air quality standards.
- Midstream Dual Enthalpy Economizer Controls: The measure is to upgrade the outside-air dry-bulb economizer to a dual enthalpy economizer. 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.
- Midstream Unitary Air Conditioners: 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:

Midstream Circulator Pump: 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.
Midstream Demand Control Ventilation (DCV): The baseline efficiency case assumes the relevant HVAC equipment has no ventilation control.
Midstream Dual Enthalpy Economizer Controls: The baseline efficiency case for this measure assumes the relevant HVAC equipment is operating with a fixed dry-bulb economizer.
Midstream Unitary Air Conditioners: The baseline efficiency case for new installations assumes compliance with the efficiency requirements as mandated by Massachusetts State Building Code.

High Efficiency:

Midstream Circulator Pump: The high efficiency case is a circulator pump with an ECM.
Midstream Demand Control Ventilation (DCV): The high efficiency case is the installation of an outside air intake control based on CO2 sensors.

Midstream Dual Enthalpy Economizer Controls: 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.
Midstream Unitary Air Conditioners: The high efficiency case assumes the HVAC equipment meets or exceeds the Consortium for Energy Efficiency's (CEE) specification. This specification results in cost-effective energy savings by specifying higher efficiency HVAC equipment while ensuring that several manufacturers produce compliant equipment. The CEE specification is reviewed and updated annually to reflect changes to the ASHRAE and IECC energy code baseline as well as improvements in the HVAC equipment technology. Equipment efficiency is the rated efficiency of the installed equipment for each project.

Algorithms for Calculating Primary Energy Impact:

- Midstream Circulator Pump: Savings depend on application and pump size as described in table below. [1]

BC Measure ID	Size	Type	Program	ΔkW	ΔkWh
	<= 1 HP	Hydronic Heating		$\Delta kW = 0.245 * HP_{rated} + 0.02$	$\Delta kWh = 1,325 * HP_{rated} + 111$
		Service Hot Water		$\Delta kW = 0.245 * HP_{rated} + 0.02$	$\Delta kWh = 2,780 * HP_{rated} + 233$
	> 1 HP	Hydronic Heating		ΔkW = 0.265	ΔkWh = 1,436
		Service Hot Water		ΔkW = 0.265	ΔkWh = 3,013

- Midstream Demand Control Ventilation (DCV): Gross energy and demand savings for implementation of demand control ventilation are custom calculated using the PA's DCV savings calculation tools. These tools are used to calculate energy and demand savings based on site-specific project details including hours of operation, HVAC system efficiency and total air flow, and enthalpy and temperature set points. [2] Alternatively, the energy and demand savings may be calculated using the following algorithms and inputs:

  $kWh = kBtuh * (1 Ton/12 kBtu/h) * SAVE_{kWh}$
  $kW = kBtuh * (1 Ton/12 kBtu/h) * SAVE_{kW}$

  Where:
  kBtu/h = Capacity of the cooling equipment in kBtu per hour
  $SAVE_{kWh}$ = Average annual kWh reduction per ton of cooling capacity: 170 kWh/ton [3]
  $SAVE_{kW}$ = Average kW reduction per ton of cooling capacity: 0.15 kW/ton [4]

- Midstream Dual Enthalpy Economizer Controls: ΔkWh = (kBtu/h)(1 Ton/12 kBtu / h)(SAVEkW)

  Where:
  kBtu/h = Capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h)
  SAVEkWh = Average annual kWh reduction per ton of cooling capacity: 289 kWh/ton [5]
  SAVEkW = Average kW reduction per ton of cooling capacity: 0.289 kW/ton [6]

- Midstream Unitary Air Conditioners:

For units with cooling capacities less than 65 kBtu/h:
$\Delta kWh = (kBtu/h)\ (1/\ SEER_{BASE} - 1/\ SEER_{EE})\ (EFLH_{Cool})$
$\Delta kW = (kBtu/h)\ (1/EERbase - 1/\ EERee)$

For units with cooling capacities equal to or greater than 65 kBtu/h and EER available:
$\Delta kWh = (kBtu/h)\ (1/\ EER_{BASE} - 1/\ EER_{EE})\ (EFLH_{Cool})$
$\Delta kW = (kBtu/h)\ (1/\ EER_{BASE} - 1/\ EER_{EE})$

For units with cooling capacities equal to or greater than 65 kBtu/h and IEER available
$\Delta kWh = (kBtu/h)\ (1/\ IEER_{BASE} - 1/\ IEER_{EE})\ (Hours_{Cool})\ (Capadj)$
$\Delta kWh = (kBtu/h)\ (1/\ IEER_{BASE} - 1/\ IEER_{EE})$

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)
$SEER_{BASE}$ = Seasonal Energy Efficiency Ratio of the baseline equipment.
$SEER_{EE}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment.
$EFLH_{Cool}$ = Cooling equivalent full load hours.
EER_{BASE} = Energy Efficiency Ratio of the baseline equipment.
EER_{EE} = Energy Efficiency Ratio of the energy efficient equipment.
$IEER_{BASE}$ = Integrated Energy Efficiency Ratio of the baseline equipment.
$IEER_{EE}$ = Integrated Energy Efficiency Ratio of the energy efficient equipment.
$Hours_{Cool}$ = Annual Cooling Hours
Capadj = Capacity Adjustment Factor

Measure Life:

BC Measure ID	Measure Name	Program	Measure Life
E21C1c001 E21C2c001	Midstream Circulator Pump:	LBES Mid SBES Mid	15[7]
E21C1c002 E21C2c002	Midstream Demand Control Ventilation (DCV):	LBES Mid SBES Mid	10[8]
E21C1c004 E21C2c004	Midstream Dual Enthalpy Economizer Controls:	LBES Mid SBES Mid	10[9]
E21C1c007 E21C2c007	Midstream Unitary Air Conditioners:	LBES Mid SBES Mid	12[10]

Other Resource Impacts:

There are no other resource impacts for this measure.

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}
E21C1c001 E21C2c001	Midstream Circulator Pump	LBES Mid SBES Mid	1.00	0.86	0.86	0.86	0.86	0.82	0.05
E21C1c002 E21C2c002	Midstream Demand Control Ventilation (DCV)	LBES Mid SBES Mid	1.00	0.86	0.86	0.86	0.86	0.82	0.05
E21C1c004 E21C2c004	Midstream Dual Enthalpy Economizer Controls	LBES Mid SBES Mid	1.00	0.86	0.86	0.86	0.86	0.45	0.00
E21C1c007 E21C2c007	Midstream Unitary Air Conditioners	LBES Mid SBES Mid	1.00	0.86	0.86	0.86	0.86	0.45	0.00

In-Service Rates:

A

Realization Rates:

- Midstream Circulator Pump:
- Midstream Demand Control Ventilation (DCV): Realization Rates are from an impact evaluation 2006 HVAC installations and impact evaluation of 2007/2008 installations. [11]
- Midstream Dual Enthalpy Economizer Controls: Realization Rates same as Unitary AC.
- Midstream Unitary Air Conditioners: Energy RRs set to 1.00 based 2011 NEEP C&I Unitary HVAC Loadshape Project. [12]

Coincidence Factors:

- Midstream Circulator Pump: Not applicable for this measure since no electric savings are claimed.
- Midstream Demand Control Ventilation (DCV): CFs based on standard assumptions.
- Midstream Dual Enthalpy Economizer Controls: All PAs on-peak CFs based 2011 NEEP C&I Unitary AC Loadshape Project [13]
- Midstream Unitary Air Conditioners: CFs based 2011 NEEP C&I Unitary HVAC Loadshape Project.[14]

Energy Load Shape:

See [Appendix X]

Impact Factors for Calculating Net Savings):

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG

E21C1c001 E21C2c001	Midstream Circulator Pump	LBES Mid SBES Mid				
E21C1c002 E21C2c002	Midstream Demand Control Ventilation (DCV)	LBES Mid SBES Mid				
E21C1c004 E21C2c004	Midstream Dual Enthalpy Economizer Controls	LBES Mid SBES Mid				
E21C1c007 E21C2c007	Midstream Unitary Air Conditioners	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: The Cadmus Group (2017). Circulator Pump Technical Memo. Prepared for National Grid and Eversource engineers.
2: Detailed descriptions of the DCV Savings Calculation Tools are included in the TRM Library under the "C&I Spreadsheet Tools" folder.
3: Keena, Kevin (2008). Analysis of CO2 Control Energy Savings on Unitary HVAC Units. Prepared for National Grid
4: Keena, Kevin (2008). Analysis of CO2 Control Energy Savings on Unitary HVAC Units. Prepared for National Grid
5: Patel, Dinesh (2001). Energy Analysis: Dual Enthalpy Control. Prepared for Eversource (NSTAR).
6: Patel, Dinesh (2001). Energy Analysis: Dual Enthalpy Control. Prepared for Eversource (NSTAR).
7: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities
8: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1. Measure life is assumed to be the same as Enthalpy Economizer.
9: Energy & Resource Solutions (2005). Measure Life Study. Prepared for The Massachusetts Joint Utilities; Table 1-1
10:
11: KEMA (2011). 2007/2008 Large C&I Programs Final Report. Prepared for Western Massachusetts Electric Company.
12:
13: KEMA (2011). C&I Unitary HVAC Loadshape Project - Final Report. Prepared for the Regional Evaluation, Measurement & Verification Forum.
14:

2.56. **Midstream Food Service - Dishwasher**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Dishwasher High Temp: 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 Temp: 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:

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption (gal/rack)
High Temp Under Counter Dishwasher	0.76	1.09
High Temp Door Type Dishwasher	0.87	1.29
High Temp Single Tank Conveyer Dishwasher	1.93	0.87
High Temp Multi Tank Conveyer Dishwasher	2.59	0.97
High Temp Pots & Pans Dishwasher	1.20	0.70
Low Temp Under Counter Dishwasher	0.50	1.73
Low Temp Door Type Dishwasher	0.60	2.10
Low Temp Single Tank Conveyor Dishwasher	1.60	1.31
Low Temp Multi Tank Conveyor Dishwasher	2.00	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 as follows:

Dishwasher Type	Idle Energy Rate (kW)	Water Consumption (gal/rack)
High Temp Under Counter Dishwasher	0.50	0.86
High Temp Door Type Dishwasher	0.70	0.89
High Temp Single Tank Conveyer Dishwasher	1.50	0.70
High Temp Multi Tank Conveyer Dishwasher	2.25	0.54
High Temp Pots & Pans Dishwasher	1.20	0.58
Low Temp Under Counter Dishwasher	0.50	1.19
Low Temp Door Type Dishwasher	0.60	1.18
Low Temp Single Tank Conveyor Dishwasher	1.60	0.79
Low Temp Multi Tank Conveyor Dishwasher	2.00	0.54

Algorithms for Calculating Primary Energy Impact:

Dishwasher High Temp: Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator:
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 = Average annual equipment operating hours, see Hours section below.

BC Measure ID	**Measure Name**	**P**rogram	**ΔkW**	**ΔkWh**

E21C1c024 E21C2c024	High Temp Under Counter Dishwasher	LBES Mid SBES Mid	0.32	1,791
E21C1c020 E21C2c020	High Temp Door Type Dishwasher	LBES Mid SBES Mid	0.74	4,151
E21C1c023 E21C2c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid SBES Mid	0.75	4,243
E21C1c021 E21C2c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid SBES Mid	1.71	9,630
E21C1c022 E21C2c022	High Temp Pots & Pans Dishwasher	LBES Mid SBES Mid	0.18	1,032
E21C1c028 E21C2c028	Low Temp Under Counter Dishwasher	LBES Mid SBES Mid	0.39	2,178
E21C1c025 E21C2c025	Low Temp Door Type Dishwasher	LBES Mid SBES Mid	2.46	13,851
E21C1c027 E21C2c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid SBES Mid	2.07	11,685
E21C1c026 E21C2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid SBES Mid	2.86	16,131

Measure Life:

The measure life for a new high temperature dishwasher is given by type below [2.]:

BC Measure ID	**Measure Name**	**P**rogram	**Measure Life**
E21C1c024 E21C2c024	High Temp Under Counter Dishwasher	LBES Mid SBES Mid	10
E21C1c020 E21C2c020	High Temp Door Type Dishwasher	LBES Mid SBES Mid	15
E21C1c023 E21C2c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid SBES Mid	20
E21C1c021 E21C2c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid SBES Mid	20
E21C1c022 E21C2c022	High Temp Pots & Pans Dishwasher	LBES Mid SBES Mid	10
E21C1c028 E21C2c028	Low Temp Under Counter Dishwasher	LBES Mid SBES Mid	10
E21C1c025 E21C2c025	Low Temp Door Type Dishwasher	LBES Mid SBES Mid	15
E21C1c027 E21C2c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid SBES Mid	20

E21C1c026 E21C2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid SBES Mid	20

Other Resource Impacts:

Dishwasher high temp: There are water savings associated with this measure. [3]

Dishwasher Type	Annual water savings (gal/unit)
High Temp Under Counter Dishwasher	5,399
High Temp Door Type Dishwasher	35,056
High Temp Single Tank Conveyer Dishwasher	21,284
High Temp Multi Tank Conveyer Dishwasher	80,754
High Temp Pots & Pans Dishwasher	10,517
Low Temp Under Counter Dishwasher	12,677
Low Temp Door Type Dishwasher	80,629
Low Temp Single Tank Conveyor Dishwasher	65,104
Low Temp Multi Tank Conveyor Dishwasher	93,900

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}
E21C1c024 E21C2c024	High Temp Under Counter Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c020 E21C2c020	High Temp Door Type Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c023 E21C2c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c021 E21C2c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c022 E21C2c022	High Temp Pots & Pans Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c028 E21C2c028	Low Temp Under Counter Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c025 E21C2c025	Low Temp Door Type Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c027 E21C2c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90

BC Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1c026 E21C2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21C1c024 E21C2c024	High Temp Under Counter Dishwasher	LBES Mid SBES Mid				
E21C1c020 E21C2c020	High Temp Door Type Dishwasher	LBES Mid SBES Mid				
E21C1c023 E21C2c023	High Temp Single Tank Conveyer Dishwasher	LBES Mid SBES Mid				
E21C1c021 E21C2c021	High Temp Multi Tank Conveyer Dishwasher	LBES Mid SBES Mid				
E21C1c022 E21C2c022	High Temp Pots & Pans Dishwasher	LBES Mid SBES Mid				
E21C1c028 E21C2c028	Low Temp Under Counter Dishwasher	LBES Mid SBES Mid				
E21C1c025 E21C2c025	Low Temp Door Type Dishwasher	LBES Mid SBES Mid				
E21C1c027 E21C2c027	Low Temp Single Tank Conveyor Dishwasher	LBES Mid SBES Mid				
E21C1c026 E21C2c026	Low Temp Multi Tank Conveyor Dishwasher	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten

percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:

2.57. **Midstream Food Service - Fryer**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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 a standard sized fryer is a deep-fat fryer with a cooking energy efficiency of 75%, shortening capacity of up to 65 pounds, and idle energy rate of 1.05 kW. The baseline efficiency case for a large sized fryer is a deep-fat fryer with a cooking energy efficiency of 70%, shortening capacity of up to 100 pounds, and idle energy rate of 1.35 kW.

Gas Fryer: The baseline efficiency case is a non-Energy Star qualified fryer.

High Efficiency:

Electric Fryer: The high efficiency case for a standard sized fryer is a deep-fat fryer with a cooking energy efficiency of 80%, shortening capacity of up to 70 pounds, and idle energy rate of no more than 1.0 kW. For large capacity fryers (shortening capacity exceeds 70 pounds), the idle energy rate may be up to 1.1 kW.

Gas Fryer: The high efficiency case is an Energy Star qualified fryer.

Algorithms for Calculating Primary Energy Impact:

Electric Fryer: Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator:
$\Delta kWh = \Delta kWh$
$\Delta kW = \Delta kW / Hours$
Where:
ΔkWh = gross annual kWh savings from the measure per table below
ΔkW = gross average kW savings from the measure per table below
Hours = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Fryer [1, 2]

BC Measure ID	Measure Name	Program	ΔkW	ΔkWh	ΔMMBtu
E21C1c032 E21C2c032	Electric Fryer, Standard Vat	LBES Mid SBES Mid	0.50	2,976	
E21C1c031 E21C2c031	Electric Fryer, Large Vat	LBES Mid SBES Mid	0.50	2,841	
G21C1c004 G21C2c004	Gas Fryer	LBES Mid SBES Mid			78.3

Measure Life:

The measure life for a new commercial fryer 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}
E21C1c032 E21C2c032	Electric Fryer, Standard Vat	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c031 E21C2c031	Electric Fryer, Large Vat	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
G21C1c004 G21C2c004	Gas Fryer	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG

E21C1c032 E21C2c032	Electric Fryer, Standard Vat	LBES Mid SBES Mid				
E21C1c031 E21C2c031	Electric Fryer, Large Vat	LBES Mid SBES Mid				
G21C1c004 G21C2c004	Gas Fryer	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:

2.58. **Midstream Food Service - Griddle**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Electric Griddle: Installation of a qualified ENERGY STAR® griddle. ENERGY STAR® griddles save energy cooking and idle times due to improved cooking efficiency and idle energy rates.

Gas Griddle: Installation of a gas griddle with efficiency of 38%.

Baseline Efficiency:

Electric Griddle: The baseline efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 65%, production capacity of 35 pounds per hour, and idle energy rate of 400 W/sq. ft.

Gas Griddle: The baseline efficiency case is a standard efficiency (32% efficient) gas griddle.

High Efficiency:

Electric Griddle: The high efficiency case is a typically sized, 6 sq. ft. commercial griddle with a cooking energy efficiency of 70%, production capacity of 40 pounds per hour, and idle energy rate of 320 W/sq. ft.

Gas Griddle: The high efficiency case is a gas griddle with an efficiency of 38%.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the FSTC Commercial Kitchen Equipment Savings Calculator

BC Measure ID	Measure Name	Program	ΔkWh	ΔkW	Δmmbtu
E21C1c033 E21C2c033	Electric Griddle	LBES Mid SBES Mid	3,965	0.90	
G21C1c005 G21C2c005	Gas Griddle	LBES Mid SBES Mid			37.9

delkWh = SAVE x Width x Hours
delkW = SAVE x Width

Where:

ΔkWh = gross annual kWh savings from the measure. With default Width, average savings are 3,965 kWh.
ΔkW = gross average kW savings from the measure. With default Width, average savings are 0.90 kW.
SAVE = Savings per foot of griddle width: 0.15 kW/ft [1]
Width = Width of griddle in feet. Default of 3 feet.
Hours = Griddles are assumed to operate 313 days per year. The average griddle is assumed to operate 12 hours per day, or 3,756 hours per year. [2]

Measure Life:

The measure life for a new commercial griddle 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}
E21C1c033 E21C2c033	Electric Griddle	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	1.00	1.00
G21C1c005 G21C2c005	Gas Griddle	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21C1c033 E21C2c033	Electric Griddle	LBES Mid SBES Mid				
G21C1c005 G21C2c005	Gas Griddle	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1: ENERGY STAR Commercial Kitchen Equipment Savings Calculator: Griddle Calcs.< http://www.energystar.gov/buildings/sites/default/uploads/files/commercial_kitchen_equipment_calculator.xlsx >. Tool downloaded August 10, 2015.
2: The Energy Star Calculator default value of 365 days per year seems excessive. Though many or most restaurants operate 7 days per week, many institutional kitchens do not. 6 day operation is assumed. 365 * 6/7 = 313 days/yr for 12 hours per day, or 3,756 hours.
3: PG&E calculator: http://www.fishnick.com/saveenergy/tools/calculators/egridcalc.php

2.59. Midstream Food Service - Holding Cabinet

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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 half size HFHC.

Baseline Efficiency:

The baseline efficiency idle energy rate for a HFHC is 40 W for all sizes.

High Efficiency:

The high efficiency idle energy rate for HFHC is 294 W for full size, 258 W for 3/4 size, and 172 W for 1/2 size.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the FSTC Life Cycle Kitchen Equipment Savings Calculator:

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 = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Hot Food Holding Cabinets [1]

BC Measure ID	Equipment Type	Program		ΔkW	ΔkWh

E21C1c035 E21C2c035	Full Size – 20 cu.ft.	LBES Mid SBES Mid		0.50	2,737
E21C1c034 E21C2c034	3/4 Size – 12 cu.ft.	LBES Mid SBES Mid		0.20	1,095
E21C1c036 E21C2c036	1/2 Size – 8 cu.ft.	LBES Mid SBES Mid		0.20	1,095

Measure Life:

The measure life for a new commercial griddle is 12 years. [2]

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}
E21C1c035 E21C2c035	Hot Food Holding Cabinet Full Size	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.90	0.90
E21C1c034 E21C2c034	Hot Food Holding Cabinet 3/4 Size	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.90	0.90
E21C1c036 E21C2c036	Hot Food Holding Cabinet Half Size	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	0.90	0.90

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG

E21C1c035 E21C2c035	Hot Food Holding Cabinet Full Size	LBES Mid SBES Mid				
E21C1c034 E21C2c034	Hot Food Holding Cabinet 3/4 Size	LBES Mid SBES Mid				
E21C1c036 E21C2c036	Hot Food Holding Cabinet Half Size	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:

2.60. **Midstream Food Service - Ice Machine**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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.

High Efficiency:

The high efficiency case is a commercial ice machine meeting the ENERGY STAR® Efficiency Requirements.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Fishnick Commercial Kitchen Equipment Savings Calculator

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 = Average annual equipment operating hours, see Hours section below.

Energy Savings for Commercial Ice Machine [1:]

Equipment Type	kW	kWh
Ice Making Head	0.30	1,117
Self Contained Unit	0.30	805
Remote Condensing Unit (Batch)	0.30	2,601
Remote Condensing Unit (Continuous)	0.30	3,641

Measure Life:

The measure life for a new ice making machine is 8 years. [2]

Other Resource Impacts:

There are water savings associated with this measure [3]:

Dishwasher Type	Annual water savings (gal/unit)
Ice Making Head	3,322
Self Contained Unit	3,526
Remote Condensing Unit (Batch)	2,631
Remote Condensing Unit (Continuous)	0

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}
E21C1c037 E21C2c037	Ice Machine - Ice Making Head	LBES Mid SBES Mid	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1c038 E21C2c038	Ice Machine - Remote Cond./Split Unit - Batch	LBES Mid SBES Mid	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1c039 E21C2c039	Ice Machine - Remote Cond./Split Unit - Continuous	LBES Mid SBES Mid	1.00	1.00	1.00	1.00	1.00	0.9	0.9
E21C1c040 E21C2c040	Ice Machine - Self Contained	LBES Mid SBES Mid	1.00	1.00	1.00	1.00	1.00	0.9	0.9

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG

E21C1c037 E21C2c037	Ice Machine - Ice Making Head	LBES Mid SBES Mid				
E21C1c038 E21C2c038	Ice Machine - Remote Cond./Split Unit - Batch	LBES Mid SBES Mid				
E21C1c039 E21C2c039	Ice Machine - Remote Cond./Split Unit - Continuous	LBES Mid SBES Mid				
E21C1c040 E21C2c040	Ice Machine - Self Contained	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:

2.61. **Midstream Food Service - Oven**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Combination Oven, Electric Convection Oven, 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.

Combination Oven, Gas Convection Oven, Gas Conveyor Oven, Gas Rack Oven, Gas	Installation of High Efficiency Gas Ovens

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Baseline Efficiency:

Combination Oven, Electric Convection Oven, Electric	The baseline efficiency case is a convection oven with a cooking energy efficiency of 65%, production capacity of 90 pounds per hour, and idle energy rate of 2.0 kW. The baseline efficiency case for a combination oven is a commercial combination oven with a convection cooking energy efficiency of 72% with a production capacity of 79 pounds per hour for convection mode and 49% steam cooking energy efficiency, with a production capacity of 126 pounds per hour for steammode. Idle energy is assumed to be 1.3 kW for convection mode and 5.3 kW for steam mode.

Gas Ovens: The baseline efficiency case is a standard efficiency oven as follows.

Measure Name	Baseline Efficiency
Convection Oven, Gas	44%
Combination Oven, Gas	35%
Conveyor Oven, Gas	20% Heavy Load
Rack Oven, Gas	30%

High Efficiency:

Combination Oven, Electric Convection Oven, Electric	The high efficiency case is a convection oven with a cooking energy efficiency of 71%, production capacity of 90 pounds per hour, and idle energy rate of 1.6 kW. The high efficiency case for a combination oven is a commercial combination oven with a cooking energy efficiency of 76% with a production capacity of 119 pounds per hour for convection mode, and 55% cooking energy efficiency with a production capacity of 177 pounds per hour for steam mode, and idle energy rate of 1.3 kW for convection mode and 2.0 kW for steam mode.

Gas Ovens: High efficiency case is an oven that meets or exceeds the high efficiency ratings per oven type shown in table below.

Measure Name	Efficiency Requirement
Convection Oven	>= 46%
Combination Oven	>= 44%
Conveyer Oven	>= 42%
Rack Oven	>= 50%

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Energy Star Commercial Kitchen Equipment Savings Calculator and the Food Services Technology Center Life Cycle Cost Calculator:
ΔkWh = kWh
ΔkW = KWh / hours

Where:
ΔkWh = gross annual kWh savings from the measure. See table below.
ΔkW = gross average kW savings from the measure. See table below.
Hours = Annual hours of operation. See Hours section below.

Energy Savings for Commercial Ovens [1]

BC Measure ID	Equipment Type	Program	ΔkW	ΔkWh	Δmmbtu

E21C1c019 E21C2c019	Electric Full Size Convection Oven	LBES Mid SBES Mid	0.70	2,787	
E21C1c018 E21C2c018	Electric Combination Oven	LBES Mid SBES Mid	3.50	15,095	
G21C1c002 G21C2c002	Gas Convection Oven	LBES Mid SBES Mid			35.7 [2]
G21C1c001 G21C2c001	Gas Combination Oven	LBES Mid SBES Mid			110.3 [3]
G21C1c003 G21C2c003	Gas Conveyer Oven	LBES Mid SBES Mid			88.4 [4]
G21C1c007 G21C2c007	Gas Rack Oven	LBES Mid SBES Mid			211.3 [5]

Measure Life:

The measure life for a new commercial oven is 12 years. [6]

Other Resource Impacts:

Electric Ovens: There are no other resource impacts for these measures.

Combination Oven, Gas: Annual water savings of 65,700 gallons per unit.
There are no other resource impacts for the other gas oven 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}
E21C1c019 E21C2c019	Electric Convection Oven	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c018 E21C2c018	Electric Combination Oven	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
G21C1c002 G21C2c002	Gas Convection Oven	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1c001 G21C2c001	Gas Combination Oven	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1c003 G21C2c003	Gas Conveyer Oven	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a
G21C1c007 G21C2c007	Gas Rack Oven	LBES Mid SBES Mid	1.00	n/a	1.00	n/a	n/a	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21C1c019 E21C2c019	Electric Convection Oven	LBES Mid SBES Mid				
E21C1c018 E21C2c018	Electric Combination Oven	LBES Mid SBES Mid				
G21C1c002 G21C2c002	Gas Convection Oven	LBES Mid SBES Mid				
G21C1c001 G21C2c001	Gas Combination Oven	LBES Mid SBES Mid				
G21C1c003 G21C2c003	Gas Conveyer Oven	LBES Mid SBES Mid				
G21C1c007 G21C2c007	Gas Rack Oven	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:
3:
4:
5:
6:

2.62. **Midstream Food Service - Steam Cooker**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

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, with heavy-load cooking efficiency of at least 38%. 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 of 30%, pan production capacity of 23.3 pounds per hour, preheat energy of 1.5 kWh, and idle energy rate of 1.2 kW
Gas Steam Cooker: The baseline efficiency case is a non-energy star steamer.

High Efficiency:

Electric Steam Cooker: The High Efficiency case is an ENERGY STAR® electric steam cooker with a cooking energy efficiency of 50%, pan production capacity of 16.7 pounds per hour, preheat energy of 1.5 kWh, and an idle energy rate of 0.4 kW.

Gas Steam Cooker: The high efficiency case is an ENERGY STAR® qualified gas-fired steamer.

Algorithms for Calculating Primary Energy Impact:

Unit savings are deemed based on the Fishnick Energy Star Commercial Kitchen Equipment Savings Calculator: [1]

BC Measure ID	Measure Name	Program	ΔkWH	ΔkW	ΔMmbtu
E21C1c043 E21C2c043	Electric Steam Cooker	LBES Mid SBES Mid	30,156	6.89	
G21C1c008 G21C2c008	Gas Steam Cooker	LBES Mid SBES Mid			370.7

Quantity = Number of pans. Default of 3 pans.

Hours = Average annual equipment operating hours. See Hours section below.

Measure Life:

The measure life for a new steamer is 12 years. [2]

Other Resource Impacts:

Electric Steam Cooker: Per unit annual water savings of 139 gallons due to the improved cooking efficiency of the high efficiency equipment.

Gas Steam Cooker: Deemed annual water savings of 162,060 gallons per unit.

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}
E21C1c043 E21C2c043	Electric Steam Cooker	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
G21C1c008 G21C2c008	Gas Steam Cooker	LBES Mid SBES Mid	1.00	n/a	1.00	1.00	1.00	n/a	n/a

In-Service Rates:

Realization Rates:

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 X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2:

2.63. **Midstream Food Service - Freezer**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Installation of a qualified ENERGY STAR® freezer (glass or solid door).**Baseline Efficiency:**

The baseline efficiency case is a freezer with standard energy consumption.

High Efficiency:

The high efficiency case is an Energy Star rated freezer.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated and based on the Energy Star Commercial Kitchen Equipment Calculator.

High Efficiency Usage Calculation

Size Thresholds	Freezer
0 < V < 15 (Solid Door)	0.21 x V + 0.90 x D
15 < V < 30 (Solid Door)	0.12 x V + 2.248 x D
30 < V < 50 (Solid Door)	0.285 x V - 2.703 x D
50 < V (Solid Door)	0.142 x V + 4.445 x D
0 < V < 15 (Glass Door)	0.232 x V + 2.36 x D
15 < V < 30 (Glass Door)	0.232 x V + 2.36 x D
30 < V < 50 (Glass Door)	0.232 x V + 2.36 x D
50 < V (Glass Door)	0.232 x V + 2.36 x D

Baseline Usage Calculation

Size Thresholds	**Freezer**
All (Solid Door)	0.22 x V + 1.38 x D
All (Glass Door)	0.29 x V + 2.95 x D

Where:
kWh Savings = difference between baseline and HE calculations above.
kW Savings = kWh / H
V = volume in cubic feet

D = days (365)
H = hours (8,760)

Measure Life:

Measure Name	Measure Life
Freezer, Glass Door	12
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 Measure ID	Measure Name	Program	ISR	RR_E	RR_{NE}	RR_{SP}	RR_{WP}	CF_{SP}	CF_{WP}
E21C1c030 E21C2c030	Freezer, Glass Door	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c029 E21C2c029	Freezer, Solid Door	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21C1c030 E21C2c030	Freezer, Glass Door	LBES Mid SBES Mid				
E21C1c029 E21C2c029	Freezer, Solid Door	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1:

2.64. **Midstream Food Service - Pre-Rinse Spray Valve**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Retrofitting existing standard spray nozzles in locations where service water is supplied by natural gas fired hot water heater with new low flow pre-rinse spray nozzles with an average flow rate of 1.6 GPM.

Baseline Efficiency:

The baseline efficiency case is an existing efficiency spray valve.

High Efficiency:

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 and based on study results.[2]

BC Measure ID	Measure Name	Program	ΔMMBtu
G21C1c006 G21C2c006	Pre Rinse Spray Valve	LBES Mid SBES Mid	11.4

Measure Life:

The measure life steamer is 8 years. [3]

Other Resource Impacts:

There are water savings of 6,410 gallons per unit.[4]

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}
G21C1c006 G21C2c006	Pre Rinse Spray Valve	LBES Mid SBES Mid	1.00	0.86	1.00	0.86	0.86	n/a	n/a

In-Service Rates:

Realization Rates:

Coincidence Factors:

Not applicable for this measure since no electric savings are claimed.

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:

1:
2, 3, 4: DNV GL (2014). Impact Evaluation of Massachusetts Prescriptive Gas Pre-Rinse Spray Valves.

2.65. **Midstream Food Service - Refrigerator**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Lost Opportunity
Category	Food Service

Description:

Installation of a qualified ENERGY STAR® refrigerator(glass or solid door).

Baseline Efficiency:

The baseline efficiency case is a refrigerator with standard energy consumption.

High Efficiency:

The high efficiency case is an Energy Star rated refrigerator.

Algorithms for Calculating Primary Energy Impact:

Unit savings are calculated and based on the Energy Star Commercial Kitchen Equipment Calculator.

High Efficiency Usage Calculation

Size Thresholds	Refrigerator
0 < V < 15 (Solid Door)	0.022 x V + 0.97 x D
15 < V < 30 (Solid Door)	0.066 x V + 0.31 x D
30 < V < 50 (Solid Door)	0.04 x V + 1.09 x D
50 < V (Solid Door)	0.024 x V + 1.89 x D
0 < V < 15 (Glass Door)	0.095 x V + 0.445 x D
15 < V < 30 (Glass Door)	0.05 x V + 1.12 x D
30 < V < 50 (Glass Door)	0.076 x V + 0.34 x D
50 < V (Glass Door)	0.105 x V - 1.111 x D

Baseline Usage Calculation

Size Thresholds	Refrigerator
All (Solid Door)	0.05 x V + 1.36 x D
All (Glass Door)	0.10 x V + 0.86 x D

Where:
kWh Savings = difference between baseline and HE calculations above.

kW Savings = kWh / H
V = volume in cubic feet
D = days (365)
H = hours (8,760)

Measure Life:

BC Measure ID	Measure Name	Program	Measure Life
E21C1c041 E21C2c041	Refrigerator, Glass Door	LBES Mid SBES Mid	12
E21C1c042 E21C2c042	Refrigerator, Solid Door	LBES Mid SBES Mid	12

Other Resource Impacts:

There are no other resource impacts identified for this measure.

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}
E21C1c041 E21C2c041	Refrigerator, Glass Door	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90
E21C1c042 E21C2c042	Refrigerator, Solid Door	LBES Mid SBES Mid	1.00	0.86	n/a	0.86	0.86	0.90	0.90

In-Service Rates:

Realization Rates:

Coincidence Factors:

Energy Load Shape:

See [Appendix X]

Impact Factors for Calculating Net Savings:

BC Measure ID	Measure Name	Program	FR	SO_P	SO_{NP}	NTG
E21C1c041 E21C2c041	Refrigerator, Glass Door	LBES Mid SBES Mid				
E21C1c042 E21C2c042	Refrigerator, Solid Door	LBES Mid SBES Mid				

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1:

2.66. **HVAC - Heat Pump Systems**

Measure Code	[To Be Defined in ANB system]
Market	Commercial
Program Type	Retrofit/Lost Opportunity
Category	HVAC

Description:

[Measure description]

Baseline Efficiency:

The baseline efficiency case is [XXX].

High Efficiency:

The high efficiency case is [XXX].

Algorithms for Calculating Primary Energy Impact:

[Insert any deemed savings, algorithms, or other lookup tables such as hours that are needed to calculate savings. Add superscript numeric references for each source; list source(s) in the endnotes.]

Measure Life:

The table below includes [describe the measure life basis, e.g., effective useful life (EUL) or adjusted measure life (AML), note any adjustments made such as for LED market trends. Add superscript numeric references for each source; list source(s) in the endnotes.]

BC Measure ID	Measure Name	Program	Measure Life
	Ductless Mini Split Heat Pump	C1 - Large Business Energy Solutions	XX
	Ground Source Heat Pump	C1 - Large Business Energy Solutions	
	Water Source Heat Pump	C1 - Large Business Energy Solutions	
	Ductless Mini Split Heat Pump	C2 - Small Business Energy Solutions	
	Ground Source Heat Pump	C2 - Small Business Energy Solutions	
	Water Source Heat Pump	C2 - Small Business Energy Solutions	
	Ductless Mini Split Heat Pump	C3 - Municipal Energy Solutions	
	Ground Source Heat Pump	C3 - Municipal Energy Solutions	

Other Resource Impacts:

There are no other resource impacts identified for this measure. [If there are water savings, insert here in lieu of the prior sentence]

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}
	[Measure Name]	[Abbr]	X.XX	X.XX	n/a	X.XX	X.XX	X.XX	X.XX

In-Service Rates:

All installations have 100% in-service-rates since programs include verification of equipment installations. [If upstream or non-verified installation, describe source of ISR in lieu of the prior sentence]

Realization Rates:

Realization rates are based on [vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes]

Coincidence Factors:

Summer and winter coincidence factors are estimated using [method, vendor/study name/date; add superscript numeric reference and list source(s) in the endnotes].

Energy Load Shape:

See [Appendix X]

Non-Energy Impacts for Secondary Cost Test:

For the secondary Granite State Test, an adder of ten percent of the total electric, gas, and other fuel benefits will be applied. For measures in the Home Energy Assistance program, an additional adder of ten percent of total electric, gas, and other fuel benefits will be applied to reflect additional benefits accruing to low-income participants. Future application of measure-specific NEI values will be considered by the NH Benefit/Cost Working Group, per Commission Order No. 26,323, December 31, 2019.

Endnotes:
1: SOURCES/NOTES

HVAC - Steam Traps Surveys and Repairs

Appendix X: 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%
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%

Source: Navigant (2018). RES1 Demand Impact Model Update