Multifamily

Technical Reference Manual

Version 2016.1

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Efficiency Maine Trust
168 Capitol Street
Augusta, ME 04330
efficiencymaine.com

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Introduction

PURPOSE

The Efficiency Maine Trust Residential/Retail, Commercial and Multifamily Technical Reference Manuals (TRMs) provide documentation for the Trust's calculation of energy and demand savings from energy efficiency measures. Each TRM serves as a central repository and common point of reference for the methods, formulas, assumptions and sources that are used to estimate savings from energy efficiency measures, and provides a common platform for analyzing energy savings across measures and programs. The importance of the TRM is derived from the importance of energy and demand savings calculations, which are at the foundation of the Trust's program planning and management, cost-effectiveness analysis, program evaluation, Annual Report and ISO-NE Forward Capacity Market participation.

GENERAL FORMAT

The TRM is organized by end use and then by measure category, where a measure category may include one or more measures. Each measure category is presented in its own section as a measure characterization, which follows a standard format. The measure characterization includes: a measure overview; energy and demand savings algorithms; baseline assumptions; deemed parameter values or instructions for inputs to savings algorithms, measure life and measure costs; and impact factors for calculating adjusted gross savings and net savings. When there is a set of common values across measures, summary tables are provided at the end of the relevant section or in an appendix.

Where deemed savings values are specified, the Trust uses integer values when reporting in units of kWh, one decimal place when reporting in units of MMBtu, and three decimal places for all demand (kW) values.

GUIDANCE & COMMON ASSUMPTIONS

In using the Trust's TRMs, it is helpful to note the following:

- ***Gross savings****:* Algorithms are specified for *gross* savings. To calculate *adjusted gross* savings or *net* savings, impact factors that account verified measure performance (adjusted gross) and attribution (net) must be applied. The formulas used to calculate adjusted gross and net savings are described below.

- ***Annual savings****:* Algorithms are specified for *annual* savings. Unless otherwise noted, annual savings are assumed to be realized for each year of the measure life.

- ***Unit savings****:* Algorithms are specified for *per unit savings*. The Trust's program databases track and record the number of units delivered through the program.

- ***Meter-level savings****:* Savings are assumed to be the savings that occur at the customer's meter (or point of use for non-electric savings); line losses are not included in these calculations.

- ***Non-Electric Savings:*** When applicable, savings are counted for natural gas, oil, propane, kerosene, wood and/or water. The deemed unit savings, algorithms and assumptions for these non-electric impacts are described in the measure characterizations only for those measures for which those savings are counted. If a non-electric impact is not described for a measure, it can be assumed that no non-electric impacts are counted for that measure.

- ***In-Service Rate (ISR)****:* The in-service rate represents the percentage of program units which are installed or implemented. Unless otherwise stated in the measure-specific sections in this TRM, the ISR is set to 100% for the following reasons:

    - In the commercial sector, it is uncommon for customers to purchase equipment and not immediately install or use it.

- The Trust's non-retail programs include some level of verification of the measure purchase and/or installation. These verification procedures ensure that projects and savings are counted only for measures which are implemented.

- The effects of non-implemented units may be identified in the program impact evaluation and accounted for in the energy and demand realization rates.

- Direct install measures result in 100% installation rates.

- ***Coincidence factors (CF)****:* Coincidence factors are provided for the summer and winter on-peak periods 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:

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

- ***Life:*** Life refers to the effective useful life of the measure. It represents the equivalent number of years the savings are expected to be realized. Lifetime savings = annual savings * life. Measure life takes one or more of the following aspects into consideration: 1) projected equipment life, 2) documented equipment warranty, 3) measure persistence[1], and 4) savings persistence[2]. Life is set to represent a conservative estimate of the aggregate life of all measures of that type installed and not the characterization of the life of a single, specific installed measure.

- ***Deemed savings value vs. deemed savings algorithm****:* For some measures, deemed savings values are provided representing average savings per unit for the measure. The deemed savings value may be based directly on the results from an evaluation or other research study, or may be based on a set of deemed input parameters applied to the stated energy and demand savings algorithms. For other measures, deemed values are provided for only some of the parameters in the algorithm and actual values for a given measure are required to calculate savings. In these cases, project-specific (or "Actual") data recorded in the relevant program tracking database is used in combination with the TRM deemed parameters to compute savings.

- ***Project-specific ("Actual") data for Parameter Inputs****:* The savings methods for some measures specify "Actual" data for at least one of the input parameters. Actual data refers to values that are specific to the project. Unless otherwise stated, these actual project data should be collected and documented on the project application forms. For some measures, the TRM provides alternative values if the actual data is unknown.

- ***Data Sources for Deemed Parameter Inputs****:* Wherever possible, deemed parameter values and assumptions are based on Maine-specific research and data. When such data are not available, the TRM relies on relevant data sources from other areas within the U.S; in doing so, data sources from neighboring states and regions are prioritized. In some cases, engineering judgment and scaling for regional differences are used.

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[1] Measure persistence is a quantification of how long the measure will remain in place. Causes of reduced measure persistence include any activity that removes the measure or eliminates the savings such as equipment upgrade, refurbishment or renovation of the building, closure of a business, override of efficiency controls.
[2] Savings persistence is a quantification of how long the defined savings will remain. Causes of reduced savings persistence include a change to the baseline over the useful life of the measure so that future savings are less than first year savings and changes in usage behavior over time.

- ***Decision type***: The decision type describes the underlying scenario that is assumed for the savings calculation of a given measure. The decision type has implications for the baseline efficiency case and the measure cost assumptions as shown below.[3] For each energy efficiency measure, the TRM identifies the relevant decision type, or types, corresponding to the scenarios in which the given measure may be implemented.

Decision Type	Scenario	Baseline	Measure Cost
New Construction	Customer is in the market to purchase new equipment for a new construction or new capacity project or as part of a planned renovation or to add controls to improve the performance of new equipment	Federal standards or standard market practice for new equipment	Incremental cost: difference between the cost of baseline and cost of high-efficiency equipment
Replace on Burnout	Customer is in the market to purchase new equipment to replace existing equipment that has worn out or otherwise needs replacing	Federal standards or standard market practice for new equipment	Incremental cost: difference between the cost of baseline and cost of high-efficiency equipment
Retrofit	Customer's existing equipment is in working order and has remaining useful life or is adding controls to improve the performance of operating equipment in an existing facility.	Existing equipment or conditions	Full measure cost: cost of the high-efficiency equipment (including installation)

- ***Efficiency standards****:* The TRM anticipates the effects of changes in efficiency standards for some measures, including shifts in the baseline for CFL and LED bulbs due to changes in Federal Standards for lighting products under the Energy Independence & Security Act of 2007 (EISA).

- ***TRM Updates****:* The TRMs are reviewed and updated annually, or more frequently if needed, to reflect new information obtained through research and evaluation studies, changes in program offerings (measures) and shifts in technology and baselines. Annual updates to the TRM are published as a new version (Version YYYY.1) with a specific effective date. Inter-year updates to the TRM are published as iterations to the version year (Version YYYY.x) with changes and effective date indicated.

SAVINGS FORMULAS

The formulas and inputs used to calculate the deemed gross annual energy (ΔkWh/yr) and gross demand (ΔkW) savings for each measure are described in the measure sections. The formulas used to calculate adjusted gross savings, on-peak demand savings, and lifetime savings are described below:

Adjusted Gross Savings

Adjusted gross savings represent the total energy and demand savings achieved by measures implemented through the Trust's programs. The adjusted gross savings values are calculated by applying various evaluation parameters to the gross annual energy and demand savings:

[3] Table adapted from National Action Plan for Energy Efficiency (2008). Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers. Energy and Environmental Economics, Inc. and Regulatory Assistance Project. <http://www.epa.gov/eeactionplan>

Adjusted Gross Annual kWh = ΔkWh/yr × ISR × RR_E

Adjusted Gross Lifetime kWh = ΔkWh/yr × ISR × RR_E × Measure Life

Adjusted Gross Annual MMBtu[4] = ΔMMBtu/yr × ISR × RR_E

Adjusted Gross Lifetime MMBtu[4] = ΔMMBtu/yr × ISR × RR_E × Measure Life

Adjusted Gross Summer On-Peak kW = ΔkW × ISR × RR_D × CF_S

Adjusted Gross Winter On-Peak kW = ΔkW × ISR × RR_D × CF_W

The Adjusted Gross Summer On-Peak kW value is equivalent to the the Demand Reduction Value reported to the ISO-NE Forward Capacity Market.

Net Savings

Net Savings represent the total realized energy and demand savings that are attributable to the Trust's programs. These net savings are calculated by applying the net-to-gross (NTG) factors such as free-ridership and spillover to the adjusted gross savings.

Net Annual kWh = ΔkWh/yr × ISR × RR_E × (1 – FR + SO)

Net Lifetime kWh = ΔkWh/yr × ISR × RR_E × (1 – FR + SO) × Measure Life

Net Summer On-Peak kW = ΔkW × ISR × RR_D × CF_S × (1 – FR + SO)

Net Winter On-Peak kW = ΔkW × ISR × RR_D × CF_W × (1 – FR + SO)

**The parameter (1 - FR + SO) may be replaced with the net-to-gross (NTG) ratio.*

SAVINGS CALCULATIONS

The actual calculation of energy efficiency savings, pursuant to the algorithms and assumptions documented in the TRM, occurs in the Trust's program tracking databases. In 2012, the Trust initiated a significant effort to upgrade and transform its existing program-specific databases into a comprehensive, unified database system that supports multiple programs with standardized internal processes, features and quality. This initiative builds on the foundation of the successful Efficiency Maine Reporting and Tracking (effRT) database system that historically supported the Business Programs to create a new multi-program database system, effRT 2.0. As part of this effort, the Trust is mapping the TRM deemed values and algorithms into effRT, and establishing processes for updates to effRT to coincide with TRM updates.

As of January 1, 14, the Trust added adjustment factors for the in-service rate (ISR) and the evaluated realization rate (RR) to the formulas used to calculate the demand reduction value (DRV) for Forward Capacity Market (FCM) monthly reporting. Results using these two additional factors are referred to as *Adjusted Gross Savings* in the effRT report.

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[4] In this document and other reporting documents, fossil fuel savings are reporting in unit of MMBtu. In the tracking data base (effRT), natural gas savings are calculated in units of therms and then must be converted to MMBtu.

TRM Change Log

Change Type	TRM Section	Description	Effective Date	effRT update
Revision	All	Incorporation of Multifamily Efficiency Program measures into standard TRM format	7/1/2014	Y
Revision	Appendix B	Coincidence Factors and Energy Period Factors for air sealing, insulation and programmable thermostat updated to reflect residential ductless heat pump usage profile.	7/1/2014	Y
Other	Prescriptive Lighting: Lighting Fixtures – Multifamily (Retrofit)	Moved Multifamily Lighting measures from Commercial TRM to Multifamily TRM	1/1/2015	N
New	Prescriptive Lighting: Lighting Fixtures – Multifamily (New Construction)	Leveraged Commercial new construction lighting measures for multifamily new construction	1/1/2015	Y
Other	Introduction	Updated TRM Update section. Inter-year updates will be released as iterations of the complete document.	11/30/2014	N
Revision	Multifamily Boiler or Furnace, Programmable Thermostats, High Efficiency Water Heater	Added New Construction to project type	1/1/2015	Y
New	Ductless Heat Pump New Construction	New measure added for multifamily for ductless heat pumps for new construction and gut rehabs	1/1/2015	Y
Correction	Ductless Heat Pump Retrofit	Adjusted modeling to account for multifamily unit annual heat loss. This correction is applied retroactively to 1 July 2014.	7/1/2014	Y
Revision	Prescriptive Lighting	Updated interactive effect factors	7/1/2015	Y
Correction	Insulation Measures	Added conversion factor to algorithm to convert from Therms to MMBTU. EffRT already reflected the correct units	7/1/2015	N
Revision	Multiple	Updated Btu per Wh conversion factor from 3.413 to 3.412	7/1/2015	Y

Change Type	TRM Section	Description	Effective Date	effRT update
Revision	Multiple	Updated Btu per kWh conversion factor from 3413 to 3412	7/1/2015	Y
Revision	Ductless Heat Pump	Updated to reflect refined assumptions and modeling	7/1/2015	Y
Other	Ductless Heat Pump Retrofit	Measure removed	7/1/2015	Y
New	Ductless Heat Pump Retrofit Low Income	New measure added for income eligible multifamily ductless heat pump due to operational differences observed during Low Income Weatherization Evaluation	7/1/2015	Y
Revision	Low Flow Faucet Aerator, Low Flow Showerhead	Updated assumptions and corrected calculation	7/1/2015	Y
Revision	Appendix B	Updated coincidence factors and energy period factors for new and modified measures	7/1/2015	Y
Other	Appendix: Carbon Dioxide Emission Factors	Added carbon dioxide emission factors table	7/1/2015	N
Revision	Prescriptive Lighting Measure Cost	Lighting measure costs updated	7/1/2015	Y
Revision	S11	New wattage sub-division added	7/1/2015	Y

Correction: indicates a correction to an existing error in the previous TRM.
New: indicates a measure that was not included in the previous TRM
Revision: indicates a revision to the savings or costs of an existing measure
Other: indicates a change to an existing measure or existing text and that does not affect savings or cost calculation

Multifamily Efficiency

Prescriptive Lighting: Lighting Fixtures – Multifamily (Retrofit), Code ML10, ML10.1, ML15, ML15.1, ML25, ML30, ML30.1, ML32, ML32.1, ML35, MS20, MS50, MS10, MS12, MS14, MS22, MS8, MX10	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the replacement of existing inefficient lighting fixtures with new high-efficiency lighting fixtures in the common areas, individual units, and exterior spaces for multifamily buildings.
Primary Energy Impact	Electric
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Lighting
Project Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE} / 1000) \times WHF_d$
Annual Energy Savings	$\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE} / 1000) \times HoursYr \times WHF_{e,cool}$ $\Delta MMBtu/yr = -(Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursYr \times WHF_{e,heat}$
Definitions	Unit = Lighting fixture upgrade measure Qty_{BASE} = Quantity of baseline fixtures Qty_{EE} = Quantity of installed fixtures $Watts_{BASE}$ = Watts of baseline fixture (based on the specified existing fixture type) (Watts) $Watts_{EE}$ = Watts of Energy efficient fixture (based on the specified installed fixture type) (Watts) HoursYr = Annual operating hours (hrs/yr) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting[5] $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting[5] $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting[5] 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline	Existing incandescent or fluorescent light fixtures
High Efficiency	High efficiency CFL or LED fixtures

PARAMETER VALUES

Measure/Type	Qty_{BASE}	$Watts_{BASE}$	Qty_{EE}	$Watts_{EE}$	HoursYr	Life (yrs)	Cost ($)
Retrofit	Actual	Table 21[6]	Actual	Table 19[7]	Table 24[8]	13[9]	Table 23[10]
Measure/Type	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$				
Retrofit	1.067[11]	1.198[11]	0.00246[11]				

[5] Waste heat factors are only applied to interior lighting measures.
[6] See Appendix E. The baseline fixture wattage is based on the specified baseline fixture type.
[7] See Appendix E. The installed fixture wattage is based on the specified installed fixture type.
[8] See Appendix G. The annual hours of use are based on the specified space type.
[9] GDS Associates, Inc., Residential and Commercial/Industrial Lighting and HVAC Measures Prepared for The New England State Program Working Group (SPWG), June 2007 and the 2005 Measure Life Study Report prepared for The Massachusetts Joint Utilities, by ERS and the 2005 *Measure Life Study Report* prepared for The Massachusetts Joint Utilities, by ERS
[10] See Appendix F.
[11] Analysis performed by Cadmus June 2015 based on 2015 NY TRM, Appendix D. HVAC Interactive Effects Multipliers.

Prescriptive Lighting: Lighting Fixtures – Multifamily (Retrofit), Code ML10, ML10.1, ML15, ML15.1, ML25, ML30, ML30.1, ML32, ML32.1, ML35, MS20, MS50, MS10, MS12, MS14, MS22, MS8, MX10							
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Multifamily Efficiency	100%	107%[12]	100%[13]	Table 2[14]	Table 2[14]	11.0%[15]	1.0%[15]

[12] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; realization rates are based on weighted average results from the evaluation, adjusted for each measure group and program tracking changes. See workbook: MEP_EvaluationAdjustments.

[13] Demand impacts have not been evaluated for the multifamily program. Until the next program evaluation, EMT assumes 100% realization rate.

[14] See Appendix B: Load Shapes and Coincidence Factors

[15] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 4-5.

Prescriptive Lighting: Lighting Fixtures – Multifamily (New Construction), Code ML16, ML31, ML33, ML35, MS11, MS13, MS15, MS21, MS23, MS51	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency lighting fixtures instead of new standard efficiency fixtures.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Multifamily Efficiency Program
End-Use	Lighting
Project Type	New Construction, Replace on Burnout
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For lighting power density based new construction/ROB measures (ML16, ML31, ML33, ML35, MS15, MS21, MS51):* [16] $\Delta kW = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times WHF_d$ *For wattage reduction based new construction/ROB measures (MS11, MS13, MS23):* [16] $\Delta kW = Qty_{EE} \times SAVE_{EE} / 1000 \times WHF_d$
Annual Energy Savings	*For lighting power density based new construction/ROB measures (ML16, ML31, ML33, ML35, MS15, MS21, MS51):* [16] $\Delta kWh/yr = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursYr \times WHF_{e,cool}$ $\Delta MMBtu/yr = -(LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursYr \times WHF_{e,heat}$ *For wattage reduction based new construction/ROB measures (MS11, MS13, MS23):* [16] $\Delta kWh/yr = Qty_{EE} \times SAVE_{EE} / 1000 \times HoursYr \times WHF_{e,cool}$
Definitions	Unit = Lighting fixture upgrade measure Qty_{EE} = Quantity of energy efficient fixtures $Watts_{EE}$ = Watts of energy efficient fixture (based on the specified installed fixture type) (Watts) $SAVE_{EE}$ = Average wattage reduction of fixture (based on the specified installed fixture type) (Watts) LPD_{BASE} = Baseline maximum lighting power density (LPD) for space type (Watts/ft^2) Area = Area of the building or space associated with the design LPD_{BASE} value (ft^2) HoursYr = Annual hours of equipment operation (hrs/year) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting[17] $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting[17] $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting[17] 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline is represented by building code or standard design practice for the building or space type.
High Efficiency	High-efficiency lighting system that exceeds building code.

[16] The LPD baseline approach is not used for parking lot, wall pack, spot, track or task lighting. For those measures, the savings are based on average per fixture wattage reduction.
[17] Waste heat factors are only applied to interior lighting measures.

Prescriptive Lighting: Lighting Fixtures – Multifamily (New Construction), Code ML16, ML31, ML33, ML35, MS11, MS13, MS15, MS21, MS23, MS51						
PARAMETER VALUES						
Measure/Type	Qty_{EE}	$Watts_{EE}$		$SAVE_{EE}$	Area	LPD_{BASE}
Lighting – NC/ROB	Actual	Table 19[18]		Table 20[18]	Actual	Table 22[18]
Measure/Type	HoursYr	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$	Life (yrs)	Cost ($)
Lighting – NC/ROB	Table 24[19]	1.067[20]	1.198[20]	0.00246[20]	15[21]	Table 23[22]

IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[23]	101%[23]	Table 2[24]	Table 2[24]	28%[25]	0.4%[26]

[18] See Appendix E. The fixture wattage and wattage reduction values are based on the specified fixture type. The baseline LPD is based on the specified space type.
[19] See Appendix G. The annual hours of use are based on the specified space type.
[20] Analysis performed by Cadmus June 2015 based on 2015 NY TRM, Appendix D. HVAC Interactive Effects Multipliers.
[21] GDS Associates, Inc., Residential and Commercial/Industrial Lighting and HVAC Measures Prepared for The New England State Program Working Group (SPWG), June 2007 and the 2005 Measure Life Study Report prepared for The Massachusetts Joint Utilities, by ERS and the 2005 *Measure Life Study Report* prepared for The Massachusetts Joint Utilities, by ERS
[22] See Appendix F.
[23] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Values for prescriptive measures.
[24] See Appendix B: Load Shapes and Coincidence Factors.
[25] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[26] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Lighting: Lighting Controls – Multifamily, Code ML70, ML71	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the installation of lighting controls on new or existing interior lighting fixtures in the common areas, individual units, or exterior spaces for multifamily buildings.
Primary Energy Impact	Electric
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Lighting
Project Type	Retrofit, New Construction, Replace on Burnout
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = Qty_{FIXTURES} \times Watts / 1000 \times WHF_d$
Annual Energy Savings	$\Delta kWh/yr = Qty_{FIXTURES} \times Watts / 1000 \times HoursYr \times SVG \times WHF_{e,cool}$ $\Delta MMBtu/yr = -Qty_{FIXTURES} \times Watts / 1000 \times HoursYr \times SVG \times WHF_{e,heat}$
Definitions	Unit = Lighting control project or space $Qty_{FIXTURES}$ = Total quantity of fixtures connected to the new controls Watts = Wattage per fixture connected to the new control (Watts) HoursYr = Annual hours of equipment operation before installation of controls (hrs/year) SVG = % of annual lighting energy saved by lighting control (%) WHF_d = Waste heat factor for demand to account for cooling savings from reduced run time $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from reduced run time $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heat load from reduced run time 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case is a manual switch in the absence of controls.
High Efficiency	Lighting controls that automatically control the connected lighting systems.

PARAMETER VALUES

Measure/Type	Qty	Watts[27]	HoursYr	SVG	Life (yrs)	Cost ($)
All	Actual	Table 19 or Table 21	Table 24[28]	Table 25[28]	9[29]	Table 23[30]

Measure/Type	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$				
Retrofit	1.067[20]	1.198[20]	0.00246[20]				

IMPACT FACTORS

Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Multifamily	100%	107%[31]	100%[32]	Table 2[33]	Table 2[33]	11.0%[34]	1.0%[34]

[27] See Appendix E. The controlled fixture may be selected from either the baseline or installed wattage tables. The controlled wattage is determined using the wattage tables and the selected of controlled fixture type.
[28] See Appendix G. The annual hours of use and savings factors are based on the specified space type.
[29] GDS Associates, Inc., Residential and Commercial/Industrial Lighting and HVAC Measures Prepared for The New England State Program Working Group (SPWG), June 2007 and the 2005 Measure Life Study Report prepared for The Massachusetts Joint Utilities, by ERS.
[30] Appendix F.
[31] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; realization rates are based on weighted average results from the evaluation, adjusted for each measure group and program tracking changes. See workbook: MEP_EvaluationAdjustments.
[32] Demand impacts have not been evaluated for the multifamily program. Until the next program evaluation, EMT assumes 100% realization rate.
[33] See Appendix B: Load Shapes and Coincidence Factors.
[34] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 4-5.

Multifamily Air Sealing	
Last Revised Date	7/1/2014 (added to TRM for PY15)
MEASURE OVERVIEW	
Description	This measure involves sealing air leaks in the building envelop walls to decrease overall heating and cooling losses by natural air infiltration. Energy savings are achieved by reducing building heating and cooling loads that are served by the heating and cooling equipment.
Energy Impacts	Electric, Natural Gas, Oil, Propane, Wood, Kerosene
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating, Cooling
Decision Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings Annual energy savings	*Energy and Demand savings are based on project specific data and are counted for the specific heating and cooling fuels for the multifamily building.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	*For low-rise multifamily buildings (3 stories or less):* $\Delta kW = (CFM50_{PRE} - CFM50_{POST}) / NF \times DSF_{LR}$ *For high-rise multifamily buildings (4 or more stories):* $\Delta kW = SQFT / 1{,}000 \times DSF_{HR}$
Annual Energy savings	*For low-rise multifamily buildings (3 stories or less, with maximum 20 apartment units):* $\Delta kWh = (CFM50_{PRE} - CFM50_{POST}) / NF \times EESF_{LR}$ $\Delta MMBtu = (CFM50_{PRE} - CFM50_{POST}) / NF \times HFSF_{LR}$ *For high-rise multifamily buildings (4 or more stories, with maximum 20 apartment units):* $\Delta kWh = SQFT / 1{,}000 \times EESF_{HR}$ $\Delta MMBtu = SQFT / 1{,}000 \times HFSF_{HR}$
Definitions	Unit = air-sealing project for a multifamily building $CFM50_{PRE}$ = Pre-upgrade infiltration value $CFM50_{POST}$ = Post-upgrade infiltration value NF = Correction factor from CFM50 to natural infiltration rate SQFT = Floor area of conditioned facility (ft^2) DSF_{LR} = Demand savings factor for air sealing in low-rise MF building (kW/CFM) DSF_{HR} = Demand savings factor for air sealing in high-rise MF building (kW/1000-ft^2) $EESF_{LR}$ = Electric energy savings factor for air sealing in low-rise MF building (kWh/CFM) $EESF_{HR}$ = Electric energy savings factor for air sealing in high-rise MF building (kWh/1000-ft^2) $HFSF_{LR}$ = Heating fuel savings factor for air sealing in low-rise MF building (MMBtu/CFM) $HFSF_{HR}$ = Heating fuel savings factor for air-sealing in high-rise MF building (MMBtu/1000-ft^2)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case is the existing multifamily building before the air-sealing project. For low-rise buildings, the program contractor will measure the pre-retrofit air leakage ($CFM50_{PRE}$).
Efficient Measure	The high-efficiency case is the building after the air-sealing project. For low-rise buildings, the program contractor will measure the post-retrofit air leakage ($CFM50_{POST}$).

Multifamily Air Sealing								
PARAMETER VALUES (DEEMED)								
Measure/Type	$CFM50_{PRE}$	$CFM50_{POST}$	SQFT	NF	DSF	EESF	HFSF	Life (yrs)	Cost ($)
Air Sealing	Actual	Actual	Actual	15[35]	Table 3 Table 4	Table 3 Table 4	Table 3 Table 4	15[35]	$247.86[36]

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Air Sealing	100%[37]	69.5%[38]	100%[38]	10.2%[39]	79.6%[39]	11.0%[40]	1.0%[40]

[35] Two story building with normal wind exposure in climate zone 2. Sherman, "Estimation of Infiltration for Leakage and Climate Indicators," Energy and Buildings, 10, 1987.
[36] Per dwelling unit costs based on program data from PY 2014.
[37] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[38] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu); $RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[39] Efficiency Maine Commercial Technical Reference Manual 2014.1; the measure's savings follow the heating and cooling consumption loadshape. Therefore, the coincidence factors for the measure are assumed to be the same as the coincidence factors for the heat pump measure.
[40] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Multifamily Attic/Roof Insulation	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves improving the thermal resistance of the building envelope by upgrading the insulation in existing attic/roof constructions to higher total R-value. Energy savings are achieved by reduced heating and cooling loads.
Energy Impacts	Electric, Natural Gas, Oil, Propane, Kerosene, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating, Cooling
Project Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings Annual energy savings	*Energy and Demand savings are based on project specific data and are counted for the specific heating and cooling fuels for the multifamily building.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	ΔkW = SQFT / 1,000 x DSF
Annual Energy savings	ΔkWh = SQFT / 1,000 x EESF ΔMMBtu = SQFT / 1,000 x HFSF/10
Definitions	Unit = attic insulation project SQFT = Surface area of installed insulation (= Area must be ≥ 500 ft^2) $RVAL_{PRE}$ = R-value of existing insulation $RVAL_{POST}$ = Combined R-value of final insulation DSF = Demand savings factor from attic insulation in a multifamily building (kW/1000-ft^2) EESF = Electric energy savings factor from attic insulation in a multifamily building (kWh/1000-ft^2) HFSF = Heating fuel savings factor from attic insulation in a multifamily building (Therms/1000-ft^2) 10 = Conversion factor: 10 = Therms/MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline condition is the existing insulation with air-sealing measures already implemented (per program requirements).
Efficient Measure	The efficiency measure involves increasing insulation for at least 500 ft^2 area to meet the state energy code (IECC 2009).

PARAMETER VALUES (DEEMED)

Measure/Type	SQFT	$RVAL_{PRE}$	$RVAL_{POST}$	DSF	EESF	HFSF	Life (yrs)	Cost ($)
Insulation	Actual	Actual	Actual	Table 6 Table 7 Table 8 Table 9	Table 6 Table 7 Table 8 Table 9	Table 6 Table 7 Table 8 Table 9	20[41]	$775.32[42]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Insulation	100%[43]	69.9%[44]	100%[45]	10.2%[46]	79.6%[46]	11.0%[47]	1.0%[47]

[41] Measure life for this measure is assumed to be 20 years for consistency with other Efficiency Maine programs; business programs cap all measure lives at 20 years.
[42] Per dwelling unit costs based on program data from PY 2014.
[43] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[44] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu); $RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[45] Demand savings for this measure has not been evaluated yet. Until the next program impact evaluation, EMT assumes 100% realization rate.

Multifamily Wall Insulation	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves improving the thermal resistance of the building envelope by upgrading the insulation in existing wall constructions to higher total R-value. Energy savings are achieved by reduced heating and cooling loads. Insulation of other building components is not covered under this measure.
Energy Impacts	Electric, Natural Gas, Oil, Propane, Kerosene, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating, Cooling
Project Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings Annual energy savings	*Energy and Demand savings are based on project specific data and are counted for the specific heating and cooling fuels for the multifamily building.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	$\Delta kW = SQFT / 1{,}000 \times DSF$
Annual Energy savings	$\Delta kWh = SQFT / 1{,}000 \times EESF$ $\Delta MMBtu = SQFT / 1{,}000 \times HFSF/10$
Definitions	Unit = wall insulation project SQFT = Surface area of installed insulation $RVAL_{PRE}$ = R-value of existing insulation $RVAL_{POST}$ = Combined R-value of final insulation DSF = Demand savings factor from wall insulation in a multifamily building ($kW/1000\text{-}ft^2$) EESF = Electric energy savings factor from wall insulation in a multifamily building ($kWh/1000\text{-}ft^2$) HFSF = Heating fuel savings factor from wall insulation in a multifamily building ($Therms/1000\text{-}ft^2$) 10 = Conversion factor: 10 = Therms/MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline condition is the existing insulation with air sealing implemented (per program requirements).
Efficient Measure	The efficiency measure involves increasing insulation to meet the state energy code (IECC 2009).

PARAMETER VALUES (DEEMED)

Measure/Type	SQFT	$RVAL_{PRE}$	$RVAL_{POST}$	DSF	EESF	HFSF	Life (yrs)	Cost ($)
Insulation	Actual	Actual	Actual	Table 10 Table 11 Table 12 Table 13	Table 10 Table 11 Table 12 Table 13	Table 10 Table 11 Table 12 Table 13	20[48]	526.95[49]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Insulation	100%[50]	69.3%[51]	100%[52]	10.2%[53]	79.6%[53]	11.0%[54]	1.0%[54]

[46] Efficiency Maine Commercial Technical Reference Manual 2014.1; the measure's savings follow the heating and cooling consumption loadshape. Therefore, the coincidence factors for the measure are assumed to be the same as the coincidence factors for the heat pump measure.
[47] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.
[48] Measure life for this measure is assumed to be 20 years for consistency with other Efficiency Maine programs; business programs cap all measure lives at 20 years.
[49] Per dwelling unit costs based on program data from PY 2014.
[50] EMT assumes that all purchased units are installed (i.e. ISR = 100%).

Multifamily Floor Insulation	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves improving the thermal resistance of the building envelope by upgrading the insulation in existing floor constructions to higher total R-value. Energy savings are achieved by reduced heating and cooling loads.
Energy Impacts	Electric, Natural Gas, Oil, Propane, Kerosene, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating, Cooling
Project Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings	*Energy and Demand savings are based on project specific data and are counted for the specific heating and cooling fuels for the multifamily building.*
Annual energy savings	
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	$\Delta kW = SQFT / 1,000 \times DSF$
Annual Energy savings	$\Delta kWh = SQFT / 1,000 \times EESF$ $\Delta MMBtu = SQFT / 1,000 \times HFSF/10$
Definitions	Unit = floor insulation project SQFT = Surface area of installed insulation $RVAL_{PRE}$ = R-value of existing insulation $RVAL_{POST}$ = Combined R-value of final insulation DSF = Demand savings factor from floor insulation in a multifamily building (kW/1000-ft^2) EESF = Electric energy savings factor from floor insulation in a multifamily building (kWh/1000-ft^2) HFSF = Heating fuel savings factor from floor insulation in a multifamily building (Therms/1000-ft^2) 10 = Conversion factor: 10 = Therms/MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline condition is the existing insulation with air sealing implemented (per program requirements).
Efficient Measure	The efficiency measure involves increasing insulation to meet the state energy code (IECC 2009).
PARAMETER VALUES (DEEMED)	

Measure/Type	SQFT	$RVAL_{PRE}$	$RVAL_{POST}$	DSF[55]	EESF[55]	HFSF[55]	Life (yrs)	Cost ($)
Insulation	Actual	Actual	Actual	Table 10 Table 11 Table 12 Table 13	Table 10 Table 11 Table 12 Table 13	Table 10 Table 11 Table 12 Table 13	20[56]	468.54[57]

[51] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu);
$RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[52] Demand savings for this measure has not been evaluated yet. Until the next program impact evaluation, EMT assumes 100% realization rate.
[53] Efficiency Maine Commercial Technical Reference Manual 2014.1; the measure's savings follow the heating and cooling consumption loadshape. Therefore, the coincidence factors for the measure are assumed to be the same as the coincidence factors for the heat pump measure.
[54] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.
[55] Assumed to be the same as savings factors for wall insulation measure
[56] Measure life for this measure is assumed to be 20 years for consistency with other Efficiency Maine programs; business programs cap all measure lives at 20 years.
[57] Per dwelling unit costs based on program data from PY 2014.

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Insulation	100%[58]	69.0%[59]	100%[60]	10.2%[61]	79.6%[61]	11.0%[62]	1.0%[62]

[58] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[59] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu);
$RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[60] Demand savings for this measure has not been evaluated yet. Until the next program impact evaluation, EMT assumes 100% realization rate.
[61] Efficiency Maine Commercial Technical Reference Manual 2014.1; the measure's savings follow the heating and cooling consumption loadshape. Therefore, the coincidence factors for the measure are assumed to be the same as the coincidence factors for the heat pump measure.
[62] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Multifamily Boiler or Furnace Retrofit/Replacement	
Last Revised Date	1/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new high-efficiency condensing and non-condensing boilers and furnaces to replace the existing heating equipment. For this prescriptive measure, the new equipment is assumed to be the same type (boiler or furnace) and have the same capacity and heating fuel. (Fuel switching projects are processed through the custom approach.)
Energy Impacts	Natural Gas, Oil, Propane, Kerosene, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating
Decision Type	Retrofit, New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings	$\Delta kW = 0$
Annual energy savings	*Energy savings are based on project specific data.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	$\Delta kW = 0$
Annual Energy savings	$\Delta kWh/yr = 0$ $\Delta MMBtu/yr = CAP_{INPUT} / 1,000 \times (EF_{EE} / EF_{BASE} - 1) \times EFLH_{HEAT}$
Definitions	Unit = 1 high efficiency heating system CAP_{INPUT} = Input heating capacity of the new equipment (MBtu/h) $EFLH_{HEAT}$ = Full load heating hours defined as the total annual fuel consumption of the equipment divided by its full load heating capacity (in Btu/yr and Btu/h, respectively). EF_{EE} = Rated efficiency of the new high-efficiency equipment EF_{BASE} = Rated efficiency of the existing heating equipment. If the efficiency of the existing equipment is unknown, use 84% as a default. 1,000 = Conversion factor: 1,000 = MBtu/MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case for retrofit is the existing furnace or boiler. The baseline case for new construction/replace on burnout is boiler/furnace that meets the federal minimum of 84% AFUE for an oil boiler.
Efficient Measure	The high-efficiency case is a new furnace or boiler.

PARAMETER VALUES (DEEMED)

<table>
<tr><th>Measure/Type</th><th>CAP_{INPUT}</th><th>EF_{BASE}</th><th>EF_{EE}</th><th>$EFLH_{HEAT}$</th><th>Life (yrs)</th><th>Cost ($)</th></tr>
<tr><td>Prescriptive - Retrofit</td><td rowspan="4">Actual</td><td rowspan="2">Table 14</td><td rowspan="4">Actual</td><td rowspan="4">2,455[63]</td><td rowspan="4">20[64]</td><td>1,983.90[65]</td></tr>
<tr><td>Prescriptive – ROB, NC</td><td>297.59[66]</td></tr>
<tr><td>Fast Track - Retrofit</td><td rowspan="2">Actual</td><td>1,983.90[65]</td></tr>
<tr><td>Fast Track – ROB, NC</td><td>297.59[66]</td></tr>
</table>

63 Value is based on TMY3 heating degree hours for Portland, Bangor and Caribou and an assumed design temperature of -11 degrees F.

64 PA Consulting Group for the State of Wisconsin Public Service Commission, Focus on Energy Evaluation. Business Programs: Measure Life Study. August 25, 2009. Appendix B.

65 Per dwelling unit costs based on program data from PY 2014.

66 Per dwelling unit costs based on project cost from PY 2014 program data and 15% incremental cost based on ratio of full and incremental cost reported for hot water boiler in DEER and non-DEER Ex Ante 13-14 Cycle database accessed through READI (Remote Ex-Ante Database Interface) http://www.deeresources.com/.

Multifamily Boiler or Furnace Retrofit/Replacement							
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
AFUE	100%[67]	69.2%[68]	NA	NA	NA	11.0%[69]	1.0%[69]

[67] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[68] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu);
$RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[69] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Multifamily Boiler Control							
Last Revised Date	7/1/2014						
MEASURE OVERVIEW							
Description	This measure involves the installation of a zone thermostat control to an existing non-condensing hot water boiler system. The control resets the hot water temperature set point to match the heating and hot water needs of the building. Boiler controls are not eligible for condensing boilers or for new boiler installations.						
Energy Impacts	Natural Gas, Oil, Propane, Kerosene, Wood						
Sector	Multifamily						
Program(s)	Multifamily Efficiency Program						
End-Use	Heating						
Decision Type	Retrofit						
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)							
Demand savings	$\Delta kW = 0$						
Annual energy savings	*Energy savings are based on project specific data.*						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand savings	$\Delta kW = 0$						
Annual Energy savings	$\Delta kWh/yr = 0$ $\Delta MMBtu/yr = CAP_{INPUT} \times EFLH_{HEAT} \times ESF_{BC} / 1{,}000$						
Definitions	Unit = Boiler control(s) installed on an existing boiler or boiler system CAP_{INPUT} = Total input heating capacity of the existing non-condensing boiler or boiler system (MBH) $EFLH_{HEAT}$ = Full load heating hours defined as the total annual fuel consumption of the equipment divided by its full load heating capacity (in Btu and Btu/h, respectively). ESF_{BC} = Energy savings factor for hot water boiler controls 1,000 = Conversion factor: 1,000 = MBtu/MMBtu						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	The baseline case is the existing non-condensing hot water boiler or boiler system that operates at a constant hot water temperature setpoint.						
Efficient Measure	The efficient case is the existing non-condensing hot water boiler or boiler system that operates with a boiler control to reset the hot water temperature setpoint to adjust to ambient weather or facility heating and hot water needs.						
PARAMETER VALUES (DEEMED)							
Measure/Type	CAP_{INPUT}	$EFLH_{HEAT}$	ESF_{BC}			Life (yrs)	Cost ($)
Boiler Reset Control	Actual	2,455[70]	5%[71]			15[72]	153.00[73]
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Boiler Reset Control	100%[74]	100%[75]	NA	NA	NA	11.0%[76]	1.0%[76]

[70] Value based on TMY3 heating degree hours for Portland, Bangor and Caribou and an assumed design temperature of -11 degrees F.
[71] As referenced in Efficiency Maine Prescriptive Path Technical Reference Manual Version 2014.1, page 9; New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, New York Evaluation Advisory Contractor Team & TecMarket Works, October 15, 2010; “Boiler Reset Controls”, pg 50-52
[72] ACEEE (2006). Emerging Technologies Report: Advanced Boiler Controls. Prepared for ACEEE; Page 2. (http://aceee.org/files/pdf/2006_BoilerControls.pdf)
[73] Per dwelling unit costs based on program data from PY 2014.
[74] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[75] The measure has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[76] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Programmable Thermostats	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the installation of programmable electronic thermostats with ± 1.5°of setpoint on all heating and cooling units and the disposal of existing mechanical thermostats according to local codes.
Energy Impacts	Electric, Natural Gas, Oil, Propane, Kerosene, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	Heating, Cooling
Decision Type	Retrofit, New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings	$\Delta kW = 0$
Annual energy savings	*Energy savings are based on project specific data.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	$\Delta kW = 0$
Annual Energy savings	$\Delta kWh/yr = CAP_C \times 12 / SEER \times EFLH_C \times ESFC + (CAP_{RH} / 3.412 + CAP_{HP} / HSPF) \times EFLH_H \times ESFH$ $\Delta MMBtu/yr = CAP_{INPUT} / 1{,}000 \times EFLH_H \times ESFH$
Definitions	CAP_C = Total electric cooling capacity of all HVAC equipment to be controlled (Tons) CAP_{HP} = Total output heating capacity of controlled heat pumps (kBtu/h). CAP_{RH} = Total heating capacity of controlled electric resistance heating (kBtu/h). CAP_{INPUT} = Total input heating capacity of controlled non-electric heating equipment (kBtu/h). SEER = Seasonal Energy Efficiency Ratio of cooling equipment (Btu/W-h). HSPF = Heating Seasonal Performance Factor (Btu/watt-h), a measure of the seasonal average efficiency of the heat pump in heating mode. $EFLH_C$ = Equivalent full load hours – cooling $EFLH_H$ = Equivalent full load hours – heating ESFC = Energy Savings Factor – Cooling: the estimated percentage reduction in annual electric cooling usage resultant from implementation of HVAC controls. ESFH = Energy Savings Factor – Heating: the estimated percentage reduction in annual electric/fuel heating consumption resultant from implementation of HVAC controls. 3.412 = Conversion Factor (3.412 = Btu/Wh) 12 = Conversion factor (12 kBtu/ton) 1,000 = Conversion Factor (1,000 = kBtu/MMBtu)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case is the existing building with heating and cooling equipment using mechanical thermostats.
Efficient Measure	The high-efficiency case includes programmable electronic thermostats controlling the heating and cooling equipment.

Programmable Thermostats								
PARAMETER VALUES (DEEMED)								
Measure/Type	CAP_C	CAP_{HP}	CAP_{RH}	CAP_{INPUT}	SEER	HSPF	Life (yrs)	Cost ($)
Thermostat	Actual	Actual	Actual	Actual	10	7.7	8[77]	138.50[78]
Measure/Type	$EFLH_H$	$EFLH_C$	ESFC	ESFH				
Thermostat	2,455[79]	239[80]	0.09[81]	0.068[81]				

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Thermostat	100%[82]	100%[83]	NA	NA	NA	11.0%[84]	1.0%[84]

[77] GDS, Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, Prepared for the New England State Program Working Group, June 2007; Table 2.
[78] Per dwelling unit costs based on program data from PY 2014.
[79] $ELFH_H$ based on TMY3 temperature bin analysis with a design temperature of -11 degrees F. $ELFH_H$ = annual heating degree hours/heating degrees at design temperature = 183,454 HDH/76 degree F.
[80] $ELFH_C$ based on TMY3 temperature bin analysis for unit sized to provide 100% of cooling load at 93 degrees F.
[81] As referenced in Efficiency Maine Prescriptive Path Technical Reference Manual Version 2014.1, page 11; New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, New York Evaluation Advisory Contractor Team & TecMarket Works, October 15, 2010; "Setback Thermostat", pg 53-56
[82] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[83] The measure has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[84] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Smart Pump with ECM Motor							
Last Revised Date	7/1/2014 (added to TRM for PY15)						
MEASURE OVERVIEW							
Description	The measure involves the installation of Variable Frequency Drive (VFD) pumps with Electronically Commutated Motors (ECM) for hot water supply pumps.						
Energy Impacts	Electric						
Sector	Multifamily						
Program(s)	Multifamily Efficiency Program						
End-Use	Motors/Drives						
Decision Type	Retrofit						
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)							
Demand savings	*Energy savings are based on project specific data.*						
Annual energy savings							
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand savings	$\Delta kW = HP \times DSF$						
Annual Energy savings	$\Delta kWh = HP \times ESF$						
Definitions	Unit = 1 existing pump installed with VFD control device HP = Rated motor horsepower (hp) DSF = Demand savings factor (kW/hp) ESF = Energy savings factor (kWh/hp)						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	The baseline case is the existing equipment with motors operating at full speed.						
Efficient Measure	This high-efficiency case involves new high-efficiency ECM motors controlled by variable frequency drives.						
PARAMETER VALUES							
Measure/Type	HP	DSF	ESF			Life (yrs)	Cost ($)
Smart Pump	Actual	0.188[85]	1,746[85]			15[86]	79.50[87]
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Smart Pump	100%[88]	100%[89]	100%[89]	0%[90]	100%[91]	11.0%[92]	1.0%[92]

[85] National Grid 2001 values averaged from previous evaluations of VFD installations. Values for hot water pump selected.
[86] GDS, Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, Prepared for the New England State Program Working Group, June 2007; Table 2.
[87] Costs based on program data from PY 2014.
[88] EMT assumes that all purchased units are installed (i.e. ISR = 100%). This is consistent with the MA 2013-2015 TRM.
[89] The measure has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[90] This measure does not reduce electric demand during the summer peak period.
[91] Winter Peak Coincidence Factor for this measure is embedded in the evaluated peak demand impact.
[92] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Ductless Heat Pump	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a high efficiency ductless heat pump (DHP) system as the primary heating system in new construction, gut-rehab or planned retirement/upgrade multifamily projects.
Energy Impacts	Electric
Sector	Residential
Program(s)	Multifamily Program
End-Use	Cooling, Heating
Decision Type	New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW_{max} = 0.57$, $\Delta kW_{WP} = 0.18$, $\Delta kW_{SP} = 0.02$
Annual Energy Savings	$\Delta kWh/yr = 874$ $\Delta kWh_H = 845$ $\Delta kWh_C = 29$
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	<u>Modeled</u>
Annual Energy Savings	Modeled[93] Heating and cooling savings are modeled using TMY3 data for Portland, Bangor and Caribou. Results are weighted based on population (71.2% Portland, 23.4% Bangor, 5.4% Caribou) [94]. Savings were calculated based on a model employing the following key assumptions: • Average annual Heat Loss is 30 MMBtu per year per housing unit corresponding to an average UA of 161 MMBtu/h/deg F. • DHP's contribution to heating does not exceed 50% of the home's heating load in any temperature bin. Even in temperature bins in which 100% of the home's heating load can be supplied by the DHP, the DHP supplies 50% of the heating load, and the remaining 50% is supplied by the existing heating system to account for behavior effects.[95] • DHP heating output capacity and DHP heating efficiency vary linearly with outside air temperature. • Heating is called for when outside air temperature is less than or equal to 65°F. • Cooling is called for when outside air temperature is greater than or equal to 70°F.
Definitions	Unit = 1 ductless heat pump (DHP) system $HSPF_B$ = Heating seasonal performance factor of the baseline DHP (Btu/Watt-hr) $HSPF_{EE}$ = Heating seasonal performance factor of the high-efficiency DHP (Btu/Watt-hr) CAP_{Cool} = Rated cooling capacity of the DHP (kBtu/h) CAP_{Heat} = Rated heating capacity of the DHP (kBtu/h) $SEER_B$ = Seasonal energy efficiency ratio for baseline cooling unit (Btu/Watt-hr) $SEER_E$ = Seasonal energy efficiency ratio for high-efficiency DHP (Btu/Watt-hr)

[93] Based on Excel Workbook for Ductless Heat Pump
[94] Calculated based on population of each region; U.S. Census Bureau Census 2010 Summary File 1 population by census tract
[95] Heat load offset of 50% is extrapolated from other findings. Ecotope, Ductless Heat Pump Retrofits in Multifamily and Small Commercial Buildings, December 7, 2012 reported savings were equivalent to 43-75% heat load offset in multifamily buildings.

Ductless Heat Pump	
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case assumes the multifamily units would be heated with new ductless heat pumps that meets Federal minimum efficiency requirement for units manufactured on or after January 1, 2015: HSPF=8.2 and SEER=14.0.
Efficient Measure	The high-efficiency case assumes a new *high efficiency* ductless heat pump that meets minimum efficiency requirements for program rebate: HSPF=12.0 Btu/W-h HSPF=12.0 and SEER=18.0.

PARAMETER VALUES

Measure	CAP_{Heat}	CAP_{Cool}	$HSPF_E$	$HSPF_B$	$SEER_E$	$SEER_B$	Life (yrs)	Cost ($)
DHP Retrofit	17.5[96]	14.2[96]	13.2[96]	8.2[97]	25.6[96]	14[98]	18[99]	$682[100]

IMPACT FACTORS

Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
DHP – NC/ROB	100%[101]	100%[102]	100%[102]	3.0%[103]	32.4%[103]	11.0%[104]	1.0%[104]

[96] Weighted average values of the most popular units that have been incentivized under the Efficiency Maine program.
[97] Federal minimum efficiency requirement for units manufactured on or after January 1, 2015
[98] DOE standards for Central air conditioners and central air conditioning heat pumps manufactured on or after January 1, 2015 (http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75)
[99] GDS Associates, Inc., Measure Life Report – Residential and Commercial/Industrial Lighting and HVAC Measures, June 2007; Table 1.
[100] The incremental cost is the difference in cost between a typical high-efficiency unit ($1,645 based on Fujitsu model 12RLS2, ecomfort.com) and a typical baseline unit ($963 based on LG model LS093HE, ecomfort.com).
[101] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[102] This measure is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[103] See Appendix B.
[104] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Ductless Heat Pump Retrofit – Low Income Multifamily	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a high efficiency ductless heat pump (DHP) system to supplement the existing heating system in electric heated homes and to replace existing window air conditioning units. The new DHP equipment may have one (single-head) or multiple (multi-head) indoor units per outdoor unit.
Energy Impacts	Electric
Sector	Residential
Program(s)	Low Income Program
End-Use	Cooling, Heating
Decision Type	Retrofit
DEEMED GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW_{max} = 0.89$ $\Delta kW_{WP} = 0.62$ $\Delta kW_{SP} = 0.00$
Annual Energy Savings	$\Delta kWh/yr = 3{,}013$
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	Modeled
Annual Energy Savings	Modeled[105] Heating and cooling savings are modeled using TMY3 data for Portland, Bangor and Caribou. Results are weighted based on population (71.2% Portland, 23.4% Bangor, 5.4% Caribou) [106]. Savings were calculated based on a model employing the following key assumptions: • Average annual Heat Loss is 30 MMBtu corresponding to an average UA of 161 MMBtu/h/deg F. • DHP's contribution to heating does not exceed 35% of the home's heating load in any temperature bin. Even in temperature bins in which 100% of the home's heating load can be supplied by the DHP, the DHP supplies 35% of the heating load, and the remaining 65% is supplied by the existing heating system to account for distribution and behavior effects.[107] • DHP heating output capacity and DHP heating efficiency (both baseline and efficient units) vary linearly with outside air temperature. • Heating is called for when outside air temperature is less than or equal to 65°F. • Cooling is called for when outside air temperature is greater than or equal to 70°F. • For homes that have equivalent of whole home A/C already installed, DHP will replace the cooling load equivalent to the DHP's rated capacity. • For homes that have existing partial cooling (i.e. 1 or 2 existing window A/C units), it is unknown if the DHP will be installed in the same areas served by the existing window A/C units. If installed in the same area, the DHP will replace the existing cooling load and result in positive savings due to increased efficiency. However, if installed in a different area, DHP may result in additional cooling load and hence increased energy use. Without any in-situ data, zero net savings is assumed for homes with existing partial cooling. For homes with no existing cooling equipment, it is assumed that the DHP will be used to its full cooling capacity.

[105] Based on Excel Workbook for Ductless Heat Pump
[106] Calculated based on population of each region; U.S. Census Bureau Census 2010 Summary File 1 population by census tract
[107] Heat load offset of 16% is consistent with findings of the Low Income Weatherization Program Evaluation, NMR Group, 7/1/2015.

Ductless Heat Pump Retrofit – Low Income Multifamily		
Definitions	Unit	= 1 ductless heat pump (DHP) system
	EF_B	= Efficiency Factor of electric baseboard heating system (Btu/Watt-hr)
	$HSPF_E$	= Heating seasonal performance factor of the high-efficiency DHP (Btu/Watt-hr)
	CAP_{Cool}	= Rated cooling capacity of the DHP (kBtu/h)
	CAP_{Heat}	= Rated heating capacity of the DHP (kBtu/h)
	$SEER_B$	= Seasonal energy efficiency ratio for baseline DHP (Btu/Watt-hr)
	$SEER_E$	= Seasonal energy efficiency ratio for high-efficiency DHP (Btu/Watt-hr)=
	$\%COOL_{FULL}$	Percentage of homes with existing cooling equipment equivalent of a whole home air conditioner (equivalent of 3 window A/C units)
	$\%COOL_{NONE}$	= Percentage of homes with no existing cooling equipment
	%FUEL	= Home heating fuel distribution excluding coal and other

EFFICIENCY ASSUMPTIONS

Baseline Efficiency	The baseline case assumes the home retains its existing electric resistance, natural gas, oil, kerosene, or propane heating system and uses a window air conditioning unit for cooling (or has no cooling). A weighted average of the blended baseline fuel heating systems and electric resistance heating systems in Maine homes and single package air conditioner are used in the model (see **Table 1**).
Efficient Measure	The high-efficiency case assumes the home retains its existing heating system and adds a new *high efficiency* ductless heat pump that meets minimum efficiency requirements for program rebate: HSPF=12.0 Btu/W-h.

PARAMETER VALUES

Measure	CAP_{Heat}	CAP_{Cool}	$HSPF_E$	EF_B	$SEER_E$	$SEER_B$	$\%COOL_{FULL}$	$\%COOL_{NONE}$
DHP Retrofit	17.5[108]	14.2[108]	13.2[108]	3.4[109]	25.6[108]	9.8[110]	40%[111]	21%[112]
Measure							Life (yrs)	Cost ($)
DHP Retrofit							18[113]	$Actual[114]

IMPACT FACTORS

Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
DHP Retrofit	100%[115]	100%[116]	100%[116]	0.0%[117]	69.5%[117]	0%[118]	0%[118]

[108] Weighted average values of the most popular units that have been incentivized under the Efficiency Maine program.
[109] Assumes electric baseboard heating system has virtually no distribution losses.
[110] Federal minimum efficiency requirement for units manufactured before January 1, 2015
[111] Portland Press Herald, http://www.pressherald.com/2014/05/26/put_power_rates_on_ice___that_s_a_cool_idea_/. In 2010, an estimated 79% of customers in ISO-New England region had room air conditioners. Of the 79%, 40% of homes have equivalent of whole home A/C (3 window A/C's); 39% of homes have total cooling capacity equivalent of 1 or 2 window A/C units. The remaining 21% have no cooling equipment installed.
[112] Portland Press Herald, http://www.pressherald.com/2014/05/26/put_power_rates_on_ice___that_s_a_cool_idea_/. In 2010, an estimated 79% of customers in ISO-New England region had room air conditioners. Of the 79%, 40% of homes have equivalent of whole home A/C (3 window A/C's); 39% of homes have total cooling capacity equivalent of 1 or 2 window A/C units. The remaining 21% have no cooling equipment installed.
[113] GDS Associates, Inc., Measure Life Report – Residential and Commercial/Industrial Lighting and HVAC Measures, June 2007; Table 1.
[114] Total cost to program which covers 100% of installation cost..
[115] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[116] This measure is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[117] See Appendix B.
[118] This measure is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG.

Table 1. Parameters for Existing Heating Systems

Fuel	Baseline: Main Heating Equipment	Efficiency Measure	Share	Efficiency
Heating Baseline Assumptions				
Electric	Electric Baseboard	HSPF	Calculated Separately	3.4
Gas	Gas-Fired Forced hot water boiler	AFUE	6%	75%
Gas	Gas-Fired Steam boiler	AFUE	3%	75%
Propane	Propane-Fired Forced hot water boiler	AFUE	8%	75%
Propane	Propane-Fired Steam boiler	AFUE	4%	75%
Oil	Oil-Fired Forced hot water boiler	AFUE	22%	75%
Oil	Oil-Fired Steam boiler	AFUE	22%	75%
Oil	Oil-Fired Ducted Furnace	AFUE * Duct Efficiency	22%	56%
Wood	Wood Stove	AFUE	12%	60%
Blended	Blended MMBtu Baseline	Blended Efficiency	100.0%	76%
		Duct Efficiency		*75%*
Cooling Baseline Assumptions				
Electric	Single-Package Air Conditioner	SEER	40%	14
Electric	Single-Package Air Conditioner	EER	40%	12

Sources

DOE standards for boilers manufactured on or after September 1, 2012 (http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72)
DOE standards for furnaces manufactured on or after May 1, 2013 (http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72)
US DOE: Better Duct Systems for Home Heating and Cooling (http://www.nrel.gov/docs/fy05osti/30506.pdf)
DOE standards for Central air conditioners and central air conditioning heat pumps manufactured on or after January 1, 2015 (http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75)
Maine Governor's Energy Office, SPACE HEATING FUEL COMPARISON CALCULATOR (http://www.maine.gov/energy/fuel_prices/heating-calculator.php)
DOE standards for AC and Heat Pump (on or after January 23, 2006, and before January 1, 2015) (http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75)

High Efficiency Water Heater	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new ENERGY STAR high-efficiency water heating equipment to replace the existing water heater. For this prescriptive measure, the new equipment is assumed to have the same capacity and heating fuel as the replaced equipment. Also, low-flow devices must also be installed if they are not already in use. (Fuel switching projects are processed through the custom approach.)
Primary Energy Impact	Electric, Natural Gas, Oil, Propane, Propane, Wood
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	DHW
Decision Type	Retrofit, New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand Savings	*Energy savings are based on project specific data.*
Annual Energy Savings	
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*Storage-Type Water Heaters:* $\Delta kW = NA$ *Electric Instantaneous Water Heaters:* $\Delta kW = UA_{BASE} \times \Delta T_S / 3{,}412$ *Non-Electric Instantaneous Water Heaters:* $\Delta kW = NA$ *Indirect Water Heaters:* $\Delta kW = NA$ *Heat Pump Water Heaters:* $\Delta kW_{WP} = 0.374$[119] $\Delta kW_{SP} = 0.175$[119]
Annual Energy Savings	*Instantaneous/Storage-Type Water Heaters, Heat Pump Water Heaters* • Electric: $\Delta kWh = GPD \times 365 \times 8.33 \times \Delta T_W / 3{,}412 \times (1/EF_{BASE\text{-}EWH} - 1/EF_{EE})$ • Fossil-fuel fired: ○ If tank volume is less than or Equal to 50 gallons: $\Delta MMBtu = GPD \times 365 \times 8.33 \times \Delta T_W / 1{,}000{,}000 \times (1/EF_{BASE\text{-}NEWH} - 1/EF_{EE})$ If tank volume is greater than 50 gallons: $\Delta MMBtu = GPD \times 365 \times 8.33 \times \Delta T_W / 1{,}000{,}000 \times (1/TE_{BASE} - 1/TE_{EE})$ *Indirect Water Heaters (V≤50 Gallons)* $\Delta kWh = NA$ $\Delta MMBtu = GPD \times 365 \times 8.33 \times \Delta T_W / 1{,}000{,}000 \times (1/EC_{BASE\text{-}NEWH} - 1/EC_{EE}) + [TYPE_{BASE} \times (UA_{BASE}/EC_{BASE} - UA_{EE}/EC_{EE}) \times \Delta Ts / 1{,}000{,}000 \times 8{,}760]$ *Indirect Water Heaters (V>50 Gallons)* $\Delta kWh = NA$ $\Delta MMBtu = GPD \times 365 \times 8.33 \times \Delta T_W / 1{,}000{,}000 \times (1/EC_{BASE\text{-}NEWH} - 1/EC_{EE}) + [TYPE_{BASE} \times [[\{(CAP / 800) + (110 \times V^{1/2})\}/\Delta T_{TEST}] / EC_{BASE} - (UA_{EE}/EC_{EE})] \times \Delta Ts / 1{,}000{,}000 \times 8{,}760]$

[119] Steven Winters Associates, Inc., Heat Pump Water Heaters: Evaluation of Field Installed Performance, 2012

High Efficiency Water Heater	
	Additional Details: UA_{BASE} is calculated per guidance in the New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs document as follows: $UA = \frac{\frac{1}{EF} - \frac{1}{RE}}{67.5 \times \left(0.000584 - \frac{1}{RE \times CAP}\right)}$ EF_{BASE} is calculated or determined according to federal minimum standards as follows: $EF_{BASE\text{-}EWH} = 0.93 - 0.00132 \times V_{BASE}$ $EF_{BASE\text{-}NEWH} = 0.67 - 0.0019 \times V_{BASE}$
Definitions	UA_{BASE} = Heat loss coefficient of baseline hot water heater (Btu/h-°F), calculated using the equation found in "Annual Energy Savings" UA_{EE} = Heat loss coefficient of proposed hot water heater (Btu/h-°F). ΔT_S = Temperature difference between stored hot water temperature and ambient air (°F). GPD = Average daily water consumption (gallons/day) ΔT_W = Temperature difference between cold inlet temperature and hot water delivery temperature in (°F). Hot water delivery temperature is assumed to be 130 °F. Cold inlet/main temperature is 50.8 °F[120]. $EF_{BASE\text{-}EWH}$ = Baseline electric water heater energy factor, calculated using the equation found above in "Annual Energy Savings" $EF_{BASE\text{-}NEWH}$ = Baseline non-electric water heater energy factor, calculated using the equation found above in "Annual Energy Savings" EF_{EE} = Proposed water heater energy factor. ΔT_{TEST} = Temperature difference associated with standby loss specification TE_{BASE} = Thermal efficiency of baseline water heater TE_{EE} = Thermal efficiency of proposed efficient water heater EC_{BASE} = Combustion efficiency of baseline water heater EC_{EE} = Combustion efficiency of proposed indirect water heater boiler $TYPE_{BASE}$ = Binary flag to indicate whether the baseline water heater was an indirect water heater (0 if an indirect water heater; 1 if not an indirect water heater) V_{BASE} = Baseline Water heater storage tank volume (Gallons) – assumed to be 40 gallons[121]. RE = Water heater recovery efficiency. CAP = Water heater capacity (in Btu/h) 1,000,000 = Conversion factor (1,000,000 = Btu/MMBtu). 3,412 = Conversion factor (3,412 = Btu/kWh) 365 = Days per year. 8.33 = Heat content of water (Btu/gal-°F) 8,760 = Hours per year.

[120] Standard Building America DHW Schedules, weighted average by population of all Maine water main sources.

[121] Baseline water heater volume of 40 gallons results in conservative estimate for baseline water efficiency factor based on smallest water heater generally considered for multifamily units.

High Efficiency Water Heater	
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case for retrofit is the existing water heating equipment with low-flow devices installed. The baseline case for new construction/replace on burnout is a standard efficiency unit of the same type and volume.
Efficient Measure	The efficient case is the new high-efficiency water heating equipment with low flow devices installed.

PARAMETER VALUES

Measure	GPD	ΔT_S	ΔT_W	EF_{EE}	ΔT_{TEST}	CAP	Life (yrs)	Cost ($)
Water Heater – Retrofit	Table 15	65[122]	79.2	Table 16	70[123]	Actual	13[124]	504.60[125]
Water Heater – ROB, NC								75.69[126]

Measure	EC_{BASE}	EC_{EE}	UA_{EE}	RE_{BASE}		TE_{BASE}	TE_{EE}
Water Heater	0.75	Actual	Table 17	Gas: 0.75	Electric: 0.97	0.80	Actual

IMPACT FACTORS

Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Storage, Indirect, and Tankless Water Heaters	100%[127]	73%[128]	100%[129]	NA	NA	11.0%[130]	1.0%[130]
Heat Pump Water Heaters		100%[129]	100%[129]	100%[131]	100%[131]		

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122 Efficiency Maine Prescriptive Path Technical Reference Manual Version 2014.1; page 14

123 Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and Efficiency Standards for Commercial Water Heaters, Hot Water Supply Boilers and Unfired Hot Water Storage Tanks; Office of Energy Efficiency and Renewable Energy, Department of Energy; Federal Register / Vol. 69, No. 203 / Thursday, October 21, 2004 / Rules and Regulations; 10 CFR Part 431. http://www.gpo.gov/fdsys/pkg/FR-2004-10-21/pdf/04-17732.pdf

124 NREL, National Residential Efficiency Measures Database.

125 Per dwelling unit costs based on program data from PY 2014.

126 Per dwelling unit costs based on total project costs from PY 2014 program data and program assumption of 15% incremental cost (same incremental cost percentage observed for high efficiency boilers).

127 EMT assumes that all purchased units are installed (i.e. ISR = 100%). This is consistent with the MA 2013-2015 TRM.

128 Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu); $RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$

129 The measure has not yet been evaluated for demand savings. Until the next program impact evaluation, EMT assumes 100% realization rate.

130 Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

131 Peak Coincidence Factors for this measure are embedded in the evaluated peak demand impact.

Low-Flow Faucet Aerator	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves replacing existing bathroom and kitchen faucet aerators with low-flow (1.5 GPM) faucet aerators. Water and water heating energy are saved by reducing the annual hot water consumption.
Primary Energy Impact	Electric, Propane, Oil, Kerosene, Wood (additional impacts include: water)
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	DHW
Decision Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = 0.01$
Annual Energy Savings	$\Delta kWh/yr = 80$ (electric water heater only) $\Delta MMBtu/yr = 0.36$ (non-electric water heater only)
Annual Water Savings	$\Delta Gallons/yr = 3{,}833$
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (GPM_{BASE} - GPM_{EE}) \times 60 \times \rho_{H20} \times Cp_{H20} / 3{,}412 \times (T_{pou} - T_{in}) / RE_{EWH}$
Annual Energy Savings	$\Delta kWh/yr = \Delta Gallons/yr \times \rho_{H20} \times Cp_{H20} / 3{,}412 \times (T_{pou} - T_{in}) / RE_{EWH}$ $\Delta MMBtu/yr = \Delta Gallons/yr \times \rho_{H20} \times Cp_{H20} / 1{,}000{,}000 \times (T_{pou} - T_{in}) / RE_{NEWH}$
Annual Water Savings	$\Delta Gallons/yr = (GPM_{BASE} - GPM_{EE}) \times t \times 365$
Definitions	Unit = 1 low flow device GPM_{BASE} = Flow rate of existing low flow device (GPM) GPM_{EE} = Flow rate of new low-flow device (GPM) t = total time low flow device is used per day (min/day) T_{pou} = temperature at point of use (°F) T_{in} = temperature of water mains (°F) RE_{EWH} = Recovery efficiency of electric hot water heater RE_{NEWH} = Recovery efficiency of non-electric hot water heater ρ_{H20} = Density of water: 8.33 lbs per gallons Cp_{H20} = Specific heat of water: 1 Btu/lb/°F 3,412 = Conversion: 3,412 Btu per kWh 365 = Conversion: 365 days per year 60 = Conversion: 60 minutes per hour
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Federal standards set a maximum 2.2 GPM for faucet aerators manufactured after January 1, 1994.[132]
Efficient Measure	The new low-flow faucet aerators have a maximum flow rate of 1.5 GPM.[133]

PARAMETER VALUES

Measure	GPM_{BASE}	GPM_{EE}	t	T_{pou}	T_{in}	RE_{EWH}	RE_{NEWH}	Life (yrs)	Cost ($)
Faucet Aerator	2.2	1.5	2.99[134]	93[135]	50.8[136]	0.98[137]	0.75[137]	10[138]	32.28[139]

[132] Federal Standard, Code of Federal Regulations, Title 10, Part 430, Subpart C.
[133] http://www.epa.gov/WaterSense/docs/faucet_spec508.pdf
[134] Weighted average time per day per faucet for 1 kitchen aerator and 2.96 bathroom aerators with 2.34 people per home and usage times from The Cadmus Group and Opinion Dynamics, MEMO: Showerhead and Faucet Aerator Meter Study, June 2013. Prepare for Michigan Evaluation Working Group.
[135] The Cadmus Group and Opinion Dynamics, MEMO: Showerhead and Faucet Aerator Meter Study, June 2013. Prepare for Michigan Evaluation Working Group.
[136] Standard Building America DHW Schedules, weighted average by population of all Maine water main sources.
[137] NREL, Building America Research Benchmark Definition, 2009, p.12, http://www.nrel.gov/docs/fy10osti/47246.pdf
[138] NYSERDA Multifamily Efficiency Program, Benchmarking Tool Excel Sheet, Version 4.1.
[139] Costs based on program data from PY 2014.

Low-Flow Faucet Aerator							
IMPACT FACTORS							
Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Faucet Aerator	100%[140]	72.7%[141]	100%[142]	0.3%[143]	0.4%[143]	11.0%[144]	1.0%[144]

[140] EMT assumes that all units are installed (i.e. ISR = 100%)..
[141] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu); $RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$
[142] The measure has not yet been evaluated for demand savings. Until the next program impact evaluation, EMT assumes 100% realization rate.
[143] Efficiency Maine Residential Technical Reference Manual 2014.1; Values developed based on residential hot water usage profiles from: Aquacraft, Inc.,The End Uses of Hot Water in Single Family Homes from Flow Trace Analysis. Coincidence Factors for Bathroom low-flow aerator were assumed (as opposed to kitchen low-flow aerator) to assume a conservative approach to seasonal peak kW savings.
[144] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Low-Flow Showerheads	
Last Revised Date	7/1/2014 (added to TRM for PY15)
MEASURE OVERVIEW	
Description	This measure involves replacing existing showerheads with low-flow (2.0 GPM) showerheads. Water and water heating energy are saved by reducing the annual hot water consumption.
Primary Energy Impact	Electric, Propane, Oil, Kerosene, Wood (additional impacts include: water)
Sector	Multifamily
Program(s)	Multifamily Efficiency Program
End-Use	DHW
Decision Type	Retrofit
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = 0.02$
Annual Energy Savings	$\Delta kWh/yr = 250$ (electric water heater only) $\Delta MMBtu/yr = 1.1$ (non-electric water heater only)
Annual Water Savings	$\Delta Gallons/yr = 2{,}000$
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = \Delta kWh/yr \times F_{ED} 3{,}412$
Annual Energy Savings	$\Delta kWh/yr = \Delta Gallons/yr \times \rho_{H20} \times C_{H20} \times (T_{pou} - T_{in}) / RE_{EWH} / 3{,}412$ $\Delta MMBtu/yr = \Delta Gallons/yr \times \rho_{H20} \times C_{H20} \times (T_{pou} - T_{in}) / RE_{NEWH} / 1{,}000{,}000$
Annual Water Savings	$\Delta Gallons/yr = (GPM_{BASE} - GPM_{EE}) \times N \times t \times 365$
Definitions	Unit = 1 low-flow device GPM_{BASE} = Flow rate of existing showerhead (GPM) GPM_{EE} = Flow rate of new low-flow showerhead (GPM) N = number of faucet uses per day (uses/day) t = total time low flow device is used per use (min/use) T_{pou} = temperature at point of use (°F) T_{in} = temperature of water mains (°F) RE_{EWH} = Recovery efficiency of electric hot water heater RE_{NEWH} = Recovery efficiency of non-electric hot water heater ρ_{H20} = Density of water: 8.33 lbs per gallons C_{H20} = Specific heat of water: 1 Btu/lb/°F 3,412 = Conversion: 3,412 Btu per kWh 365 = Conversion: 365 days per year 60 = Conversion: 60 minutes per hour F_{ED} = Energy to Demand factor
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Federal standards set a maximum 2.5 GPM for faucet aerators manufactured after January 1, 1994.[145]
Efficient Measure	The new low-flow faucet aerators have a maximum flow rate of 2.0 GPM.[146]

PARAMETER VALUES

[145] Federal Standard, Code of Federal Regulations, Title 10, Part 430, Subpart C.
[146] http://www.epa.gov/WaterSense/docs/faucet_spec508.pdf

Low-Flow Showerheads								
Measure	GPM_{BASE}	GPM_{EE}	N	t	T_{pou}	T_{in}	Life (yrs)	Cost ($)
Showerhead	2.5	2.0	1.4[147]	7.83[148]	101[149]	50.8[150]	10[151]	32.28[152]
Measure	F_{ED}	RE_{EWH}	RE_{NEWH}					
Showerhead	0.00008013[153]	0.98[154]	0.75[154]					

IMPACT FACTORS							
Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Showerhead	100%[155]	72.7%[156]	100%[157]	0.5%[158]	0.8%[158]	11.0%[159]	1.0%[159]

[147] Based on 2.34people per home (American Community Survey, 2011 1 year estimate for population of Maine: http://www.census.gov/acs/www/) and 0.61 showers per person (The Cadmus Group and Opinion Dynamics, MEMO: Showerhead and Faucet Aerator Meter Study, June 2013. Prepare for Michigan Evaluation Working Group).

[148] The Cadmus Group and Opinion Dynamics, MEMO: Showerhead and Faucet Aerator Meter Study, June 2013. Prepare for Michigan Evaluation Working Group.

[149] The Cadmus Group and Opinion Dynamics, MEMO: Showerhead and Faucet Aerator Meter Study, June 2013. Prepare for Michigan Evaluation Working Group.

[150] Standard Building America DHW Schedules, weighted average by population of all Maine water main sources.

[151] NYSERDA Multifamily Efficiency Program, Benchmarking Tool Excel Sheet, Version 4.1.

[152] Costs based on program data from PY 2014.

[153] State of Pennsylvania, Technical Reference Manual, Rev Date: March 2015, page 126.

[154] NREL, Building America Research Benchmark Definition, 2009, p.12, http://www.nrel.gov/docs/fy10osti/47246.pdf

[155] EMT assumes that all purchased units are installed (i.e. ISR = 100%). This is consistent with the MA 2013-2015 TRM.

[156] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, March 2014; using the program-wide electric and fuel realization rates determined by the evaluation report, measure-specific weighted average was calculated for each measure (based on the relative magnitude of electric and fuel savings in MMBtu);
$RR_E = [(RR_{ELECTRIC} \times \Delta MMBtu_{ELECTRIC}) + (RR_{FUEL} \times \Delta MMBtu_{FUEL})] / (\Delta MMBtu_{ELECTRIC} + \Delta MMBtu_{FUEL})$

[157] The measure has not yet been evaluated for demand savings. Until the next program impact evaluation, EMT assumes 100% realization rate.

[158] Efficiency Maine Residential Technical Reference Manual 2014.1; Values developed based on residential hot water usage profiles from: Aquacraft, Inc.,The End Uses of Hot Water in Single Family Homes from Flow Trace Analysis.

[159] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Multifamily Custom Fast Track	
Last Revised Date	7/1/2014 (added to TRM for PY15)
MEASURE OVERVIEW	
Description	The custom Fast Track path for Multifamily Efficiency Program projects allows program contractors to use TREAT to estimate the energy-efficiency savings for bundled energy-efficiency measures. A successful MEP custom Fast Track project must reduce total annual energy consumption by at least 20% compared to baseline annual energy consumption.
Primary Energy Impact	Electricity, Natural Gas, Oil, Propane
Sector	Multifamily
Program(s)	Multifamily Efficiency Program (Custom)
End-Use	Heating, Cooling, DHW, Lighting, Appliances
Decision Type	Retrofit, New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings	*Demand savings are based on project specific data.*
Annual energy savings	*Energy savings are based on project specific data.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings Annual energy savings	Approved implementation contractors estimate energy and demand savings using the Targeted Retrofit Energy Analysis Tool (TREAT) modeling software. Contractors use the modeling software to project the annual energy savings and demand savings achieved by the selected energy-efficiency measures.
Definitions	Unit = 1 project $MMBTU_{PRE}$ = Baseline annual energy consumption before energy-efficiency measures are installed $\Delta MMBTU$ = Annual energy savings after energy-efficiency measures are installed, estimated using TREAT building modeling software.
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline scenario is the existing multifamily building with all existing systems and equipment. The baseline energy consumption is characterized by the normalized actual energy consumption for the building.
Efficient Measure	The efficient measure involves multiple energy-efficiency measures that reduce the baseline energy consumption by at least 20%.

PARAMETER VALUES (DEEMED)

Measure/Type	$MMBTU_{PRE}$	$\Delta MMBTU$	ΔkWh	ΔkW	Life (yrs)	Cost ($)
Custom Model	Actual	Model	Model	Model	Table 18	Actual

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Custom Model	100%	73%[160]	100%[163]	Custom[161]	Custom[164]	11.0%[162]	1.0%[165]

[160] Weighted average of Fossil Fuel and Electric Realization Rates based on the respective magnitude of Ex Post Gross Savings; Realization Rates and Ex Post Gross Savings are retrieved from: Table 1-1. Annual Program-Level Ex Ante and Ex Post Gross Impacts, Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, 2014

[161] Dependent on measure type; See Table 2. Multifamily Measures Coincidence Factors and Energy Period Factors.

[162] Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Multifamily Custom Modeling	
Last Revised Date	7/1/2014 (added to TRM for PY15)
MEASURE OVERVIEW	
Description	The custom modeling path for Multifamily Efficiency Program projects allows program contractors to use building energy simulation tools estimate the energy-efficiency savings, including interactive effects, for bundled energy-efficiency measures. A successful MEP custom project must reduce total annual energy consumption by at least 20% compared to baseline annual energy consumption.
Primary Energy Impact	Electricity, Natural Gas, Oil, Propane
Sector	Multifamily
Program(s)	Multifamily Efficiency Program (Custom)
End-Use	Heating, Cooling, DHW, Lighting, Appliances
Decision Type	Retrofit, New Construction, Replace on Burnout
DEEMED GROSS ENERGY SAVINGS (UNIT SAVINGS)	
Demand savings	*Demand savings are based on project specific data.*
Annual energy savings	*Energy savings are based on project specific data.*
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings Annual energy savings	Approved implementation contractors estimate energy and demand savings using the Targeted Retrofit Energy Analysis Tool (TREAT) modeling software. Contractors use the modeling software to project the annual energy savings and demand savings achieved by the selected energy-efficiency measures.
Definitions	Unit = 1 project $MMBTU_{PRE}$ = Baseline annual energy consumption before energy-efficiency measures are installed $\Delta MMBTU$ = Annual energy savings after energy-efficiency measures are installed, estimated using TREAT building modeling software.
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline scenario is the existing multifamily building with all existing systems and equipment. The baseline energy consumption is characterized by the normalized actual energy consumption for the building.
Efficient Measure	The efficient measure involves multiple energy-efficiency measures that reduce the baseline energy consumption by at least 20%.

PARAMETER VALUES (DEEMED)

Measure/Type	$MMBTU_{PRE}$	$\Delta MMBTU$	ΔkWh	ΔkW			Life (yrs)	Cost ($)
Custom Model	Actual	Model	Model	Model			Table 18	Actual

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Custom Model	100%	73%[163]	100%[163]	Custom[164]	Custom[164]	11.0%[165]	1.0%[165]

163 Weighted average of Fossil Fuel and Electric Realization Rates based on the respective magnitude of Ex Post Gross Savings; Realization Rates and Ex Post Gross Savings are retrieved from: Table 1-1. Annual Program-Level Ex Ante and Ex Post Gross Impacts, Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation, 2014

164 Dependent on measure type; See Table 2. Multifamily Measures Coincidence Factors and Energy Period Factors.

165 Opinion Dynamics, Efficiency Maine Multifamily Efficiency Program Evaluation Final, March 2014; Table 1-2.

Appendix A: Glossary

Definitions are based primarily on the ***Northeast Energy Efficiency Partnerships (NEEP), Regional Evaluation, Measurement & Verification (EMV) Forum, Glossary of Terms, Version 2.0 (PAH Associates, March 2011)***, cited at the end of each definition as: [NEEP EMV Glossary].

Adjusted Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. It adjusts for such factors as data errors, installation and persistence rates and hours of use, but does not adjust for free ridership or spillover. This can be calculated as an annual or lifetime value. [NEEP EMV Glossary]

Actual: Actual means the project specific value that is recorded in the Project Application/Documentation for this measure.

Algorithm: An equation or set of equations, more broadly a method, used to calculate a number. In this case, it is an estimate of energy use or energy savings tied to operation of a piece of equipment or a system of interacting pieces of equipment. An algorithm may include certain standard numerical assumptions about some relevant quantities, leaving the user to supply other data to calculate the use or savings for the particular measure or equipment. [NEEP EMV Glossary]

Annual Demand Savings: The maximum reduction in electric or gas demand in a given year within defined boundaries. The demand reduction is typically the result of the installation of higher efficiency equipment, controls, or behavioral change. The term can be applied at various levels, from individual projects to energy efficiency programs, to overall program portfolios. [NEEP EMV Glossary]

Annual Energy Savings: The reduction in electricity usage (kWh) or in fossil fuel use in thermal unit(s) from the savings associated with an energy saving measure, project, or program in a given year. [NEEP EMV Glossary]

Average Annual Operating Hours: The annual hours that equipment is expected to operate.

Baseline Efficiency: The assumed efficiency condition of the baseline equipment that is being replaced by the subject energy efficiency measure. It is used to determine the energy savings obtained by the more efficient measure. [NEEP EMV Glossary, edited]

Btu: The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water one degree Fahrenheit from 58.5 to 59.5 degrees under standard pressure of 30 inches of mercury at or near its point of maximum density. [NEEP EMV Glossary]

Coincident Demand: The demand of a device, circuit or building that occurs at the same time as the peak demand of a system load or some other peak of interest. The peak of interest should be specified. [NEEP EMV Glossary]

Coincidence Factor (CF): The ratio of the average hourly demand during a specified period of time of a group of measures to the sum of their individual maximum demands (or connected loads) within the same period. [NEEP EMV Glossary, edited]

Deemed Savings: An estimate of energy or demand savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (b) is applicable to the situation being evaluated. A measure with deemed savings will have the same savings per unit. Individual parameters used to calculate savings and/or savings calculation methods can also be deemed. [NEEP EMV Glossary, edited]

Delta Watts: The difference in the wattage between existing or baseline equipment and its more efficient replacement or installation at a specific time, expressed in watts or kilowatts. [NEEP EMV Glossary]

Demand: The time rate of energy flow. Demand usually refers to the amount of electric energy used by a customer or piece of equipment at a specific time, expressed in kilowatts (kW). [NEEP EMV Glossary]

ENERGY STAR®: A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy designed to reduce energy use and the impact on the environment. The Energy Star label is awarded to products that meet applicable energy efficiency guidelines and to homes and commercial buildings that meet specified energy efficiency standards. [NEEP EMV Glossary]

Free Rider: A program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be: 1) total, in which the participant's activity would have completely replicated the program measure; 2) partial, in which the participant's activity would have partially replicated the program measure; or 3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe. [NEEP EMV Glossary]

Free Ridership Rate (FR): The percent of energy savings through an energy efficiency program attributable to free riders. [NEEP EMV Glossary, edited]

Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated and unadjusted by any factors. [NEEP EMV Glossary]

Hours of Use (HOU) or Operating Hours: The average number of hours a measure is in use during a specified time period, typically a day or a year. [NEEP EMV Glossary]

Incremental Cost: The difference between the cost of existing or baseline equipment/service and the cost of energy efficient equipment/service. [NEEP EMV Glossary]

In-Service Rate (ISR): The percentage of energy efficiency measures incented by a program that are actually installed and operating. The in-service rate is calculated by dividing the number of measures installed and operating by the number of measures incented by an efficiency program in a defined period of time. [NEEP EMV Glossary]

Kilowatt (kW): A measure of the rate of power used during a preset time period (e.g. minutes, hours, days or months) equal to 1,000 watts. [NEEP EMV Glossary]

Kilowatt-Hour (kWh): A common unit of electric energy; one kilowatt-hour is numerically equal to 1,000 watts used for one hour. [NEEP EMV Glossary]

Lifetime Energy Savings: The energy savings over the lifetime of an installed measure calculated by multiplying the annual energy usage reduction associated with a measure by the expected lifetime of the measure. [NEEP EMV Glossary, edited]

Measure Life: The length of time that a measure is expected to be functional. Measure Life is a function of: (1) *equipment life* means the number of years that a measure is installed and will operate until failure; and (2) *measure persistence* takes into account business turnover, early retirement of installed equipment and other reasons measures might be removed or discontinued. Measure Life is sometimes referred to as expected useful life (EUL). [NEEP EMV Glossary]

Meter Level Savings: Savings from energy efficiency programs that are at the customer meter or premise level. [NEEP EMV Glossary]

Net Savings: The savings that is attributable to an energy efficiency program. Net savings differs from gross savings because it includes the effects of the free-ridership and/or spillover rates.

Net-to-Gross Ratio (NTGR): The ratio of net savings to gross savings. The NTGR may be determined from the free-ridership and spillover rates (NTGR=1-FR+SO), if available, or it may be a distinct value relating gross savings to the net effect of the program with no separate specification of FR and SO values; it can be applied separately to either energy or demand savings.

Realization Rate (RR): The ratio of savings adjusted for data errors and for evaluated or verified results (verified) to program tracking system savings data (e.g. initial estimates of project savings).

Seasonal Energy Efficiency Ratio (SEER): The total cooling output of a central AC unit in Btus during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using specified federal test procedures. [NEEP EMV Glossary]

Spillover: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or non-participant spillover. *Participant spillover* is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program's influence. *Non-participant spillover* refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices as a result of a program's influence. [NEEP EMV Glossary]

Spillover Rate (SO): Estimate of energy savings attributable to spillover effects expressed as a percent of savings installed by participants through an energy efficiency program. [NEEP EMV Glossary]

Appendix B: Load Shapes and Coincidence Factors

Table 2. Multifamily Measures Coincidence Factors and Energy Period Factors

Measure Name	End-Use	Coincidence Factor (CF)		Energy Period Factors (EPF)				Footnote Reference	
		Winter On-Peak	Summer On-Peak	Winter		Summer		CF	EPF
				Peak	Off Peak	Peak	Off Peak		
Lighting Fixtures – Interior Spaces	Lighting	63.0%	76.0%	50.0%	19.0%	23.0%	9.0%	166	167
Lighting Fixtures – LED Exit Signs	Lighting	100.0%	100.0%	30.4%	36.2%	15.6%	17.9%	168	168
Lighting Fixtures – Exterior Spaces	Lighting	70.2%	3.7%	20.5%	50.6%	6.1%	22.8%	169	169
Lighting Controls – Interior Spaces	Lighting	12.0%	18.0%	50.0%	19.0%	23.0%	9.0%	170	167
Custom	Heating, Cooling, Domestic Hot Water	Custom	Custom	58.4%	33.8%	3.6%	4.1%	171	172
Air Sealing	Heating, Cooling	79.6%	10.2%	58.4%	33.8%	3.6%	4.1%	173	
Boiler Control	Heating	NA	NA	NA	NA	NA	NA	174	
Programmable Thermostats	Heating	NA	NA	58.4%	33.8%	3.6%	4.1%	173	
Boiler or Furnace Retrofit/Replacement	Heating	NA	NA	NA	NA	NA	NA	174	
Wall Insulation	Heating, Cooling	79.6%	10.2%	58.4%	33.8%	3.6%	4.1%	173	
Floor Insulation	Heating, Cooling	79.6%	10.2%	58.4%	33.8%	3.6%	4.1%	173	
Attic/Roof Insulation	Heating, Cooling	79.6%	10.2%	58.4%	33.8%	3.6%	4.1%	173	

[166] KEMA, C&I Lighting Load Shape Project FINAL Report, July 2011.
[167] Central Maine Power, Non-residential load profile for 3/1/08-2/28/09
[168] Values are based on continuous operation. For energy period factors, values may assume that energy savings are evenly distributed across all hours of the year.
[169] Efficiency Vermont TRM 2012, Commercial Outdoor Lighting
[170] The Cadmus Group, Inc. (2012). Final Report, Small Business Direct Install Program: Pre/Post Occupancy Sensor Study.
[171] Winter and Summer Peak demand are project specific based on modeling
[172] The majority of custom projects will have the greatest impact on heating and cooling; therefore the energy period factors are set to the same as for ductless heat pump.
[173] The measure's savings follow the heating and cooling consumption loadshape. Therefore, the coincidence factors and energy period factors for the measure are assumed to be the same as the coincidence factors for the heat pump measure.
[174] Coincidence Factors and Energy Period Factors are not tracked for non-electric measures.

Measure Name	End-Use	Coincidence Factor (CF)		Energy Period Factors (EPF)				Footnote Reference	
		Winter	Summer	Winter		Summer		CF	EPF
Low-Flow Faucet Aerator	Domestic Hot Water	0.3%	0.4%	39.7%	26.8%	20.3%	13.1%	175	
Low-Flow Showerhead	Domestic Hot Water	0.8%	0.5%	35.5%	31.1%	18.1%	15.3%	176	
Smart Pump with ECM Motor	Heating	100.0%	0.0%	53.6%	46.3%	0.0%	0.1%	177	178
Ductless Heat Pump New Construction	Heating, Cooling	32.4%	3.0%	57.4%	36.9%	2.6%	3.1%	179	
Ductless Heat Pump Retrofit Income Eligible	Heating, Cooling	69.5%	0.0%	58.0%	34.5%	3.4%	4.1%	180	
Indirect/Tankless/Storage Type Water Heaters	Domestic Hot Water	NA	NA	NA	NA	NA	NA	174	
Heat Pump Water Heaters	Domestic Hot Water	100.0%	100.0%	35.8%	30.8%	17.9%	15.5%	181	182

[175] Efficiency Maine Residential Technical Reference Manual 2014.1; Values developed based on residential hot water usage profiles from: Aquacraft, Inc.,The End Uses of Hot Water in Single Family Homes from Flow Trace Analysis. Coincidence Factors for Bathroom low-flow aerator were assumed (as opposed to kitchen low-flow aerator) to assume a conservative approach to seasonal peak kW savings.

[176] Ibid.; analysis for low-flow showerheads

[177] Summer Coincidence Factor is not applicable to this measure; Winter Coincidence Factor is embedded in the demand savings calculated using the algorithm provided.

[178] As referenced in Efficiency Maine Commercial Technical Reference Manual v2015.1; Efficiency Vermont TRM 2012. Values used for VFDs on VFD Boiler Feedwater Pumps, 10 HP; VFD Chilled Water Pumps, <10 HP; VFD Supply Fans, <10 HP; VFD Returns Fans, <10 HP; and VFD Exhaust Fans, <10 HP

[179] Values developed based on the bin analysis calculations for DHP savings using typical annual hours in each weather bin during each demand and energy period.

[180] Values developed based on the bin analysis calculations for DHP retrofit savings using typical annual hours in each weather bin during each demand and energy period.

[181] Coincidence Factors are embedded in the seasonal demand savings provided in the measure entry.

[182] As referenced in Efficiency Maine Residential Technical Reference Manual v2015.1; Memo provided to supplement NMR Group, Inc., Efficiency Maine Appliance Rebate Program Evaluation Overall Report – FINAL, July 18, 2014.

Appendix C: Carbon Dioxide Emission Factors

Fuel	Pounds of CO_2 per [183]	Unit
Petroleum Products		
Distillate Fuel (No. 1, No. 2, No. 4, Fuel Oil and Diesel)	22.384	per gallon
Jet Fuel	21.095	per gallon
Kerosene	21.537	per gallon
Liquefied Petroleum Gases	12.805	per gallon
Motor Gasoline	19.564	per gallon
Petroleum Coke	32.397	per gallon
Petroleum Coke	6768.667	per short ton
Residual Fuel(No.5 and No. 6 Fuel oil)	26.033	per gallon
Natural Gas and Other Gaseous Fuels		
Methane	116.375	per 1000 ft3
Landfill Gas	Multiple methane factor by the share of the landfill gas methane	per 1000 ft3
Flare Gas	133.759	per 1000 ft3
Natural Gas (pipeline)	120.593	per 1000 ft3
Propane	12.669	per gallon
Coal		
Anthracite	5685	per short ton
Bituminous	4931.30	per short ton
Sub bituminous	3715.90	per short ton
Lignite	2791.60	per short ton
Other		
Wind	0	
Photovoltaic and Solar Thermal	0	
Tires/Tire – Derived Fuel	6160	per short ton
Wood and Wood Waste	0	
Municipal Solid Waste	0	
Electricity[184]	1.0262	Pounds per kWh

[183] From the Energy Information Administration: http://www.eia.doe.gov/oiaf/1605/coefficients.html
[184] From Avoided Energy Supply Cost in New England, 2013, Synapse Energy Economics Inc.

Appendix D: Supporting Tables for Multifamily Measures

Table 3. Savings Factors for Air Sealing in Low Rise Buildings[185]

HVAC System	Savings Factor	Zone 1	Zone 2	Zone 3
AC with Gas, Propane, Oil, Kerosene or Wood Heat	$EESF_{LR}$	1.3	1.0	1.5
	DSF_{LR}	0.0	0.0	0.0
	$HFSF_{LR}$	2.7	2.3	2.5
Heat Pump	$EESF_{LR}$	44.5	31.2	32.7
	DSF_{LR}	0.0	0.0	0.0
	$HFSF_{LR}$	0.0	0.0	0.0
AC with Electric Heat	$EESF_{LR}$	44.6	36.6	40.2
	DSF_{LR}	0.0	0.0	0.0
	$HFSF_{LR}$	0.0	0.0	0.0
Gas, Propane, Oil, Kerosene, or Wood Heat, No AC	$EESF_{LR}$	1.2	1.1	1.6
	DSF_{LR}	0.0	0.0	0.0
	$HFSF_{LR}$	2.7	2.3	2.5
Electric Heat, No AC	$EESF_{LR}$	44.5	36.7	40.3
	DSF_{LR}	0.0	0.0	0.0
	$HFSF_{LR}$	0.0	0.0	0.0
See Table 5. Weather Zones for Air Sealing Measure to find the appropriate weather zone for specific location.				

Table 4. Savings Factors for Air Sealing in High Rise Buildings[186]

Zone	Vintage	$EESF_{HR}$	DSF_{HR}	$HFSF_{HR}$
Zone 1	Old	68	0.101	34
	Average	20	0.079	19
Zone 2	Old	66	0.127	30
	Average	20	0.098	17
Zone 3	Old	64	0.116	33
	Average	11	0.085	17
See Table 5. Weather Zones for Air Sealing Measure to find the appropriate weather zone for specific location.				

[185] New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, New York Evaluation Advisory Contractor Team & TecMarket Works, October 15, 2010; Appendix E, Pg #394-395; Zone 1 mapped to Buffalo, NY, Zone 2 mapped to Massena, NY, and Zone 3 mapped to Binghamton, NY.

[186] Ibid.

Table 5. Weather Zones for Air Sealing Measure

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04210	Auburn	Androscoggin	04003	Bailey Island	Cumberland	04225	Dryden	Franklin
04211	Auburn	Androscoggin	04009	Bridgton	Cumberland	04227	East Dixfield	Franklin
04212	Auburn	Androscoggin	04011	Brunswick	Cumberland	04234	East Wilton	Franklin
04222	Durham	Androscoggin	04013	Bustins Island	Cumberland	04239	Jay	Franklin
04223	Danville	Androscoggin	04015	Casco	Cumberland	04262	North Jay	Franklin
04228	East Livermore	Androscoggin	04017	Chebeague Island	Cumberland	04285	Weld	Franklin
04230	East Poland	Androscoggin	04019	Cliff Island	Cumberland	04294	Wilton	Franklin
04236	Greene	Androscoggin	04021	Cumberland Center	Cumberland	04936	Eustis	Franklin
04240	Lewiston	Androscoggin	04024	East Baldwin	Cumberland	04938	Farmington	Franklin
04241	Lewiston	Androscoggin	04029	Sebago	Cumberland	04940	Farmington Falls	Franklin
04243	Lewiston	Androscoggin	04032	Freeport	Cumberland	04947	Kingfield	Franklin
04250	Lisbon	Androscoggin	04033	Freeport	Cumberland	04955	New Sharon	Franklin
04252	Lisbon Falls	Androscoggin	04034	Freeport	Cumberland	04956	New Vineyard	Franklin
04253	Livermore	Androscoggin	04038	Gorham	Cumberland	04964	Oquossoc	Franklin
04254	Livermore Falls	Androscoggin	04039	Gray	Cumberland	04966	Phillips	Franklin
04256	Mechanic Falls	Androscoggin	04040	Harrison	Cumberland	04970	Rangeley	Franklin
04258	Minot	Androscoggin	04050	Long Island	Cumberland	04982	Stratton	Franklin
04263	Leeds	Androscoggin	04055	Naples	Cumberland	04983	Strong	Franklin
04266	North Turner	Androscoggin	04057	North Bridgton	Cumberland	04984	Temple	Franklin
04274	Poland	Androscoggin	04062	Windham	Cumberland	04992	West Farmington	Franklin
04280	Sabattus	Androscoggin	04066	Orrs Island	Cumberland	04408	Aurora	Hancock
04282	Turner	Androscoggin	04069	Pownal	Cumberland	04416	Bucksport	Hancock
04288	West Minot	Androscoggin	04070	Scarborough	Cumberland	04420	Castine	Hancock
04291	West Poland	Androscoggin	04071	Raymond	Cumberland	04421	Castine	Hancock
04471	Orient	Aroostook	04074	Scarborough	Cumberland	04431	East Orland	Hancock
04497	Wytopitlock	Aroostook	04075	Sebago Lake	Cumberland	04472	Orland	Hancock
04730	Houlton	Aroostook	04077	South Casco	Cumberland	04476	Penobscot	Hancock
04732	Ashland	Aroostook	04078	South Freeport	Cumberland	04605	Ellsworth	Hancock
04733	Benedicta	Aroostook	04079	Harpswell	Cumberland	04607	Gouldsboro	Hancock
04734	Blaine	Aroostook	04082	South Windham	Cumberland	04609	Bar Harbor	Hancock
04735	Bridgewater	Aroostook	04084	Standish	Cumberland	04612	Bernard	Hancock
04736	Caribou	Aroostook	04085	Steep Falls	Cumberland	04613	Birch Harbor	Hancock
04737	Clayton Lake	Aroostook	04091	West Baldwin	Cumberland	04614	Blue Hill	Hancock
04738	Crouseville	Aroostook	04092	Westbrook	Cumberland	04616	Brooklin	Hancock

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04739	Eagle Lake	Aroostook	04096	Yarmouth	Cumberland	04617	Brooksville	Hancock
04740	Easton	Aroostook	04097	North Yarmouth	Cumberland	04624	Corea	Hancock
04741	Estcourt Station	Aroostook	04098	Westbrook	Cumberland	04625	Cranberry Isles	Hancock
04742	Fort Fairfield	Aroostook	04101	Portland	Cumberland	04627	Deer Isle	Hancock
04743	Fort Kent	Aroostook	04102	Portland	Cumberland	04629	East Blue Hill	Hancock
04744	Fort Kent Mills	Aroostook	04103	Portland	Cumberland	04634	Franklin	Hancock
04745	Frenchville	Aroostook	04104	Portland	Cumberland	04635	Frenchboro	Hancock
04746	Grand Isle	Aroostook	04105	Falmouth	Cumberland	04640	Hancock	Hancock
04747	Island Falls	Aroostook	04106	South Portland	Cumberland	04642	Harborside	Hancock
04750	Limestone	Aroostook	04107	Cape Elizabeth	Cumberland	04644	Hulls Cove	Hancock
04751	Limestone	Aroostook	04108	Peaks Island	Cumberland	04646	Islesford	Hancock
04756	Madawaska	Aroostook	04109	Portland	Cumberland	04650	Little Deer Isle	Hancock
04757	Mapleton	Aroostook	04110	Cumberland Foreside	Cumberland	04653	Bass Harbor	Hancock
04758	Mars Hill	Aroostook	04112	Portland	Cumberland	04660	Mount Desert	Hancock
04760	Monticello	Aroostook	04116	South Portland	Cumberland	04662	Northeast Harbor	Hancock
04761	New Limerick	Aroostook	04122	Portland	Cumberland	04664	Sullivan	Hancock
04762	New Sweden	Aroostook	04123	Portland	Cumberland	04669	Prospect Harbor	Hancock
04763	Oakfield	Aroostook	04124	Portland	Cumberland	04672	Salsbury Cove	Hancock
04764	Oxbow	Aroostook	04260	New Gloucester	Cumberland	04673	Sargentville	Hancock
04766	Perham	Aroostook	03902	Cape Neddick	York	04674	Seal Cove	Hancock
04768	Portage	Aroostook	03903	Eliot	York	04675	Seal Harbor	Hancock
04769	Presque Isle	Aroostook	03904	Kittery	York	04676	Sedgwick	Hancock
04772	Saint Agatha	Aroostook	03905	Kittery Point	York	04677	Sorrento	Hancock
04773	Saint David	Aroostook	03906	North Berwick	York	04679	Southwest Harbor	Hancock
04774	Saint Francis	Aroostook	03907	Ogunquit	York	04681	Stonington	Hancock
04775	Sheridan	Aroostook	03908	South Berwick	York	04683	Sunset	Hancock
04776	Sherman	Aroostook	03909	York	York	04684	Surry	Hancock
04779	Sinclair	Aroostook	03910	York Beach	York	04685	Swans Island	Hancock
04780	Smyrna Mills	Aroostook	03911	York Harbor	York	04693	Winter Harbor	Hancock
04781	Wallagrass	Aroostook	04001	Acton	York	04259	Monmouth	Kennebec
04783	Stockholm	Aroostook	04002	Alfred	York	04265	North Monmouth	Kennebec
04785	Van Buren	Aroostook	04004	Bar Mills	York	04284	Wayne	Kennebec
04786	Washburn	Aroostook	04005	Biddeford	York	04330	Augusta	Kennebec
04787	Westfield	Aroostook	04006	Biddeford Pool	York	04332	Augusta	Kennebec

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04010	Brownfield	Oxford	04007	Biddeford	York	04333	Augusta	Kennebec
04016	Center Lovell	Oxford	04014	Cape Porpoise	York	04336	Augusta	Kennebec
04022	Denmark	Oxford	04020	Cornish	York	04338	Augusta	Kennebec
04037	Fryeburg	Oxford	04027	Lebanon	York	04343	East Winthrop	Kennebec
04041	Hiram	Oxford	04028	East Parsonsfield	York	04344	Farmingdale	Kennebec
04051	Lovell	Oxford	04030	East Waterboro	York	04345	Gardiner	Kennebec
04068	Porter	Oxford	04042	Hollis Center	York	04346	Randolph	Kennebec
04088	Waterford	Oxford	04043	Kennebunk	York	04347	Hallowell	Kennebec
04216	Andover	Oxford	04046	Kennebunkport	York	04349	Kents Hill	Kennebec
04217	Bethel	Oxford	04047	Parsonsfield	York	04350	Litchfield	Kennebec
04219	Bryant Pond	Oxford	04048	Limerick	York	04351	Manchester	Kennebec
04220	Buckfield	Oxford	04049	Limington	York	04352	Mount Vernon	Kennebec
04221	Canton	Oxford	04054	Moody	York	04355	Readfield	Kennebec
04224	Dixfield	Oxford	04056	Newfield	York	04358	South China	Kennebec
04226	East Andover	Oxford	04061	North Waterboro	York	04359	South Gardiner	Kennebec
04231	Stoneham	Oxford	04063	Ocean Park	York	04360	Vienna	Kennebec
04237	Hanover	Oxford	04064	Old Orchard Beach	York	04363	Windsor	Kennebec
04238	Hebron	Oxford	04072	Saco	York	04364	Winthrop	Kennebec
04255	Greenwood	Oxford	04073	Sanford	York	04901	Waterville	Kennebec
04257	Mexico	Oxford	04076	Shapleigh	York	04903	Waterville	Kennebec
04261	Newry	Oxford	04083	Springvale	York	04910	Albion	Kennebec
04267	North Waterford	Oxford	04087	Waterboro	York	04917	Belgrade	Kennebec
04268	Norway	Oxford	04090	Wells	York	04918	Belgrade Lakes	Kennebec
04270	Oxford	Oxford	04093	Buxton	York	04926	China Village	Kennebec
04271	Paris	Oxford	04094	West Kennebunk	York	04927	Clinton	Kennebec
04275	Roxbury	Oxford	04095	West Newfield	York	04935	East Vassalboro	Kennebec
04276	Rumford	Oxford				04962	North Vassalboro	Kennebec
04278	Rumford Center	Oxford				04963	Oakland	Kennebec
04281	South Paris	Oxford				04989	Vassalboro	Kennebec
04286	West Bethel	Oxford				04547	Friendship	Knox
04289	West Paris	Oxford				04563	Cushing	Knox
04290	Peru	Oxford				04574	Washington	Knox
04292	Sumner	Oxford				04645	Isle Au Haut	Knox
04401	Bangor	Penobscot				04841	Rockland	Knox
04402	Bangor	Penobscot				04843	Camden	Knox
04410	Bradford	Penobscot				04846	Glen Cove	Knox

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04411	Bradley	Penobscot				04847	Hope	Knox
04412	Brewer	Penobscot				04851	Matinicus	Knox
04417	Burlington	Penobscot				04853	North Haven	Knox
04418	Greenbush	Penobscot				04854	Owls Head	Knox
04419	Carmel	Penobscot				04855	Port Clyde	Knox
04422	Charleston	Penobscot				04856	Rockport	Knox
04427	Corinth	Penobscot				04858	South Thomaston	Knox
04428	Eddington	Penobscot				04859	Spruce Head	Knox
04429	Holden	Penobscot				04860	Tenants Harbor	Knox
04430	East Millinocket	Penobscot				04861	Thomaston	Knox
04434	Etna	Penobscot				04862	Union	Knox
04435	Exeter	Penobscot				04863	Vinalhaven	Knox
04444	Hampden	Penobscot				04864	Warren	Knox
04448	Howland	Penobscot				04865	West Rockport	Knox
04449	Hudson	Penobscot				04341	Coopers Mills	Lincoln
04450	Kenduskeag	Penobscot				04342	Dresden	Lincoln
04451	Kingman	Penobscot				04348	Jefferson	Lincoln
04453	Lagrange	Penobscot				04353	Whitefield	Lincoln
04455	Lee	Penobscot				04535	Alna	Lincoln
04456	Levant	Penobscot				04537	Boothbay	Lincoln
04457	Lincoln	Penobscot				04538	Boothbay Harbor	Lincoln
04459	Mattawamkeag	Penobscot				04539	Bristol	Lincoln
04460	Medway	Penobscot				04541	Chamberlain	Lincoln
04461	Milford	Penobscot				04543	Damariscotta	Lincoln
04462	Millinocket	Penobscot				04544	East Boothbay	Lincoln
04467	Olamon	Penobscot				04549	Isle Of Springs	Lincoln
04468	Old Town	Penobscot				04551	Bremen	Lincoln
04469	Orono	Penobscot				04553	Newcastle	Lincoln
04473	Orono	Penobscot				04554	New Harbor	Lincoln
04474	Orrington	Penobscot				04555	Nobleboro	Lincoln
04475	Passadumkeag	Penobscot				04556	Edgecomb	Lincoln
04487	Springfield	Penobscot				04558	Pemaquid	Lincoln
04488	Stetson	Penobscot				04564	Round Pond	Lincoln
04489	Stillwater	Penobscot				04568	South Bristol	Lincoln
04493	West Enfield	Penobscot				04570	Squirrel Island	Lincoln
04495	Winn	Penobscot				04571	Trevett	Lincoln

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04765	Patten	Penobscot				04572	Waldoboro	Lincoln
04777	Stacyville	Penobscot				04573	Walpole	Lincoln
04928	Corinna	Penobscot				04575	West Boothbay Harbor	Lincoln
04930	Dexter	Penobscot				04576	Southport	Lincoln
04932	Dixmont	Penobscot				04578	Wiscasset	Lincoln
04933	East Newport	Penobscot				04852	Monhegan	Lincoln
04939	Garland	Penobscot				04354	Palermo	Waldo
04953	Newport	Penobscot				04438	Frankfort	Waldo
04969	Plymouth	Penobscot				04496	Winterport	Waldo
04406	Abbot	Piscataquis				04848	Islesboro	Waldo
04414	Brownville	Piscataquis				04849	Lincolnville	Waldo
04415	Brownville Junction	Piscataquis				04850	Lincolnville Center	Waldo
04426	Dover Foxcroft	Piscataquis				04915	Belfast	Waldo
04441	Greenville	Piscataquis				04921	Brooks	Waldo
04442	Greenville Junction	Piscataquis				04922	Burnham	Waldo
04443	Guilford	Piscataquis				04941	Freedom	Waldo
04463	Milo	Piscataquis				04949	Liberty	Waldo
04464	Monson	Piscataquis				04951	Monroe	Waldo
04479	Sangerville	Piscataquis				04952	Morrill	Waldo
04481	Sebec	Piscataquis				04972	Sandy Point	Waldo
04485	Shirley Mills	Piscataquis				04973	Searsmont	Waldo
04008	Bowdoinham	Sagadahoc				04974	Searsport	Waldo
04086	Topsham	Sagadahoc				04981	Stockton Springs	Waldo
04287	Bowdoin	Sagadahoc				04986	Thorndike	Waldo
04357	Richmond	Sagadahoc				04987	Troy	Waldo
04530	Bath	Sagadahoc				04988	Unity	Waldo
04548	Georgetown	Sagadahoc				04413	Brookton	Washington
04562	Phippsburg	Sagadahoc				04424	Danforth	Washington
04565	Sebasco Estates	Sagadahoc				04454	Lambert Lake	Washington
04579	Woolwich	Sagadahoc				04490	Topsfield	Washington
04478	Rockwood	Somerset				04491	Vanceboro	Washington
04911	Anson	Somerset				04492	Waite	Washington
04912	Athens	Somerset				04606	Addison	Washington
04920	Bingham	Somerset				04611	Beals	Washington

ZONE 1 LOCATIONS			ZONE 2 LOCATIONS			ZONE 3 LOCATIONS		
Zip Code	City	County	Zip Code	City	County	Zip Code	City	County
04923	Cambridge	Somerset				04619	Calais	Washington
04924	Canaan	Somerset				04622	Cherryfield	Washington
04925	Caratunk	Somerset				04623	Columbia Falls	Washington
04929	Detroit	Somerset				04626	Cutler	Washington
04937	Fairfield	Somerset				04628	Dennysville	Washington
04942	Harmony	Somerset				04630	East Machias	Washington
04943	Hartland	Somerset				04631	Eastport	Washington
04944	Hinckley	Somerset				04637	Grand Lake Stream	Washington
04945	Jackman	Somerset				04643	Harrington	Washington
04950	Madison	Somerset				04648	Jonesboro	Washington
04954	New Portland	Somerset				04649	Jonesport	Washington
04957	Norridgewock	Somerset				04652	Lubec	Washington
04958	North Anson	Somerset				04654	Machias	Washington
04961	New Portland	Somerset				04655	Machiasport	Washington
04965	Palmyra	Somerset				04657	Meddybemps	Washington
04967	Pittsfield	Somerset				04658	Milbridge	Washington
04971	Saint Albans	Somerset				04666	Pembroke	Washington
04975	Shawmut	Somerset				04667	Perry	Washington
04976	Skowhegan	Somerset				04668	Princeton	Washington
04978	Smithfield	Somerset				04671	Robbinston	Washington
04979	Solon	Somerset				04680	Steuben	Washington
04985	West Forks	Somerset				04686	Wesley	Washington
						04691	Whiting	Washington
						04694	Baileyville	Washington

Table 6. Savings Factors for Attic/Roof Insulation: Zone 1, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base R-0			Base R-11			Base R-19			Base R-30			Base R-38		
AC with Gas Heat	11	283.9	0.193	255.7												
	19	332.8	0.237	302.5	48.8	0.044	46.7									
	30	364.2	0.246	332.2	80.3	0.053	76.4	31.5	0.009	29.7						
	38	377.1	0.255	344.2	93.1	0.061	88.5	44.3	0.018	41.7	12.8	0.009	12.0			
	49	387.5	0.272	354.8	103.6	0.079	99.1	54.7	0.035	52.4	23.3	0.026	22.7	10.5	0.018	10.6
	60	394.8	0.272	361.9	110.9	0.079	106.2	62.0	0.035	59.5	30.6	0.026	29.8	17.7	0.018	17.7
Heat Pump	11	4,262.2	0.193													
	19	4,950.5	0.228		688.3	0.035										
	30	5,361.6	0.246		1,099.4	0.053		411.1	0.018							
	38	5,525.9	0.246		1,263.6	0.053		575.3	0.018		164.3	-				
	49	5,670.6	0.255		1,408.4	0.061		720.1	0.026		309.1	0.009		144.8	0.009	
	60	5,769.6	0.264		1,507.3	0.070		819.0	0.035		408.0	0.018		243.7	0.018	
AC with Electric Heat	11	5,017.6	0.193													
	19	5,846.5	0.237		829.0	0.044										
	30	6,357.2	0.246		1,339.6	0.053		510.7	0.009							
	38	6,562.5	0.255		1,544.9	0.061		716.0	0.018		205.3	0.009				
	49	6,743.3	0.272		1,725.7	0.079		896.8	0.035		386.1	0.026		180.8	0.018	
	60	6,862.8	0.272		1,845.2	0.079		1,016.3	0.035		505.6	0.026		300.3	0.018	
Electric Heat, No AC	11	4,884.2	-													
	19	5,690.2	(0.044)		806.0	-										
	30	6,186.5	(0.018)		1,302.3	0.026		496.3	-							
	38	6,385.3	(0.018)		1,501.1	0.026		695.1	-		198.8	-				
	49	6,561.2	(0.018)		1,677.0	0.026		870.9	-		374.7	-		175.9	-	
	60	6,677.4	(0.018)		1,793.2	0.026		987.2	-		490.9	-		292.1	-	
Gas Heat, No AC	11	150.6	-	255.7												
	19	176.6	(0.044)	302.5	26.0	-	46.7									
	30	193.6	(0.018)	332.2	43.0	0.026	76.4	17.0	-	29.7						
	38	199.9	(0.018)	344.2	49.3	0.026	88.5	23.3	-	41.7	6.2	-	12.0			
	49	205.4	(0.018)	354.8	54.8	0.026	99.1	28.8	-	52.4	11.8	-	22.7	5.5	-	10.6
	60	209.4	(0.018)	361.9	58.9	0.026	106.2	32.9	-	59.5	15.8	-	29.8	9.6	-	17.7

Table 7. Savings Factors for Attic/Roof Insulation: Zone 2, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base R-0			Base R-11			Base R-19			Base R-30			Base R-38		
AC with Gas Heat	11	350.3	0.404	301.6												
	19	414.3	0.466	357.2	64.0	0.061	55.6									
	30	450.0	0.510	392.4	99.7	0.105	90.8	35.7	0.044	35.2						
	38	466.7	0.527	406.7	116.4	0.123	105.2	52.4	0.061	49.5	16.7	0.018	14.3			
	49	480.0	0.536	419.7	129.8	0.132	118.2	65.7	0.070	62.5	30.0	0.026	27.3	13.4	0.009	13.0
	60	487.8	0.545	428.1	137.6	0.141	126.5	73.5	0.079	70.9	37.9	0.035	35.7	21.2	0.018	21.3
Heat Pump	11	5,933.3	0.387													
	19	6,907.4	0.457		974.1	0.070										
	30	7,488.7	0.492		1,555.4	0.105		581.3	0.035							
	38	7,715.0	0.501		1,781.7	0.114		807.6	0.044		226.3	0.009				
	49	7,921.5	0.518		1,988.1	0.132		1,014.1	0.061		432.8	0.026		206.4	0.018	
	60	8,056.0	0.527		2,122.7	0.141		1,148.6	0.070		567.3	0.035		341.0	0.026	
AC with Electric Heat	11	6,004.7	0.404													
	19	7,014.4	0.466		1,009.8	0.061										
	30	7,635.5	0.510		1,630.9	0.105		621.1	0.044							
	38	7,887.7	0.527		1,883.1	0.123		873.3	0.061		252.2	0.018				
	49	8,110.2	0.536		2,105.5	0.132		1,095.8	0.070		474.7	0.026		222.4	0.009	
	60	8,255.6	0.545		2,251.0	0.141		1,241.2	0.079		620.1	0.035		367.9	0.018	
Electric Heat, No AC	11	5,829.0	-													
	19	6,806.8	(0.026)		977.8	-										
	30	7,412.7	(0.044)		1,583.7	(0.018)		605.9	-							
	38	7,655.7	(0.044)		1,826.7	(0.018)		848.9	-		243.0	-				
	49	7,871.7	(0.044)		2,042.6	(0.018)		1,064.8	-		458.9	-		215.9	-	
	60	8,014.6	(0.044)		2,185.5	(0.018)		1,207.8	-		601.9	-		358.9	-	
Gas Heat, No AC	11	174.8	-	301.6												
	19	206.7	(0.026)	357.2	31.9	-	55.6									
	30	227.2	(0.044)	392.4	52.4	(0.018)	90.8	20.5	-	35.2						
	38	234.7	(0.044)	406.7	59.9	(0.018)	105.2	28.0	-	49.5	7.6	-	14.3			
	49	241.8	(0.044)	419.7	66.9	(0.018)	118.1	35.1	-	62.5	14.6	-	27.2	7.0	-	12.9
	60	247.0	(0.044)	428.1	72.2	(0.018)	126.5	40.3	-	70.9	19.9	-	35.7	12.3	-	21.3

Table 8. Savings Factors for Attic/Roof Insulation: Zone 3, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base R-0			Base R-11			Base R-19			Base R-30			Base R-38		
AC with Gas Heat	11	301.9	0.264	257.9												
	19	356.6	0.307	306.3	54.7	0.044	48.4									
	30	392.1	0.343	337.3	90.2	0.079	79.3	35.5	0.035	30.9						
	38	404.6	0.351	350.3	102.7	0.088	92.4	48.0	0.044	44.0	12.5	0.009	13.1			
	49	417.3	0.360	360.9	115.4	0.097	103.0	60.7	0.053	54.6	25.2	0.018	23.6	12.7	0.009	10.5
	60	424.9	0.369	368.4	123.1	0.105	110.4	68.3	0.061	62.0	32.9	0.026	31.1	20.4	0.018	18.0
Heat Pump	11	4,382.6	0.255													
	19	5,099.3	0.299		716.7	0.044										
	30	5,544.9	0.334		1,162.3	0.079		445.7	0.035							
	38	5,723.0	0.343		1,340.4	0.088		623.7	0.044		178.1	0.009				
	49	5,881.2	0.351		1,498.6	0.097		782.0	0.053		336.3	0.018		158.2	0.009	
	60	5,987.4	0.360		1,604.8	0.105		888.2	0.061		442.5	0.026		264.4	0.018	
AC with Electric Heat	11	5,076.3	0.264													
	19	5,946.5	0.307		870.2	0.044										
	30	6,484.6	0.343		1,408.2	0.079		538.1	0.035							
	38	6,698.7	0.351		1,622.3	0.088		752.2	0.044		214.1	0.009				
	49	6,890.3	0.360		1,813.9	0.097		943.8	0.053		405.7	0.018		191.6	0.009	
	60	7,015.9	0.369		1,939.6	0.105		1,069.4	0.061		531.3	0.026		317.2	0.018	
Electric Heat, No AC	11	4,935.8	-													
	19	5,778.6	0.018		842.8	-										
	30	6,301.2	0.026		1,365.5	0.009		522.6	-							
	38	6,510.2	0.026		1,574.5	0.009		731.6	-		209.0	-				
	49	6,696.9	0.026		1,761.1	0.009		918.3	-		395.7	-		186.7	-	
	60	6,818.9	0.026		1,883.1	0.009		1,040.2	-		517.6	-		308.6	-	
Gas Heat, No AC	11	161.2	-	257.9												
	19	188.5	0.018	306.3	27.3	-	48.4									
	30	208.6	0.026	337.3	47.4	0.009	79.3	20.1	-	30.9						
	38	215.9	0.026	350.3	54.7	0.009	92.4	27.4	-	44.0	7.3	-	13.1			
	49	223.8	0.026	360.9	62.5	0.009	103.0	35.2	-	54.6	15.1	-	23.6	7.8	-	10.5
	60	227.8	0.026	368.4	66.6	0.009	110.4	39.3	-	62.0	19.2	-	31.1	11.9	-	18.0

Table 9. Savings Factor for Attic/Roof Insulation: Zones 1-3, High-Rise Multifamily Buildings (4 or More Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base R-0			Base R-11			Base R-19			Base R-30			Base R-38		
ZONE 1																
Chiller and Boiler with FPFC	11	110.0	0.079	406.5												
	19	117.0	0.105	468.2	7.0	0.026	61.7									
	30	120.1	0.123	506.7	10.1	0.044	100.3	3.1	0.018	38.6						
	38	121.0	0.131	521.7	11.0	0.053	115.2	3.9	0.026	53.5	0.9	0.009	14.9			
	49	121.7	0.131	535.6	11.7	0.053	129.1	4.6	0.026	67.4	1.6	0.009	28.8	0.7	-	13.9
	60	122.1	0.140	544.5	12.1	0.061	138.1	5.1	0.035	76.3	2.0	0.018	37.8	1.1	0.009	22.9
Steam Boiler Only	11	-	-	452.9												
	19	-	-	521.7	-	-	68.8									
	30	-	-	564.7	-	-	111.7	-	-	43.0						
	38	-	-	581.3	-	-	128.3	-	-	59.6	-	-	16.6			
	49	-	-	596.8	-	-	143.9	-	-	75.1	-	-	32.1	-	-	15.5
	60	-	-	606.8	-	-	153.8	-	-	85.1	-	-	42.1	-	-	25.5
ZONE 2																
Chiller and Boiler with FPFC	11	130.3	0.149	481.9												
	19	140.4	0.175	556.3	10.1	0.026	74.3									
	30	145.5	0.193	601.4	15.2	0.044	119.5	5.1	0.018	45.1						
	38	147.3	0.210	619.5	16.9	0.061	137.5	6.8	0.035	63.2	1.8	0.018	18.1			
	49	148.8	0.219	635.5	18.4	0.070	153.6	8.3	0.044	79.2	3.2	0.026	34.1	1.5	0.009	16.0
	60	149.5	0.228	645.7	19.2	0.079	163.7	9.1	0.053	89.4	4.0	0.035	44.3	2.3	0.018	26.2
Steam Boiler Only	11	-	-	537.0												
	19	-	-	619.9	-	-	82.8									
	30	-	-	670.2	-	-	133.1	-	-	50.3						
	38	-	-	690.3	-	-	153.3	-	-	70.4	-	-	20.1			
	49	-	-	708.1	-	-	171.1	-	-	88.3	-	-	38.0	-	-	17.9
	60	-	-	719.5	-	-	182.5	-	-	99.6	-	-	49.3	-	-	29.2
ZONE 3																
Chiller and Boiler with FPFC	11	140.8	0.088	420.9												
	19	152.9	0.096	489.0	12.1	0.009	68.1									
	30	158.9	0.123	531.7	18.1	0.035	110.8	6.0	0.026	42.7						
	38	161.0	0.131	548.0	20.2	0.044	127.1	8.2	0.035	59.0	2.1	0.009	16.3			
	49	162.8	0.140	562.9	22.0	0.053	142.0	9.9	0.044	73.9	3.9	0.018	31.2	1.8	0.009	14.9
	60	163.7	0.140	572.7	23.0	0.053	151.7	10.9	0.044	83.6	4.8	0.018	40.9	2.7	0.009	24.6
Steam Boiler Only	11	-	-	469.0												
	19	-	-	544.9	-	-	75.9									
	30	-	-	592.5	-	-	123.5	-	-	47.6						
	38	-	-	610.7	-	-	141.6	-	-	65.7	-	-	18.2			
	49	-	-	627.3	-	-	158.2	-	-	82.3	-	-	34.8	-	-	16.6
	60	-	-	638.1	-	-	169.1	-	-	93.2	-	-	45.6	-	-	27.4

Table 10. Savings Factors for Floor/Wall Insulation: Zone 1, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base 0-R			Base 11-R			Base 13-R			Base 17-R			Base 19-R		
AC with Gas Heat	11	35.3	0.023	61.7												
	13	48.8	0.023	81.0	13.5	-	19.3									
	17	62.5	0.034	107.7	27.2	0.011	46.0	13.6	0.011	26.7						
	19	67.7	0.034	117.5	32.3	0.011	55.8	18.8	0.011	36.6	5.2	-	9.9			
	21	72.6	0.046	125.8	37.3	0.023	64.1	23.7	0.023	44.8	10.1	0.011	18.1	4.9	0.011	8.3
	25	80.5	0.046	139.1	45.2	0.023	77.4	31.6	0.023	58.1	18.0	0.011	31.4	12.8	0.011	21.6
	27	83.7	0.046	144.5	48.4	0.023	82.8	34.9	0.023	63.5	21.2	0.011	36.8	16.1	0.011	26.9
Heat Pump	11	760.8	-													
	13	1,005.4	-		244.6	-										
	17	1,336.9	0.011		576.1	0.011		331.5	-							
	19	1,457.6	0.011		696.8	0.011		452.2	-		120.7	-				
	21	1,557.4	0.011		796.6	0.011		552.0	-		220.5	-		99.8	-	
	25	1,716.5	0.023		955.7	0.023		711.2	0.011		379.7	0.011		258.9	-	
	27	1,781.2	0.023		1,020.4	0.023		775.8	0.011		444.3	0.011		323.6	-	
AC with Electric Heat	11	964.0	-													
	13	1,275.2	-		311.2	-										
	17	1,698.2	0.011		734.2	0.011		423.0	-							
	19	1,852.5	0.011		888.5	0.011		577.3	-		154.3	-				
	21	1,982.3	0.023		1,018.3	0.023		707.1	0.011		284.1	0.011		129.8	-	
	25	2,187.0	0.023		1,223.0	0.023		911.8	0.011		488.8	0.011		334.5	-	
	27	2,268.8	0.023		1,304.8	0.023		993.6	0.011		570.6	0.011		416.2	-	
Electric Heat, No AC	11	960.2	-													
	13	1,267.2	-		307.0	-										
	17	1,690.7	(0.023)		730.5	(0.023)		423.6	-							
	19	1,843.7	-		883.5	-		576.5	0.023		153.0	-				
	21	1,975.5	-		1,015.3	-		708.3	0.023		284.7	-		131.8	-	
	25	2,177.4	(0.023)		1,217.2	(0.023)		910.2	-		486.6	(0.023)		333.7	-	
	27	2,260.1	-		1,299.9	-		992.9	0.023		569.3	-		416.4	-	
Gas Heat, No AC	11	31.5	-	61.7												
	13	40.8	-	81.0	9.3	-	19.3									
	17	55.2	(0.023)	107.7	23.6	(0.023)	46.0	14.3	-	26.7						
	19	58.7	-	117.5	27.2	-	55.8	17.9	0.023	36.6	3.6	-	9.9			
	21	65.8	-	125.8	34.3	-	64.1	25.0	0.023	44.8	10.7	-	18.1	7.1	-	8.3
	25	70.9	(0.023)	139.1	39.3	(0.023)	77.4	30.0	-	58.1	15.7	(0.023)	31.4	12.2	-	21.6
	27	74.9	-	144.5	43.3	-	82.8	34.1	0.023	63.5	19.7	-	36.8	16.2	-	26.9

Table 11. Savings Factors for Floor/Wall Insulation: Zone 2, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base 0-R			Base 11-R			Base 13-R			Base 17-R			Base 19-R		
AC with Gas Heat	11	43.1	0.034	68.1												
	13	56.8	0.046	90.7	13.6	0.011	22.6									
	17	77.3	0.057	122.9	34.2	0.023	54.8	20.5	0.011	32.2						
	19	83.0	0.069	134.6	39.9	0.034	66.5	26.3	0.023	43.9	5.7	0.011	11.7			
	21	87.9	0.069	144.1	44.8	0.034	76.0	31.2	0.023	53.4	10.7	0.011	21.2	4.9	-	9.5
	25	96.4	0.080	159.7	53.3	0.046	91.6	39.7	0.034	69.0	19.1	0.023	36.8	13.4	0.011	25.1
	27	100.4	0.080	166.0	57.3	0.046	97.9	43.7	0.034	75.3	23.2	0.023	43.1	17.4	0.011	31.4
Heat Pump	11	933.6	-													
	13	1,229.6	0.011		296.0	-										
	17	1,645.5	0.023		711.8	0.011		415.9	-							
	19	1,795.1	0.034		861.5	0.023		565.5	0.011		149.6	-				
	21	1,921.3	0.034		987.7	0.023		691.8	0.011		275.9	-		126.2	-	
	25	2,118.2	0.046		1,184.6	0.034		888.7	0.023		472.8	0.011		323.1	-	
	27	2,195.4	0.046		1,261.8	0.034		965.8	0.023		549.9	0.011		400.3	-	
AC with Electric Heat	11	1,142.6	-													
	13	1,504.5	0.011		361.9	-										
	17	2,034.9	0.023		892.2	0.011		530.3	-							
	19	2,219.4	0.034		1,076.7	0.023		714.8	0.011		184.5	-				
	21	2,373.1	0.034		1,230.5	0.023		868.6	0.011		338.3	-		153.8	-	
	25	2,616.9	0.046		1,474.3	0.034		1,112.4	0.023		582.0	0.011		397.5	-	
	27	2,715.5	0.046		1,572.9	0.034		1,211.0	0.023		680.7	0.011		496.2	-	
Electric Heat, No AC	11	1,136.1	-													
	13	1,496.4	-		360.3	-										
	17	2,022.1	-		886.0	-		525.7	-							
	19	2,206.7	-		1,070.6	-		710.4	-		184.6	-				
	21	2,362.3	-		1,226.2	-		866.0	-		340.2	-		155.6	-	
	25	2,604.1	-		1,468.0	-		1,107.7	-		581.9	-		397.3	-	
	27	2,703.2	-		1,567.1	-		1,206.9	-		681.1	-		496.5	-	
Gas Heat, No AC	11	36.2	-	68.1												
	13	48.2	-	90.7	11.9	-	22.6									
	17	64.4	-	122.8	28.2	-	54.7	16.3	-	32.1						
	19	70.6	-	134.5	34.4	-	66.4	22.5	-	43.8	6.2	-	11.7			
	21	76.9	-	144.0	40.7	-	75.9	28.8	-	53.3	12.5	-	21.2	6.3	-	9.5
	25	83.5	-	159.6	47.2	-	91.5	35.3	-	68.9	19.0	-	36.8	12.8	-	25.1
	27	88.1	-	166.0	51.8	-	97.9	39.9	-	75.3	23.6	-	43.2	17.4	-	31.5

Table 12 . Savings Factors for Floor/Wall Insulation: Zone 3, Low-Rise Multifamily Buildings (3 or Less Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base 0-R			Base 11-R			Base 13-R			Base 17-R			Base 19-R		
AC with Gas Heat	11	41.6	0.023	62.8												
	13	55.7	0.034	82.8	14.1	0.011	20.0									
	17	73.2	0.046	112.0	31.5	0.023	49.2	17.4	0.011	29.2						
	19	80.7	0.046	122.7	39.1	0.023	59.9	25.0	0.011	39.9	7.6	-	10.7			
	21	87.5	0.046	132.1	45.9	0.023	69.3	31.8	0.011	49.3	14.3	-	20.1	6.8	-	9.4
	25	96.2	0.057	146.5	54.6	0.034	83.7	40.5	0.023	63.8	23.0	0.011	34.5	15.5	0.011	23.9
	27	99.8	0.057	152.2	58.1	0.034	89.3	44.0	0.023	69.4	26.6	0.011	40.1	19.0	0.011	29.5
Heat Pump	11	791.9	-													
	13	1,040.8	0.011		248.9	-										
	17	1,395.4	0.023		603.5	0.011		354.5	-							
	19	1,524.5	0.023		732.6	0.011		483.7	-		129.1	-				
	21	1,633.2	0.023		841.3	0.011		592.4	-		237.8	-		108.7	-	
	25	1,802.5	0.034		1,010.7	0.023		761.7	0.011		407.2	0.011		278.1	-	
	27	1,869.7	0.034		1,077.9	0.023		828.9	0.011		474.4	0.011		345.3	-	
AC with Electric Heat	11	1,019.7	-													
	13	1,341.6	0.011		321.9	-										
	17	1,793.1	0.023		773.4	0.011		451.6	-							
	19	1,960.3	0.023		940.6	0.011		618.7	-		167.2	-				
	21	2,101.1	0.023		1,081.4	0.011		759.5	-		308.0	-		140.8	-	
	25	2,319.2	0.034		1,299.5	0.023		977.6	0.011		526.1	0.011		358.9	-	
	27	2,406.7	0.034		1,387.0	0.023		1,065.1	0.011		613.6	0.011		446.4	-	
Electric Heat, No AC	11	1,014.6	-													
	13	1,333.0	-		318.4	-										
	17	1,785.0	0.011		770.4	0.011		452.0	-							
	19	1,950.6	0.011		936.0	0.011		617.6	-		165.6	-				
	21	2,089.0	0.011		1,074.4	0.011		756.0	-		304.0	-		138.4	-	
	25	2,307.5	0.023		1,293.0	0.023		974.5	0.011		522.5	0.011		357.0	-	
	27	2,394.3	0.023		1,379.8	0.023		1,061.3	0.011		609.3	0.011		443.8	-	
Gas Heat, No AC	11	36.6	-	62.8												
	13	47.1	-	82.8	10.5	-	20.0									
	17	64.9	0.011	112.0	28.3	0.011	49.2	17.8	-	29.2						
	19	71.2	0.011	122.7	34.6	0.011	59.9	24.1	-	39.9	6.3	-	10.7			
	21	75.2	0.011	132.1	38.6	0.011	69.3	28.1	-	49.3	10.3	-	20.1	4.0	-	9.4
	25	84.5	0.023	146.4	47.9	0.023	83.6	37.4	0.011	63.6	19.6	0.011	34.4	13.3	-	23.7
	27	87.3	0.023	152.2	50.7	0.023	89.3	40.1	0.011	69.4	22.4	0.011	40.1	16.1	-	29.5

Table 13. Savings Factor for Floor/Wall Insulation: Zones 1-3, High-Rise Multifamily Buildings (4 or More Stories)

HVAC	Measure R-Value	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF	EESF	DSF	HFSF
		Base R-0			Base R-11			Base R-19			Base R-30			Base R-38		
ZONE 1																
Chiller and Boiler with FPFC	11	10.2	0.005	52.3												
	13	13.2	0.008	68.8	3.0	0.003	16.5									
	17	17.3	0.011	91.8	7.1	0.005	39.5	4.1	0.003	23.0						
	19	18.7	0.011	100.0	8.5	0.005	47.7	5.5	0.003	31.2	1.4	-	8.2			
	21	19.9	0.014	106.8	9.7	0.008	54.5	6.7	0.005	38.0	2.6	0.003	15.0	1.2	0.003	6.8
	25	21.7	0.014	117.4	11.4	0.008	65.1	8.4	0.005	48.6	4.4	0.003	25.6	3.0	0.003	17.4
	27	22.4	0.014	121.7	12.2	0.008	69.4	9.1	0.005	52.9	5.1	0.003	29.9	3.7	0.003	21.7
Steam Boiler Only	11	-	-	58.3												
	13	-	-	76.7	-	-	18.4									
	17	-	-	102.3	-	-	44.0	-	-	25.6						
	19	-	-	111.4	-	-	53.1	-	-	34.8	-	-	9.1			
	21	-	-	119.0	-	-	60.7	-	-	42.4	-	-	16.7	-	-	7.6
	25	-	-	130.8	-	-	72.5	-	-	54.1	-	-	28.5	-	-	19.4
	27	-	-	135.6	-	-	77.3	-	-	59.0	-	-	33.3	-	-	24.2
ZONE 2																
Chiller and Boiler with FPFC	11	17.9	0.016	61.3												
	13	23.2	0.024	80.3	5.3	0.008	19.0									
	17	30.5	0.033	106.3	12.6	0.016	45.0	7.3	0.008	26.0						
	19	33.1	0.035	115.6	15.2	0.019	54.3	9.9	0.011	35.3	2.6	0.003	9.4			
	21	35.3	0.038	123.6	17.4	0.022	62.3	12.1	0.014	43.3	4.8	0.005	17.3	2.2	0.003	8.0
	25	38.6	0.041	136.0	20.8	0.024	74.7	15.4	0.016	55.7	8.1	0.008	29.7	5.5	0.005	20.3
	27	40.0	0.044	140.9	22.1	0.027	79.6	16.8	0.019	60.6	9.5	0.011	34.6	6.9	0.008	25.3
Steam Boiler Only	11	-	-	68.3												
	13	-	-	89.5	-	-	21.2									
	17	-	-	118.4	-	-	50.1	-	-	28.9						
	19	-	-	128.9	-	-	60.5	-	-	39.4	-	-	10.4			
	21	-	-	137.7	-	-	69.4	-	-	48.2	-	-	19.3	-	-	8.9
	25	-	-	151.5	-	-	83.2	-	-	62.0	-	-	33.1	-	-	22.7
	27	-	-	157.0	-	-	88.7	-	-	67.5	-	-	38.6	-	-	28.2
ZONE 3																
Chiller and Boiler with FPFC	11	9.7	0.005	55.6												
	13	12.5	0.005	72.8	2.8	-	17.2									
	17	16.2	0.008	96.9	6.4	0.003	41.3	3.7	0.003	24.1						
	19	17.5	0.008	105.5	7.7	0.003	49.9	4.9	0.003	32.7	1.3	-	8.6			
	21	18.5	0.011	112.7	8.7	0.005	57.1	6.0	0.005	39.9	2.3	0.003	15.8	1.0	0.003	7.2
	25	20.0	0.011	123.8	10.3	0.005	68.2	7.5	0.005	51.0	3.9	0.003	26.9	2.6	0.003	18.3
	27	20.6	0.011	128.4	10.9	0.005	72.8	8.1	0.005	55.6	4.5	0.003	31.5	3.2	0.003	22.9
Steam Boiler Only	11	-	-	62.0												
	13	-	-	81.1	-	-	19.2									
	17	-	-	108.0	-	-	46.0	-	-	26.9						
	19	-	-	117.6	-	-	55.6	-	-	36.4	-	-	9.6			
	21	-	-	125.6	-	-	63.6	-	-	44.4	-	-	17.6	-	-	8.0
	25	-	-	137.9	-	-	76.0	-	-	56.8	-	-	30.0	-	-	20.4
	27	-	-	143.0	-	-	81.1	-	-	61.9	-	-	35.1	-	-	25.5

Table 14. Deemed Baseline Efficiency for Existing Heating System (Multifamily)

Existing Equipment Type	EF_{BASE}
Air Furnace ≤ 300 Mbtu/hr	78%
Non-Condensing Hot Water Boiler ≤ 300 Mbtu/hr	80%
Non-Condensing Hot Water Boiler > 300 and ≤ 500 Mbtu/hr	75%
Non-Condensing Hot Water Boiler > 500 and ≤ 1,000 Mbtu/hr	75%
Non-Condensing Hot Water Boiler > 1,000 and ≤ 1,700 Mbtu/hr	75%
Non-Condensing Hot Water Boiler > 1,700 Mbtu/hr	80%
Condensing Hot Water Boiler ≤ 300 Mbtu/hr	80%
Condensing Hot Water Boiler > 300 and ≤ 500 Mbtu/hr	75%
Condensing Hot Water Boiler > 500 and ≤ 1,000 Mbtu/hr	75%
Condensing Hot Water Boiler > 1,000 and ≤ 1,700 Mbtu/hr	75%
Condensing Hot Water Boiler > 1,700 Mbtu/hr	80%
Steam Boiler ≤ 300 Mbtu/hr	75%
Steam Boiler > 300 and ≤ 2,500 Mbtu/hr	75%
Steam Boiler > 2,500 and ≤ 10,000 Mbtu/hr	80%
Unit Heater - Low-intensity, infrared, all capacity ranges	80%
Unit Heater - Warm Air, all capacity ranges	80%
New Construction, Replace on Burnout Standard Baseline	84%[187]

Table 15. Daily Water Usage by Number of People in Household[188]

Number of People/household	GPD/household
1	29
2	46
3	62
4	78
5	94
6	111

Table 16. Efficient Water Heater EF_{EE}

Efficient Measure Type	EF_{EE}
Heat Pump Water Heater	2.2
Instantaneous (Tankless) Water Heater	2.2
Storage-Type Water Heater (V≤50 Gallons)	Actual

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187 Based on Code of Federal Regulations minimum AFUE for Non-weatherized oil-fired hot water boiler: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=61b33caa9460da7b2e875b478972dfdc&rgn=div6&view=text&node=10:3.0.1.4.18.3&idno=10

188 New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, New York Evaluation Advisory Contractor Team & TecMarket Works, October 15, 2010; Page 90

Table 17. Deemed UA Values for Indirect Water Heaters, by Tank Size[189]

Tank Size (Gal)	UA (Btu/hr-°F)
0	4.1
40	4.1
80	6.1
120	8.4
140	9.6
200	11.7
250	13.3
350	17.1
400	18.5
500	20.9
750	27.7
1000	34.6

[189] New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, New York Evaluation Advisory Contractor Team & TecMarket Works, October 15, 2010; Page 87

Table 18. Measure Life Reference for Custom Projects[190]

End-Use	Measure Category	New Construction	Retrofit
Custom Lighting	Equipment	15	13
	Controls	10	9
Custom HVAC	Chillers/Chiller Plant	20	NA
	HVAC Equipment	15	13
	EMS & HVAC Controls	15	10
	Heating System Replacement/Upgrade	25	25
	Heating System Maintenance (e.g,. burner optimization, tune-up)	10	10
Custom Motors and VFDs	Equipment	15	13
Custom Compressed Air	Equipment	15	13
Custom Miscellaneous	Process Cooling or Heating	15	13
	Commercial Compressors	15	13
	Industrial Compressors	20	18
	Controls	10	9
	O&M	NA	5
	Retro-commissioning	NA	5
	Envelope	20	20

[190] ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-2.

Appendix E: Lighting Installed and Baseline Fixture Rated Wattage Tables and Baseline Lighting Power Density (LPD)

The TRM shows the installed fixture table that is current at the start of the program year. New measure codes and fixture types may be added during the program year. For the most up to date table of eligible fixture types, see the Measure Code Reference Forms available on the Business Program Incentive Application page of the Efficiency Maine website: http://www.efficiencymaine.com.

Table 19 - Installed Fixture Rated Wattage Table ($Watts_{EE}$)[191]

Installed Fixture Description	Wattage ($Watts_{EE}$)	Installed Fixture Description	Wattage ($Watts_{EE}$)
CFL - 1/10W	12	T5 - 10-Lamp 4' T5 HO	588
CFL - 1/13W	15	T5 - 1-Lamp 2' T5	19
CFL - 1/16W 2D	18	T5 - 1-Lamp 2' T5 HO	28
CFL - 1/18W	20	T5 - 1-Lamp 4' T5	32
CFL - 1/21W 2D	22	T5 - 1-Lamp 4' T5 HO	59
CFL - 1/22W	24	T5 - 2-Lamp 2' T5	27
CFL - 1/23W	25	T5 - 2-Lamp 2' T5 HO	55
CFL - 1/26W	28	T5 - 2-Lamp 4' T5	63
CFL - 1/28W	30	T5 - 2-Lamp 4' T5 HO	117
CFL - 1/32W CIRCLINE	34	T5 - 3-Lamp 4' T5 HO	177
CFL - 1/38W 2D	36	T5 - 4-Lamp 4' T5 HO	234
CFL - 1/42W	48	T5 - 5-Lamp 4' T5 HO	294
CFL - 1/44W CIRCLINE	46	T5 - 6-Lamp 4' T5 HO	351
CFL - 1/5W	7	T5 - 8-Lamp 4' T5 HO	468
CFL - 1/7W	9	T8 - 10-Lamp 4' HPT8	279
CFL - 1/9W	11	T8 - 1-Lamp 2' HPT8	17
CFL - 2/11W	26	T8 - 1-Lamp 4' HPT8	28
CFL - 2/13W	30	T8 - 1-Lamp 4' HPT8 (25&28 Watts)	24
CFL - 2/18W	40	T8 - 1-Lamp 4' HPT8 HIGH LMN	39
CFL - 2/26W	54	T8 - 1-Lamp 4' HPT8 LOW PWR	25
CFL - 2/32W	68	T8 - 2-Lamp 2' HPT8	37
CFL - 2/42W	100	T8 - 2-Lamp 4' HPT8	53
CFL - 2/5W	14	T8 - 2-Lamp 4' HPT8 (25&28 Watts)	44
CFL - 2/7W	18	T8 - 2-Lamp 4' HPT8 HIGH LMN	78
CFL - 2/9W	22	T8 - 2-Lamp 4' HPT8 LOW PWR	47
CFL - 3/13W	45	T8 - 3-Lamp 2' HPT8	53
CFL - 3/18W	60	T8 - 3-Lamp 4' HPT8	77
CFL - 3/26W	82	T8 - 3-Lamp 4' HPT8 (25&28 Watts)	67
CFL - 3/32W	114	T8 - 3-Lamp 4' HPT8 HIGH LMN	112
CFL - 3/42W	141	T8 - 3-Lamp 4' HPT8 LOW PWR	73

[191] Note that not all installed fixtures are appropriate for each measure. For example, a high efficiency fluorescent bulb cannot be the installed fixture for a refrigerated case LED. The selection of installed fixtures is controlled within effRT based on the measure code selection.

Installed Fixture Description	Wattage ($Watts_{EE}$)	Installed Fixture Description	Wattage ($Watts_{EE}$)
CFL - 3/9W	33	T8 - 4-Lamp 2' HPT8	62
CFL - 4/26W	108	T8 - 4-Lamp 4' HPT8	101
CFL - 4/32W	152	T8 - 4-Lamp 4' HPT8 (25&28 Watts)	88
CFL - 4/42W	188	LED 2x2 Recessed Fixture <50W	40
Exit Sign - 2.5W LED	2.5	LED 2x2 Recessed Fixture ≥50W	58
LED A	10	LED 2x4 Recessed Fixture <50W	44
LED BR30	10	LED 2x4 Recessed Fixture ≥50W	63
LED BR40	15	LED 1x4 Recessed Fixture <40W	33
LED Canopy	106	LED 1x4 Recessed Fixture ≥40W	48
LED D	12	LED High/Low Bay Fixtures <150W	105
LED Flood/Spot <50W	35	LED High/Low Bay Fixtures ≥150W	236
LED Flood/Spot (50W – 100W)	65	LED Refrigerated Case Light - Horizontal	2.4 W/ft
LED Flood/Spot ≥100W	138		
LED Kit (<50W)	35	T8 - 4-Lamp 4' HPT8 HIGH LMN	156
LED Kit (>100W)	130	T8 - 4-Lamp 4' HPT8 LOW PWR	93
LED Kit (50W-100W)	70	T8 - 5-Lamp 4' HPT8	0
LED MR16	7	T8 - 6-Lamp 4' HPT8	154
LED PAR 20	8	T8 - 6-Lamp 4' HPT8 HIGH LMN	224
LED PAR 30	12	T8 - 6-Lamp 4' HPT8 LOW PWR	134
LED PAR 38	22	T8 - 8-Lamp 4' HPT8	202
LED PG	60	LED Utility Pole (<50W)	32
LED PL (<50W)	40	LED Utility Pole (50W-100W)	70
LED PL (>100W)	150	LED Utility Pole (>100W)	156
LED PL (50W-100W)	80		
LED R	38		
LED SL (<50W)	40		
LED SL (>100W)	150		
LED SL (50W-100W)	80		
LED WP	35		

Table 20 - Installed Fixture Rated Wattage Reduction Table ($SAVE_{EE}$)

Measure	Installed Fixture Description	Wattage Reduction ($SAVE_{EE}$)
S11 LED Street & Parking Lot Lights	LED PL (<50W)	88
	LED PL (>100W)	308
	LED PL (50W-100W)	208
	LED SL (<50W)	88
	LED SL (>100W)	308
	LED SL (50W-100W)	208
S13 LED Wallpacks	LED WP	93
S17 Fuel Pump Canopy	LED Canopy	352
S23 LED Flood/Spot	LED Flood/Spot <50W	60
	LED Flood/Spot 50-100W	230
	LED Flood/Spot ≥100W	327
S31 Refrigerated Case LED Fixture	LED R	62
S31 Refrigerated Case LED Fixture - Horizontal	LED RH	4.6 W/ft
S41 Screw-In LED Lamps	LED A	50
	LED BR30	50
	LED BR40	45
	LED MR16	33
	LED PAR 20	31
	LED PAR 30	28
	LED PAR 38	78

Table 21 - Existing Fixture Rated Wattage Table[192]

Existing Fixture Description	Wattage	Existing Fixture Description	Wattage
CFL - 11W	11	PSMH - 100W	118
CFL - 13W	13	PSMH - 150W	170
CFL - 27W	27	PSMH - 200W	219
Exit Sign - (2) 20W Incandescent	40	PSMH - 320W	349
Exit Sign - (2) 5W CFL	10	PSMH - 400W	435
Exit Sign - (2) 7.5W Incandescent	15	T12 - 1-Lamp 4' T12	41.7
Exit Sign - (2) 9W CFL	18	T12 - 1-Lamp 4' T12 HO	84
Halogen - 20W	20	T12 - 1-Lamp 5' T12 HO	97
Halogen - 50W	50	T12 - 1-Lamp 6' T12 HO	113
HPS - 100W	138	T12 - 2-Lamp 4' T12	70.7
HPS - 150W	188	T12 - 2-Lamp 4' T12 HO	131
HPS - 250W	295	T12 - 2-Lamp 5' T12 HO	170
HPS - 400W	465	T12 - 2-Lamp 6' T12 HO	193
HPS - 50W	65	T12 - 2-Lamp 8' T12	120.6
HPS - 70W	95	T12 - 2-Lamp 8' T12 HO	197.9
Incandescent - 100W	100	T12 - 2-Lamp U T12	72.5
Incandescent - 40W	40	T12 - 3-Lamp 4' T12	112.3
Incandescent - 60W	60	T12 - 4-Lamp 4' T12	141.2
Incandescent - 65W	65	T8 - 1-Lamp 4' T8	31
Incandescent - 75W	75	T8 - 1-Lamp 4' T8 HO	53
MH - 1000W	1075	T8 - 1-Lamp 5' T8 HO	62
MH - 100W	128	T8 - 1-Lamp 6' T8 HO	80
MH - 150W	190	T8 - 2-Lamp 4' T8	59
MH - 175W	215	T8 - 2-Lamp 4' T8 HO	100
MH - 200W	232	T8 - 2-Lamp 5' T8 HO	116
MH - 250W	288	T8 - 2-Lamp 6' T8 HO	136
MH - 400W	458	T8 - 2-Lamp U T8	60
		T8 - 3-Lamp 4' T8	89
		T8 - 4-Lamp 4' T8	112

[192] Note that not all baseline fixtures are appropriate for each measure. For example, and incandescent exit sign cannot be the baseline for a new super-efficient T8. The selection of baseline fixtures is controlled within effRT based on the selected measure code.

Table 22 – Lighting Power Allowance (Watt/ft^2) by Space-Type

Space Type	LPD_{BASE}
In Unit	1.1
Restrooms	0.9
Lobby	1.3
Stairs (Active)	0.6
Corridor/Transition	0.5
Multipurpose	1.3
Gymnasium/Exercise Center (Exercise Area)	0.9
Inactive Storage	0.3
Electrical/Mechanical	1.5
Parking Garage (Garage Area)	0.2

Appendix F: Prescriptive Lighting Measure Cost

Table 23 – Measure Costs for Prescriptive Lighting[193]

Measure Code	Measure Subdivision	Installed Cost: High Efficiency	Installed Cost: Standard Practice	Incremental Cost
L10	NA	$36	$0	$36
L10.1	NA	$36	$0	$36
L15	NA	$85	$0	$85
L15.1	NA	$85	$0	$85
L16	NA	$93	$45	$48
L20	NA	$86	$0	$86
L25	NA	$72	$0	$72
L30	NA	$92	$0	$92
L30.1	NA	$92	$0	$92
L31	NA	$94	$63	$31
L32	NA	$175	$0	$175
L32.1	NA	$175	$0	$175
L33	NA	$143	$63	$80
L35	NA	$174	$67	$107
L50	NA	$68	$0	$68
L60	NA	$74	$0	$74
L70	NA	$120	$0	$120
L71	NA	$59	$0	$59
X10	NA	$47	$0	$47
S8	NA	$500	$0	$500
S10	<50 W	$330	$0	$330
	50-100 W	$585	$0	$585
	>100 W	$830	$0	$830
S11	<50 W	$330	$215	$115
	50-100 W	$585	$400	$185
	>100 W	$830	$565	$265
S12	NA	$370	$0	$370
S13	NA	$370	$130	$240
S16	LED Canopy < 50 W	$350	$0	$350
	LED Canopy 50 W – 80 W	$550	$0	$550
	LED Canopy > 80 W	$600	$0	$600

[193] Measure cost analysis performed by Cadmus June 2015 based on the following sources:
Illinois TRM V4.0, 2/24/15, http://www.icc.illinois.gov/downloads/public/Illinois_Statewide_TRM_Effective_060115_Final_022415_Clean.pdf
Mid-Atlantic TRM V5.0, 6/2015, http://www.neep.org/sites/default/files/resources/Mid-Atlantic_TRM_V5_FINAL_5-26-2015.pdf
Design Light Consortium, https://www.designlights.org/qpl
Northwest Power and Conservation Council 7th Power Plan, updated 2015, http://www.nwcouncil.org/energy/powerplan/7/technical
Regional Technical Forum (RTF), http://rtf.nwcouncil.org/measures/Default.asp

Measure Code	Measure Subdivision	Installed Cost: High Efficiency	Installed Cost: Standard Practice	Incremental Cost
S17	LED Canopy < 50 W	$350	$250	$100
	LED Canopy 50 W – 80 W	$550	$350	$200
	LED Canopy > 80 W	$600	$450	$150
S20	NA	$75	$0	$75
S21	NA	$75	$60	$15
S22	LED Flood/Spot <50 W	$280	$0	$280
	LED Flood/Spot 50W – 100 W	$500	0	$500
	LED Flood/Spot ≥100 W	$700	$0	$700
S23	LED Flood/Spot <50W	$280	$110	$170
	LED Flood/Spot 50W – 100W	$500	$210	$290
	LED Flood/Spot ≥100 W	$700	$310	$390
S30	NA	$192	$0	$192
S31	NA	$192	$100	$92
S32	NA	$220	$0	$220
S33	NA	$220	$100	$120
S50	LED 2x2 Interior Fixture <50 W	$160	$0	$160
	LED 2x2 Interior Fixture ≥50W	$205	$0	$205
	LED 2x4 Interior Fixture <50W	$190	$0	$190
	LED 2x4 Interior Fixture ≥50W	$239	$0	$239
	LED 1x4 Interior Fixture <40W	$164	$0	$164
	LED 1x4 Interior Fixture ≥40W	$220	$0	$220
S51	LED 2x2 Interior Fixture <50W	$160	$60	$100
	LED 2x2 Interior Fixture ≥50W	$205	$78	$127
	LED 2x4 Interior Fixture <50W	$190	$72	$118
	LED 2x4 Interior Fixture ≥50W	$239	$92	$147
	LED 1x4 Interior Fixture <40W	$164	$61	$103
	LED 1x4 Interior Fixture ≥40W	$220	$84	$136
S52	Retrofit Kit for LED 2x2 Interior Fixture <50W	$160	$0	$160
	Retrofit Kit for LED 2x2 Interior Fixture ≥50W	$205	$0	$205
	Retrofit Kit for LED 2x4 Interior Fixture <50W	$190	$0	$190
	Retrofit Kit for LED 2x4 Interior Fixture ≥50W	$239	$0	$239
	Retrofit Kit for LED 1x4 Interior Fixture <40W	$164	$0	$164
	Retrofit Kit for LED 1x4 Interior Fixture ≥40W	$220	$0	$220
S60	LED High/Low Bay Fixtures <150W	$450	$0	$450
	LED High/Low Bay Fixtures ≥150W	$585	$0	$585
S61	LED High/Low Bay Fixtures <150W	$450	$140	$310
	LED High/Low Bay Fixtures ≥150W	$585	$140	$445
S70	LED Stairway ≤ 40 W	$250	$0	$250
	LED Stairway > 40 W	$325	$0	$325

Measure Code	Measure Subdivision	Installed Cost: High Efficiency	Installed Cost: Standard Practice	Incremental Cost
S71	LED Stairway ≤ 40 W	$250	$45	$205
	LED Stairway > 40 W	$325	$45	$280
S80	LED Linear Ambient < 50 W	$200	$0	$200
	LED Linear Ambient 50 W – 100 W	$300	$0	$300
	LED Linear Ambient > 100 W	$375	$0	$375
S81	LED Linear Ambient < 50 W	$200	$45	$155
	LED Linear Ambient 50 W – 100 W	$300	$45	$255
	LED Linear Ambient > 100 W	$375	$45	$330

Appendix G: Average Annual Lighting Operating Hours and other Lookup Tables

Table 24 – Reference Lighting Annual Operating Hours

Multifamily Buildings	
Space Type	**Annual Hours**
In-Unit: Kitchen/Dining	744.6 [A]
In-Unit: Living Room	744.6 [A]
In-Unit: Hallways	744.6 [A]
in-Unit: Laundry/Utility Room	744.6 [A]
In-Unit: Bedroom	744.6 [A]
In-Unit: Bathroom	744.6 [A]
Common Area: Corridors/Hallways (24 HR)	8,760 [C]
Common Area: Stairs (24 HR)	8,760 [B]
Common Area: Other (non-24 HR)	2,278 [B]
Exterior Lighting	4,380 [B]
[A] Annual hours based on evaluated results for residential CFL and LED [B] ASHRAE 90.1-2007, Section 9.4.1.1 [C] Average value for "Other" building type in Commercial/Industrial sector.	

Table 25 – Savings Factors for Lighting Controls

Multifamily Buildings	
Space Type	**% of Annual Lighting Energy Saved (SVG)**
Common Area: Corridors/Hallways (24 HR)	25% [A]
Common Area: Stairs (24 HR)	35% [A]
Common Area: Other (non-24 HR)	25% [B]

[A] Efficiency Maine Multifamily Efficiency Program Simulation Guidelines, Table 9.1, page 23
[B] Average value for "Other" building type in Commercial/Industrial sector.

Appendix H: Standard Assumptions for Maine

Table 26. Distribution of Heating Fuel for Maine Residential Customers

Heating Fuel	Percentage of Homes	Distribution Excluding Coal and Other	Distribution Excluding Natural Gas, Coal and Other
Natural Gas	9%	9%	N/A
Oil	65%	66%	72%
Wood	8%	8%	9%
Propane	6%	6%	7%
Kerosene	6%	6%	7%
Pellet	4%	4%	4%
Electricity	0.80%	0.80%	0.9%
Coal	0.40%	N/A	N/A
Other	0.30%	N/A	N/A

Appendix I: Custom Projects – Process Documentation

This appendix documents the eligibility, application and proposal requirements, and the review process for custom projects under the Multifamily Efficiency Program.

PROJECT ELIGIBILITY

- **Eligible Measures:** Measures representing technologies that are not supported by the Multifamily Efficiency Program, or are prohibited by the Multifamily Efficiency Program's Terms and Conditions, will not be considered for custom incentives regardless of project economics.
- **Internal Rate of Return > 10%:** Custom projects must have an internal rate of return (IRR) greater than 10% as determined in the Efficiency Maine screening tool. In calculating the IRR for Custom Project screening, the benefit is calculated as the net present value of the projected avoided cost of the saved energy (kWh) from the project, over the defined measure life, and the cost is the measure cost appropriate to the Project Type (incremental cost for new construction or replacement and full measure cost for retrofit).
- **Incentive Limit**: Incentives on Custom projects may not exceed 50% of total project cost.
- **Preapproval prior to implementation:** Preapproval is required for all custom incentives. Measures that are implemented before preapproval is obtained are not eligible for incentives.

PROJECT APPLICATION AND PROPOSAL REQUIREMENTS

All applications and proposals for Custom Projects through the Multifamily Efficiency Program must include:

- An analysis and description of the projected energy savings, including all data, calculations, spreadsheet tools, and the basis for any assumptions clearly presented.
- Cut sheets and manufacturers performance data that is pertinent to the savings analysis.
- Clearly worded descriptions of the baseline and the energy efficient equipment and operating conditions.
- Equipment and installation costs associated with each component of the proposed measures. For new or replacement measures, cost data must be provided for both the baseline and the energy efficient options.

REVIEW OF APPLICATIONS AND PROPOSALS

Review of the Custom Project Applications consists of the following steps.

1. **Initial review.** The assigned engineer completes initial review of the application or proposal package to determine if sufficient information is provided to validate appropriateness and make a preliminary eligibility decision.

   Based on the initial application review, the assigned reviewing engineer proceeds as follows:

   - If application is *incomplete*, engineer provides written request for additional required information.

- If application appears to be *complete and appropriate* for the program, engineer acknowledges receipt of application and proceeds to Step 2 - Validation of submitted measure cost and savings values.
- If application is *inappropriate* for the program to which it was submitted (e.g., project fails basic eligibility requirements), engineer suspends review. For Business Incentive Program, engineer contacts applicant to redirect or explain reason for determination.

2. **Validation of submitted measure cost**. The assigned engineer completes a thorough review of submitted cost data to determine that it is reasonable and that it represents only costs of equipment and installation necessary to facilitate implementation of the proposed measure(s) that lead directly to the projected energy savings.
    - If the submitted costs lack adequate documentation and/or appears to be inappropriate, request additional detail and supporting documents (e.g., vendor quotes, schedule of values, line item budget, etc.).
    - If the submitted costs appear to include inappropriate or extraneous elements, deduct such costs, and document the rationale for the deductions (for example, if the cost reflects installation of a new chiller with a water side economizer, and submitted savings are all associated with the economizer, the measure cost should only be those associated with the economizer).
    - If the submitted costs appear appropriate for the proposed measure(s), proceed to validation of the projected savings.
3. **Validation of projected annual energy savings**. The assigned engineer completes a thorough review of the submitted savings analysis to verify accuracy of calculations and to verify that the analysis is based on accepted engineering practices, documented equipment performance specifications, actual recorded data and/or reasonable and documented assumptions related to operating hours and load profiles.
    - If submitted savings analysis is found to include inconsistencies and/or errors that can be readily corrected, make appropriate adjustments to the projected level of savings and document the adjustment.
    - If the submitted savings analysis is based on a building simulation model, or other analysis that does not provide details of the underlying actual calculations, validate projected savings through one of the following methods:
        - Review of sufficient inputs and outputs from the model to validate the accuracy and reasonableness of the projection. Historical consumption data for the facility should be requested in cases where it is deemed appropriate; such data can often be useful to verify that models have been calibrated and projected baseline consumption levels are feasible.
        - Independent derivation of the savings based on the submitted equipment performance specifications and load profiles.
    - If the submitted savings cannot be validated using the process outlined above, the applicant/bidder should be informed in writing of the deficiencies and the additional documentation that is necessary to complete the review of the application/proposal. In the case of Business Incentive Program

applications, the applicant/QP can be advised of Technical Assistance Funding and provided with contacts for technical experts capable of projecting the savings associated with the measure, as appropriate.

4. **Determination of peak demand savings:** The assigned engineer uses the project documentation to calculate the coincident peak demand savings, which are used to report the impact of measures on grid electrical demands during on-peak summer and on-peak winter periods. For all custom projects (Business Incentive Program and Large Customer Program), the reviewing engineer uses the following process to determine and document the project's coincident peak demand savings:
   - The reviewer will calculate the gross reduction in input kW resulting from the measure using one of the following methods:
     - *Demand Reduction (kW)= overall connected kW of the base line system – overall connected load of the proposed system*
     - *Average Demand Reduction (kW) = Validated Annual Energy Savings (kWh/year) / Annual Operating Hours (hours/year)*
   - If the measure technology is described in one of the categories with coincidence factors provided in Appendix C of this document, apply the appropriate coincidence factor from Appendix C to the calculated average demand reduction and document the resulting summer and winter demand impact using the following formula.
     - *Summer Peak Demand savings (kW) = Average Demand Reduction (kW) x Applicable Summer Coincidence Factor (%)*
     - *Winter Peak Demand savings (kW) = Average Demand Reduction (kW) x Applicable Winter Coincidence Factor (%)*
   - For cases where the measure technology does not fit within a category with coincidence factors provided in Appendix C, or where it is defined by the category but the load shape is clearly documented as non-typical for the category (e.g., exterior lighting with photo-cell control), the reviewing engineer will use the available data to predict and document the project specific winter and summer peak demand savings.

     In many cases, the submitted savings analysis will include an hourly projection of baseline and proposed consumption that will allow the engineer to quickly and accurately calculate project specific peak demand savings using the following algorithm:
     - *Average Summer Peak Demand savings (kW) = [Validated Annual Energy Savings During Summer Coincident Demand Hours (kWh/year]) / [Total Number of Summer Coincident Demand Hours (hrs/year)]*
     - *Average Winter Peak Demand savings (kW)= [Validated Annual Energy Savings During Winter Coincident Demand Hours (kWh/year)] / [Total Number of Winter Coincident Demand Hours (hrs/year)]*

In other cases, the load shape data included in the submitted savings analysis will be less specific, and the engineer will use whatever site specific data is available and apply assumptions to extrapolate a reasonable approximation of the demand savings during coincident peak summer and winter hours.

5. **Validation of cost effectiveness:** Once measure cost and annual energy savings have been validated, the reviewing engineer verify and validate the project meets the cost-effectiveness requirements as documented above (under PROJECT ELIGIBILITY).
   To complete this step, the engineer will enter the following data into the Efficiency Maine screening tool:
   - Measure life
   - Validated annual energy savings
   - Projected peak demand savings
   - Validated measure cost
   - Blended average energy cost[194]

6. **Documentation:** The reviewing engineer will use the Efficiency Maine *Custom Incentive Review Summary Template* to document the review process, including the following elements:
   - Brief summary of the submitted application/proposal including a measure description, measure cost, projected annual savings and requested incentive amount.
   - Brief summary of the review process with specific mention of any adjustments to the submitted cost and savings values including the rationale supporting these adjustments.
   - Explanation of the reviewing engineer's derivation of the peak demand savings.
   - Efficiency Maine screening tool inputs and outputs, including, but not limited to: energy savings, peak demand savings, measure life, benefit-cost ratio and simple payback period, and projects.
   - The approved incentive level.

[194] The blended average cost values provided with the application are typically based on a single monthly bill. In cases where this blended average cost value significantly impacts eligibility and/or the magnitude of the available incentive, additional effort will be made to validate these values based on a recent 12 months of historical cost and consumption data.