Commercial

Technical Reference Manual

Version 2016.1

Effective Date: July 1, 2015

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

Table of Contents

TABLE OF CONTENTS **2**

INTRODUCTION **4**

TRM CHANGE LOG **10**

LIGHTING EQUIPMENT **14**

Prescriptive Lighting: Lighting Fixtures – Interior Spaces (New Construction), Code L16, L31, L33, L35, L41, S21, S41, S51, S61, S81 16
Prescriptive Lighting: Lighting Fixtures – Interior Spaces (Retrofit), Code L10, L10.1, L15, L15.1, L20, L25, L30, L30.1, L32, L32.1, L35, L40, S20, S40, S50, S52,S60, S80 18
Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (New Construction), Code S71 20
Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (Retrofit), Code S70 22
Prescriptive Lighting: Lighting Fixtures – LED Exit Sign, Code X10 24
Prescriptive Lighting: Lighting Fixtures – Exterior Spaces (New construction), Code S11, S13, S15, S17, S23 25
Prescriptive Lighting: Lighting Fixtures – Exterior Spaces (Retrofit), Code S8, S10, S12, S16, S22 27
Prescriptive Lighting: Lighting Controls – Interior Spaces, Code L60, L70, L71, L60.1, L70.1, L71.1 28
Prescriptive Lighting: Lighting Fixtures – Refrigerated Spaces, Code S30, S31, S32, S33 30
Prescriptive Lighting: Lighting Controls – Refrigerated Spaces, Code L50 32

VARIABLE FREQUENCY DRIVES **34**

Prescriptive VFD: Variable Frequency Drives (VFD) for HVAC 35

HVAC EQUIPMENT **37**

Prescriptive HVAC: Unitary Air-Conditioners 38
Prescriptive HVAC: Heat Pump Systems 40
Prescriptive HVAC: Packaged Terminal Air Conditioners and Heat Pumps 42
Prescriptive HVAC: Demand Control Ventilation 45
Prescriptive HVAC: Variable Refrigerant Flow 46
Ductless Heat Pump 48
Prescriptive HVAC: Modulating Burner Controls for Boilers and Heaters, Code AF1 50
Prescriptive HVAC: Boiler Stack Heat Exchanger (Boiler Economizer), Code AF2 51
Prescriptive HVAC: Boiler Reset/Lockout Controls, Code AF3 52
Prescriptive HVAC: Oxygen Trim for Boilers and Heaters, Code AF4 53
Prescriptive HVAC: Boiler Turbulator, Code AF5 54
Prescriptive HVAC: Programmable Thermostat, Code AF6 55

REFRIGERATION EQUIPMENT **56**

Prescriptive Refrigeration: Evaporator Fan Motor Control for Cooler/Freezer, Code R10 57
Prescriptive Refrigeration: Door Heater Controls for Cooler/Freezer, Code R20 58
Prescriptive Refrigeration: Zero Energy Doors for Coolers/Freezers, Code R30, R31 60
Prescriptive Refrigeration: High Efficiency Evaporative Fan Motors, Code R40, R41, R42 61
Prescriptive Refrigeration: Floating-Head Pressure Controls, Code R50, R51, R52 63
Prescriptive Refrigeration: Discus & Scroll Compressors, Code R60, R61, R62, R63, R70, R71, R72, R73, R74 65
Prescriptive Refrigeration: ENERGY STAR® Reach-in Coolers and Freezers, Code R80 67
Prescriptive Refrigeration: ENERGY STAR® Commercial Ice Makers, Code R90 69

WATER HEATING EQUIPMENT **71**

Prescriptive Water Heating: Tankless Water Heater, Code WH1 72

AGRICULTURAL EQUIPMENT **74**

Prescriptive Agricultural: New Vapor-Tight High Performance T8 Fluorescent Fixtures 75
Prescriptive Agricultural: Plate Heat Exchangers for Milk Processing 76
Prescriptive Agricultural: Adjustable Speed Drives for Dairy Vacuum Pumps 77
Prescriptive Agricultural: Scroll Compressors 79
Prescriptive Agricultural: Adjustable Speed Drives on Ventilation Fans (Potato Storage Equipment) 80
Prescriptive Agricultural: High Volume Low Speed Fans 82

GAS EQUIPMENT 83

Prescriptive Gas: Natural Gas Heating Equipment, Code G1-G16 84
Prescriptive Gas: ENERGY STAR® Natural Gas Kitchen Equipment, Code G17 - G22 87

COMPRESSED AIR EQUIPMENT 89

Prescriptive Compressed Air: High Efficiency Air Compressors, Codes C1-C4 90
Prescriptive Compressed Air: High Efficiency Dryers, Codes C10-C16 92
Prescriptive Compressed Air: Receivers, Codes C20-C27 93
Prescriptive Compressed Air: Low Pressure Drop Filters, Codes C30-C33 95
Prescriptive Compressed Air: Air-Entraining Nozzles, Code C40 96

CUSTOM INCENTIVES 98

Custom – Custom Electric Projects 99
Custom – Custom Natural Gas Projects 101
Custom – Custom Green House Gas Projects 101

APPENDIX A: GLOSSARY 104

APPENDIX B: ENERGY PERIOD FACTORS AND COINCIDENCE FACTORS 108

APPENDIX C: CARBON DIOXIDE EMISSION FACTORS 113

APPENDIX D: LIGHTING INSTALLED AND BASELINE FIXTURE RATED WATTAGE TABLES AND BASELINE LIGHTING POWER DENSITY (LPD) 115

APPENDIX E: PRESCRIPTIVE LIGHTING MEASURE COST 122

APPENDIX F: AVERAGE ANNUAL LIGHTING OPERATING HOURS AND OTHER LOOKUP TABLES 126

APPENDIX G: CUSTOM PROJECTS – PROCESS DOCUMENTATION 131

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 all commercial measures for the following reasons:

- Purchased units are assumed to be installed. In the commercial sector, it is uncommon for customers to purchase equipment and not immediately install or use it.

- The Trust's 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.

- For most commercial measures, it is common to assume ISR=100% or, equivalently, not include an ISR factor. For example, the 2013-2015 MA TRM assumes 100% in-service rate for all commercial measure except screw-in measures, stating that "All installations have 100% in service rate since all programs include verification of equipment installations." Many other TRMs, including NY, CT, and the Mid-Atlantic TRM do not include an in-service rate in savings equations for commercial measures.

- ***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 the estimated 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

[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.

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 most commercial 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 neighboring states and regions and when necessary data from other areas within the U.S. In some cases, engineering judgment and scaling for regional differences are used.

- ***Project type***: The project 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 project 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 CFLs due to changes in Federal Standards for lighting products under the Energy Independence & Security Act of 2007 (EISA).

[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>

- ***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 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:

$$\text{Adjusted Gross Annual kWh} = \Delta\text{kWh/yr} \times \text{ISR} \times \text{RR}_E$$

$$\text{Adjusted Gross Lifetime kWh} = \Delta\text{kWh/yr} \times \text{ISR} \times \text{RR}_E \times \text{Measure Life}$$

$$\text{Adjusted Gross Annual MMBtu}^{4} = \Delta\text{MMBtu/yr} \times \text{ISR} \times \text{RR}_E$$

$$\text{Adjusted Gross Lifetime MMBtu}^{4} = \Delta\text{MMBtu/yr} \times \text{ISR} \times \text{RR}_E \times \text{Measure Life}$$

$$\text{Adjusted Gross Summer On-Peak kW} = \Delta\text{kW} \times \text{ISR} \times \text{RR}_D \times \text{CF}_S$$

$$\text{Adjusted Gross Winter On-Peak kW} = \Delta\text{kW} \times \text{ISR} \times \text{RR}_D \times \text{CF}_W$$

The Adjusted Gross Summer On-Peak kW value is equivalent to 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.

$$\text{Net Annual kWh} = \Delta\text{kWh/yr} \times \text{ISR} \times \text{RR}_E \times (1 - \text{FR} + \text{SO})$$

$$\text{Net Lifetime kWh} = \Delta\text{kWh/yr} \times \text{ISR} \times \text{RR}_E \times (1 - \text{FR} + \text{SO}) \times \text{Measure Life}$$

$$\text{Net Summer On-Peak kW} = \Delta\text{kW} \times \text{ISR} \times \text{RR}_D \times \text{CF}_S \times (1 - \text{FR} + \text{SO})$$

---

[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.

$$\text{Net Winter On-Peak kW} = \Delta kW \times ISR \times RR_D \times CF_W \times (1 - FR + SO)$$

**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, 2014, 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.

TRM Change Log

Change Type	TRM Section	Description	Revision Date	effRT update
PY2014 Addendum				
Correction	Table 29 - Installed Fixture Rated Wattage Reduction Table (SAVEEE)	• Corrected the $SAVE_{EE}$ values to show the average wattage reduction per fixture code. The previous values showed the fixture wattage rather than the wattage reduction. • Added wattage savings values for new measure codes S51 and S61.	11/12/2013	N/A
New	Prescriptive Lighting: Lighting Fixtures – Interior Spaces (New Construction)	Added new fixture codes: • Code S51 – LED Recessed Fixtures • Code S61 – LED High/Low Bay Fixtures	11/12/2013	Y
New	Prescriptive Lighting: Lighting Fixtures – Interior Spaces (Retrofit)	Added new fixture codes: • Code S50 – LED Recessed Fixtures • Code S60 – LED High/Low Bay Fixtures	11/12/2013	Y
New	Prescriptive Lighting: Lighting Fixtures – Refrigerated Spaces	Added new fixture codes: • Code S32 – LED Refrigerated Case Light – Horizontal (Retrofit) • Code S33 – LED Refrigerated Case Light – Horizontal (New Construction)	11/12/2013	Y
Revision	Table 28 - Installed Fixture Rated Wattage Table (WattsEE)	Added fixture wattage values for new measure codes S50, S51, S60, S61, S32 and S32	11/12/2013	Y
Revision	Table 32 – Measure Costs for Prescriptive Lighting	Added measure costs for new measure codes S50, S51, S60, and S61.	11/12/2013	Y
New	Prescriptive DHP Retrofit: Ductless Heat Pump Retrofit	Added two new measures: • DHP Retrofit (Electric Heat Baseline) • DHP Retrofit (Non-Electric Heat Baseline)	12/17/2013	Y
Revision	Table 26 – Commercial Coincidence Factors and Energy Period Factors	Added coincidence and energy period factors for the two new DHP Retrofit measures	12/17/2013	Y
Revision	Appendix G: Custom Projects – Process Documentation	Updated eligibility requirements to reflect a mid-year change announced in a January 30, 2013 program opportunity notice	2/25/2014	N/A
PY2015 Updates				
New	Multifamily Efficiency Program lighting measures	Added Multifamily Efficiency Program for retrofit lighting measures (superseded by subsequent modification)	7/1/2014	N/A
Revision	Prescriptive HVAC: Unitary Air-Conditioners	Updated baseline efficiency for Window AC units to reflect change to federal minimum efficiency standards	7/1/2014	N/A
Revision	Natural Gas Heating Equipment	Update baseline efficiency values based on new federal minimum efficiency requirements; updated measure costs	7/1/2014	Y
Other	Prescriptive Lighting: Lighting Controls – Interior Spaces	Revised description of savings calculation method to improve clarity; the change does not change the savings estimation approach	7/1/2014	N/A

Change Type	TRM Section	Description	Revision Date	effRT update
Revision	Prescriptive HVAC: PTAC and PTHP	Updated baseline efficiency values	7/1/2014	N/A
New	Prescriptive HVAC: Ductless Heat Pump Retrofit	Updated the existing Ductless Heat Pump Retrofit measure to include multi-head option; updated measure cost	7/1/2014	Y
Other	Small Business Direct Install Program	The PY2014 Direct Install Pilot Program is changed to the Small Business Direct Install Program in PY2015.	7/1/2014	N/A
Revision	DHP Retrofit	Updated the formula to include an HSPF adjustment factor and updated the annual EFLH value based on updates to the DHP workbook. Updates also included CF and EPF values for this measure.	7/1/2014	Y
Revision	HVAC: VRF	Updated baseline COP to reflect cold climate operation.	9/23/2014	Y
Revision	DHP Retrofit	Updated measure life	9/27/2014	Y
Other	DHP Retrofit	Removed qualifications table, revised measure cost for 4 zones to be 4+ zones	11/30/2014	Y
Other	Introduction	Updated TRM Update section. Inter-year updates will be released as iterations of the complete document.	11/30/2014	N
Other	Prescriptive Lighting: Lighting Fixtures – Multifamily (Retrofit), Prescriptive Lighting: Lighting Controls – Multifamily	Moved Multifamily lighting measures from Commercial TRM to Multifamily TRM	1/1/2015	N
Other	Prescriptive DHP	Removed Multifamily option. Included in Multifamily TRM	1/1/2015	N
Other	Custom Electric, Custom Natural Gas	Removed Multifamily section. Included in Multifamily TRM. Custom Natural Gas criteria updated.	1/1/2015	N
Other	Custom Natural Gas	Modified minimum savings threshold	3/1/2015	N
New	Prescriptive HVAC	Added new measures: Boiler Turbulator, Modulating Burner Controls, Oxygen Trim Controls, Boiler Economizer, Programmable Thermostats, Boiler Reset/Lockout Controls	3/1/2015	Y
New	Prescriptive Water Heating	Tankless Water Heater	3/1/2015	Y
New	Prescriptive Lighting	Added new measure codes:	3/1/2015	Y
New	Prescriptive Lighting: Lighting Fixtures – Interior Spaces (New Construction)	Added new fixture codes: • Code S81 – LED Linear Ambient Fixtures	3/1/2015	Y
New	Prescriptive Lighting: Lighting Fixtures – Interior Spaces (Retrofit)	Added new fixture codes: • Code S80 – LED Linear Ambient Fixtures	3/1/2015	Y

Change Type	TRM Section	Description	Revision Date	effRT update
New	Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (New Construction)	Added new fixture codes: • Code S71 – LED StairwayFixtures	3/1/2015	Y
New	Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (Retrofit)	Added new fixture codes: • Code S70 – LED Stairway Fixtures	3/1/2015	Y
PY2016 Updates				
Revision	Lighting Equipment	Revised waste heat factors for cooling. Added waste heat factor for heating	7/1/2015	Y
Revision	Lighting Equipment	Revised sub-division for LED Flood/Spot and High/Low Bay fixtures.	7/1/2015	Y
Revision	Appendix E: Lighting Costs	Revised measure costs for lighting measures	7/1/2015	Y
Revision	Ductless Heat Pump	Changed decision type to Lost Opportunity. Revised parameters based on updated modeling.	7/1/2015	Y
Revision	Prescriptive HVAC	Updated measure cost for Unitary A/C, Heat Pump Systems, Oxygen Trim Controls	7/1/2015	Y
Revision	Prescriptive Refrigeration	Updated measure cost for R80, R90	7/1/2015	Y
Revision	Prescriptive Agriculture	Updated measure cost for vapor-tight high performance T8,	7/1/2015	Y
Revision	Prescriptive Agriculture	Adjustable Speed Drive savings calculation updated to reflect Variable Frequency Drive Evaluation Protocol	7/1/2015	Y
Revision	Prescriptive Natural Gas	Updated measure cost for natural gas heating equipment and natural gas kitchen equipment	7/1/2015	Y
Revision	Custom Incentives	Updated measure life for heating system replacement/upgrade and maintenance	7/1/2015	Y
Other	Appendix: Carbon Dioxide Emission Factors	Added carbon dioxide emission factors table	7/1/2015	N
Other	Lighting	Expanded Hospital entries to include all health care facilities	7/1/2015	Y
Other	Appendix: Average Annual Lighting Operating Hours and other Lookup Tables	Added annual operation hours reference for nursing homes/assisted living/health care and agriculture, added health care ventilation rates	7/1/2015	N
Other	Multiple	Updated kBtuh per kW conversion factor from 3.413 to 3.412	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

Lighting Equipment

ORGANIZATION

Prescriptive lighting equipment is grouped into the following eight lighting groups:

- Lighting Fixtures – Interior Spaces (New construction)
- Lighting Fixtures – Interior Spaces (Retrofit)
- Lighting Fixtures with Integrated Controls – Interior Spaces (New construction)
- Lighting Fixtures with Integrated Controls – Interior Spaces (Retrofit)
- Lighting Fixtures – LED Exit Signs
- Lighting Fixtures – Exterior Spaces (New construction)
- Lighting Fixtures – Exterior Spaces (Retrofit)
- Lighting Controls – Interior Spaces
- Lighting Fixtures – Refrigerated Spaces
- Lighting Controls – Refrigerated Spaces

LIGHT MEASURE CODES

The list of eligible lighting products may change throughout the program year. For the most up to date table of eligible fixture types, see Business Program Lighting information available on the Efficiency Maine website: http://www.efficiencymaine.com/.

Prescriptive Lighting: Lighting Fixtures – Interior Spaces (New Construction), Code L16, L31, L33, L35, L41, S21, S41, S51, S61, S81	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency interior lighting fixtures instead of new standard efficiency fixtures.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program
End-Use	Lighting
Project Type	New construction
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For new construction measures (except measure S41):* [5] $\Delta kW = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times WHF_d$ *For measure S41:* [5] $\Delta kW = Qty_{EE} \times SAVE_{EE} / 1000 \times WHF_d$
Annual Energy Savings	*For new construction measures (except measure S41):* [5] $\Delta kWh/yr = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times WHF_{e,cool}$ $\Delta MMBtu/yr = -(LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times WHF_{e,heat}$ *For measure S41:* [5] $\Delta kWh/yr = Qty_{EE} \times SAVE_{EE} / 1000 \times HoursWk \times Weeks \times WHF_{e,cool}$ $\Delta MMBtu/yr = -Qty_{EE} \times SAVE_{EE} / 1000 \times HoursWk \times Weeks \times WHF_{e,heat}$
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) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting 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.

[5] The LPD baseline approach is not used for measure code S41 Screw-In LED lamps since these fixtures are typically used for track or task lighting and exempted from the LPD approach. When measure S41 is used, the savings are based on average per fixture wattage reduction.

Prescriptive Lighting: Lighting Fixtures – Interior Spaces (New Construction), Code L16, L31, L33, L35, L41, S21, S41, S51, S61, S81						
PARAMETER VALUES						
Measure/Type	Qty_{EE}	$Watts_{EE}$	$SAVE_{EE}$	Area	LPD_{BASE}	$WHF_{e,heat}$
New construction	Actual	Table 28[6]	Table 29[6]	Actual	Table 31[6]	0.00246[8]
Measure/Type	HoursWk	Weeks	WHF_d	$WHF_{e,cool}$	Life (yrs)	Cost ($)
New construction	Actual[7]	Actual	1.067[8]	1.198[8]	15[9]	Table 32[10]

IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[11]	101%[11]	Table 26[12]	Table 26[12]	28%[13]	0.4%[14]

[6] See Appendix D. The fixture wattage and wattage reduction values are based on the specified fixture type. The baseline LPD is based on the specified space type.
[7] Use actual hours when known. If hours are unknown, use the values from Table 33.
[8] Analysis performed by Cadmus June 2015 based on 2015 NY TRM, Appendix D. HVAC Interactive Effects Multipliers.
[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 E.
[11] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Values for prescriptive measures.
[12] See Appendix B.
[13] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[14] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Lighting: Lighting Fixtures – Interior Spaces (Retrofit), Code L10, L10.1, L15, L15.1, L20, L25, L30, L30.1, L32, L32.1, L35, L40, S20, S40, S50, S52,S60, S80

Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency interior lighting fixtures to replace existing operating lighting equipment (retrofit).
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install 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	$\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times WHF_{e,cool}$ $\Delta MMBtu/yr = -(Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times WHF_{e,heat}$
Definitions	Unit = Lighting fixture upgrade measure Qty_{BASE} = Quantity of baseline fixtures $Watts_{BASE}$ = Watts of baseline fixture (based on the specified existing fixture type) (Watts) Qty_{EE} = Quantity of energy efficient fixtures $Watts_{EE}$ = Watts of energy efficient fixture (based on the specified installed fixture type) (Watts) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The existing lighting system.
High Efficiency	High-efficiency lighting system that exceeds building code.
PARAMETER VALUES	

Measure/Type	Qty_{BASE}	$Watts_{BASE}$	Qty_{EE}	$Watts_{EE}$	HoursWk[15]	Weeks	Life (yrs)	Cost ($)
Retrofit	Actual	Table 30[16]	Actual	Table 28[16]	Actual	Actual	13[17]	Table 32[18]
Measure/Type	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$					
Retrofit	1.067[8]	1.198[8]	0.00246[8]					

[15] Use actual hours when known. If hours are unknown, use the values from Table 33.
[16] See Appendix D. The fixture wattages are based on the specified fixture types for baseline and installed fixtures.
[17] 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
[18] See Appendix E.

Prescriptive Lighting: Lighting Fixtures – Interior Spaces (Retrofit), Code L10, L10.1, L15, L15.1, L20, L25, L30, L30.1, L32, L32.1, L35, L40, S20, S40, S50, S52,S60, S80							
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[19]	101%[19]	Table 26[20]	Table 26[20]	28%[21]	0.4%[22]
Direct Install	100%	100%[23]	100%[23]	Table 26[20]	Table 26[20]	0%[24]	0%[24]

[19] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[20] See Appendix B.
[21] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[22] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[23] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[24] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small business.

Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (New Construction), Code S71	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of LED stairway lighting fixtures instead of new standard efficiency fixtures (new construction). The fixtures must meet one of the following conditions: include integral controls, operate off of remote sensors where remote sensor is packaged together with the luminaire under a single model number, or be designed to operate off of remote sensors, where the luminaire and sensors are sold separately, but the luminaire has features enabling communication with a remote sensor. Controls must assure the luminaire reverts to lower-power, lower-light output state when there are no occupants in the vicinity.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program
End-Use	Lighting
Project Type	New Construction
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (WHF_d / 1000) \times ((LPD_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times (1-Occ)))$
Annual Energy Savings	$\Delta kWh/yr = (HoursWk \times Wks \times WHF_{e,cool} / 1000) \times ((LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times (1-Occ)))$ $\Delta MMBtu/yr = -(HoursWk \times Wks \times WHF_{e,heat} / 1000) \times ((LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times (1-Occ)))$
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) SAVEEE = 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/ft2) Area = Area of the building or space associated with the design LPD value (ft2) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) ContOutRed = % light output reduction sensor set point (must be minimum of 50%) Occ = % occupancy for space (default to 10%) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting 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 with controls that automatically control the connected lighting systems.

Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (New Construction), Code S71								
PARAMETER VALUES								
Measure/Type	Qty_{EE}	$Watts_{EE}$	$SAVE_{EE}$	Area	HoursWk[25]	Weeks	Life (yrs)	Cost ($)
Retrofit	Actual	Table 28[16]	Table 29[16]	Actual	Actual	Actual	13[26]	Table 32[27]
Measure/Type	ContOutRed	Occ	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$			
Retrofit	Actual	Actual	1.067[8]	1.198[8]	0.00246[8]			
IMPACT FACTORS								
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO	
Business Incentive	100%	99%[28]	101%[19]	Table 26[29]	Table 26[20]	28%[30]	0.4%[31]	

[25] Use actual hours when known. If hours are unknown, use the values from Table 33.
[26] 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
[27] See Appendix E.
[28] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[29] See Appendix B.
[30] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[31] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (Retrofit), Code S70	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of LED stairway lighting fixtures to replace existing operating lighting equipment (retrofit). The fixtures must meet one of the following conditions: include integral controls, operate off of remote sensors where remote sensor is packaged together with the luminaire under a single model number, or be designed to operate off of remote sensors, where the luminaire and sensors are sold separately, but the luminaire has features enabling communication with a remote sensor. Controls must assure the luminaire reverts to lower-power, lower-light output state when there are no occupants in the vicinity.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install Program
End-Use	Lighting
Project Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (WHF_d / 1000) \times ((Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times 1\text{-}Occ))$
Annual Energy Savings	$\Delta kWh/yr = (HoursWk \times Wks \times WHF_{e,cool} / 1000) \times ((Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times 1\text{-}Occ))$ $\Delta MMBtu/yr = -(HoursWk \times Wks \times WHF_{e,heat} / 1000) \times ((Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) + (Qty_{EE} \times Watts_{EE} \times ContOutRed \times 1\text{-}Occ))$
Definitions	Unit = Lighting fixture upgrade measure Qty_{BASE} = Quantity of baseline fixtures $Watts_{BASE}$ = Watts of baseline fixture (based on the specified existing fixture type) (Watts) Qty_{EE} = Quantity of energy efficient fixtures $Watts_{EE}$ = Watts of energy efficient fixture (based on the specified installed fixture type) (Watts) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) ContOutRed = % light output reduction sensor set point (must be minimum of 50%) Occ = % occupancy for space (default to 10%) WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The existing lighting system.
High Efficiency	High-efficiency lighting system that exceeds building code with controls that automatically control the connected lighting systems.

Prescriptive Lighting: Lighting Fixtures with Integrated Controls – Interior Spaces (Retrofit), Code S70

PARAMETER VALUES

Measure/Type	Qty_{BASE}	$Watts_{BASE}$	Qty_{EE}	$Watts_{EE}$	HoursWk[32]	Weeks	Life (yrs)	Cost ($)
Retrofit	Actual	Table 30[33]	Actual	Table 28[16]	Actual	Actual	13[34]	Table 32[35]

Measure/Type	ContOutRed	Occ	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$		
Retrofit	Actual	Actual	1.067[8]	1.198[8]	0.00246[8]		

IMPACT FACTORS

Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[36]	101%[19]	Table 26[37]	Table 26[20]	28%[38]	0.4%[39]
Direct Install	100%	100%[40]	100%[23]	Table 26[20]	Table 26[20]	0%[41]	0%[24]

[32] Use actual hours when known. If hours are unknown, use the values from Table 33.
[33] See Appendix D. The fixture wattages are based on the specified fixture types for baseline and installed fixtures.
[34] 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
[35] See Appendix E.
[36] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[37] See Appendix B.
[38] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[39] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[40] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[41] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small business.

Prescriptive Lighting: Lighting Fixtures – LED Exit Sign, Code X10

Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new LED exit signs to replace existing, operating incandescent or fluorescent exit signs (retrofit).
Primary Energy Impact	Electric
Sector	Commercial/ Industrial
Program(s)	Business Incentive Program, Small Business Direct Install 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 = Exit sign 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 $WHF_{e,cool}$ = Waste heat factor for energy to account for cooling savings from efficient lighting $WHF_{e,heat}$ = Waste heat factor for energy to account for increased heating load from efficient lighting 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline	Existing incandescent or fluorescent exit sign
High Efficiency	Exit sign illuminated with light emitting diodes (LED)

PARAMETER VALUES

Measure/Type	Qty_{BASE}	$Watts_{BASE}$	Qty_{EE}	$Watts_{EE}$	HoursYr	Life (yrs)	Cost ($)
Retrofit	Actual	Table 30[42]	Actual	Table 28[42]	8,760[43]	13[44]	Table 32[45]
Measure/Type	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$				
Retrofit	1.067[8]	1.198[8]	0.00246[8]				

IMPACT FACTORS

Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[46]	101%[46]	Table 26[47]	Table 26[47]	28%[48]	0.4%[49]
Direct Install	100%	100%[50]	100%[50]	Table 26[47]	Table 26[47]	0%[51]	0%[51]

[42] See Appendix D. The fixture wattages are based on the specified fixture types for baseline and installed fixtures.
[43] Exit signs operate continuously, so annual operating hours are 8,760 hours/year (24 hours/day * 365 days/year = 8,760 hours/year).
[44] 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
[45] See Appendix E.
[46] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[47] See Appendix B.
[48] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[49] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[50] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

Prescriptive Lighting: Lighting Fixtures – Exterior Spaces (New construction), Code S11, S13, S15, S17, S23	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency exterior lighting fixtures instead of new standard efficiency lighting fixtures.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program
End-Use	Lighting
Project Type	New construction
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For all measures (except measure S15):* [52] $\Delta kW = Qty_{EE} \times SAVE_{EE} / 1000$ *For measure S15:*[52] $\Delta kW = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000$
Annual Energy Savings	*For all measures (except measure S15):* [52] $\Delta kWh/yr = Qty_{EE} \times SAVE_{EE} / 1000 \times HoursWk \times Weeks$ *For measure S15:* [52] $\Delta kWh/yr = (LPD_{BASE} \times Area - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks$
Definitions	Unit = Lighting fixture upgrade measure Qty_{EE} = Quantity of installed 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) HoursW = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Building code or standard design practice for the building or space type.
High Efficiency	High-efficiency lighting system that exceeds building code.
PARAMETER VALUES	

Measure/Type	Qty_{EE}	$Watts_{EE}$	$SAVE_{EE}$	Area	LPD_{BASE}	HoursWk [53]	Weeks	Life (yrs)	Cost ($)
New construction	Actual	Table 28[54]	Table 29[54]	Actual	Table 31[55]	Actual	Actual	15[56]	Table 32[57]

[51] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small businesses.
[52] The LPD baseline approach is used for measure code S15 (LED Parking Garage Fixture measures in new construction projects) since the parking garage is a defined space with a maximum lighting power density allowed based on building code. For all other measures, savings are based on average wattage reduction per fixture.
[53] Use actual when available; otherwise use 4,380 (operating 12 hrs 365 days a year)
[54] See Appendix D. The installed fixture wattage and wattage reduction values are based on the specified installed fixture type.
[55] See Appendix D. The baseline LPD is based on the specified space type.

IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[58]	101%[58]	Table 26[59]	Table 26[59]	28%[60]	0.4%[61]

[56] 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

[57] See Appendix E.

[58] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.

[59] See Appendix B.

[60] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.

[61] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Lighting: Lighting Fixtures – Exterior Spaces (Retrofit), Code S8, S10, S12, S16, S22	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency exterior lighting fixtures to replace existing operating lighting equipment (retrofit).
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install Program
End-Use	Lighting
Project Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000$
Annual Energy Savings	$\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000 \times HoursWk \times Weeks$
Definitions	Unit = Lighting fixture upgrade measure Qty_{BASE} = Quantity of baseline fixtures Qty_{EE} = Quantity of installed fixtures $Watts_{BAS}$ = Watts of baseline fixture (based on the specified existing or baseline fixture type) (Watts) $Watts_{EE}$ = Watts of Energy efficient fixture (based on the specified installed fixture type) (Watts) HoursW = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The existing lighting system.
High Efficiency	High-efficiency lighting system that exceeds building code.

PARAMETER VALUES

Measure/Type	Qty_{BASE}	$Watts_{BASE}$	Qty_{EE}	$Watts_{EE}$	HoursWk[62]	Weeks	Life (yrs)	Cost ($)
Retrofit	Actual	Table 30[63]	Actual	Table 28[63]	Actual	Actual	13[64]	Table 32[65]

IMPACT FACTORS

Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[66]	101%[58]	Table 26[67]	Table 26[67]	28%[68]	0.4%[69]
Direct Install	100%	100%[70]	100%[70]	Table 26[67]	Table 26[67]	0%[71]	0%[71]

62 Use actual when available; otherwise use 4380 (operating 12 hrs 365 days a year)
63 See Appendix D. The baseline and installed fixture wattages are based on the specified baseline fixture type.
64 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
65 See Appendix E.
66 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
67 See Appendix B.
68 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
69 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
70 This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
71 This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small bsuiness.

Prescriptive Lighting: Lighting Controls – Interior Spaces, Code L60, L70, L71, L60.1, L70.1, L71.1	
Last Revised Date	7/1/2015
MEASURE OVERVIEW	
Description	This measure involves the installation of lighting controls on new or existing interior lighting fixtures.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install Program
End-Use	Lighting
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = Qty_{FIXTURES} \times Watts / 1000 \times WHF_d$
Annual Energy Savings	$\Delta kWh/yr = Qty_{FIXTURES} \times Watts / 1000 \times HoursWk \times Weeks \times SVG \times WHF_{e,cool}$ $\Delta MMBtu/yr = -Qty_{FIXTURES} \times Watts / 1000 \times HoursWk \times Weeks \times SVG \times WHF_{e,heat}$
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) HoursWk = Weekly hours of equipment operation before installation of controls (hrs/week) Weeks = Weeks per year of equipment operation (weeks/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 heating load from efficient lighting 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[72]	HoursWk[73]	Weeks	SVG	Life (yrs)	Cost ($)
New construction	Actual	Table 28 or Table 30	Actual	Actual	Table 34[74]	10[75]	Table 32[76]
Retrofit	Actual	Table 28 or Table 30	Actual	Actual	Table 34[74]	9[75]	Table 32[76]

Measure/Type	WHF_d	$WHF_{e,cool}$	$WHF_{e,heat}$
New Construction	1.067[8]	1.198[8]	0.00246[8]
Retrofit	1.067[8]	1.198[8]	0.00246[8]

[72] See Appendix D. 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.
[73] Use actual hours when known. If hours are unknown, use the values from Table 33.
[74] See Appendix F. The savings factor is determined using the Lighting Control Savings table and the space type specified in the project Data Collection and Information Form. If the space type is unknown, use the "Other" space type value.
[75] 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.
[76] See Appendix E.

Prescriptive Lighting: Lighting Controls – Interior Spaces, Code L60, L70, L71, L60.1, L70.1, L71.1							
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[77]	101%[77]	Table 26[78]	Table 26[78]	28%[79]	0.4%[80]
Direct Install	100%	100%[81]	100%[81]	Table 26[78]	Table 26[78]	0%[82]	0%[82]

[77] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[78] See Appendix B.
[79] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[80] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[81] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[82] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small business.

Prescriptive Lighting: Lighting Fixtures – Refrigerated Spaces, Code S30, S31, S32, S33	
Last Revised Date	11/12/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of high-efficiency lighting fixtures in refrigerated spaces instead of standard lighting fixtures (new construction projects) or to replace existing operating lighting fixtures (retrofit). The new fixtures may be installed vertically or horizontally in the refrigerated cases.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install Program
End-Use	Lighting
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For new construction vertical:* $\Delta kW = \#doors \times SAVE_{EE} / 1000 \times BF$ *For new construction horizontal:* $\Delta kW = \#feet \times SAVE_{EE} / 1000 \times BF$ *For retrofit vertical:* $\Delta kW = (Qty_{BASE} \times Watts_{BASE} - \#doors \times Watts_{EE}) / 1000 \times BF$ *For retrofit horizontal*: $\Delta kW = (Qty_{BASE} \times Watts_{BASE} - \#feet \times Watts_{EE}) / 1000 \times BF$
Annual Energy Savings	*For new construction vertical:* $\Delta kWh/yr = \#doors \times SAVE_{EE} / 1000 \times HoursWk \times Weeks \times BF$ *For new construction horizontal:* $\Delta kWh/yr = \#feet \times SAVE_{EE} / 1000 \times HoursWk \times Weeks \times BF$ *For retrofit-vertical:* $\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - \#doors \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times BF$ *For retrofit horizontal:* $\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - \#feet \times Watts_{EE}) / 1000 \times HoursWk \times Weeks \times BF$
Definitions	Unit = Lighting fixture upgrade measure Qty_{BASE} = Quantity of baseline fixtures #doors = Quantity of refrigerated doors with installed LED fixtures #feet = Horizontal feet of new lighting fixture(s) (ft) $SAVE_{EE}$ = Average wattage reduction per door (vertical) or per foot (horizontal) with LED (Watts) $Watts_{BASE}$ = Watts of baseline fixture (based on the specified baseline fixture type) (Watts) $Watts_{EE}$ = Watts per refrigerated door (vertical) or per foot (horizontal) with LED fixture (Watts) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) BF = Bonus factor to account for refrigeration savings due to reduced waste heat 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	For new construction projects, the baseline is represented by building code or standard design practice for the building or space type. For retrofit projects, the baseline is the existing lighting system.
High Efficiency	High-efficiency lighting system that exceeds building code.

Prescriptive Lighting: Lighting Fixtures – Refrigerated Spaces, Code S30, S31, S32, S33							
PARAMETER VALUES							
Measure/Type	Qty_{BASE}	$Watts_{BASE}$	#doors, #feet		$Watts_{EE}$		$SAVE_{EE}$
New construction	NA	NA	Actual		NA		Table 29[83]
Retrofit	Actual	Table 30[83]	Actual		Table 28[83]		NA
Measure/Type	HoursWk[84]	Weeks	BF		Life (yrs)		Cost ($)
New construction	Actual	Actual	1.29[85]		15[86]		Table 32[87]
Retrofit	Actual	Actual	1.29[85]		13[86]		Table 32[87]
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[88]	101%[88]	Table 26[89]	Table 26[89]	28%[90]	0.4%[91]
Direct Install	100%	100%[92]	100%[92]	Table 26[89]	Table 26[89]	0%[93]	0%[93]

[83] See Appendix D. The fixture wattage and wattage reduction values are based on the specified fixture types for both baseline and installed fixtures.
[84] Use actual when available; otherwise use 4,057 (retail average annual operating hours, From New York Technical Reference Manual, 2010)
[85] For prescriptive refrigerated lighting measures, the default value is 1.29 (calculated as (1 + (1.0 / 3.5))), based on the assumption that all lighting in refrigerated cases is mechanically cooled, a typical refrigeration efficiency 3.5 COP, and assuming 100% of lighting heat needs to be mechanically cooled at time of summer peak.
[86] 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.
[87] See Appendix E.
[88] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[89] See Appendix B.
[90] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.
[91] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[92] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[93] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small business.

Prescriptive Lighting: Lighting Controls – Refrigerated Spaces, Code L50	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of occupancy-based lighting controls on new high-efficiency lighting fixtures in refrigerated spaces. The program does not provide incentives for lighting controls on existing inefficient lighting.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program, Small Business Direct Install Program
End-Use	Lighting
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	ΔkW = Qty x Watts / 1000 x BF
Annual Energy Savings	$\Delta kWh/yr$ = Qty x Watts / 1000 x HoursWk x Weeks x SF x BF
Definitions	Unit = 1 new sensor (that may control multiple lighting fixtures) Qty = Quantity of fixtures connected to the control Watts = Fixture wattage of the fixture(s) connected to the control (Watts) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) SF = Savings factor, or percentage of savings resulting from a reduction in operating hours BF = Bonus factor to account for refrigeration savings due to reduced waste heat 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline	No occupancy sensor.
High Efficiency	Lighting controls which automatically control connected lighting systems based on occupancy.
PARAMETER VALUES	

Measure/Type	Qty	Watts[94]	HoursWk[95]	Weeks	SF	BF	Life (yrs)	Cost ($)
New construction	Actual	Table 28	Actual	Actual	30.7%[96]	1.29[97]	10[98]	Table 32[99]
Retrofit	Actual	Table 28	Actual	Actual	30.7%[96]	1.29[97]	9[98]	Table 32[99]

[94] See Appendix D. 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.
[95] Use actual when available; otherwise use 8,760 hours per year (assuming equipment operates 24 hours per day, 365 days a year).
[96] US DOE, "Demonstration Assessment of Light-Emitting Diode (LED) Freezer Case Lighting." Refrigerated cases were metered for 12 days to determine savings from occupancy sensors. Assumes that refrigerated freezers and refrigerated coolers will see the same amount of savings from sensors.
[97] For prescriptive refrigerated lighting measures, the default value is 1.29 (calculated as (1 + (1.0 / 3.5))). Based on the assumption that all lighting in refrigerated cases is mechanically cooled, with a typical 3.5[97] COP refrigeration system efficiency, and assuming 100% of lighting heat needs to be mechanically cooled at time of summer peak.
[98] 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.
[99] See Appendix E.

Prescriptive Lighting: Lighting Controls – Refrigerated Spaces, Code L50							
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	99%[100]	101%[100]	Table 26[101]	Table 26[101]	28%[102]	0.4%[103]
Direct Install	100%	100%[104]	100%[104]	Table 26[101]	Table 26[101]	0%[105]	0%[105]

[100] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.

[101] See Appendix B.

[102] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive lighting.

[103] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

[104] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

[105] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG because the market is small business.

Variable Frequency Drives

Prescriptive VFD: Variable Frequency Drives (VFD) for HVAC	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a variable frequency drive (VFD) on an electric motor serving HVAC loads. A VFD is a specific type of adjustable-speed drive. VFDs are also known as adjustable-frequency drives (AFD), variable-speed drives (VSD), AC drives or inverter drives. This measure covers VFDs on 5 HP to 100 HP motors for the following HVAC equipment: supply fans, return fans, building exhaust fans, chilled water distribution pumps, and heating hot water circulation pumps. For VFDs on other equipment type or serving non-HVAC loads, use the Custom Measure approach. This measure is not eligible for new construction applications for which VSDs are required per Section 503.2.5.1 of IECC 2009.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	VFDs for HVAC
Project Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = HP_{VFD} \times DSVG$
Annual Energy Savings	$\Delta kWh/yr = HP_{VFD} \times ESVG$
Definitions	Unit = 1 VFD (that may control multiple motors) HP_{VFD} = Total horsepower of motor(s) connected to VFD (hp) ESVG = energy savings factor (kWh/yr/hp) DSVG = demand savings factor (kW/hp)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline reflects no VFD installed on the HVAC equipment.
High Efficiency	The high-efficiency case involves a VFD installed on existing HVAC equipment to reduce the average motor speed.

PARAMETER VALUES

Measure/Type	HP_{VFD}	ESVG	DSVG	Life (yrs)	Cost ($)
All	Actual	Table 1	Table 1	13[106]	Table 2

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[107]	101%[107]	Table 26[108]	Table 26[108]	50%[109]	0.4%[110]

[106] 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.
[107] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[108] See Appendix C.
[109] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[110] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 1 – VFD Energy and Peak Demand Savings Factors (ESVG and DSVG)[111]

Measure Code	Measure Description	ESVG (kWh/yr/hp)	DSVG (kW/hp)
SFA, SFP	Supply Fans	1,001	0.173
RFA, RFP	Return Fans	1,524	0.263
BEF	Exhaust Fans	755	0.120
CWP	Chilled Water Pumps	1,746	0.188
HHWP	Heating Hot Water Circulation Pump	1,746	0.188

Table 2 – Measure Costs for VFD[112]

Cumulative Motor HP Controlled by Each VFD (HP_{VFD})	Measure Cost ($)
5	$2,425
7.5	$2,648
10	$2,871
15	$3,317
20	$3,763
25	$4,209
30	$4,655
40	$5,547
50	$6,439
60	$7,331
70	$8,223
80	$9,115
90	$10,007
100	$10,899

[111] National Grid 2001 values averaged from previous evaluations of VFD installations. Values are those used for existing construction, except for chilled water pumps which is used for new construction. National Grid existing construction baseline is similar to Vermont baseline for new and existing applications.

[112] Cost data estimated based on correlation between total cost and controlled HP results from: Navigant, NEEP Incremental Cost Study Phase Two Final Report, January 2013, Table 15.

HVAC Equipment

Prescriptive HVAC: Unitary Air-Conditioners	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new high-efficiency air conditioning equipment instead of new standard efficiency air conditioning equipment. This measure includes high-efficiency electrically operated air-cooled single package and split system air conditioners, including room or window air conditioners for commercial/industrial facilities.
Primary Energy Impact	Electric
Sector	Commercial
Program	Business Incentive Program
End-Use	HVAC
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For equipment with rated size < 5.4 tons (< 65,000 Btuh):* $\Delta kW = Tons \times 12 \times [(1/SEER_{BASE} - 1/SEER_{EE})]$ *For equipment with rated size ≥ 5.4 tons (≥ 65,000 Btuh):* $\Delta kW = Tons \times 12 \times [(1/EER_{BASE} - 1/EER_{EE})]$
Annual Energy Savings	*For equipment with rated size < 5.4 tons (< 65,000 Btuh):* $\Delta kWh/yr = Tons \times 12 \times [(1/SEER_{BASE} - 1/SEER_{EE})] \times EFLH_C$ *For equipment with rated size ≥ 5.4 tons (≥ 65,000 Btuh):* $\Delta kWh/yr = Tons \times 12 \times [(1/EER_{BASE} - 1/EER_{EE})] \times EFLH_C$
Definitions	Unit = 1 air conditioning unit Tons = Nominal rating of the capacity of the heat pump in Tons (tons = kBtuh/12) $SEER_{BAS}$ = Cooling seasonal energy efficiency ratio of the baseline equipment < 5.4 tons (Btuh/Watt) $SEER_{EE}$ = Cooling seasonal energy efficiency ratio of the efficient equipment < 5.4 tons (Btuh/Watt) EER_{BASE} = Cooling energy efficiency ratio of the baseline equipment ≥ 5.4 tons (Btuh/Watt) EER_{EE} = Cooling energy efficiency ratio of the efficient equipment ≥ 5.4 tons (Btuh/Watt) $EFLH_C$ = Cooling equivalent full load hours per year (hrs/yr) 12 = Conversion: 1 ton = 12 kBtuh
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Meets minimum cooling efficiency requirements based on IECC 2009, Table 503.2.3(1)
High Efficiency	Rated cooling and heating efficiency of new equipment must meet or exceed the minimum requirements on the program Data Collection and Measure Code Reference Forms (available on the Efficiency Maine website: http://www.efficiencymaine.com/).

Prescriptive HVAC: Unitary Air-Conditioners						
PARAMETER VALUES						
Measure/Type	Tons	$SEER_{BASE}$, EER_{BASE}	$SEER_{EE}$, EER_{EE}	$EFLH_C$	Life (yrs)	Cost ($)
Unitary AC < 11.25 tons	Actual	Table 3	Actual	829[113]	15[114]	Table 3
Unitary AC ≥ 11.25 tons	Actual	Table 3	Actual	605[113]	15[114]	Table 3
Window AC	Actual	Table 3	Actual	829[113]	9[115]	Table 3

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[116]	101%[116]	Table 26[117]	Table 26[117]	50%[118]	0.4%[119]

Table 3 – Baseline Efficiency Values and Measure Cost for Unitary AC Systems

Equipment Type	Cooling Capacity (Tons)	Cooling Capacity (Btuh)	Base Efficiency[A]	Incremental Cost ($/ton)[B]
Air Conditioners, Air-Cooled	< 5.4 (Split System)	< 65,000 (Split System)	13.0 SEER	$115
	< 5.4 (Single Package)	< 65,000 (Single Package)	13.0 SEER	$115
	≥ 5.4 and < 11.25	≥ 65,000 and < 135,000	11.2 EER	$91
	≥ 11.25 and < 20	≥ 135,000 and < 240,000	11.0 EER	$99
	≥ 20 and < 63.3	≥ 240,000 and < 760,000	10.0 EER	$100[C]
	≥ 63.3	≥ 760,000	9.7 EER	$100[C]
Window AC	All	All	11.0 EER [C]	$50 [D]

[A] IECC 2009, Table 503.2.3(1): Minimum Efficiency Requirements: Electrically Operated Unitary Air Conditioners and Condensing Units.
[B] The total incremental cost values are comparable to the values found in Navigant, NEEP Incremental Cost Study Report Final, September 2011, Table 1-15.
[C] Vermont TRM 2014 Tier 1.
[D] The baseline efficiency and measure cost for Window AC units is based on a 10,000 Btu/h unit (same as assumption for Window AC in the Residential TRM).

113 KEMA, NEEP C&I Unitary HVAC Loadshape Project, June 2011, Table 0-3 and 0-4. Values are for the NE-North region.
114 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.
115 Default assumptions used in the ENERGY STAR® calculator, April 2013.
116 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
117 See Appendix B.
118 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
119 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Heat Pump Systems	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a new high-efficiency heat pump system instead of a new standard efficiency heat pump. It includes high-efficiency electric air-to-air, water source (open loop), and ground source (closed loop) heat pump systems.
Primary Energy Impact	Electric
Sector	Commercial
Program	Business Incentive Program
End-Use	HVAC
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	*For air-to-air equipment < 5.4 tons (< 65,000 Btuh):* $\Delta kW_C = CAP_C \times 12 \times [(1/SEER_{BASE} - 1/SEER_{EE})]$ $\Delta kW_H = CAP_H \times 12 \times [(1/HSPF_{BASE} - 1/HSPF_{EE})]$ *For air-to-air equipment ≥ 5.4 tons (≥ 65,000 Btuh) and all water and ground source equipment:* $\Delta kW_C = CAP_C \times 12 \times [(1/EER_{BASE} - 1/EER_{EE})]$ $\Delta kW_H = CAP_H \times 12 \times [(1/COP_{BASE} - 1/COP_{EE})] / 3.412$
Annual Energy Savings	*For air-to-air equipment < 5.4 tons (< 65,000 Btuh):* $\Delta kWh_C/yr = CAP_C \times 12 \times [(1/SEER_{BASE} - 1/SEER_{EE})] \times EFLH_C$ $\Delta kWh_H/yr = CAP_H / 1000 \times [(1/HSPF_{BASE} - 1/HSPF_{EE})] \times EFLH_H$ *For air-to-air equipment ≥ 5.4 tons (≥ 65,000 Btuh) and all water and ground source equipment:* $\Delta kWh_C/yr = CAP_C \times 12 \times [(1/EER_{BASE} - 1/EER_{EE})] \times EFLH_C$ $\Delta kWh_H/yr = CAP_H / 1000 \times [(1/COP_{BASE} - 1/COP_{EE})] \times EFLH_H / 3.412$
Definitions	Unit = 1 new heat pump CAP_C = Rated cooling capacity of the heat pump in tons (tons) CAP_H = Rated heating capacity of the heat pump (Btuh) $SEER_{BASE}$ = Cooling seasonal energy efficiency ratio of the baseline equipment (Btuh/Watt) $SEER_{EE}$ = Cooling seasonal energy efficiency ratio of the efficient equipment (Btuh/Watt) $HSPF_{BASE}$ = Heating seasonal performance factor of the baseline equipment (Btuh/Watt) $HSPF_{EE}$ = Heating seasonal performance factor of the efficient equipment (Btuh/Watt) EER_{BASE} = Cooling energy efficiency ratio of the baseline equipment (Btuh/Watt) EER_{EE} = Cooling energy efficiency ratio of the efficient equipment (Btuh/Watt) COP_{BASE} = Heating coefficient of performance of the baseline equipment COP_{EE} = Heating coefficient of performance of the efficient equipment $EFLH_C$ = Cooling equivalent full load hours per year (hrs/yr) $EFLH_H$ = Heating equivalent full load hours per year (hrs/yr) 12 = Conversion: 1 ton = 12 kBtuh 3.412 = Conversion: 3.412 kBtuh per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Meets minimum cooling and heating efficiency requirements based on IECC 2009, Table 503.2.3(2)
High Efficiency	Rated cooling and heating efficiency of new equipment must meet or exceed the minimum requirements on the program Data Collection and Measure Code Reference Forms (available on the Efficiency Maine website: http://www.efficiencymaine.com/).

Prescriptive HVAC: Heat Pump Systems										
PARAMETER VALUES										
Measure/Type	CAP_C	CAP_H[120]	$SEER_{BASE}$ EER_{BASE}	$SEER_{EE}$ EER_{EE}	$HSPF_{BASE}$ COP_{BASE}	$HSPF_{EE}$ COP_{EE}	$EFLH_C$[121]	$EFLH_H$[122]	Life (yrs)	Cost ($/ton)
Heat Pump < 5.4 tons	Actual	Actual	Table 4	Actual	Table 4	Actual	829	2,200	15[123]	$100[124]
Heat Pump ≥ 5.4 tons and < 11.25 tons	Actual	Actual	Table 4	Actual	Table 4	Actual	829	1,600	15[123]	$100[124]
Heat Pump ≥ 11.25 tons	Actual	Actual	Table 4	Actual	Table 4	Actual	605	1,600	15[123]	$100[124]

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[125]	101%[125]	Table 26[126]	Table 26[126]	50%[127]	0.4%[128]

Table 4 – Efficiency Requirements and Measure Cost for Heat Pump Systems

Equipment Type	Rated Cooling Capacity, CAP_C		Base Efficiency [A]	
	Tons	Btuh	Cooling	Heating
Air-Cooled	< 5.4 (split system)	< 65,000 (split system)	13.0 SEER	7.7 HSPF
	< 5.4 (single package)	< 65,000 (single package)	13.0 SEER	7.7 HSPF
	≥ 5.4 and < 11.25	≥ 65,000 and < 135,000	11.0 EER	3.3 COP
	≥ 11.25 and < 20	≥ 135,000 and < 240,000	10.6 EER	3.2 COP
	≥ 20	≥ 240,000	9.5 EER	3.2 COP
Water Source	< 1.4	< 17,000	11.2 EER	4.2 COP
	≥ 1.4 and < 11.25	≥ 17,000 and < 135,000	12.0 EER	4.2 COP
Groundwater Source (open loop)	< 11.25	< 135,000	16.2 EER	3.6 COP
Ground source (closed loop)	< 11.25	< 135,000	13.4 EER	3.1 COP

[A] IECC 2009, Table 503.2.3(2). Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps

[120] Use actual heating capacity based on application form or equipment specifications. If the heating capacity is unknown, calculate heating capacity based on cooling capacity as follows: for equipment < 5.4 tons: heating capacity = cooling capacity; for equipment ≥ 5.4 tons, heating capacity = cooling capacity × 13,900/12,000.

[121] KEMA, NEEP C&I Unitary HVAC Loadshape Project, June 2011, Table 0-3 and 0-4. Values are for the NE-North region.

[122] EMT assumes 2,200 heating full load hours for heat pumps smaller than 5.4 tons (65,000 BTUh) and 1,600 heating full load hours for heat pumps larger than or equal to 5.4 tons.

[123] 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.

[124] Efficiency Vermont Technical Reference User Manual (TRM) 2014, Table 1, page 40.

[125] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.

[126] See Appendix B.

[127] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.

[128] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Packaged Terminal Air Conditioners and Heat Pumps	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new high-efficiency packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs) equipment instead of new standard efficiency PTAC or PTHP equipment.
Primary Energy Impact	Electric
Sector	Commercial
Program	Business Incentive Program
End-Use	HVAC
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW_C = CAP_C / 1{,}000 \times [(1/EER_{BASE} - 1/EER_{EE})]$ $\Delta kW_H = CAP_H / 1{,}000 \times [(1/COP_{BASE} - 1/COP_{EE})] / 3.412$
Annual Energy Savings	$\Delta kWh_C/yr = CAP_C / 1{,}000 \times [(1/EER_{BASE} - 1/EER_{EE})] \times EFLH_C$ $\Delta kWh_H/yr = CAP_H / 1{,}000 \times [(1/COP_{BASE} - 1/COP_{EE})] \times EFLH_H / 3.412$
Definitions	Unit = 1 PTAC or PTHP CAP_C = Rated cooling capacity of the new equipment (Btuh). CAP_H = Rated heating capacity of the new equipment (Btuh). EER_{BASE} = Cooling energy efficiency ratio of the baseline equipment (Btuh/Watt) EER_{EE} = Cooling energy efficiency ratio of the efficient equipment (Btuh/Watt) COP_{BASE} = Heating coefficient of performance of the baseline equipment COP_{EE} = Heating coefficient of performance of the efficient equipment $EFLH_C$ = Cooling equivalent full load hours per year (hrs/yr) $EFLH_H$ = Heating equivalent full load hours per year (hrs/yr) 3.412 = Conversion: 3.412 kBtuh per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline equipment must meet the minimum cooling and heating efficiency requirements based on the current federal energy conservation standards (effective September 30, 2012).
High Efficiency	Rated cooling and heating efficiency of new equipment must meet or exceed the minimum requirements on the program Data Collection and Measure Code Reference Forms (available on the Efficiency Maine website: http://www.efficiencymaine.com/).
PARAMETER VALUES	

Measure/Type	CAP_C	CAP_H	EER_{BASE}	EER_{EE}	COP_{BASE}	COP_{EE}	$EFLH_C$	$EFLH_H$	Life (yrs)	Cost ($)
PTAC	Actual	Actual	Table 5	Actual	Table 5	Actual	829[129]	NA	15[130]	$75[131]
PTHP	Actual	Actual	Table 5	Actual	Table 5	Actual	605[129]	2,200[132]	15[130]	$75[131]

[129] KEMA, NEEP C&I Unitary HVAC Loadshape Project, June 2011, Table 0-3 and 0-4. Values are for the NE-North region.
[130] 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.
[131] Environmental Protection Agency, ENERGY STAR® Market & Industry Scoping Report Packaged Terminal Air Conditioners and Heat Pumps, December 2011.
[132] EMT assumes 2,200 heating full load hours for heat pumps smaller than 5.4 tons (65,000 BTUh) and 1,600 heating full load hours for heat pumps larger than or equal to 5.4 tons.

Prescriptive HVAC: Packaged Terminal Air Conditioners and Heat Pumps							
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[133]	101%[133]	Table 26[134]	Table 26[134]	50%[135]	0.4%[136]

[133] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[134] See Appendix B.
[135] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[136] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 5 - Baseline Efficiencies for PTAC and PTHP (effective September 20, 2012)[137]

Equipment Class			Minimum Energy Conservation Standards	
Equipment	Category [A]	Cooling Capacity (Btu/h)	Cooling (EER)	Heating (COP)
PTAC	Standard Size	<7,000	11.7	NA
		7,000 – 15,000	13.8 – (0.300 × Cap [B])	NA
		>15,000	9.3	NA
	Non-Standard Size	<7,000	9.4	NA
		7,000 – 15,000	10.9 – (0.213 × Cap [B])	NA
		>15,000	7.7	NA
PTHP	Standard Size	<7,000	11.9	3.3
		7,000 – 15,000	14.0 – (0.300 × Cap [B])	3.7 – (0.052 x Cap [B])
		>15,000	9.5	2.9
	Non-Standard Size	<7,000	9.3	2.7
		7,000 – 15,000	10.8 – (0.213 × Cap [B])	2.9 – (0.026 × Cap [B])
		>15,000	7.6	2.5

[A] Standard size PTAC or PTHP refers to equipment with wall sleeve dimensions having an external wall opening greater than or equal to 16 inches high or greater than or equal to 42 inches wide, and a cross-sectional area greater than or equal to 670 square inches.; Non-standard size refers to PTAC or PTHP equipment with existing wall sleeve dimensions having an external wall opening of less than 16 inches high or less than 42 inches wide, and a cross-sectional area less than 670 square inches.
[B] ”Cap” means cooling capacity in thousand Btu/h at 95 °F outdoor dry-bulb temperature.

[137] Standards for Packaged Terminal Air Conditioners and Heat Pumps: http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/45

Prescriptive HVAC: Demand Control Ventilation	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves installation of demand control ventilation (DCV) on new high-efficiency HVAC systems to reduce heating/cooling requirements when spaces are unoccupied. Typically, DCV involves the installation of CO_2 sensors and controls to measure CO_2 levels in the controlled space and the outdoor ventilation air and to reduce heating/cooling of the ventilated air during low occupancy periods. This measure is not eligible for new construction applications for which DCV is already required per Section 503.2.5.1 of IECC 2009.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	HVAC
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = Area \times VentilationRate \times SF_{kW} \times 12 / EER_{EE}$
Annual Energy Savings	$\Delta kWh/yr = Area \times VentilationRate \times SF_{kW} \times 12 / EER_{EE} \times EFLH_C$
Definitions	Unit = 1 DCV system Area = Area of conditioned space benefitting from the DCV (ft^2) VentilationRate = Design outdoor air ventilation rate, based on space type (CFM/ft^2). SF_{kW} = Savings factor is the average demand cooling load savings per CFM of ventilated air provided to the conditioned space (tons/CFM) EER_{EE} = Cooling energy efficiency ratio of the new equipment, from application form or customer information. EER may be estimated as SEER/1.1. (Btuh/Watt) $EFLH_C$ = Cooling equivalent full load hours (hrs/yr) 12 = Conversion: 12 kBtuh per ton
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	No demand control ventilation system installed on the HVAC units.
High Efficiency	New high efficiency HVAC unit with demand control ventilation system installed.

PARAMETER VALUES

Measure/Type	Area	VentilationRate	SF_{kW}	EER_{EE}	$EFLH_C$	Life (yrs)	Cost ($)
All	Actual	Table 35[138]	0.000433[139]	Actual	719[140]	10[141]	$2,100 (Retrofit) $850 (NC)[142]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[143]	101%[143]	Table 26[144]	Table 26[144]	50%[145]	0.4%[146]

[138] See Appendix F.
[139] The demand cooling load saving factor is dependent on the amount of ventilated air brought into the conditioned space, which in turns depend on the occupancy within the space. If the space is frequently filled to its designed capacity, then there will not be any demand savings. This is because the system will bring in the corresponding amount of ventilated air required for the occupants, which is the same as the baseline system minimum ventilation. However from our past experience, such spaces are typically occupied 85% to 90% of their designed capacities. Thus, there is an approximate savings of 10% to 15% in the amount of ventilated air brought in. This also translates to about the same amount of demand saved in conditioning the ventilated air.
[140] KEMA, NEEP C&I Unitary HVAC Loadshape Project, June 2011, Table 0-2. Values are for the NE-North region.
[141] Studies have shown that the typical life of most electronic control devices and sensor is approximately 10 years
[142] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011
[143] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.

Prescriptive HVAC: Variable Refrigerant Flow	
Last Revised Date	7/1/2014 (New measure in 2015)
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a new high-efficiency variable refrigerant flow (VRF) AC or heat pump system instead of a new standard efficiency variable refrigerant flow (VRF) AC or heat pump system.
Energy Impacts[147]	ELECTRIC; NATURAL GAS; HEATING OIL
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	HVAC
Decision Type[148]	New Construction, Replace on Burnout/End of Useful life
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand savings	$kW_c = kBtu/hr_{capacity} * \left(\frac{1}{IEER_{base}} - \frac{1}{IEER_{ee}}\right)$ $kW_h = kBtu_{heat\ load} * \left(\frac{1}{COP_{base}} - \frac{1}{COP_{ee}}\right) * \frac{1}{EFLH_h}$
Annual energy savings	$kWh_c = kBtu/hr_{capacity} * \left(\frac{1}{IEER_{base}} - \frac{1}{IEER_{ee}}\right) * EFLH_c$ $kWh_h = kBtu_{heat\ load} * \left(\frac{1}{COP_{base}} - \frac{1}{COP_{ee}}\right)$
Definitions	$kBtu/hr_{capacity}$ = Cooling capacity of equipment $IEER_{base}$ = Integrated energy efficiency ratio for baseline system $IEER_{ee}$ = Integrated energy efficiency ratio for VRF system $EFLH_c$ = Equivalent full-load cooling hours $EFLH_c$ = Equivalent full-load cooling hours $kBtu_{heat\ load}$ = (Square feet of building) * (47.4 kBtu/sf [149]) COP_{base} = Coefficient of performance for baseline system COP_{ee} = Coefficient of performance for VRF system at 47°F db/43°F wb outdoor air
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Air cooled variable refrigerant flow unit that meets minimum efficiency standards of 90.1-2007.
Efficient Measure	High efficiency variable refrigerant flow unit with IEER of 17 or greater.

[144] See Appendix B.
[145] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[146] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[147] Select one or more of the following: ELECTRIC; NATURAL GAS; HEATING OIL; PROPANE; WATER; OTHER
[148] Select one or more of the following: NEW (e.g. new construction); REPLACEMENT (e.g. replace-on-burnout); RETROFIT
[149] New England average heating load from 2003 CBECs

Prescriptive HVAC: Variable Refrigerant Flow								
PARAMETER VALUES (DEEMED)								
Measure/Type	$kBtu/hr_{capacity}$	$IEER_{base}$	$IEER_{ee}$	$EFLH_c$	$EFLH_h$	$kBtu_{heat\ load}$	COP_{base}	COP_{ee}
VRF HVAC System	Actual	12.7[150]	Actual	829[151]	1600[152]	Actual	2.25[153]	Actual
Measure/Type	Conditioned Space (sq. ft.)						Life (yrs)	Cost ($)[154]
VRF HVAC System	Actual						20	$0.5648 / sf
IMPACT FACTORS								
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO	
All	100%	99%[155]	101%[155]	Table 26[156]	Table 26[156]	50%[145]	0.4%[146]	

[150] ANSI/ASHRAE/IES Addenda CE and CP to ANSI/ASHRAE/IESNA 90.1-2007, Table 6.8.1M, VRF Air Cooled (cooling mode) >=65,000 Btu/h and < 135,000 Btu/h
[151] KEMA, NEEP C&I Unitary HVAC Loadshape Project, June 2011, Table 0-3 and 0-4. Values are for the NE-North region.
[152] EMT assumes 1,600 heating full load hours.
[153] ANSI/ASHRAE/IES Addenda CE and CP to ANSI/ASHRAE/IESNA 90.1-2007, Table 6.8.1M, VRF Air Cooled (heating mode) >=65,000 Btu/h and < 135,000 Btu/h (cooling capacity) 17°F db/15°F wb outdoor air
[154] Average incremental cost over air source heat pump systems, or packaged/split air conditioning systems with an oil- or natural gas-fired boiler
[155] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[156] See Appendix C.

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 projects. 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)	Business Incentive Program
End-Use	Cooling, Heating
Decision Type	New Construction, Replace on Burnout
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW_C = CAP_{COOL} \times [(1 / EER_B) - (1 / EER_{EE})] / 1{,}000$ $\Delta kW_H = CAP_{HEAT} \times [(1/ HSPF_B) - (1 / HSPF_{EE})] / 1{,}000$
Annual Energy Savings	$\Delta kWh_C = CAP_{COOL} \times [(1/ SEER_B) - (1 / SEER_{EE})] \times EFLH_{COOL} / 1{,}000$ $\Delta kWh_H = CAP_{HEAT} \times [1 / (HSPF_B) - 1 / (HSPF_{EE})] \times ADJ \times EFLH_{HEAT} / 1{,}000$
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) EER_B = energy efficiency ratio for baseline cooling unit (Btu/Watt-hr) EER_E = energy efficiency ratio for high-efficiency DHP (Btu/Watt-hr) $EFLH_{COOL}$ =Equivalent full load hours cooling $EFLH_{HEAT}$ =Equivalent full load hours heating ADJ =Adjustment factor to account for realized HSPF during Maine winter
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	The baseline case assumes the business 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 (single head), 10.0 (multi-head). Ductless heat pump is sized to provide 100% of the heat load of the area served at 11 degrees F ambient temperature.

PARAMETER VALUES

Measure	CAP_{HEAT}	CAP_{COOL}	$HSPF_E$	$HSPF_B$	$SEER_E$	$SEER_B$	EER_E	EER_B
DHP Retrofit	Actual	Actual	Actual	8.2[157]	Actual	14[158]	Actual	11.7[159]

Measure	ADJ	$EFLH_{HEAT}$	$EFLH_{COOL}$			Life (yrs)	Cost ($)
DHP Retrofit	0.79[160]	2,655[161]	629[162]			18[163]	Table 6

[157] Federal minimum efficiency requirement for units manufactured on or after January 1, 2015
[158] 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)
[159] 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)
[160] Adjustment factor is estimated using the weather bin analysis for Portland, Bangor and Caribou, ME and manufacturer curves to estimate unit efficiency during each weather bin.
[161] Heating EFLH is estimated using a weather bin analysis for Portland, Bangor and Caribou, ME and the following assumptions: (1) heat system is supplemented by internal loads equivalent to 30% of the rated cooling capacity of the DHP (2) the DHP serves 100% of space heating load at 11 degrees F, and (3) winter indoor temperature is set at 70 degrees F. The heating EFLH are estimated relative to the rated heating capacity of the DHP.
[162] Cooling EFLH is estimated using a weather bin analysis for Portland, Bangor and Caribou, ME using the same scenario defined for Heating EFLH with summer indoor temperature set to 70 degrees F. The cooling EFLH are estimated relative to the rated cooling capacity of the DHP.
[163] GDS Associates, Inc., Measure Life Report – Residential and Commercial/Industrial Lighting and HVAC Measures, June 2007; Table 2.

Ductless Heat Pump							
IMPACT FACTORS							
Measure	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
DHP – NC/ROB	100%[164]	100%[165]	100%[165]	Table 26[166]	Table 26[166]	0%[167]	0%[167]

Table 6 – Measure Cost for DHP Equipment[168]

# of Indoor Units per Outdoor Unit	Measure Cost ($)
1	$682
2	$682
3	$682
4+	$682

[164] EMT assumes that all purchased units are installed (i.e. ISR = 100%).
[165] This measure is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[166] See Appendix B.
[167] This measure is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG.
[168] The measure cost is based on program average incremental cost. Measure cost will be refined for number of zones as data becomes available.

Prescriptive HVAC: Modulating Burner Controls for Boilers and Heaters, Code AF1							
Last Revised Date	3/1/2015 (New)						
MEASURE OVERVIEW							
Description	This measure is for a non-residential boiler providing heat with a current turndown capacity less than 6:1 between the high firing rate and low firing rate. The modulating burner controls will reduce burner start up and shut down and allow the burners to meet load more effectively between the high firing rate and the low firing rate. It will also allow for an increased turn down rate to eliminate start up and shut down when the load is lower than the low firing rate.						
Energy Impacts	Natural Gas; Heating Oil; Propane						
Sector	Commercial, Industrial						
Program(s)	Business Incentive Program						
End-Use	Boilers, Space Heating, Process Heating						
Decision Type	Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Annual energy savings	ΔMMBtu/yr = Ngi * SF * T / 1000						
Definitions	Unit = Modulating burner control installed on a single boiler Ngi = Boiler/Heater gas input size (Mbtu/hr) SF = Estimate of annual fuel consumption conserved by modulating burner T = Hours of operation. (Space heating = Effective full Load heating hours (EFLH)) 1000 = Conversion 1,000 MBtu per MMBtu						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	A baseline boiler high and low firing rate ratio must be a maximum of 6:1; or be subject to loads of less than 30% of the boiler/heater full firing rate for at least 60% of the time.						
Efficient Measure	A boiler burner must have a turn down rate of 10:1 or greater and be able to effectively modulate the burner firing rate between the low and high firing rates.						
PARAMETER VALUES (DEEMED)							
Measure/Type	SF[169]	T (Process)	T (Space Heating)[170]	Life (yrs)[171]	Cost ($)[172]		
	3%	Hours of Operation	1,600 EFLH	21	$2.53/Mbtuh		
IMPACT FACTORS							
Measure/Type	ISR	RR_E[173]	RR_D	CF_S	CF_W	FR[174]	SO[175]
Retrofit	100%	100%	N/A	NA	NA	34%	0.4%

[169] Xcel Energy, 2010/2011/2012 Triennial Plan, Minnesota Electric and natural gas Conservation Improvement Program, E,G002/CIP-09-198. Page 474: 80% baseline boiler to 83% overall efficiency with improvement.

[170] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.

[171] Illinois Statewide Technical Reference Manual version 4.0, measure 4.4.20 – High Turndown Burner.

[172] Ibid.

[173] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

[174] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.

[175] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Boiler Stack Heat Exchanger (Boiler Economizer), Code AF2	
Last Revised Date	3/1/2015 (New)
MEASURE OVERVIEW	
Description	Boiler stack economizers are heat exchangers with hot flue gas on one side and boiler feed water on the other. The waste heat from the stack is used to preheat the boiler feed water, which reduces the energy required by the boiler to heat the water. There are two types of stack heat exchangers: standard and condensing. Condensing units conserve more energy by recovering even more energy from the flue gas. But since reducing the stack temperature lower causes the flue gas to condense, additional venting and moisture control precautions must be added, which increases the cost of the unit.
Energy Impacts	Natural Gas; Heating Oil; Propane
Sector	Industrial
Program(s)	Business Incentive Program
End-Use	Boiler; Process Heat Recovery
Decision Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Annual energy savings	ΔMMBtu/yr = CAPINPUT × EFLH x SF/ 1,000
Definitions	Unit = 1 Boiler retrofitted to add stack heat exchanger CAP_{INPUT} = Boiler Input Capacity (MBH = MBtu/h) EFLH = Equivalent Full Load Heating Hours SF = Estimate of annual gas consumption conserved by adding boiler stack heat exchanger 1,000 = Conversion 1,000 MBtu per MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Assumed to be a non-condensing boiler with no existing stack heat exchanger installed
Efficient Measure	Assumed to be a boiler with newly installed stack heat exchanger

PARAMETER VALUES (DEEMED)

Measure/Type	CAP_{INPUT}	EFLH[176]	SF[177]	Life (yrs)[178]	Cost ($)
Standard Economizer	Actual	1,600	5%	20	$1,500/MMBtuh[179]
Condensing Economizer	Actual	1,600	10%	20	$2,120/MMBtuh

IMPACT FACTORS

Measure/Type	ISR	RR_E[180]	RR_D	CF_S	CF_W	FR[181]	SO[182]
	100%	100%	N/A	N/A	N/A	34%	0.4%

[176] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.

[177] GDS Associates, Inc. (2009). *Natural Gas Energy Efficiency Potential in Massachusetts*. Prepared for GasNetworks.

[178] GDS Associates, Inc. (2009). *Natural Gas Energy Efficiency Potential in Massachusetts*. Prepared for GasNetworks. The study references NYSERDA Deemed Savings Database, Rev 09-082006.

[179] Ibid.

[180] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

[181] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.

[182] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Boiler Reset/Lockout Controls, Code AF3	
Last Revised Date	3/1/2015 (New)
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of Boiler reset and lockout controls for a non-residential boiler that does not currently have such controls installed. Reset controls achieve energy savings by reducing the hot water supply temperature as a function of outdoor air temperature. As the site heating load decreases (higher OAT), the temperature to which the boiler must heat the supply hot water decreases. Lockout controls achieve energy savings by shutting down (locking out) the boiler entirely when the outdoor air temperature is high enough to ensure there is no heating load. For the purposes of this measure, the lockout temperature should be set no higher than 55F. **Boiler reset controls should not be implemented in conjunction with -or on boilers that already have- modulating burner controls.**
Energy Impacts	Natural Gas; Heating Oil; Propane
Sector	Commercial, Industrial
Program(s)	Business Incentive Program
End-Use	Boilers, Space Heating, Process Heating
Decision Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Annual energy savings	$\Delta MMBtu/yr = CAP_{INPUT} \times EFLH \times SF / 1{,}000$
Definitions	Unit = 1 Boiler retrofitted with reset and lockout controls CAP_{INPUT} = Boiler Input Capacity (MBH = MBtu/h) EFLH = Equivalent Full Load Heating Hours SF = Estimate of annual fuel consumption conserved by adding boiler reset controls 1,000 = Conversion 1,000 MBtu per MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Assumed to be a boiler with no boiler reset or lockout controls installed.
Efficient Measure	Assumed to be a boiler with newly installed reset and lockout controls.

PARAMETER VALUES (DEEMED)

Measure/Type	CAP_{INPUT}	EFLH[183]	SF[184]	Life (yrs)[185]	Cost ($)[186]
	Actual	1,600	8%	20	$612/boiler

IMPACT FACTORS

Measure/Type	ISR	RR_E[187]	RR_D	CF_S	CF_W	FR[188]	SO[189]
	100%	100%	N/A	N/A	N/A	34%	0.4%

[183] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.

[184] Illinois Statewide TRM version 4, measure 4.4.4. http://www.icc.illinois.gov/electricity/TRM.aspx

[185] Ibid.

[186] Ibid.

[187] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

[188] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.

[189] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Oxygen Trim for Boilers and Heaters, Code AF4	
Last Revised Date	3/1/2015 (New)
MEASURE OVERVIEW	
Description	This measure is for a non-residential boiler providing heat without controls for the amount of excess oxygen provided to the burner for combustion. The amount of oxygen is dependent on the amount of air provided. The measure involves the installation of an oxygen sensor in the flue exhaust and a fuel valve and combustion air controls to adjust from that sensor.
Energy Impacts	Natural Gas; Heating Oil; Propane
Sector	Commercial, Industrial
Program(s)	Business Incentive Program
End-Use	Boilers, Space Heating, Process Heating
Decision Type	Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Annual energy savings	ΔMMBtu/yr = Ngi * SF * T / 1000
Definitions	Unit = Single boiler with oxygen trim sensor and control installed Ngi = Boiler/Heater gas input size (Mbtu/hr) SF = Estimate of annual fuel consumption conserved by adding oxygen trim controls T = Hours of operation. (Space heating = Effective full Load heating hours (EFLH)) 1000 = Conversion 1,000 MBtu per MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A baseline boiler utilizes a single point positioning for burner combustion control.
Efficient Measure	A boiler burner will have an oxygen control system allowing the combustion air to be adjusted based upon operating parameters and the output of oxygen sensors in the flue exhaust or other comparable control scenarios.

PARAMETER VALUES (DEEMED)

Measure/Type	Ngi	SF[190]	T (Process)	T (Space Heating)[191]	Life (yrs)[192]	Cost ($)
	Actual	2%	Actual Hours of Operation	1,600 EFLH	15	$20,000[193]

IMPACT FACTORS

Measure/Type	ISR	RR_E[194]	RR_D	CF_S	CF_W	FR[195]	SO[196]
	100%	100%	N/A	N/A	N/A	34%	0.4%

[190] United States EPA, Climate Wise: Wise Rules for industrial Efficiency, July 1998.
[191] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.
[192] Michigan Master Database of Deemed Savings - 2014 - Weather Sensitive Commercial, Adjusted for Maine heating hours.
[193] CODES AND STANDARDS ENHANCEMENT INITIATIVE (CASE) PROCESS BOILERS, 2013 California Building Energy Efficiency Standards, California Utilities Statewide Codes and Standards Team, October 2011, pg. 22
[194] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[195] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.
[196] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Boiler Turbulator, Code AF5							
Last Revised Date	3/1/2015 (New)						
MEASURE OVERVIEW							
Description	This measure involves the installation of turbulators in the tubes of firetube boilers to help to increase heat transfer efficiency. Normally located inside of only the last pass tubes, turbulators help to recreate lost turbulence and to also extract the maximum heat transfer possible before the gases exit the unit.						
Energy Impacts	Natural Gas; Heating Oil; Propane						
Sector	Commercial, Industrial						
Program(s)	Business Incentive Program						
End-Use	Boilers, Space Heating, Process Heating						
Decision Type	Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Annual energy savings	$\Delta MMBtu/yr = CAP_{INPUT} \times EFLH \times OF \times \Delta E / 1000$						
Definitions	Unit = single boiler with turbulators installed CAP_{INPUT} = Boiler input capacity (MBtu/hr) OF = Oversize Factor (decimal) ΔE = Efficiency improvement. An efficiency improvement of 1% is gained per each 40 °F reduction of flue gas temperature.[197] EFLH = Equivalent Full Load Hours 1000 = Conversion 1,000 MBtu per MMBtu						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Assumed to be a boiler with no turbulators installed.						
Efficient Measure	Assumed to be a boiler with newly installed turbulators in the boiler tubes.						
PARAMETER VALUES (DEEMED)							
Measure/Type	CAP_{INPUT}	OF	ΔE	EFLH[198]	Life (yrs)[199]	Cost ($)[200]	
	Actual	0.70[201]	Actual	1,600	20	$15 per turbulator	
IMPACT FACTORS							
Measure/Type	ISR	RR_E[202]	RR_D	CF_S	CF_W	FR[203]	SO[204]
	100%	100%	N/A	N/A	N/A	34%	0.4%

[197] http://energy.gov/sites/prod/files/2014/05/f16/steam25_firetube_boilers.pdf.
[198] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.
[199] CenterPoint Energy, Triennial CIP/DSM Plan 2010-2012, June 1, 2009.
[200] http://energy.gov/sites/prod/files/2014/05/f16/steam25_firetube_boilers.pdf
[201] PA Consulting, KEMA, Focus on Energy Evaluation, Business Programs: Deemed Savings Manual V1.0, March 22, 2010. This factor implies that boilers are 30% oversized on average.
[202] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[203] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.
[204] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive HVAC: Programmable Thermostat, Code AF6							
Last Revised Date	3/1/2015 (New)						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of a single programmable thermostat connected to a single boiler.						
Energy Impacts	Natural Gas, Heating Oil, Propane						
Sector	Commercial, Industrial						
Program(s)	Business Incentive Program						
End-Use	Space Heating						
Decision Type	Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Annual energy savings	$\Delta MMBtu/yr = (CAP_{INPUT} \times EFLH \times \%_{SAVE}) / 1{,}000$						
Definitions	Unit = Single thermostat connected to a single boiler CAP_{INPUT} = Boiler input capacity (MBtu/hr) EFLH = Equivalent Full Load Hours $\%_{SAVE}$ = Savings percentage with installation of a programmable thermostat= Conversion 1000 1000 MBtu per MMBtu						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Assumed to be a non-programmable thermostat						
Efficient Measure	Assumed to be a programmable thermostat with setbacks						
PARAMETER VALUES (DEEMED)							
Measure/Type	CAP_{INPUT}	EFLH[205]	$\%_{SAVE}$[206]	Life (yrs)[207]	Cost ($)[208]		
	Actual	1,600	.068	8	$181		
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
	100%	100%	N/A	N/A	N/A	34%	0.4%

[205] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.

[206] New York Technical Reference Manual, Commercial Programmable Thermostat ESF, revised 10.15.10. While designated as a percentage, the value should be used as a decimal in the savings algorithm.

[207] Illinois Statewide Technical Reference Manual version 4.0, measure 4.4.18 – Small Commercial Programmable Thermostats. 100% persistence factor has been assumed for Maine due to the nature of a new measure and lack of data. http://www.icc.illinois.gov/electricity/TRM.aspx

[208] Ibid.

Refrigeration Equipment

Prescriptive Refrigeration: Evaporator Fan Motor Control for Cooler/Freezer, Code R10	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the installation of evaporator fan controls on refrigeration systems (coolers and freezers). These systems save energy by turning off cooler/freezer evaporator fans while the compressor is not running, and instead turning on an energy-efficient 35 watt fan to provide air circulation. This measure is not eligible for systems already equipped with ECM evaporator fan motors.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (kW_{EVAP} \times n_{EVAP} - kW_{CIRC}) \times (1 - DC_{COMP}) \times BF$
Annual Energy Savings	$\Delta kWh/yr = (kW_{EVAP} \times n_{EVAP} - kW_{CIRC}) \times (1 - DC_{COMP}) \times Hours \times BF$
Definitions	Unit = 1 evaporator fan control kW_{EVAP} = Connected load kW of each evaporator fan (kW) n_{EVAP} = Number of controlled evaporator fans kW_{CIRC} = Connected load kW of the circulating fan (kW) DC_{COMP} = Duty cycle of the compressor BF = Bonus factor for reduced cooling load from replacing the evaporator fan with a lower wattage circulating fan when the compressor is not running Hours = Annual operating hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A refrigeration system equipped with either shaded pole or PSC evaporator fans motors and no evaporator fan control.
High Efficiency	A refrigeration system with an evaporator fan control and a smaller wattage circulating fan.

PARAMETER VALUES

Measure/Type	kW_{EVAP}	n_{EVAP}	kW_{CIRC}	DC_{COMP}	BF	Hours	Life (yrs)	Cost ($)
All	0.123[209]	Actual	0.035[210]	50%[211]	Table 36[212]	Actual	10[213]	$2,254[214]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[215]	101%[215]	Table 26[216]	Table 26[216]	50%[217]	0.4%[218]

209 Based on a weighted average of 80% shaded pole motors at 132 watts and 20% PSC motors at 88 watts. This weighted average is based on discussions with refrigeration contractors and is considered conservative (market penetration estimated at approximately 10%).
210 Wattage of fan is used by Freeaire and Cooltrol.
211 A 50% duty cycle is assumed based on examination of duty cycle assumptions from Richard Traverse, Freeaire Refrigeration (35%-65%), Cooltrol (35%-65%), Natural Cool (70%), Pacific Gas & Electric (58%). Also, manufacturers typically size equipment with a built-in 67% duty factor and contractors typically add another 25% safety factor, which results in a 50% overall duty factor.
212 See Appendix F.
213 ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-1.
214 Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011.
215 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
216 See Appendix C.
217 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.

Prescriptive Refrigeration: Door Heater Controls for Cooler/Freezer, Code R20

Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the installation of door heater controls on refrigeration systems (coolers and freezers). Door heater controls save energy by allowing “on-off” control of the door heaters based on either the relative humidity in the space or the door conductivity level. Door heater controls are not applicable to freezers or coolers with “zero energy” doors.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = kW_{door} \times n_{door} \times BF$
Annual Energy Savings	$\Delta kWh/yr = kW_{door} \times n_{door} \times BF \times Hours \times SF$
Definitions	Unit = 1 door heater control kW_{door} = Connected load kW of a typical reach-in cooler or freezer door with a heater (kW) n_{door} = Number of doors controlled by sensor BF = Bonus factor for reduced cooling load from eliminating heat generated by the door heater from entering the cooler or freezer. SF = Demand savings factor to account for cycling of door heaters after installation of controls Hours = Annual operating hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A cooler or freezer glass door that is continuously heated to prevent condensation.
High Efficiency	A cooler or freezer glass door with either a humidity-based or conductivity-based door-heater control.

PARAMETER VALUES

Measure/Type	kW_{door} [219]	n_{door}	BF	SF	Hours	Life (yrs)	Cost ($)
All	0.075 for cooler 0.200 for freezer	Actual	Table 36[220]	Table 7	8,760[221]	10[222]	$300[223]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[224]	101%[224]	Table 26[225]	Table 26[225]	50%[226]	0.4%[227]

---

218 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
219 Based on range of wattages from two manufacturers and metered data (cooler 50-130 W, freezer 200-320 W).
220 See Appendix F.
221 Refrigeration equipment is assumed to operate continuously.
222 ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-1.
223 Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011.
224 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
225 See Appendix C.
226 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
227 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 7 – Savings Factor (SF) for Door Heater Controls[228]

Control Type	Savings Factor (SF)
Conductivity	80%[229]
Humidity	55%[230]

[228] Based on the average of standard reciprocating and discus compressor efficiencies with Saturated Suction Temperatures of -20°F, 20°F, and 45°F, respectively, and a condensing temperature of 90°F, and manufacturers assumption that 65% of heat generated by door enters the refrigerated case (1+ 0.65/COP).
[229] Door Miser savings claim.
[230] R.H. Travers' Freeaire Refrigeration, estimated savings.

Prescriptive Refrigeration: Zero Energy Doors for Coolers/Freezers, Code R30, R31	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of zero energy doors for refrigeration systems (coolers and freezers) instead of standard doors for new construction or retrofit projects. The zero energy doors consist of two or three panes of glass and include a low-conductivity filler gas (e.g., Argon) and low-emissivity glass coatings. Standard cooler or freezer doors are glass doors that typically have electric resistance heaters within the door frames to prevent condensation from forming on the glass and to prevent frost formation on door frames.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = kW_{door} \times BF$
Annual Energy Savings	$\Delta kWh/yr = kW_{door} \times BF \times Hours$
Definitions	Unit = 1 zero energy door kW_{door} = Connected load kW of a typical reach-in cooler or freezer door with a heater (kW) BF = Bonus factor for reduced cooling load from eliminating heat generated by the door heater from entering the cooler or freezer Hours = Annual operating hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A cooler or freezer glass door that is continuously heated to prevent condensation.
High Efficiency	A cooler or freezer glass door that prevents condensation with multiple panes of glass, inert gas, and low-e coatings instead of using electrically generated heat.

PARAMETER VALUES

Measure/Type	kW_{door}[231]	BF	Hours	Life (yrs)	Cost ($)
Cooler (R30)	0.075	Table 36[232]	8,760	10[233]	$275[234]
Freezer (R31)	0.200	Table 36[232]	8,760	10[233]	$800[234]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[235]	101%[235]	Table 26[236]	Table 26[236]	50%[237]	0.4%[238]

[231] Based on range of wattages from two manufacturers and metered data (cooler 50-130 W, freezer 200-320 W).
[232] See Appendix F.
[233] ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-1.
[234] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011
[235] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[236] See Appendix B.
[237] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[238] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Refrigeration: High Efficiency Evaporative Fan Motors, Code R40, R41, R42	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a new high efficiency brushless DC fan electronically commutated motor (ECM) on a refrigeration system, instead of conventional, shaded-pole or permanent split capacitor (PSC) evaporator fan motor. Refrigeration systems typically contain two to six evaporator fans that run nearly 24 hours per day, 365 days a year. If the system has single-phase power, electricity usage can be reduced by choosing brushless DC, or ECM, motors. This measure is not eligible for high efficiency motors installed in new construction walk-in coolers and freezer applications, as high efficiency motors are required by federal codes and standards.[239]
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction (refrigerated cases only), Retrofit (refrigerated cases and walk-in coolers/freezers)
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (kW_{BASE} - kW_{BDC}) \times BF$
Annual Energy Savings	$\Delta kWh/yr = (kW_{BASE} - kW_{BDC}) \times Hours \times DC_{EVAP} \times BF$
Definitions	Unit = 1 ECM fan kW_{BASE} = Connected load kW of the baseline evaporator fan (kW) kW_{BDC} = Connected load kW of a brushless DC evaporator fan (kW) DC_{Evap} = Duty cycle of the evaporator fan (%) BF = Bonus factor for reduced cooling load Hours = Annual operating hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A refrigeration system equipped with either shaded pole or PSC evaporator fan motor.
High Efficiency	A refrigeration system with a brushless DC fan electronically commutated motor (ECM).
PARAMETER VALUES	

Measure/Type	kW_{BASE}[240]	kW_{BDC}[241]	DC_{Evap}[242]	BF	Hours[243]	Life (yrs)[244]	Cost ($)
Walk-in Cooler/Freezer (R40)	0.123	0.040	100% for cooler, 94% for freezer	Table 36[245]	8,760	15	Table 8
Refrigerated Warehouse (R41)	0.123	0.040	100% for cooler, 94% for freezer	Table 36[245]	8,760	15	Table 8
Merchandise Case (R42)	0.123	0.040	100% for cooler, 94% for freezer	Table 36[245]	8,760	15	Table 8

[239] Energy Independence and Securities Act of 2007, Section 312.
[240] Based on a weighted average of 80% shaded pole motors at 132 watts and 20% PSC motors at 88 watts. This weighted average is based on discussions with refrigeration contractors and is considered conservative (market penetration estimated at approximately 10%).
[241] Based on research for typical power demand high efficiency evaporator fan motors for refrigeration applications (40 Watts).
[242] A evaporator fan in a cooler runs all the time, but a freezer only runs 8273 hours per year due to defrost cycles (4 20-min defrost cycles per day)
[243] Refrigeration equipment is assumed to operate continuously.
[244] ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-1.
[245] See Appendix F.

Prescriptive Refrigeration: High Efficiency Evaporative Fan Motors, Code R40, R41, R42							
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[246]	101%[246]	Table 26[247]	Table 26[247]	50%[248]	0.4%[249]

Table 8 – Measure Costs for Evaporative Fan Motors[250]

Measure Code	Application	Measure Cost
R40	Walk-in Coolers/Freezers	$60
R41	Refrigerated Warehouses	$135
R42	Merchandise Cases	$25

[246] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[247] See Appendix B.
[248] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[249] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[250] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011

Prescriptive Refrigeration: Floating-Head Pressure Controls, Code R50, R51, R52

Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a "floating head pressure control" condenser system on a refrigeration system. The floating-head pressure control changes the condensing temperatures in response to different outdoor temperatures so that as the outdoor temperature drops, the compressor does not have to work as hard to reject heat from the cooler or freezer.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times \Delta kWh/hp / FLH$
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times \Delta kWh/hp$
Definitions	$HP_{COMPRESSOR}$ = Compressor horsepower (hp) $\Delta kWh/hp$ = Average kWh savings per hp (kWh/yr/hp) FLH = Full load hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	A refrigeration system without a floating head pressure control system.
High Efficiency	A refrigeration system with a floating head pressure control system.

PARAMETER VALUES

Measure/Type	$HP_{COMPRESSOR}$	$\Delta kWh/hp$	FLH	Life (yrs)	Cost ($)
All	Actual	Table 9	7,221[251]	10[252]	Table 10

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[253]	101%[253]	Table 26[254]	Table 26[254]	50%[255]	0.4%[256]

---

[251] The refrigeration is assumed to be in operation every day of the year, while savings from floating head pressure control are expected to occur when the temperature outside is below 75 degree F, or 8125 hours. However, due to varied levels of savings at different temperatures, the full load hours are assumed to be 7,221 hours.

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

[253] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.

[254] See Appendix B.

[255] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.

[256] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 9 – Floating Head Pressure Control kWh Savings per Horsepower (kWh/yr/hp)[257]

Compressor Type	Temperature Range		
	Low Temperature (-35°F to -5°F SST) (Ref. Temp -20°F SST)	Medium Temperature (0°F to 30°F SST) (Ref. Temp 20°F SST)	High Temperature (35°F to 55°F SST) (Ref. Temp 45°F SST)
Standard Reciprocating	695	727	657
Discus	607	598	694
Scroll	669	599	509

Table 10 – Measure Costs for Floating Head Pressure Control [258]

Measure Code	Description	Measure/Incremental Cost
R50	Controlling 1 Coil	$518
R51	Controlling 2 Coils	$734
R52	Controlling 3 Coils	$984

[257] Average savings values are based on previous EMT projects.
[258] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011

Prescriptive Refrigeration: Discus & Scroll Compressors, Code R60, R61, R62, R63, R70, R71, R72, R73, R74	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a high efficiency discus or scroll compressor in a refrigeration system. The high efficiency discus or scroll compressor increases operating efficiency, and reduces energy consumption, of the system.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Refrigeration
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times \Delta kWh/hp / FLH$
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times \Delta kWh/hp$
Definitions	Unit = 1 compressor $HP_{COMPRESSOR}$ = Compressor horsepower (hp) $\Delta kWh/hp$ = kWh per HP (kWh/yr/hp) FLH = Full load hours (hrs/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Standard hermetic or semi-hermetic reciprocating compressor.
High Efficiency	High efficiency discus or scroll compressor.

PARAMETER VALUES

Measure/Type	$HP_{COMPRESSOR}$	$\Delta kWh/hp$	FLH	Life (yrs)	Cost ($)
All	Actual	Table 11	5,858[259]	15[260]	Table 12

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[261]	101%[261]	Table 26[262]	Table 26[262]	50%[263]	0.4%[264]

[259] Derived from Washington Electric Coop data by West Hill Energy Consultants. The freezer is assumed to always be plugged in but because of compressor and fan cycling the full load hours are 5858 hours.
[260] ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, Table 1-1.
[261] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[262] See Appendix B.
[263] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[264] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 11 - Compressor kWh Savings per Horsepower (kWh/hp)[265]

Compressor Type	Temperature Range		
	Low Temperature (-35°F to -5°F SST) (Ref. Temp -20°F SST)	Medium Temperature (0°F to 30°F SST) (Ref. Temp 20°F SST)	High Temperature (35°F to 55°F SST) (Ref. Temp 45°F SST)
Discus	517	601	652
Scroll	208	432	363

Table 12 – Measure Costs for Discus and Scroll Compressors[266]

Equipment Type	Measure Code	Size (hp)	Measure/Incremental Cost
Discus	R60	3	$650
	R61	4	$765
	R62	5	$900
	R63	6	$1,330
Scroll	R70	2	$400
	R71	3	$525
	R72	4	$600
	R73	5	$1,000
	R74	6	$1,300

[265] Savings calculations summarized in <Compressor kWh compared.xls>; calculations performed in spreadsheet tool <Refrigeration Compressor Evaluation Vers. 2.01 July 2003.xls>.
[266] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011.

Prescriptive Refrigeration: ENERGY STAR® Reach-in Coolers and Freezers, Code R80							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of a new ENERGY STAR® qualified commercial cooler (refrigerator) or freezer instead of a new standard efficiency cooler or freezer.						
Primary Energy Impact	Electric						
Sector	Commercial						
Program(s)	Business Incentive Program						
End-Use	Refrigeration						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	$\Delta kW = \Delta kWh_{UNIT} / FLH$						
Annual Energy Savings	$\Delta kWh/yr = \Delta kWh_{UNIT}$						
Definitions	Unit = 1 reach-in cooler or freezer ΔkWh_{UNIT} = Average annual energy savings from high-efficiency unit (kWh/yr) FLH = Full load hours (hrs/yr)						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Commercial reach-in refrigerators or freezers of at least 15 cubic feet interior volume that meet the Federal Code requirements for minimum daily energy consumption (MDEC).						
High Efficiency	Commercial reach-in refrigerators or freezers of at least 15 cubic feet interior volume that meet ENERGY STAR® MDEC requirements.						
PARAMETER VALUES							
Measure/Type	ΔkWh_{UNIT}	FLH	Life (yrs)	Cost ($)			
All	Table 13	5,858[267]	12[268]	155[269]			
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[270]	101%[270]	Table 26[271]	Table 26[271]	50%[272]	0.4%[273]

[267] Derived from Washington Electric Coop data by West Hill Energy Consultants. The freezer is assumed to always be plugged in but because of compressor and fan cycling the full load hours are 5858 hours.
[268] Environmental Protection Agency, "Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment." Accessed April 8, 2013.
[269] Representative cost of participating units based on the following cost data from Vermont TRM 2014: Solid Ref/Freezer Tier 1 $95 one door; $125 two door; $155 three door -- Tier 2 is TWICE Tier 1;Glass Ref Tier 1 $120 one door; $155 two door; $195 three door -- Tier 2 is TWICE Tier 1;Glass Freezer only 1 Tier $142 <15 cu ft; $166 15 to 50 cu ft; $407 > 50 cu ft
[270] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[271] See Appendix B.
[272] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[273] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 13 - Stipulated Annual Energy Consumption and Savings for Commercial Reach-in Coolers and Freezers[274]

Equipment Type	Type	Internal Volume (cubic feet)	Annual Energy Consumption per Unit (kWh/yr)		Annual Energy Savings per Unit (kWh/yr)
			Federal Code	Qualifying Products	
Coolers/Refrigerators	Solid Door	15 ≤ V < 30	1,566	1,107	459
		30 ≤ V < 50	2,205	1,414	790
		50 ≤ V	3,026	1,886	1,140
	Glass Door	15 ≤ V < 30	2,205	1,533	672
		30 ≤ V < 50	2,971	2,243	728
		50 ≤ V	3,957	3,057	900
Freezers	Solid Door	15 ≤ V < 30	3,789	2,920	869
		30 ≤ V < 50	6,344	4,615	1,728
		50 ≤ V	9,629	5,916	3,713
	Glass Door	15 ≤ V < 30	7,656	5,655	2,001
		30 ≤ V < 50	12,447	8,578	3,869
		50 ≤ V	18,606	11,543	7,063

Note: V = internal volume (ft^3)

[274] Stipulated annual energy consumption for baseline and qualifying high efficiency models calculated using the minimum efficiency requirements.

Prescriptive Refrigeration: ENERGY STAR® Commercial Ice Makers, Code R90							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of new self-contained air-cooled ice-makers that meet current ENERGY STAR® or CEE Tier 2 specifications for use in commercial applications (e.g., hospitals, hotels, food service, and food preservation) instead of standard efficiency ice makers. High efficiency ice-makers typically use high-efficiency compressors and fan motors and thicker insulation. A list of qualified CEE commercial ice makers (as of January 2015) is available at: http://library.cee1.org/sites/default/files/library/9558/2015-01_Ice_Machines.xlsx						
Primary Energy Impact	Electric						
Sector	Commercial						
Program(s)	Business Incentive Program						
End-Use	Refrigeration						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	$\Delta kW = \Delta kWh_{ICEMACHINE} / FLH$						
Annual Energy Savings	$\Delta kWh/yr = \Delta kWh_{ICEMACHINE}$						
Definitions	Unit = 1 commercial ice maker $\Delta kWh_{ICEMACHINE}$ = Average annual energy savings from high efficiency ice machine (kWh/yr) ΔFLH = Full load hours (hrs/yr)						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Commercial ice-maker that meets the federal minimum efficiency requirements.						
High Efficiency	Commercial ice maker that meets current ENERGY STAR® or CEE Tier 2 specifications.						
PARAMETER VALUES							
Measure/Type	$\Delta kWh_{ICEMACHINE}$	FLH	Life (yrs)	Cost ($)			
All	Table 14	5,858[275]	8[276]	$0[277]			
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[278]	101%[278]	Table 26[279]	Table 26[279]	50%[280]	0.4%[281]

[275] Derived from Washington Electric Coop data by West Hill Energy Consultants. The freezer is assumed to always be plugged in but because of compressor and fan cycling the full load hours are 5858 hours.
[276] Environmental Protection Agency, "Savings Calculator for ENERGY STAR Qualified Commercial Kitchen Equipment." Accessed April 8, 2013.
[277] Energy Star Commercial Kitchen Equipment Calculator
[278] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[279] See Appendix B.
[280] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[281] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 14 - CEE Specifications for Air-cooled Self-Contained Ice-Makers[282]

Equipment	Harvest Rate range (lbs ice per day)	Savings (kWh/yr)
Air Cooled, Self-Contained	< 175 lbs ice per day	758
	> 175 and <= 400 lbs ice per day	2,344
	> 400 and <= 600 lbs ice per day	6,029
	> 600 lbs ice per day	8,045

[282] From CEE, High Efficiency Specifications for Commercial Ice Makers effective 07/01/2011, and energystar.gov

Water Heating Equipment

Prescriptive Water Heating: Tankless Water Heater, Code WH1	
Last Revised Date	3/1/2015 (New)
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a new tankless (on-demand) natural gas water heater instead of a new storage natural gas water heater.
Energy Impacts	Natural Gas
Sector	Commercial, Industrial
Program(s)	Business Incentive Program
End-Use	Water Heating
Decision Type	New; Replace on Burnout;
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Annual energy savings	$\Delta MMBtu/yr = [\ GAL \times 8.33 \times 1 \times (T_{WH} - T_{in}) \times (1/\ TE_{BASE} - 1/\ TE_{EE})\ /\ 1{,}000{,}000\ ] + [\ SL \times 8760\ /\ 1{,}000{,}000]$
Definitions	Unit = Single water heater GAL = Average amount of hot water consumed annually per water heater (gal/yr) T_{WH} = Water heater setpoint temperature (°F) T_{in} = Average water at the main (°F) TE_{BASE} = Thermal Efficiency for baseline stand alone tank water heater TE_{EE} = Thermal Efficiency for on-demand water heater 8.33 = Density of water: 8.33 lb/gallon water 1 = Specific heat of water: 1 Btu/lb-°F 1,000,000 = Conversion: 1,000,000 Btu/MMBtu Input = Input rating of water heater (Btu/hr) Tank = Tank volume of baseline water heater (gallons) SL[283] = Maximum standby losses (in Btu/hr) for gas fired storage water heaters ($SL = Input/800 + 110 \times \sqrt{Tank}$)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Assumed to be a standard Gas-fired storage water heater with a Federal Minimum Thermal Efficiency and Federal Maximum Standby Loss.
Efficient Measure	Assumed to be a newly installed Tankless Water Heater with a minimum efficiency of 0.82 EF
PARAMETER VALUES (DEEMED)	

Measure/Type	GAL	T_{WH}	T_{in}	TE_{BASE}	TE_{EE}	Input	Tank	Life (yrs)	Cost ($)
<155,000Btuh	Actual[284]	126.2[285]	50.8[286]	0.80[287]	Actual	Actual	75	20[288]	$1448[289]
≥155,000Btuh							150		

[283] From Federal Standard for Commercial Water Heating Equipment, Gas-fired storage water heaters http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/51
[284] Use actual annual hot water gallons per year. Alternatively, default values from the DEER Database (www.deeresources.com) may be used based on building type.
[285] NMR Group, Inc., Efficiency Maine Appliance Rebate Program Evaluation Overall Report – FINAL, July 18, 2014.
[286] Standard Building America DHW Schedules, weighted average by population of all Maine water main sources.
[287] Federal Standards for Commercial Gas Water Heaters. http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/51
[288] DEER Database, updated 2/5/2014. http://www.deeresources.com/files/DEER2013codeUpdate/download/DEER2014-EUL-table-update_2014-02-05.xlsx.
[289] Incremental cost is shown as calculated by GDS engineering review of available cost data.

Prescriptive Water Heating: Tankless Water Heater, Code WH1							
IMPACT FACTORS							
Measure/Type	ISR	RR_E[290]	RR_D	CF_S	CF_W	FR[291]	SO[292]
	100%	100%	N/A	N/A	N/A	34%	0.4%

[290] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[291] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.
[292] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Agricultural Equipment

Prescriptive Agricultural: New Vapor-Tight High Performance T8 Fluorescent Fixtures	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of new High-Performance T8 (HPT8) Lamps and Ballasts with vapor-tight housing.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Agriculture
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000$
Annual Energy Savings	$\Delta kWh/yr = (Qty_{BASE} \times Watts_{BASE} - Qty_{EE} \times Watts_{EE}) / 1000) \times HoursWk \times Weeks$
Definitions	Unit = 1 new fixture with 1 to 4 lamps and 1 ballast. Qty_{BASE} = Quantity of baseline fixtures (fixtures) Qty_{EE} = Quantity of new efficient fixtures (fixtures) $Watts_{BASE}$ = Watts of baseline fixture (Watts/fixture) $Watts_{EE}$ = Watts new fixture (Watts/fixture) HoursWk = Weekly hours of equipment operation (hrs/week) Weeks = Weeks per year of equipment operation (weeks/year) 1000 = Conversion: 1000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	T12 lighting fixtures
High Efficiency	High-Performance T8 lamps and ballasts with vapor-tight housing.

PARAMETER VALUES

Measure/Type	Qty_{BASE}	Qty_{EE}	$Watts_{BASE}$	$Watts_{EE}$	HoursWk[293]	Weeks	Life (yrs)	Cost ($)
New Construction	Actual	Actual	Table 30[294]	Table 28[295]	Actual	Actual	15[296]	$96[297]
Retrofit	Actual	Actual	Table 30[294]	Table 28[295]	Actual	Actual	13[296]	$96[297]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[298]	101%[298]	Table 26[299]	Table 26[299]	50%[300]	0.4%[301]

[293] Use actual hours when known. If hours are unknown, use the values from Table 33.
[294] See Appendix E. The baseline fixture wattage is determined using the Baseline Fixture Rated Wattage table and the baseline fixture type specified in the project Data Collection and Information form.
[295] See Appendix D.
[296] 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.
[297] Measure Costs assume 50% retrofit and 50% market opportunity for 1 Lamp fixtures based on cost data provided in Vermont TRM 2014.
[298] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[299] See Appendix B.
[300] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[301] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Agricultural: Plate Heat Exchangers for Milk Processing	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a plate heat exchanger (PHX) which uses tap or well water to pre-cool milk (to between 55˚F and 70˚F) before the milk enters the cooling tank , thereby reducing the energy required for cooling. The PHX may also use the heat extracted from the milk to preheat water for domestic hot water (DHW) applications.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Agriculture
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = \Delta kWh/yr / Hours$
Annual Energy Savings	$\Delta kWh/yr = \Delta kWh_{COMP} + \Delta kWh_{DHW}$ $\Delta kWh_{COMP} = MPD \times 365 \times CP_{MILK} \times ETR / EER / 1{,}000$ $\Delta kWh_{DHW} = MPD \times 365 \times CP_{MILK} \times ETR \times EF_{HX} \times DHW / 3{,}412$
Definitions	Unit = 1 plate heat exchanger for milk processing ΔkWh_{COM} = Compressor annual kWh reduction ΔkWh_{DHW} = Domestic hot water annual kWh reduction ETR = Expected Temperature Reduction (°F) MPD = Pounds of milk per Day (lb/day) CP_{MILK} = Specific heat of whole milk (Btu/lb-°F) EER = EER of cooling systems (Btuh/Watt) Hours = Annual operating hours (hrs/yr) EF_{HX} = Heat transfer efficiency of device (%) DHW = Indicator for electric DHW system 365 = Conversion: 365 days per year 3,412 = Conversion: 3,412 Btu per kWh 1,000 = Conversion: 1,000 Watts per kW
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	No plate heat exchanger
High Efficiency	Plate heat exchanger installed; may be with or without DHW heat reclaim.

PARAMETER VALUES

Measure/Type	MPD	EER	ETR	CP_{MILK}	Hours	EF_{HX}	DHW	Life (yrs)	Cost ($)
PHX without DHW	Actual	Actual	35[302]	0.93[303]	2,850[304]	NA	0	20[305]	2,500[306]
PHX with Electric DHW	Actual	Actual	35[302]	0.93[303]	2,850[304]	59%	1.0	20[305]	2,500[306]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[307]	101%[307]	Table 26[308]	Table 26[308]	50%[309]	0.4%[310]

302 Estimated average temperature reduction: PHX typically reduce milk temperatures from 98 degrees Fahrenheit to temperatures to between 55˚F and 70˚F.

303 K M Sahay, K. K. Singh, *Unit Operations of Agricultural Processing*, 2001; page 346.

304 Full load operating hours of 2,850 hours per year assume 6 hours per day of full load operation during milking, with an additional 10% cycle time to maintain tank temperature during non-milking hours.

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

306 Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011

Prescriptive Agricultural: Adjustable Speed Drives for Dairy Vacuum Pumps							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of an Adjustable Speed Drive (ASD) to control the speed of the dairy vacuum pump. This prescriptive measure includes dairy vacuum pumps smaller than 20 HP.						
Primary Energy Impact	Electric						
Sector	Commercial						
Program(s)	Business Incentive Program						
End-Use	Agriculture						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	ΔkW = HP x 0.746 x LF / M_{EFF} – (0.0495 x 2 x #MilkUnits + 1.7729)						
Annual Energy Savings	ΔkWh/yr = ΔkW x DRT x 365						

Definitions	Unit = New ASD
	HP = Full load HP rating of Vacuum Pump Motor (hp)
	LF = Average load factor for constant speed vacuum pump (%)
	M_{EFF} = Motor efficiency (%)
	#MilkUnits = Number of milk units processed per day
	DRT = Daily Run Time, Hours per day of vacuum pump operation (hrs/day)
	365 = Conversion: 365 days per year
	0.746 = Conversion: 0.746 kW per hp
	0.0495, 2, 1.7729 = Regression coefficients for average ASD speed and processed milk units						

EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Standard dairy vacuum pump operating at constant speed.						
High Efficiency	Dairy vacuum pump with adjustable speed drive installed.						
PARAMETER VALUES							
Measure/Type	HP	LF	M_{EFF}[311]	#MilkUnits	DRT	Life (yrs)	Cost ($)
All	Table 15	75%[312]	Actual	Actual	Actual	15[313]	$5,322[314]
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[315]	101%[315]	Table 26[316]	Table 26[316]	50%[317]	0.4%[318]

307 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
308 See Appendix B.
309 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
310 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
311 Use rated motor efficiency for the actual equipment. If the actual efficiency value is unknown, use the values in Table 15 for existing or new motors.
312 Assumed value based on typical operations.
313 PA Consulting Group for the State of Wisconsin Public Service Commission, Focus on Energy Evaluation. Business Programs: Measure Life Study. August 25, 2009.
314 Average Incremental costs based on interviews with suppliers in Maine, the review of Efficiency Maine projects and incremental costs based from the Efficiency Vermont TRM Users Manual No. 2010-64, 12/14/10 by GDS Associates, December 2011.
315 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
316 See Appendix B.

Table 15 – Standard Motor Efficiency[319]

Measure	Size (HP)	Existing Motor	New Motor
MILK: Vacuum Pump with Adjustable Speed Drive Package – 7.5 HP	7.5	89.5%	91.7%
MILK: Vacuum Pump with Adjustable Speed Drive Package – 10 HP	10	90.2%	91.7%
MILK: Vacuum Pump with Adjustable Speed Drive Package – 15 HP	15	91.0%	93.0%
MILK: Vacuum Pump with Adjustable Speed Drive Package – 30 HP	30	92.4%	94.1%

[317] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.

[318] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

[319] Values are the highest minimum efficiency values for each size category from the Energy Policy Act of 1992 (for existing motors) and NEMA Premium Efficiency (for new motors).

Prescriptive Agricultural: Scroll Compressors

Last Revised Date	7/1/2013

MEASURE OVERVIEW

Description	This measure involves the purchase and installation of a high efficiency scroll compressor for use in the milk cooling process.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Agriculture
Project Type	New construction, Retrofit

GRISS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)

Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times \Delta kWh/hp / FLH$
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times \Delta kWh/hp$
Definitions	Unit = 1 new scroll compressor $HP_{COMPRESSOR}$ = Compressor horsepower (hp) $\Delta kWh/hp$ = kWh savings per HP (kWh/hp/yr) FLH = Full load hours (hrs/yr)

EFFICIENCY ASSUMPTIONS

Baseline Efficiency	Standard hermetic compressor. (Note: kWh savings based on an average size dairy farm in Maine with 100 milking cows.)
High Efficiency	High efficiency scroll compressor.

PARAMETER VALUES

Measure/Type	$HP_{COMPRESSOR}$	$\Delta kWh/hp$	FLH	Life (yrs)	Cost ($)
All	Actual	432[320]	2,850[321]	15[322]	Table 16

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[323]	101%[323]	Table 26[324]	Table 26[324]	50%[325]	0.4%[326]

Table 16 – Measure Costs for Scroll Compressor[327]

Equipment Type	Size (HP)	Measure/Incremental Cost
Scroll Compressor	2	$400
	3	$525
	5	$1000
	6	$1,300
	7.5	$1,538
	10	$2,051

[320] Average savings value based on Wisconsin Focus on Energy Dairy Audit tool, used for a 100 herd dairy farm in Maine.
[321] Full load operating hours of 2,850 hours per year assume 6 hours per day of full load operation during milking, with an additional 10% cycle time to maintain tank temperature during non-milking hours.
[322] PA Consulting Group for the State of Wisconsin Public Service Commission, Focus on Energy Evaluation. Business Programs: Measure Life Study. August 25, 2009.
[323] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[324] See Appendix B.
[325] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[326] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
[327] Average Incremental costs based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011.

Prescriptive Agricultural: Adjustable Speed Drives on Ventilation Fans (Potato Storage Equipment)

Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of an Adjustable Speed Drive on potato storage ventilation fans. Savings are realized during periods when less than full speed is required.
Primary Energy Impact	Electric
Sector	Commercial
Program(s)	Business Incentive Program
End-Use	Agriculture
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = HP_{VFD} \times LF/EF \times (A + B \times SF_F + C \times SF_F^2 - (A + B \times SF_H + C \times SF_H^2))$ $= HP_{VFD} \times 0.71$
Annual Energy Savings	$\Delta kWh/yr = HP_{VFD} \times LF/EF \times HOU_{HALF} \times (A + B \times SF_F + C \times SF_F^2 - A + B \times SF_H + C \times SF_H^2)$ $= HP_{VFD} \times 2540$
Definitions	Unit = 1 new ASD HP_{VFD} = Total fan horsepower connected to the ASD (hp) LF = Load factor EF = Motor efficiency HOU_{HALF} = Hours of use at half power A, B, C = Fan Default Curve Correlation Coefficients SF_F = Speed factor for full speed SF_H = Speed factor for half speed
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Standard ventilation fan with no adjustable speed drive installed.
High Efficiency	Ventilation fan with adjustable speed drive installed.

PARAMETER VALUES

Measure/Type	HP_{VFD}		HOU_{HALF}	Life (yrs)	Cost ($)
All	Actual		3600[328]	15[329]	Table 17

Measure/Type	LF	EF	A	B	C	SF_F	SF_H
All	0.8[330]	0.91[330]	0.22[331]	-0.87[331]	1.65[331]	1	0.5

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[332]	101%[332]	Table 26[333]	Table 26[333]	50%[334]	0.4%[335]

[328] Fans can run at half speed 24/7 from December 1 to April 30 as reported by Steve Belyea, ME Dept of Agriculture, evaluation.
[329] 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.
[330] Program assumption
[331] Fan Default Curve Correlation Coefficients for VFD. Variable Frequency Drive Evaluation Protocol, SBW Consulting, Inc., Table 1.
[332] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[333] See Appendix B.
[334] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[335] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 17 – Measure Cost for ASD on Ventilation Fans[336]

Size (hp)	Measure Cost
3	$963
5	$1,105
7.5	$1,467
10	$1,745
15	$2,525
20	$2,725

[336] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011

Prescriptive Agricultural: High Volume Low Speed Fans								
Last Revised Date	7/1/2013							
MEASURE OVERVIEW								
Description	This measure involves the purchase and installation of high volume low speed (HVLS) fans in a free stall dairy barn to move large amounts of air efficiently (with lower noise).							
Primary Energy Impact	Electric							
Sector	Commercial							
Program(s)	Business Incentive Program							
End-Use	Agriculture							
Project Type	New construction, Retrofit							
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)								
Demand Savings	$\Delta kW = (HP_{BASE} / M_{EFF,BASE} - HP_{HLVS} / M_{EFF,HVLS}) \times 0.746 \times LF$							
Annual Energy Savings	$\Delta kWh/yr = \Delta kW \times Hours$							
Definitions	Unit = 1 new HVLS HP_{BASE} = total combined horsepower of existing fan motors (hp) $M_{EFF,BASE}$ = average motor efficiency of existing fan motors (%) HP_{HVLS} = total combined HP of HVLS fan motors (hp) $M_{EFF,HVLS}$ = rated motor efficiency of new HVLS fan (%) LF = Average motor load factor Hours = Annual operating hours (hrs/yr) 0.746 = Conversion: 0.746 kW per hp							
EFFICIENCY ASSUMPTIONS								
Baseline Efficiency	1-hp basket type fans (approximately 10-13 four-foot fans replaced by 1 HVLS).							
High Efficiency	High Volume Low Speed (HVLS) ventilation fans.							
PARAMETER VALUES								
Measure/Type	HP_{BASE}	$M_{EFF,BASE}$	HP_{HVLS}	$M_{EFF,HVLS}$	LF	Hours	Life (yrs)	Cost ($)
All	Actual	80%[337]	Actual	Actual	80%[338]	3,660[339]	15[340]	1,165[341]

IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[342]	101%[342]	Table 26[343]	Table 26[343]	50%[344]	0.4%[345]

[337] Conservative estimate for efficiency of existing 1-2 hp fan motors, based on minimum efficiency requirements in the Energy Policy Act of 2007.
[338] Assumed value based on typical operations.
[339] Fan typically operates 5 months out of the year or approximately 3,660 hours.
[340] PA Consulting Group for the State of Wisconsin Public Service Commission, Focus on Energy Evaluation. Business Programs: Measure Life Study. August 25, 2009.
[341] Average incremental cost for this measure has not changed since the Efficiency Maine TRM revision 8/15 2010 based on interviews with suppliers in Maine and the review of Efficiency Maine projects by GDS Associates, December 2011
[342] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for prescriptive measures.
[343] See Appendix C.
[344] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for prescriptive non-lighting measures.
[345] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Gas Equipment

Prescriptive Gas: Natural Gas Heating Equipment, Code G1-G16	
Last Revised Date	7/1/2014
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a new high-efficiency natural gas furnace, boiler or unit heater instead of a new code-compliant unit with equivalent capacity.
Primary Energy Impact	Natural Gas
Sector	Commercial, Industrial
Program(s)	Business Incentive Program
End-Use	Natural Gas
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Annual Energy Savings	$\Delta MMBtu/yr = CAP_{INPUT} \times EFLH \times (EF_{EE} / EF_{BASE} - 1) / 1{,}000$
Definitions	Unit = 1 new gas heating unit CAP_{INPUT} = New Equipment input capacity (MBH = kBtu/h) EFLH = Equivalent full load heating hours EF_{BASE} = The efficiency of the baseline equipment (thermal efficiency (Et), combustion efficiency (Ec), or Annual Fuel Utilization Efficiency (AFUE), depending on equipment type and capacity) EF_{EE} = The efficiency of the efficient equipment (same as EF_{BASE}) 1,000 = Conversion: 1,000 kBtu per MMBtu
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Business Incentive Program: The baseline equipment must meet the minimum efficiency requirements specified in federal standards or Maine's building code, whichever is more stringent.
Furnace or Boiler	High efficiency natural gas-fired furnace, boiler, or unit heater.

PARAMETER VALUES

Measure/Type	CAP_{INPUT}	EFLH	EF_{BASE}	EF_{EE}	Life (yrs)	Cost ($)
All	Actual	1,600[346]	Table 18	Actual	20[347]	Table 19

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	99%[348]	NA	NA	NA	34%[349]	0.4%[350]

[346] EMT assumes 1,600 heating full load hours for all natural gas heating equipment. The value is comparable to the recommended value of 1,400 FLH for Massachusetts, which has a shorter heating season than Maine, determined in the following study: KEMA, Project 15 Prescriptive Gas – Final Program Evaluation Report, June 2012, Table ES 2.

[347] 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.

[348] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.

[349] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.

[350] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 18 – Baseline Efficiency for Natural Gas Heating Equipment

Equipment Type	Measure Code	Measure Description	Capacity Range (MBH)	Baseline Efficiency (EF_{EE})		
				Value	Units	Reference
Furnace	G1	Natural gas-fired air furnace ≤ 300 Mbtu/h, AFUE ≥ 95%	≤ 300	78%	AFUE	[2]
Non-Condensing Hot water Boiler	G2	Natural gas-fired non-condensing hot water boiler, AFUE ≥ 85%, ≤ 300 MBtu/h (ENERGY-STAR-qualified)	≤ 300	82%	AFUE	[2]
	G3	Natural gas-fired non-condensing hot water boiler, thermal efficiency ≥ 85%, >300 MBtu/h and ≤500 MBtu/h	> 300 and ≤ 500	80%	Et	[1]
	G4	Natural gas-fired non-condensing hot water boiler, thermal efficiency ≥ 85%, >500 MBtu/h and ≤1,000 MBtu/h	> 500 and ≤ 1,000	80%	Et	[1]
	G5	Natural gas-fired non-condensing hot water boiler, thermal efficiency ≥ 85%, >1,000 MBtu/h and ≤2,500 MBtu/h	> 1,000 and ≤ 2,500	80%	Et	[1]
	G6	Natural gas-fired non-condensing hot water boiler, thermal efficiency ≥ 85%, >2,500 MBtu/h	> 2,500	82%	Ec	[1]
Condensing Hot Water Boiler	G7	Natural gas-fired condensing hot water boiler, AFUE ≥ 90%, ≤ 300 MBtu/h	≤ 300	82%	AFUE	[2]
	G8	Natural gas-fired condensing hot water boiler, thermal efficiency ≥ 90%, >300 MBtu/h and ≤500 MBtu/h	> 300 and ≤ 500	80%	Et	[1]
	G9	Natural gas-fired condensing hot water boiler, thermal efficiency ≥ 90%, >500 MBtu/h and ≤1,000 MBtu/h	> 500 and ≤ 1,000	80%	Et	[1]
	G10	Natural gas-fired condensing hot water boiler, thermal efficiency ≥ 90%, >1,000 MBtu/h and ≤2,500 MBtu/h	> 1,000 and ≤ 2,500	80%	Et	[1]
	G11	Natural gas-fired condensing hot water boiler, thermal efficiency ≥ 90%, >2,500 MBtu/h	> 2,500	82%	Ec	[1]
Steam Boiler	G12	Natural gas-fired steam boiler, AFUE ≥ 82%, ≤ 300 MBtu/h	≤ 300	80%	AFUE	[2]
	G13	Natural gas-fired steam boiler, thermal efficiency ≥ 79%, >300 MBtu/h and ≤2,500 MBtu/h	> 300 and ≤ 2,500	77%	Et	[1]
	G14	Natural gas-fired steam boiler, thermal efficiency ≥ 80%, >2,500 MBtu/h and ≤10,000 MBtu/h	> 2,500 and ≤ 10,000	77%	Et	[1]
Unit Heater	G15	Low-intensity, infrared, natural gas-fired unit heater	All	80%	Ec	[3]
	G16	Natural gas-fired, warm-air unit heater, thermal efficiency ≥ 90%	All	80%	Ec	[3]

[1] Commercial Packaged Boilers: http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/74
[2] Residential Furnaces and Boilers (furnace standards effective May 1, 2013; boiler standards effective September 1, 2012): http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72
[3] IECC 2009, Table 503.2.3(4)

Table 19 – Measure Costs for Natural Gas Heating Equipment

Equipment Type	Measure Code	Baseline Cost ($/MBH)	Measure Cost ($/MBH)	Incremental Cost ($/MBH) [A]
Furnace	G1	NA	NA	$9.00
Non-Condensing Hot water Boiler	G2	NA	NA	$3.13
	G3	NA	NA	$3.13
	G4	NA	NA	$3.13
	G5	NA	NA	$3.13
	G6	NA	NA	$3.13
Condensing Hot Water Boiler	G7	NA	NA	$1982 + 3.47/MBH
	G8	NA	NA	$1982 + 3.47/MBH
	G9	NA	NA	$1982 + 3.47/MBH
	G10	NA	NA	$1982 + 3.47/MBH
	G11	NA	NA	$1982 + 3.47/MBH
		Baseline Cost ($)	**Measure Cost ($)**	**Incremental Cost ($) [B]**
Steam Boiler	G12	NA	NA	$1,200
	G13	NA	NA	$3,125
	G14	NA	NA	$3,800
Unit Heater	G15	NA	NA	$563
	G16	NA	NA	$692

[a] Based on incremental cost assumptions in the Mid-Atlantic TRM Version 3.0. For boilers, the incremental cost is based on the on the correlation between equipment size and incremental cost in the "Lost Opportunity Incremental Cost" table.

[b] Based on incremental cost gathered from various program participating contractors June 2015.

Prescriptive Gas: ENERGY STAR® Natural Gas Kitchen Equipment, Code G17 - G22							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of new High Efficiency Natural Gas Kitchen Equipment.						
Primary Energy Impact	Natural Gas						
Sector	Commercial, Industrial						
Program(s)	Efficiency Maine Business Incentive Program						
End-Use	Natural Gas						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Annual Energy Savings	ΔMMBtu/yr = $\Delta MMBTU_{UNIT}$						
Definitions	Unit = 1 new kitchen equipment $\Delta MMBTU_{UNIT}$ = Deemed annual MMBtu savings per unit (MMBtu/yr)						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Standard efficiency natural gas kitchen equipment						
High Efficiency	High efficiency natural gas kitchen equipment						
PARAMETER VALUES							
Measure/Type	$\Delta MMBTU_{UNIT}$			Life (yrs)	Cost ($)		
All	Table 20			12[351]	Table 20		
IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	100%[352]	NA	NA	NA	34%[353]	0.4%[354]

351 Energy Protection Agency, Savings Calculator for ENERGY STAR® Qualified Commercial Kitchen Equipment. Accessed April 9, 2013. The calculator uses a 12-year measure life value for the life-cycle cost analysis for ovens, fryers, griddles, and steamers.
352 This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
353 This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes the program overall values from the Business Incentive Program Evaluation (Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for program overall.
354 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 20 - Natural Gas Kitchen Equipment Measure Detail[355]

Measure Code	Description	Size	Deemed Savings		Incremental Cost ($/unit)
			$\Delta Therms_{UNIT}$	$\Delta MMBtu_{UNIT}$	
G17	Fryer	Any	505	50.5	$1,120
G18	Broiler	Any	351.5 x Width (feet)	66.1	$60
G19	Convection oven	Any	306	30.6	$0
G20	Combination oven	Any	1,103	40.3	$0
G21	Steamer	3 pan	646	153.5	$260
		4 pan	787	204.8	$420
		5 pan	927	255.9	$0
		6 pan	1,066	307.1	$870
G22	Griddle	2 feet wide	68	11.1	$360
		3 feet wide	149	18.5	$360
		4 feet wide	229	26.2	$360
		5 feet wide	309	34.8	$360
		6 feet wide	389	42.5	$360

[355] Savings and measure cost values are based on: Environmental Protection Agency, Savings Calculator for ENERGY STAR® Commercial Kitchen Equipment. Accessed June 2015.

Compressed Air Equipment

Prescriptive Compressed Air: High Efficiency Air Compressors, Codes C1-C4

Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of a high-efficiency variable frequency drive (VFD) or load/no load air compressor.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program
End-Use	Compressed Air
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times \Delta kW/HP$
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times \Delta kW/HP \times Hours/Week \times Weeks$
Definitions	Unit = 1 new compressor $HP_{COMPRESSOR}$ = HP of the proposed compressor (hp) $\Delta kW/HP$ = Stipulated savings per compressor based on compressor size (kW/hp) Hours/Week = Total operating hours per week (hrs/week) Weeks = Total operating weeks per year (week/yr)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Inlet modulation fixed-speed compressor.[356]
High Efficiency	VFD or load/no-load air compressor.

PARAMETER VALUES

Measure/Type	HP	ΔkW/HP	Hours/Week	Weeks	Life (yrs)	Cost ($)
All	Actual	Table 21	Actual	Actual	15[357]	$164/HP[358]

IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	102%[359]	109%[359]	Table 26[360]	Table 26[360]	39%[361]	0.4%[362]

[356] Stipulated measure savings derived from 149 actual Efficiency Maine projects – inlet modulation fixed-speed compressors were the dominant baseline machines among this sample of projects.
[357] 2005 Measure Life Study prepared for the Massachusetts Joint Utility by Energy Resource Solutions (2005). Measure life study prepared for the Massachusetts Joint Utilities.
[358] Based on a correlation between measure cost and compressor horsepower using measure cost data from 149 custom compressed air projects completed by Efficiency Maine between 2007 and 2011.
[359] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[360] See Appendix C.
[361] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[362] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 21 - Stipulated savings per compressor based on compressor size[363]

Measure Code	HP	ΔkW/HP
C1	≤ 15	0.2556
C2	16 HP – 30 HP	0.2358
C3	31 HP – 60 HP	0.2154
C4	> 60 HP	0.1861

[363] (kW/HP) values are derived from 149 actual custom compressed air projects completed by Efficiency Maine between 2007 and 2011.

Prescriptive Compressed Air: High Efficiency Dryers, Codes C10-C16							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of high efficiency cycling or VFD-equipped refrigerated air dryers. The dryers must be properly sized and equipped with automated controls that cycle the refrigerant compressor (or reduce the output for VFD modes) in response to compressed air demand.						
Primary Energy Impact	Electric						
Sector	Commercial/Industrial						
Program(s)	Business Incentive Program						
End-Use	Compressed Air						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	$\Delta kW = CFM_{DRYER} \times \Delta kW/CFM$						
Annual Energy Savings	$\Delta kWh/yr = CFM_{DRYER} \times \Delta kW/CFM \times Hours/Week \times Weeks$						
Definitions	Unit = 1 new dryer CFM_{DRYER} = Full flow rated capacity of refrigerated air dryer (CFM) $\Delta kW/CFM$ = Stipulated input power reduction per full-flow rating (CFM) of dryer (kW/CFM) Hours/Week = Total operating hours per week (hrs/week) Weeks = Total operating weeks per year (week/yr)						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Non-cycling refrigerated air dryer.						
High Efficiency	High efficiency cycling or VFD equipped refrigerated air dryer.						
PARAMETER VALUES							
Measure/Type	CFM_{DRYER}	ΔkW/CFM	Hours/Week	Weeks	Life (yrs)	Cost ($)	
All	Actual	Table 22	Actual	Actual	15[364]	$6.54/CFM[365]	
ADJUSTED GROSS SAVINGS – IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	102%[366]	109%[366]	Table 26[367]	Table 26[367]	39%[368]	0.4%[369]

Table 22 - Input power reduction per full-flow rating (CFM) of dryer[370]

Measure Code	Dryer CFM	ΔkW/CFM
C10	< 100	0.00474
C11, C12	100 and < 200	0.00359
C13, C14	200 and < 300	0.00316
C15	300 and < 400	0.00290
C16	>400	0.00272

364 2005 Measure Life Study prepared for the Massachusetts Joint Utility by ERS
365 Based on historical measure cost for EMT projects, provided by Greg Scott, Trask-Decrow Machinery.
366 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
367 See Appendix C.
368 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
369 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
370 Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures, 2013-2015 Program Years – Plan Version, October 2012, Page 262.

Prescriptive Compressed Air: Receivers, Codes C20-C27							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the installation of appropriately sized receivers in a compressed air system in order to diminish the downstream drop in pressure that results from surges in demand, eliminating the need for artificially high compressor output pressure. Note: When there is insufficient storage capacity in a compressed air system, surges in compressed air consumption cause dramatic dips in the downstream distribution system pressure. This requires that compressor output pressure be adjusted to artificially high levels in order to sustain downstream pressure at the desired level.						
Primary Energy Impact	Electric						
Sector	Commercial/Industrial						
Program(s)	Business Incentive Program						
End-Use	Compressed Air						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times 0.746 \times \Delta psi / 2 \times SAVE$						
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times 0.746 \times \Delta psi / 2 \times SAVE \times Hours/Week \times Weeks$						
Definitions	Unit = 1 air receiver $HP_{COMPRESSOR}$ = Compressor Horsepower (hp) Δpsi = Average reduction in system pressure (psi) SAVE = Average percentage demand reduction per pressure drop (%/psi) Hours/Week = Total compressed air system operating hours per week (hrs/week) Weeks = Total compressed air system operating weeks per year (week/yr) 0.746 = Conversion: 0.746 kW per hp						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Compressed air system with inadequate receiver capacity.						
High Efficiency	Compressed air system with receivers installed to achieve appropriately sized receiver capacity allowing a lower set point on system pressure.						
PARAMETER VALUES							
Measure/Type	$HP_{COMPRESSO}$	Δpsi	Hours/Week	Weeks	SAVE	Life (yrs)	Cost ($)
All	Actual	5[371]	Actual	Actual	1%/2 psi[372]	10[373]	Table 23
ADJUSTED GROSS SAVINGS – IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	102%[374]	109%[374]	Table 26[375]	Table 26[375]	39%[376]	0.4%[377]

[371] Compressed air systems generally range in operating pressure from 105psi to 115psi and since most compressed air end uses do not require pressure higher than 100psi, 5psi is a conservative maximum pressure drop available to systems lacking in storage capacity based on achieved results from previous Efficiency Maine projects.
[372] Rule of thumb from Paul Shaw at Scales Industrial Technologies and the instructor of the Compressed Air Challenge course: 1% demand reduction for every 2 psi system pressure reduction
[373] 2012 Technical Reference User Manual, Efficiency Vermont, 12/19/12, pg 193
[374] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[375] See Appendix C.
[376] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[377] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 23 - Measure Cost for Compressed Air Receivers[378]

Measure Code	Added Capacity (Gallons)	Cost ($)
C20	60	$360 [A]
C21	80	$630
C22	120	$1,058
C23	200	$1,418
C24	240	$1,463
C25	400	$2,195
NA	500	$3,360
C26	660	$5,327
C27	1060	$7,492

[A] Cost data projected based on correlation between cost and HP for other size levels.

[378] Cost data provided by Greg Scott, Trask-Decrow Machinery

Prescriptive Compressed Air: Low Pressure Drop Filters, Codes C30-C33							
Last Revised Date	7/1/2013						
MEASURE OVERVIEW							
Description	This measure involves the purchase and installation of low pressure drop filters in compressed air systems to remove oil particulates or other contaminates from the compressed air at the front end of the distribution system. The reduction in pressure drop across these filters translates directly to an allowable reduction in the output pressure set point of the compressor.						
Primary Energy Impact	Electric						
Sector	Commercial/Industrial						
Program(s)	Business Incentive Program						
End-Use	Compressed Air						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)							
Demand Savings	$\Delta kW = HP_{COMPRESSOR} \times 0.746 \times \Delta psi / 2 \times SAVE$						
Annual Energy Savings	$\Delta kWh/yr = HP_{COMPRESSOR} \times 0.746 \times \Delta psi / 2 \times SAVE \times HoursWk \times Weeks$						
Definitions	Unit = 1 low pressure drop filter $HP_{COMPRESSOR}$ = Compressor Horsepower (hp) Δpsi = Calculated System Pressure Reduction per LDP filter (psi) SAVE = Average percentage demand reduction per pressure drop (%/psi) HoursWk = Total compressed air system operating hours per week (hrs/week) Weeks = Total compressed air system operating weeks per year (week/yr) 0.746 = Conversion: 0.746 kW per hp						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	Compressed air system with standard filters (that result in a large drop in pressure as air passes through filter).						
High Efficiency	Compressed air system with low-pressure drop filters.						
PARAMETER VALUES							
Measure/Type	$HP_{COMPRESSR}$	Δpsi	SAVE	Hours/Week	Weeks	Life (yrs)	Cost ($)
All	Actual	2[379]	1% / 2 psi [380]	Actual	Actual	4[381]	$4.60/HP[382]
ADJUSTED GROSS SAVINGS – IMPACT FACTORS							
Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	102%[383]	109%[383]	Table 26[384]	Table 26[384]	39%[385]	0.4%[386]

[379] Based on information derived from the Compressed Air Challenge and confirmed with Trask-Decrow Machinery

[380] Rule of thumb from Paul Shaw at Scales Industrial Technologies and the instructor of the Compressed Air Challenge course: 1% demand reduction for every 2 psi system pressure reduction

[381] Rhode Island Technical Reference, 2012 Program Year. EMT uses the average of measure life for retrofit (3 years) and for new construction (5 years).

[382] Based historical measure cost data for EMT projects, provided by Greg Scott, Trask-Decrow Machinery.

[383] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.

[384] See Appendix C.

[385] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.

[386] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Prescriptive Compressed Air: Air-Entraining Nozzles, Code C40	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	This measure involves the purchase and installation of air-entraining nozzles to reduce the consumption of compressed air by "blow off" nozzles, while maintaining performance by inducing the flow of air surrounding the nozzle.
Primary Energy Impact	Electric
Sector	Commercial/Industrial
Program(s)	Business Incentive Program
End-Use	Compressed Air
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS (UNIT SAVINGS)	
Demand Savings	$\Delta kW = \Delta kW_{NOZZLE} \times \%Use$
Annual Energy Savings	$\Delta kWh/yr = \Delta kW_{NOZZLE} \times \%Use \times HoursWk \times Weeks$
Definitions	Unit = 1 nozzle ΔkW_{NOZZLE} = Average demand savings per nozzle (kW) HoursWk = Weekly hours of operation (hrs/week) Weeks = Weeks per year of operation (weeks/yr) % Use = % of compressor operating hours when nozzle is in use (%)
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	Compressed air system with standard nozzles (without air-entraining design)
High Efficiency	Compressed air system with air-entraining nozzles

PARAMETER VALUES

Measure/Type	ΔkW_{NOZZLE}	Hours/Week	Weeks	%Use	Life (yrs)	Cost ($)
All	Table 24	Actual	Actual	5%[387]	10[388]	14[389]

ADJUSTED GROSS SAVINGS – IMPACT FACTORS

Measure/Type	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
All	100%	102%[390]	109%[390]	Table 26[391]	Table 26[391]	39%[392]	0.4%[393]

[387] Assume 5% based on an average of 3 seconds per minute. Assumes 50% handheld air guns and 50% stationary air nozzles. Manual air guns tend to be used less than stationary air nozzles, and a conservative estimate of 1 second of blow-off per minute of compressor run time is assumed. Stationary air nozzles are commonly more wasteful as they are often mounted on machine tools and can be manually operated resulting in the possibility of a long term open blow situation. An assumption of 5 seconds of blow-off per minute of compressor run time is used. From 2012 Technical Reference User Manual, Efficiency Vermont, 12/19/12, pg 184
[388] 2012 Technical Reference User Manual, Efficiency Vermont, 12/19/12, pg 186
[389] 2010 Ohio Technical Reference Manual, Vermont Energy Investment Corp, August 6, 2010 pg 226-227
[390] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 1-1. Realization rates for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[391] See Appendix C.
[392] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures. Although this measure is now offered under the prescriptive program, it was included in the custom program for the 2011 program impact evaluation.
[393] Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.

Table 24 – Stipulated Savings for Standard Nozzle vs. Air-Entraining Nozzle CFM

Size	Standard Nozzle CFM[A]	Air-Entraining Nozzle CFM[B]	ΔkW/CFM[B]	ΔkW_{NOZZLE}[C]
1/8"	21	6	0.19	2.85
1/4"	58	11	0.15	7.05

[A] Machinery's Handbook, 25th Ed. Ed by Erik Oberg (Et Al). Industrial Press, Inc. ISBN-10: 0831125756

[B] 2010 Ohio Technical Reference Manual, Vermont Energy Investment Corp, August 6, 2010 Pg 226-227.

[C] $\Delta kW_{NOZZLE} = (Flow_{Standard} - Flow_{AE}) \times \Delta kW/CFM$

Custom Incentives

Custom – Custom Electric Projects	
Last Revised Date	7/1/2013
MEASURE OVERVIEW	
Description	***Business Incentive Program*** Custom Projects under the Business Incentive Program are energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects with energy conservation measures that are not covered in the prescriptive incentive offerings. Custom project incentives are available for retrofit, replace on burnout, or new installation projects that result in cost-effective electric energy savings. Custom project incentives are only available for projects where the validated first year energy savings, as determined by the Efficiency Maine custom review process, exceeds 35,000 kWh. ***Large Customer Program*** Custom Projects under the Large Customer Program are generally targeted for the nearly 500 electric customers in the state with average kW demand of over 400 kW.[394] The program offers incentives for large custom energy efficiency and cost-effective distributed generation projects that offset customer demand on the grid. Custom project incentives under the Large Customer program are designed to reduce kilowatt hour (kWh) consumption or distribution system loading during peak summer demand periods from grid-connected businesses.
Primary Energy Impact	Electric
Sector	Commercial and Industrial
Program(s)	Business Incentive Program, Large Customer Program
End-Use	See Table 25
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS	
Demand and Annual Energy Savings	Gross annual energy, summer peak demand, and winter peak demand savings projections for custom projects are calculated using engineering analysis and project specific details pertaining to equipment performance specifications, operating parameters, and load shapes. Calculation of savings for custom projects typically involves one or more of the following methods: whole-building simulation models, weather based bin analysis, other spreadsheet based tools, and generally accepted engineering practice. See additional information in Appendix H, under “Determination of coincident peak demand impact”
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	**Retrofit:** Efficiency criteria for the baseline equipment in retrofit situations is based on the operating efficiency of the existing equipment, which is determined from manufacturer’s performance specification, and/or actual recorded data related to input power and output capacity. **New Construction:** Efficiency criteria for baseline equipment in replacement (replace-on-burnout, natural replacement) and new construction situations is based upon manufacturer’s performance specifications and/or independent test data. Baseline efficiency criteria for these projects must meet or exceed any applicable energy codes.
High Efficiency	Efficiency criteria for the proposed energy efficient equipment are project specific and must be supported by manufacturer’s performance specifications and/or independent test data.

[394] Although the program targets these larger customers, there is no minimum average demand requirement for participation.

PARAMETER VALUES			
Measure	Parameters for Energy and Demand Savings Calculations	Life (yrs)[395]	Cost ($)
All	All parameters required for energy and demand savings are determined from project-specific details documented in the project application forms.	Table 25	Actual

IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	102%[396]	109%[396]	Custom[397]	Custom[397]	39%[398]	0.4%[399]
Large Customer	100%	119%[400]	89%[400]	Custom[397]	Custom[397]	22%[400]	0%[400]

395 Measure life should be determined by the project engineer. The referenced table provides suggested measure life values for various custom projects.
396 Opinion Dynamics Corporation (OPD), Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, pg. 51
397 See Appendix G.
398 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-8. NTG impacts for custom measures.
399 Opinion Dynamics Corporation, Evaluation of the Efficiency Maine Trust Business Program, November 30, 2011, Table 5-10. Participant Spillover.
400 Navigant, Impact Evaluation of the Efficiency Maine Trust 2010-2011 Large Projects Grant Program, April 9, 2012, pg.3-5

Custom – Custom Natural Gas Projects	
Last Revised Date	7/1/2014 (New entry for PY2015)
MEASURE OVERVIEW	
Description	***Business Incentive Program***: Custom Projects under the Business Incentive Program are energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects with energy conservation measures that are not covered in the prescriptive incentive offerings. Custom project incentives are available for retrofit, replace on burnout, or new installation projects that result in cost-effective natural gas energy savings. Custom project incentives are only available for projects where the validated first year energy savings, as determined by the Efficiency Maine custom review process, exceeds 2,000 Therms.
Primary Energy Impact	Natural Gas
Sector	Commercial and Industrial
Program(s)	Business Incentive Program
End-Use	See Table 25
Project Type	New construction, Retrofit
GROSS ENERGY SAVINGS ALGORITHMS	
Annual Energy Savings	Gross annual natural gas savings projections for custom projects are calculated using engineering analysis and project specific details pertaining to equipment performance specifications, operating parameters, and load shapes. Calculation of savings for custom projects typically involves one or more of the following methods: whole-building simulation models, weather based bin analysis, other spreadsheet based tools, and generally accepted engineering practice.
EFFICIENCY ASSUMPTIONS	
Baseline Efficiency	**Retrofit:** Efficiency criteria for the baseline equipment in retrofit situations is based on the operating efficiency of the existing equipment, which is determined from manufacturer's performance specification, and/or actual recorded data related to input and output capacity. **New Construction:** Efficiency criteria for baseline equipment in replacement (replace-on-burnout, natural replacement) and new construction situations is based upon manufacturer's performance specifications and/or independent test data. Baseline efficiency criteria for these projects must meet or exceed any applicable energy codes.
High Efficiency	Efficiency criteria for the proposed energy efficient equipment are project specific and must be supported by manufacturer's performance specifications and/or independent test data.

PARAMETER VALUES

Measure	Parameters for Energy Savings Calculations	Life (yrs)[401]	Cost ($)
All	All parameters required for energy and demand savings are determined from project-specific details documented in the project application forms.	Table 25	Actual

IMPACT FACTORS

Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Business Incentive	100%	100%[402]	100%[402]	NA	NA	0%[403]	0%[403]

Custom – Custom Green House Gas Projects

[401] Measure life should be determined by the project engineer. The referenced table provides suggested measure life values for various custom projects.
[402] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% realization rate.
[403] This program is new and has not yet been evaluated. Until the next program impact evaluation, EMT assumes 100% NTG.

Custom – Custom Green House Gas Projects							
Last Revised Date	7/1/2014 (New entry for PY2015)						
MEASURE OVERVIEW							
Description	***Large Customer Program/ Custom Projects*****:** Custom Projects under the Large Customer Program are generally targeted for the nearly 500 electric customers in the state with average kW demand of over 400 kW.[404] The program offers incentives for large custom projects that offset greenhouse gas emissions through the installation of more efficient equipment.						
Primary Energy Impact	Green House Gas (CO2, CO, CFC, others)						
Sector	Commercial and Industrial						
Program(s)	Large Customer Program						
End-Use	See Table 25						
Project Type	New construction, Retrofit						
GROSS ENERGY SAVINGS ALGORITHMS							
Annual Energy Savings	Gross annual energy, summer peak demand, and winter peak demand savings projections for custom projects are calculated using engineering analysis and project specific details pertaining to equipment performance specifications, operating parameters, and load shapes. Calculation of savings for custom projects typically involves one or more of the following methods: whole-building simulation models, weather based bin analysis, other spreadsheet based tools, and generally accepted engineering practice. See additional information in Appendix H, under "Determination of coincident peak demand impact"						
EFFICIENCY ASSUMPTIONS							
Baseline Efficiency	**Retrofit:** Efficiency criteria for the baseline equipment in retrofit situations is based on the operating efficiency of the existing equipment, which is determined from manufacturer's performance specification, and/or actual recorded data related to input power and output capacity. **New Construction:** Efficiency criteria for baseline equipment in replacement (replace-on-burnout, natural replacement) and new construction situations is based upon manufacturer's performance specifications and/or independent test data. Baseline efficiency criteria for these projects must meet or exceed any applicable energy codes.						
High Efficiency	Efficiency criteria for the proposed energy efficient equipment are project specific and must be supported by manufacturer's performance specifications and/or independent test data.						
PARAMETER VALUES							
Measure	Parameters for Energy and Demand Savings Calculations					Life (yrs)[405]	Cost ($)
All	All parameters required for energy and demand savings are determined from project-specific details documented in the project application forms.					Table 25	Actual
IMPACT FACTORS							
Program	ISR	RR_E	RR_D	CF_S	CF_W	FR	SO
Large Customer	100%	119%[406]	89%[406]	NA	NA	22%[406]	0%[406]

[404] Although the program targets these larger customers, there is no minimum average demand requirement for participation.
[405] Measure life should be determined by the project engineer. The referenced table provides suggested measure life values for various custom projects.
[406] Navigant, Impact Evaluation of the Efficiency Maine Trust 2010-2011 Large Projects Grant Program, April 9, 2012, pg.3-5

Table 25 – Measure Life Reference for Custom Projects[407]

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	18
	Heating System Maintenance (e.g,. burner optimization, tune-up)	5	5
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

[407] ERS, Measure Life Study Prepared for the Massachusetts Joint Utilities, November 2005, 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), indicated below 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 (NTG): The ratio of net savings to gross savings. The NTG may be determined from the free-ridership and spillover rates (NTG=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: Energy Period Factors and Coincidence Factors

Coincidence factors are used to determine the average electric demand savings during the summer and winter on-peak periods as defined by the ISO-NE Forward Capacity Market (FCM). The on-peak demand periods are defined as follows:

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

Energy period factors are used to allocate the annual energy savings into one of the four energy periods. This allocation is performed in order to apply the appropriate avoided cost values in the calculation of program benefits. The four energy periods are defined as follows:[408]

- **Winter Peak**: 7:00 AM to 11:00 PM on non-holiday weekdays in October through May (8 months).
- **Winter Off Peak**: 11:00 PM to 7:00 AM on non-holiday weekdays and all hours on weekends and holidays in October through May (8 months).
- **Summer Peak**: 7:00 AM to 11:00 PM on non-holiday weekdays in June through September (4 months).
- **Summer Off Peak**: 11:00 PM to 7:00 AM on non-holiday weekdays and all hours on weekends and holidays in June through September (4 months).

Table 26 includes a listing of measure coincidence factors and energy period allocations.

Table 26 – Commercial Coincidence Factors and Energy Period Factors

Measure	End Use	Coincidence Factor		Footnote Reference	Energy Period Factors				Footnote Reference
		Winter On-Peak	Summer On-Peak		Winter		Summer		
					Peak	Off Peak	Peak	Off Peak	
Lighting Fixtures – Interior Spaces	Lighting	63.0%	76.0%	409	50.0%	19.0%	23.0%	9.0%	410
Lighting Fixtures – LED Exit Signs	Lighting	100.0%	100.0%	411	30.4%	36.2%	15.6%	17.9%	411
Lighting Fixtures – Exterior Spaces	Lighting	70.2%	3.7%	412	20.5%	50.6%	6.1%	22.8%	412
Lighting Fixtures with Integrated Controls	Lighting	29.0%	37.3%	413	50.0%	19.0%	23.0%	9.0%	410
Lighting Controls – Interior Spaces	Lighting	12.0%	18.0%	414	50.0%	19.0%	23.0%	9.0%	410
Lighting Fixtures – Refrigerated Spaces	Lighting	84.7%	90.8%	415	39.7%	26.7%	19.7%	13.9%	415
Lighting Controls – Refrigerated Spaces	Lighting	30.7%	30.7%	416	30.4%	36.2%	15.6%	17.9%	411

[408] http://www.iso-ne.com/support/training/glossary/index-p5.html
[409] KEMA, C&I Lighting Load Shape Project FINAL Report, July 2011.
[410] Central Maine Power, Non-residential load profile for 3/1/08-2/28/09
[411] 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.
[412] Efficiency Vermont TRM 2012, Commercial Outdoor Lighting
[413] Weighted average of Fixtures and Controls coincidence factors assuming 1/3 of savings are attributable to the fixtures and 2/3 are attributable to the controls.
[414] The Cadmus Group, Inc. (2012). Final Report, Small Business Direct Install Program: Pre/Post Occupancy Sensor Study.
[415] Efficiency Vermont TRM 2012, Grocery/Convenience Store Indoor Lighting

Measure	End Use	Coincidence Factor		Footnote Reference	Energy Period Factors				Footnote Reference
		Winter On-Peak	Summer On-Peak		Winter Peak	Winter Off Peak	Summer Peak	Summer Off Peak	
VFDs on Heating Hot Water Pumps	Motors	100.0%	0.0%	417	53.6%	46.3%	0.0%	0.1%	417
VFDs on Chilled Water Pumps	Motors	0.0%	90.2%	417	30.9%	18.1%	35.9%	15.1%	417
VFDs on Supply Fan	Motors	19.8%	50.8%	417	39.0%	30.5%	21.6%	8.9%	417
VFDs on Return Fan	Motors	28.5%	71.2%	417	39.0%	30.8%	21.4%	8.8%	417
VFDs on Exhaust Fan	Motors	100.0%	37.0%	417	44.4%	22.2%	16.0%	17.4%	417
Unitary Air-Conditioners and Split Systems (< 11.25 tons)	HVAC	0.0%	37.2%	418	17.0%	3.0%	62.0%	18.0%	410
Unitary Air-Conditioners and Split Systems (≥11.25 tons)	HVAC	0.0%	29.0%	418	17.0%	3.0%	62.0%	18.0%	410
Heat Pump Systems (< 11.25 tons)	HVAC	57.0%	37.2%	418	17.0%	3.0%	62.0%	18.0%	410
Heat Pump Systems (≥11.25 tons)	HVAC	57.0%	29.0%	418	17.0%	3.0%	62.0%	18.0%	410
Packaged Terminal Air Conditioners and Heat Pumps	HVAC	57.0%	37.2%	418	17.0%	3.0%	62.0%	18.0%	410
Demand Control Ventilation	HVAC	2.0%	81.0%	410	17.0%	3.0%	62.0%	18.0%	410
Ductless Heat Pump	HVAC	51.0%	6.6%	419	58.1%	38.8%	1.7%	1.4%	419
Variable Refrigerant Flow, New Construction	HVAC	57.0%	37.2%	418	17.0%	3.0%	62.0%	18.0%	410
Modulating Burner Controls for Boilers and Heaters (AF1)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Boiler Stack Heat Exchanger (Boiler Economizer) (AF2)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Boiler Reset/Lockout Controls (AF3)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Oxygen Trim for Boilers and Heaters (AF4)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Boiler Turbulator (AF5)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Programmable Thermostat (AF6)	HVAC	NA	NA	420	NA	NA	NA	NA	420
Evaporator Fan Motor Control for Cooler/Freezer, Code R10	Refrigeration	45.9%	43.0%	421	29.1%	39.5%	13.7%	17.7%	421
Door Heater Controls for Cooler/Freezer, Code R20	Refrigeration	100.0%	100.0%	422	47.6%	52.4%	0.0%	0.0%	422

[416] US DOE, "Demonstration Assessment of Light-Emitting Diode (LED) Freezer Case Lighting." Refrigerated cases were metered for 12 days to determine savings from occupancy sensors. Assumes that refrigerated freezers and refrigerated coolers will see the same amount of savings from sensors.
[417] 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
[418] KEMA, NEEP Unitary HVAC AC Load Shape Project Final Report, June 2011.
[419] Based on weather bin analysis using assumptions defined in ductless heat pump measure entry.
[420] Measure applicable to non-electric savings only.
[421] Efficiency Vermont TRM 2012, Evaporator Fan Control

Measure	End Use	Coincidence Factor		Footnote Reference	Energy Period Factors				Footnote Reference
		Winter On-Peak	Summer On-Peak		Winter		Summer		
					Peak	Off Peak	Peak	Off Peak	
Zero Energy Doors for Coolers/Freezers, Code R30, R31	Refrigeration	100.0%	100.0%	411	30.4%	36.2%	15.6%	17.8%	410
H.E. Evaporative Fan Motors, Code R40, R41, R42	Refrigeration	100.0%	100.0%	411	30.4%	36.2%	15.6%	17.8%	410
Floating-Head Pressure Controls, Code R50, R51, R52	Refrigeration	100.0%	0.0%	423	33.3%	37.1%	12.8%	16.8%	423
Discus & Scroll Compressors, Code R60-R63, R70-R74	Refrigeration	69.0%	77.2%	424	33.0%	32.6%	17.0%	17.4%	424
Commercial Reach-in Cooler/Refrigerator and Freezers and Ice Makers	Refrigeration	69.0%	77.2%	424	33.0%	32.6%	17.0%	17.4%	424
New Vapor-Tight High Performance T8 Fluorescent Fixtures	Agriculture	63.0%	76.0%	409	50.0%	19.0%	23.0%	9.0%	410
Plate Heat Exchangers for Milk Processing	Agriculture	27.0%	16.1%	425	29.0%	16.4%	31.6%	23.0%	425
Adjustable Speed Drives for Dairy Vacuum Pumps	Agriculture	63.4%	28.7%	426	36.9%	30.1%	18.2%	14.8%	426
Scroll Compressors	Agriculture	91.5%	34.1%	427	43.6%	23.2%	21.7%	11.5%	427
Adjustable Speed Drives on Ventilation Fans, potato storage equipment	Agriculture	100%	0%	[428]	43.6%	23.2%	21.7%	11.5%	427
HVLS Fans	Agriculture	91.5%	34.1%	427	43.6%	23.2%	21.7%	11.5%	427
High Efficiency Air Compressors, Codes C1-C4	Compressed Air	95.0%	95.0%	429	30.4%	36.2%	15.6%	17.9%	411
High Efficiency Dryers, Codes C10-C16	Compressed Air	95.0%	95.0%	429	30.4%	36.2%	15.6%	17.9%	411
Receivers, Codes C20-C27	Compressed Air	95.0%	95.0%	429	30.4%	36.2%	15.6%	17.9%	411
Low Pressure Drop Filters, Codes C30-C33	Compressed Air	95.0%	95.0%	429	30.4%	36.2%	15.6%	17.9%	411
Air-Entraining Nozzles, Code C40	Compressed Air	95.0%	95.0%	429	30.4%	36.2%	15.6%	17.9%	411
Custom – Compressed Air	Compressed Air	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431
Custom - Lighting	Lighting	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431
Custom – VFD	Motors	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431

[422] Efficiency Vermont TRM 2012, Door Heater Control
[423] Efficiency Vermont TRM 2012, Floating Head Pressure Control
[424] Efficiency Vermont TRM 2012, Commercial Refrigeration
[425] Efficiency Vermont TRM 2012, Farm Plate Cooler/Heat Recover Unit
[426] Efficiency Vermont TRM 2012, VFD Milk Vacuum Pump
[427] Efficiency Vermont TRM 2012, Dairy Farm Combined End Uses
[428] Savings are realized 24/7 Dec 1 – April 30
[429] Efficiency Vermont TRM 2012, page 13
[430] Coincidence factors for custom projects are estimated for each project based on project-specific information. See Appendix G: Custom Projects – Process Documentation for more information.
[431] Values based on CMP loadshape for "Process C&I".

Measure	End Use	Coincidence Factor		Footnote Reference	Energy Period Factors				Footnote Reference
		Winter On-Peak	Summer On-Peak		Winter		Summer		
					Peak	Off Peak	Peak	Off Peak	
Custom – HVAC	HVAC	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431
Custom – Miscellaneous	All	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431
Large Custom Program – Generic	Various	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	431
Large Custom Program – Continuous Process	Process	Custom	Custom	430	29.9%	36.7%	15.5%	17.9%	432
Large Custom Program – Single Shift Process	Process	Custom	Custom	430	44.3%	30.3%	15.2%	10.2%	433
Large Custom Program – Solar PV	Solar PV	0	36.3%	434	37.0%	19.0%	29.7%	14.3%	435
Gas Equipment									
Natural Gas Heating Equipment	HVAC	NA	NA	420	NA	NA	NA	NA	420
Natural Gas Kitchen Equipment	Process	NA	NA	420	NA	NA	NA	NA	420

[432] Analysis performed by ERS. Winter peak % = (16 hours per day X 243 days during winter X 5 weekdays per week / 7 days per week – 10 holidays in winter) / 8760 hours per year; Winter off-peak % = (243 days during winter X 24 hours per day – Winter peak hours) / 8760 hours per year; Summer peak % = (16 hours per day 122 days during summer X 5 weekdays per week / 7 days per week – 2 holidays in summer) / 8760 hours per year; Summer off-peak % = (122 days during summer X 24 hours per day – summer peak hours) / 8760 hours per year.

[433] Analysis performed by ERS. Assumes shift starts after 7 AM and ends before 11 PM in summer and winter on weekdays only. Winter peak % = 243 days in winter / 365 days per year; Summer peak % = 122 days in summer / 365 days per year.

[434] Analysis performed by ERS. Factors based on TMY3 solar radiation averaged for Portland, Lewiston-Auburn, Bangor and Presque Isle.

[435] Analysis performed by ERS. Factors based on TMY3 solar radiation averaged for Portland, Lewiston-Auburn, Bangor and Presque Isle.

Appendix C: Carbon Dioxide Emission Factors

Table 27. Emission Factors

Fuel	Pounds of CO2 per [436]	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[437]	1.0262	Pounds per kWh

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

Appendix D: 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 28 - Installed Fixture Rated Wattage Table ($Watts_{EE}$)[438]

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

[438] 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 D	12	LED 1x4 Recessed Fixture ≥40W	48
LED Flood/Spot <50W	35	LED High/Low Bay Fixtures <150W	105
LED Flood/Spot (50W – 100W)	65	LED High/Low Bay Fixtures ≥150W	236
LED Flood/Spot ≥100W	138	LED Refrigerated Case Light - Horizontal	2.4 W/ft
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 Stairway ≤ 40 W	25
LED PL (<50W)	40	LED Stairway > 40 W	58
LED PL (>100W)	150	LED Linear Ambient < 50 W	35
LED PL (50W-100W)	80	LED Linear Ambient 50 W – 100 W	71
LED R	38	LED Linear Ambient > 100 W	122
LED SL (<50W)	40	LED Canopy < 50 W	35
LED SL (>100W)	150	LED Canopy 50 W – 80 W	65
LED SL (50W-100W)	80	LED Canopy > 80 W	138
LED WP	35		

Table 29 - 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 LED Canopy	LED Canopy <50W	155
	LED Canopy 50W – 80W	223
	LED Canopy > 80W	320
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 30 - Existing Fixture Rated Wattage Table[439]

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

[439] 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 31 – Lighting Power Allowance (Watt/ft^2) by Space-Type

Space Type	LPD_{BASE}	Space Type	LPD_{BASE}
Active Storage	0.8	Health Care (Operating Room)	2.2
Active Storage (For Health Care)	0.9	Health Care (Patient Room)	0.7
Atrium (Each Additional Floor)	0.2	Health Care (Pharmacy)	1.2
Atrium (First 3 Floors)	0.6	Health Care (Physical Therapy)	0.9
Audience/Seating Area	0.9	Health Care (Radiology)	0.4
Audience/Seating Area (For Convention Center)	0.7	Health Care (Recovery)	0.8
Audience/Seating Area (For Exercise Center)	0.3	Hotel/Motel Guest Rooms	1.1
Audience/Seating Area (For Gymnasium)	0.4	Inactive Storage	0.3
Audience/Seating Area (For Motion Picture Theater)	1.2	Inactive Storage (For Museum)	0.8
Audience/Seating Area (For Penitentiary)	0.7	Laboratory	1.4
Audience/Seating Area (For Performing Arts Theater)	2.6	Library (Card File and Cataloging)	1.1
Audience/Seating Area (For Religious Buildings)	1.7	Library (Reading Area)	1.2
Audience/Seating Area (For Sports Arenas)	0.4	Library (Stacks)	1.7
Audience/Seating Area (For Transportation)	0.5	Lobby	1.3
Automotive (Service/Repair)	0.7	Lobby (For Hotel)	1.1
Bank/Office (Banking Activity Area)	1.5	Lobby (For Motion Picture Theater)	1.1
Classroom/Lecture/Training	1.4	Lobby (For Performing Arts Center)	3.3
Classroom/Lecture/Training (For Penitentiary)	1.3	Lounge/Recreation	1.2
Conference/Meeting/Multipurpose	1.3	Lounge/Recreation (For Health Care)	0.8
Convention Center (Exhibit Space)	1.3	Manufacturing (Control Room)	0.5
Corridor/Transition	0.5	Manufacturing (Detailed Manufacturing)	2.1
Corridor/Transition (For Health Care)	1	Manufacturing (Equipment Room)	1.2
Corridor/Transition (For Manufacturing Facility)	0.5	Manufacturing (High Bay, >25 ft. Ceiling Height)	1.7
Courthouse/Police Station/Penitentiary (Confinement Cells)	0.9	Manufacturing (Low Bay, <25 ft. Ceiling Height)	1.2
Courthouse/Police Station/Penitentiary (Courtroom)	1.9	Museum (General Exhibition)	1
Courthouse/Police Station/Penitentiary (Judges' Chambers)	1.3	Museum (Restoration)	1.7
Dining Area	0.9	Office (Enclosed)	1.1
Dining Area (For Bar/Lounge/Leisure Dining)	1.4	Office (Open Plan)	1.1
Dining Area (For Family Dining)	2.1	Parking Garage (Garage Area)	0.2
Dining Area (For Hotel)	1.3	Post Office (Sorting Area)	1.2
Dining Area (For Motel)	1.2	Religious Buildings (Fellowship Hall)	0.9
Dining Area (For Penitentiary)	1.3	Religious Buildings (Worship Pulpit/Choir)	2.4
Dormitory Living Quarters	1.1	Restrooms	0.9
Dressing/Locker/Fitting Room	0.6	Retail (Mall Concourse)	1.7
Electrical/Mechanical	1.5	Retail (Sales Area)	1.7
Fire Stations (Engine Room)	0.8	Sales Area	1.7
Fire Stations (Sleeping Quarters)	0.3	Sports Arena (Court Sports Area)	2.3
Food Preparation	1.2	Sports Arena (Indoor Playing Field Area)	1.4
Gymnasium/Exercise Center (Exercise Area)	0.9	Sports Arena (Ring Sports Area)	2.7
Gymnasium/Exercise Center (Playing Area)	1.4	Stairs (Active)	0.6

Space Type	LPD_{BASE}	Space Type	LPD_{BASE}
Health Care (Emergency)	2.7	Transportation (Air/Tran/Bus - Baggage Area)	1
Health Care (Exam/Treatment)	1.5	Transportation (Airport - Concourse)	0.6
Health Care (Laundry/Washing)	0.6	Transportation (Terminal - Ticket Counter)	1.5
Health Care (Medical Supply)	1.4	Warehouse (Fine Material Storage)	1.4
Health Care (Nursery)	0.6	Warehouse (Medium/Bulky Storage)	0.9
Health Care (Nurses' Station)	1	Workshop	1.9

Appendix E: Prescriptive Lighting Measure Cost

Table 32 – Measure Costs for Prescriptive Lighting[440]

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
L40	<=195W	$150	$0	$150
	>195W	$269	$0	$269
L41	<=195W	$150	$100	$50
	>195W	$269	$140	$129
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

[440] Measure cost analysis performed by GDS based on projects from second half of FY15.

Measure Code	Measure Subdivision	Installed Cost: High Efficiency	Installed Cost: Standard Practice	Incremental Cost
	LED Canopy 50 W – 80 W	$550	$0	$550
	LED Canopy > 80 W	$600	$0	$600
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

Measure Code	Measure Subdivision	Installed Cost: High Efficiency	Installed Cost: Standard Practice	Incremental Cost
S70	LED Stairway ≤ 40 W	$250	$0	$250
	LED Stairway > 40 W	$325	$0	$325
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 F: Average Annual Lighting Operating Hours and other Lookup Tables

Table 33 – Reference Lighting Annual Operating Hours

Commercial/Industrial	
Building Type	**Annual Hours** [A]
Office	3,100
Restaurant	4,182
Retail	4,057
Grocery	4,055
Warehouse	2,602
K-12 School	2,187
College	2,586
Health	3,748
Hospital	7,666
Nursing Home/Assisted Living/Health Care	5,840
Lodging	3,064
Manufacturing	2,857
Other	2,278 [B]
Convenience Store	6,376
Garage/Repair	4,056
Agricultural	4,698 [C]

[A] New York Technical Reference Manual, 2010.
[B] Average value for "Other" building type in Commercial/Industrial sector.
[C] Wisconsin TRM.

Table 34 – Savings Factors for Lighting Controls

Commercial/Industrial	
Space Type	**% of Annual Lighting Energy Saved (SVG) [A]**
Private offices	30%
Open offices	15%
Classrooms	30%
Gymnasiums	35%
Conference rooms	45%
Restrooms	40%
Corridors	15%
Warehouses	50%
Storage	55%
Break room	20%
Other[B]	25%

[A] SVG values for Gymnasiums, Warehouses, and Storage areas are from IES Paper #43, An Analysis of Energy & Cost Savings Potential of Occupancy Sensors for Commercial Lighting Spaces. 8/16/2000. The SVG value for the "other" category is a conservative estimate of savings intended to ensure reported savings are not overstated when the controls are installed in areas other than those specifically listed.

[B] Each industrial/manufacturing space has very specific occupancy patterns, and a literature search revealed no published values for typical savings resulting from controls in these spaces. When sensors are installed in these space types, the "other" category, reflecting the most conservative SVG value should be selected.

Table 35 – Ventilation Rates (CFM/ft^2)[441]

Space Type	VentilationRate	Space Type	VentilationRate
Art classroom	0.38	Health club/weight rooms	0.26
Auditorium seating area	0.81	Kitchen (cooking)	0.27
Bank vaults/safe deposit	0.09	Laundry rooms within dwelling units	0.17
Banks or bank lobbies	0.17	Laundry rooms, central	0.17
Barbershop	0.25	Lecture classroom	0.55
Barracks sleeping areas	0.16	Lecture hall (fixed seats)	1.19
Bars, cocktail lounges	0.93	Legislative chambers	0.31
Beauty and nail salons	0.62	Libraries	0.17
Bedroom/living room	0.11	Lobbies	0.81
Booking/waiting	0.44	Lobbies/prefunction	0.29
Bowling alley (seating)	0.52	Main entry lobbies	0.11
Break rooms	0.19	Mall common areas	0.36
Cafeteria/fast-food dining	0.93	Media center	0.37
Cell	0.25	Multipurpose assembly	0.66
Classrooms (age 9 plus)	0.47	Multi-use assembly	0.81
Classrooms (ages 5–8)	0.37	Museums (children's)	0.42
Coffee stations	0.16	Museums/galleries	0.36
Coin-operated laundries	0.21	Music/theater/dance	0.41
Common corridors	0.06	Occupiable storage rooms for liquids or gels	0.13
Computer (not printing)	0.08	Occupiable storage rooms for dry materials	0.07
Computer lab	0.37	Office space	0.09
Conference/meeting	0.31	Pet shops (animal areas)	0.26
Corridors	0.06	Pharmacy (prep. area)	0.23
Courtrooms	0.41	Photo studios	0.17
Daycare (through age 4)	0.43	Places of religious worship	0.66
Daycare sickroom	0.43	Reception areas	0.21
Dayroom	0.21	Restaurant dining rooms	0.71
Disco/dance floors	2.06	Sales	0.23
Dwelling unit	0.07	Science laboratories	0.43
Electrical equipment rooms	0.06	Shipping/receiving	0.12
Elevator machine rooms	0.12	Sorting, packing, light assembly	0.17
Gambling casinos	1.08	Spectator areas	1.19
Game arcades	0.33	Sports arena (play area)	0.3

[441] ASHRAE Standard 62.1 Outdoor Air Rates, Table 6-1 and Table E-1. The ventilation rates are the combined rates for CFM per person and CFM per area based on default values for occupancy.

General manufacturing (excludes heavy industrial and processes using chemicals)	0.25	Stages, studios	0.76
Guard stations	0.14	Storage rooms	0.12
Gym, stadium (play area)	0.3	Supermarket	0.12
Health Care: Patient Rooms	0.25	Swimming (pool & deck)	0.48
Health Care: Medical Procedure	0.30	Telephone closets	0
Health Care: Operating Rooms	0.60	Telephone/data entry	0.36
Health Care: Recovery and ICU	0.30	Transportation waiting	0.81
Heatlh Care: Autopsy Rooms	0.50	University/college laboratories	0.43
Health Care: Physical Therapy	0.30	Warehouses	0.06
Health club/aerobics room	0.86	Wood/metal shop	0.38

Table 36 – Refrigeration Bonus Factors

Measures	Bonus Factor	Temperature		
		Low (COP = 2.0)	Medium (COP = 3.5)	High (COP = 5.4)
R10 Evaporator Fan Motor Controls R40/R41/R42 H.E. Evaporative Fan Motors	(1 + 1/COP) [A]	1.5	1.3	1.2
R20 Door Heater Controls R30/R31 Zero Energy Doors for Coolers/Freezers	(1 + 0.65/COP) [B]	1.3	1.2	1.1

[A] Based on the average of standard reciprocating and discus compressor efficiencies with Saturated Suction Temperatures of -20°F, 20°F, and 45°F, respectively, and a condensing temperature of 90°F.

[B] Based on the average of standard reciprocating and discus compressor efficiencies with Saturated Suction Temperatures of -20°F, 20°F, and 45°F, respectively, and a condensing temperature of 90°F, and manufacturers assumption that 65% of heat generated by door enters the refrigerated case (1+ 0.65/COP).

Appendix G: Custom Projects – Process Documentation

This appendix documents the eligibility, application and proposal requirements, and the review process for custom projects under the Business Incentive Program and the Large Custom Program.

PROJECT ELIGIBILITY

Business Incentive Program

The qualification requirements for custom incentives within the Business Incentive Program are:

- **Eligible Measures:** Measures representing technologies that are not supported by the Business Incentive Program (e.g., screw-in compact fluorescent bulbs), or are prohibited by the Business Incentive Program's Terms and Conditions (e.g., power conditioners), will not be considered for custom incentives regardless of project economics.
- **Benefit/cost ratio > 1.0:** Custom projects must have a benefit/cost ratio greater than 1.0 as determined in the Efficiency Maine screening tool. In calculating the B/C ratio 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).
- **Simple Payback < (0.5 × Measure Life)**: Custom projects must generally produce a simple payback that is less than ½ of the measure life, where the simple payback is calculated based on measure cost, annual energy savings validated in the application review process, and the average site-specific blended energy cost. The magnitude of any custom project incentive is limited to an amount that reduces the simple payback to 1 year.
- **Preapproval prior to implementation:** Preapproval is required for all custom incentives. Measures that are implemented before preapproval is obtained are not eligible for incentives. Incentive application forms are provided for the following types of Custom measures:
    - Custom Lighting
    - Custom HVAC
    - Custom VFD
    - Custom Compressed Air
    - Custom Miscellaneous

Large Customer Program

In the Large Customer Program, customers may implement energy efficiency and/or distributed generation projects.

The qualification requirements for Large Customer **energy efficiency** projects are:

- The incentive recipient must have an account with a Maine electric utility and must purchase kWh greater than the total kWh reductions from the measures proposed.
- The project measure(s) must increase the end-use electrical efficiency relative to an established baseline, resulting in reductions in annual electricity consumption relative to the baseline.
- The project measure(s) must be eligible measure(s) under the Efficiency Maine Business Incentive Program (Prescriptive or Custom), but for the size of the incentive requested. Products and technologies that are defined as ineligible under the Efficiency Maine Business Incentive program are not eligible for funding under the Large Commercial Program.

- Measure(s) must meet or exceed efficiency and performance standards required under the Business Incentive Program.

The qualification requirements for Large Customer **distributed generation** projects awarded *before January 30, 2014* are:

- **On-Site:** The project must be on-site at a single location or campus.
- **Benefit/cost ratio > 1.0:** The project must have a benefit/cost ratio greater than 1.0 as determined in the Efficiency Maine screening tool.
- **Reduced Energy Consumption**: The project must result in annual reductions in grid supplied energy consumption (no credit is provided for additional capacity that can be exported to the grid or other end users).
- **Capacity ≤ 5 MW**: The project may not exceed 5 MW of nameplate capacity.
- **Operating Efficiency > 60%**. Project must have an overall operating efficiency greater than 60%.
- **Metering:** The project must have 15-minute metering capable of exporting data to Efficiency Maine in CSV or XML format.

The qualification requirements for Large Customer **distributed generation** projects awarded *after January 30, 2014* are:[442]

- **On-Site:** The project must be on-site at a single location or campus.
- **Benefit/cost ratio > 1.0:** The project must have a benefit/cost ratio greater than 1.0 as determined in the Efficiency Maine screening tool.
- **Reduced Energy Consumption**: The project must result in annual reductions in grid supplied energy consumption (no credit is provided for additional capacity that can be exported to the grid or other end users).
- **Operating Efficiency > 60%**. Project must have an overall operating efficiency greater than 60%.
- **Metering:** The project must have metering capable of recording MW and MVAR in real time or recording MWh at 5-minute intervals and must be able to export metering data to Efficiency Maine in CSV or XML format automatically every month.

PROJECT APPLICATION AND PROPOSAL REQUIREMENTS

All applications and proposals for Custom Projects through the Business Incentive Program and Large Customer 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.

[442] EMT updated the eligibility requirements for projects completed after January 30, 2014.

- 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 (Business Incentive Program) and Proposals (Large Customer Program) 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[443]

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.

[443] 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.

- 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.