Massachusetts
Technical Reference Manual

for Estimating Savings from Energy Efficiency Measures

OVERVIEW

May 2017

Introduction

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

For the first time this document is available in an electronic database, called the Technical Reference Library ("TRL"), that allows interested parties to access reports and data in a consistent and easily accessible format. To access the electronic reports, please visit:
http://www.masssavedata.com/Public/TechnicalReferenceLibrary.

Within this document, efficiency measures are organized by the sector for which the measure is eligible and by the primary energy source associated with the measure. The three sectors are Residential, Low-Income, and Commercial & Industrial ("C&I"). The primary energy sources addressed in this technical reference document are electricity and natural gas.

Each measure is presented in its own section as a "measure characterization." The measure characterizations provide mathematical equations for determining savings (algorithms), as well as default assumptions and sources, where applicable. In addition, any descriptions of calculation methods or baselines are provided as appropriate. The parameters for calculating savings are listed in the same order for each measure.

Algorithms are provided for estimating annual energy and peak demand impacts for primary and secondary energy sources if appropriate. In addition, algorithms or calculated results may be provided for other non-energy impacts (such as water savings or operation and maintenance cost savings). Data assumptions are based on Massachusetts PA data where available. Where Massachusetts-specific data is not available, assumptions may be based on, 1) manufacturer and industry data, 2) a combination of the best available data from jurisdictions in the same region, or 3) credible and realistic factors developed using engineering judgment.

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

Update Process

Overview

This section describes the process for updating this document. The update process is synchronized with the filing of Three-Year Plans and Plan-Year/Term Reports by the PAs with the Department of Public Utilities ("DPU").

Updates can include:

- additions of new measures;
- updates to existing measures due to:
    - changes in baseline equipment or practices, affecting measure savings

    - changes in efficient equipment or practices, affecting measure savings
    - changes to deemed savings due the revised assumptions for algorithm parameter values (*e.g.*, due to new market research or evaluation studies)
    - other similar types of changes;
- updates to impact factors (*e.g.*, due to new impact evaluation studies);
- discontinuance of existing measures; and
- updates to the glossary and other background material included in this document.

Each report edition is associated with a specific program year, which corresponds to the calendar year. This results in two main versions for each program year:

- the "Plan Version" is filed with the PAs' Three-Year Plan, and
- the "Report Version" includes updates to the "Plan Version" document as needed and is filed with the PAs' Plan-Year/Term Reports, with the final savings algorithms and factors used to report actual savings.

This document is updated over time as needed to both plan for future program savings and to report actual savings.

Key Stakeholders and Responsibilities

Key stakeholders and their responsibilities for the TRM/TRL updates are detailed in the following table.

Stakeholder	**Responsibilities**
Coordinating Committee	Administrative coordination of activities, including: ▪ Assure collaboration and consensus by the PAs regarding updates ▪ Assure updates are compiled from the PAs and incorporated ▪ Coordinate with related program activities (*e.g.*, evaluation and program reporting processes)
Program Administrators	▪ Provide one or two representatives to the Coordinating Committee. Both the planning and evaluation functions should be represented on the Committee. ▪ Identify needed updates ▪ Coordinate with other PAs on all updates ▪ File updates with the DPU
Department of Energy Resources	▪ Provide one representative to the Coordinating Committee ▪ Assure coordination with PA submissions of program plans and reported savings

Update Cycle

The timeline below shows an example of the main milestones of the update cycle. The milestones for the 2016-2018 Three-Year Plan and Report versions are described below in the timeline.

OCTOBER 2015: The 2016-2018 Plan Version is filed with the PAs' Three-Year Plans.

The 2016-2018 Plan Version TRM is filed with the DPU jointly with the PAs' energy efficiency program plans. With regard to the program plans, the TRM is considered a "planning document" in that it provides the documentation for how the PAs *plan* to count savings for that program year. The TRM is not intended to fully document how the PAs develop their plan estimates for savings.

MAY 2017: The 2016 Plan-Year Report Version is filed with the PAs' 2016 Plan Year Reports.

The 2016 Plan Year Report Version TRM/TRL, including any updates relative to the Plan version, is filed with the PAs' Plan-Year Reports. Updates from the Plan Version may include new evaluation results or changes based on working group discussions.

Measure Characterization Structure

This section describes the common entries or inputs that make up each measure characterization. A formatted template follows the descriptions of each section of the measure characterization. A single device or behavior is defined as a measure within each program and fuel.

Source citations: The source of each assumption or default parameter value should be properly referenced.

The image below shows how a measure appears in the electronic report format. Each section of this measure report is described in more detail below.

Gas – MF Retrofit – Wi-Fi Thermostat (also controls elec cooling) – All

Measure #	Sector	Program Administrator
MAG16A1b18ALL	Residential	All
Category	**Type**	**Sub-Type**
HVAC	Control	Communicating Thermostat
Description	A communicating thermostat which allows remote set point adjustment and control via remote application. System requires an outdoor air temperature algorithm in the control logic to operate heating and cooling systems.	

01: Version Info	
Report Edition	2016 Plan Year Report
02: Measure Overview	
BCR Measure ID	G16A1b18
BCR Measure Name	Wi-Fi Thermostat (also controls elec cooling)
End Use	HVAC
PA Type	Gas
Program Administrator	All
Program Name	Residential Multi-Family Retrofit
Sector Applicability	Residential
State Applicability	MA
Target Savings Market	Retrofit
03: Savings - General	
Baseline Description	The baseline efficiency case is an HVAC system with either a manual or a programmable thermostat.
High Efficiency Description	The high efficiency case is an HVAC system that has a Wi-Fi thermostat installed.
Savings Calculation Method	Deemed
04: Savings - Electric	
Gross Annual Savings - kW	0.155
	Source: The Cadmus Group (2012). Demand Impact Model.
Gross Annual Savings - kWh	74.8
	Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis.
Summer Coincidence Factor	1.00
	Source: The Cadmus Group (2012). Demand Impact Model.
Winter Coincidence Factor	0.00
	Source: The Cadmus Group (2012). Demand Impact Model.
05: Savings - Non-Electric	
Gross Annual Savings - Gas MMBtu	4.7
	Source: The Cadmus Group (2011). Memo: Wi-fi Programmable Thermostat Billing Analysis.
07: Measure Life	
Measure Life	15
	Source: Environmental Protection Agency (2010). Life Cycle Cost Estimate for ENERGY STAR Programmable Thermostat. Assumed to have the same lifetime as a regular programmable thermostat.
08: Non-Energy Impacts	
Annual $ per Therm	$0.00
Annual $ per Unit	$5.45
	Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation.
One time $ per Therm	$0.00
One time $ per Unit	$51.49
	Source: NMR Group, Inc., Tetra Tech (2011). Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts (NEI) Evaluation.
09: Impact Factors	
In-Service Rate	1.00
	Note: In-service rates are set to 100% since all PAs verify equipment installation.
Realization Rate - kWh	1.00
	Note: Realization rates are set to 100% for deemed measures.
Realization Rate - MMBTU	1
	Note: Realization rate based on draft evaluation results. MA Common Assumptions (2015).
Realization Rate - Summer kW	1.00
	Note: Realization rates are set to 100% for deemed measures.
Realization Rate - Winter kW	1.00
	Note: Realization rates are set to 100% for deemed measures.
10: Net-to-Gross	
Free Ridership	0.00
Net-to-Gross Ratio	1.00
Non-Participant Spillover Factor	0.00
Participant Spillover Factor	0.00

Measure Summary

This section includes a high-level categorization of the energy efficiency measure:

Name: A unique name for the measure which is a concatenated field including: fuel, core initiative, measure name, and PA.
Measure Reference Number: A unique way to identify a measure where the first two characters will always be "MA" for Massachusetts, the next eight characters correspond to the BCR measure ID that the PAs use in their Benefit-Cost models, and the last three characters are an abbreviation of the PA to which the measure applies.
Sector: This is the sector for which the measure is applicable and can be Residential, Low Income or C&I
Program Administrator: Either a specific PA or "All" if the PAs use the same assumptions statewide.
Category, Type, and Sub-Type: A way of categorizing similar measures.
Description: A plain text description of the energy efficiency measure including efficient and baseline technology and the benefit(s) of its installation.

01: Version Info

This section will include information regarding the report edition of the measure entry, for example: "2016 Plan Year Report".

02: Measure Overview

This section provides a measure overview with supporting information including:

BCR Measure ID: <Unique ID used in PAs Benefit-Cost models>
BCR Measure Name: < Name used in PAs Benefit-Cost models >
End-Use: <Per New England Independent System Operator (ISO) definition>
PA Type: < Primary Fuel; Electric or Natural Gas>
Program Administrator: <Specific PA or "All" if the PAs use the same assumptions statewide>
Program Name: <Per PA definition, also referred to as Core Initiative>
Sector Applicability: <Residential, Low Income or Commercial and Industrial>
State Applicability: <Massachusetts (MA)>
Target Savings Market: <Lost Opportunity, Retrofit and/or Products and Services>

03: Savings – General

A description of the energy efficiency measure including efficient technology, baseline technology, savings calculation method, and measure specific notes (if applicable):

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

High Efficiency

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

04: Savings – Electric

This section will describe the method for calculating electric savings and electric demand savings in appropriate units, *i.e.*, kWh, kW, summer coincidence factor, and winter coincidence factor.

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

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

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

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

05: Savings – Non-Electric

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

06: Water

This section describes any water savings associated with the energy efficiency measure, including all assumptions.

07: Measure Life

Measure Life includes equipment life and the effects of measure persistence. Equipment life is the number of years that a measure is installed and will operate until failure. Measure persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.

08: Non-Energy Impacts

This section describes any non-energy impacts associated with the energy efficiency measure, including all assumptions and the method of calculation.

09: Impact Factors

The section includes a table of impact factor values for adjusting gross savings. This includes impact factors for calculating net savings (free ridership, spillover and/or net-to-gross ratio). Further descriptions of the impacts factors and the sources on which they are based are described below.

Core Initiative/Program Names

The mapping of full core initiative names to abbreviated names is given below.

	Full Core Initiative Name	Abbreviation
Residential-Electric	A1a - Residential New Construction	RNC
	A1b - Residential Multi-Family Retrofit	MF Retrofit
	A1c - Residential Home Energy Services	HES
	A1e - Residential Behavior/Feedback Program	Behavior/Feedback
	A2a - Residential Cooling & Heating Equipment	RHVAC
	A2b - Residential Consumer Products	Res Products
	A2c - Residential Lighting	Res Lighting
Low Income-Electric	B1a - Low-Income Single Family Retrofit	LI Retrofit 1-4
	B1b -Income Multi-Family Retrofit	LI MF Retrofit
C&I – Electric	C1a - C&I New Buildings & Major Renovations	NB
	C1b - C&I Initial Purchase & End of Useful Life	EUL
	C2a - C&I Existing Building Retrofit	Large Retrofit
	C2b - C&I Small Business	Small Retrofit
	C2c - C&I Multifamily Retrofit	C&I MF Retrofit
	C2d - C&I Upstream Lighting	Upstream
Residential – Gas	A1a - Residential New Construction	RNC
	A1b - Residential Multi-Family Retrofit	MF Retrofit
	A1c - Residential Home Energy Services	HES
	A1e - Residential Behavior/Feedback Program	Behavior/Feedback
	A2a - Residential Cooling & Heating Equipment	RHVAC
Low Income – Gas	B1a - Low-Income Single Family Retrofit	LI Retrofit 1-4
	B1b -Income Multi-Family Retrofit	LI MF Retrofit
C&I - Gas	C1a - C&I New Buildings & Major Renovations	NB
	C1b - C&I Initial Purchase & End of Useful Life	EUL
	C2a - C&I Existing Building Retrofit	Large Retrofit
	C2b - C&I Small Business	Small Retrofit
	C2c - C&I Multifamily Retrofit	C&I MF Retrofit

Impact Factors for Calculating Adjusted Gross and Net Savings

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

This section describes the types of impact factors used to make such adjustments, and how those impacts are applies to gross savings estimates. Definitions of the impact factors and other terms are also provided in the Glossary at Appendix 1 to this document.

Types of Impact Factors

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

Impact factors used to adjust gross savings:

- In-Service Rate ("ISR")
- Savings Persistence Factor ("SPF")
- Realization Rate ("RR")
- Summer and Winter Peak Demand Coincidence Factors ("CF").

Impact factors used to calculate net savings:

- Free-Ridership ("FR") and Spillover ("SO") Rates
- Net-to-Gross Ratios ("NTG").

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

The **savings persistence factor** is the portion of first-year energy or demand savings expected to persist over the life of the energy efficiency measure. The SPF is developed by conducting surveys of installed equipment several years after installation to determine the actual operational capability of the equipment. The SPF is 1.00 for most measures.

In contrast to savings persistence, *measure persistence* takes into account business turnover, early retirement of installed equipment, and other reasons the installed equipment might be removed or discontinued. Measure persistence is generally incorporated as part of the measure life, and therefore is not included as a separate impact factor.

The **realization rate** is used to adjust the gross savings (as calculated by the savings algorithms) based on impact evaluation studies. The realization rate is equal to the ratio of measure savings developed from an

impact evaluation to the estimated measure savings derived from the savings algorithms. The realization rate does not include the effects of any other impact factors. Depending on the impact evaluation study, there may be separate realization rates for energy (kWh), peak demand (kW), or fossil fuel energy (MMBtu).

A **coincidence factor** adjusts the connected load kW savings derived from the savings algorithm. A coincidence factor represents the fraction of the connected load reduction expected to occur at the same time as a particular system peak period. The coincidence factor includes both coincidence and diversity factors combined into one number, thus there is no need for a separate diversity factor in this TRM.

Coincidence factors are provided for both the on-peak and seasonal 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:

On-Peak Definition:

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

Seasonal Peak Definition:

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

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

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

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

The **net savings** value is the final value of savings that is attributable to a measure or program. Net savings differs from gross savings because it includes the effects of the free-ridership and/or spillover rates.

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

Standard Net–to–Gross Formulas

The TRM/TRL measure entries provide algorithms for calculating the gross savings for those efficiency measures. The following standard formulas show how the impact factors are applied to calculate the adjusted gross savings, which in turn are used to calculate the net savings. These are the calculations used by the PAs to track and report gross and net savings. The gross savings reported by the PAs are the unadjusted gross savings without the application of any impact factors.

Calculation of Net Annual Electric Energy Savings

$$adj\_gross\_kWh = gross\_kWh \times RR_E \times SPF \times ISR$$
$$net\_kWh = adj\_gross\_kWh \times NTG$$

Calculation of Net Summer Electric Peak Demand Coincident kW Savings

$$adj\_gross\_kW_{SP} = gross\_kW \times RR_{SP} \times SPF \times ISR \times CF_{SP}$$
$$net\_kW_{SP} = adj\_gross\_kW_{SP} \times NTG$$

Calculation of Net Winter Electric Peak Demand Coincident kW Savings

$$adj\_gross\_kW_{WP} = gross\_kW \times RR_{WP} \times SPF \times ISR \times CF_{WP}$$
$$net\_kW_{WP} = adj\_gross\_kW_{WP} \times NTG$$

Calculation of Net Annual Natural Gas Energy Savings

$$adj\_gross\_MMBtu = gross\_MMBtu \times RR_E \times SPF \times ISR$$
$$net\_MMbtu = adj\_gross\_MMBtu \times NTG$$

Depending on the evaluation study methodology:

- NTG is equal to $(1 - FR + SO_P + SO_{NP})$, or
- NTG is a single value with no distinction of FR, SO_P, SO_{NP}, and/or other factors that cannot be reliably isolated.

Where:

Gross_kWh	=	Gross Annual kWh Savings
adj_gross_kWh	=	Adjusted Gross Annual kWh Savings
net_kWh	=	Net Annual kWh Savings
$Gross\_kW_{SP}$	=	Gross Connected kW Savings (summer peak)
$adj\_gross\_kW_{SP}$	=	Adjusted Gross Connected kW Savings (summer peak)
$Gross\_kW_{WP}$	=	Gross Connected kW Savings (winter peak)
$adj\_gross\_kW_{WP}$	=	Adjusted Gross Connected kW Savings (summer peak)

net_kW_{SP}	=	Adjusted Gross Connected kW Savings (winter peak)
net_kW_{WP}	=	Net Coincident kW Savings (winter peak)
Gross_MMBtu	=	Gross Annual MMBtu Savings
adj_gross_MMBtu	=	Adjusted Gross Annual MMBtu Savings
net_MMBtu	=	Net Annual MMBtu Savings
SPF	=	Savings Persistence Factor
ISR	=	In-Service Rate
CF_{SP}	=	Peak Coincidence Factor (summer peak)
CF_{WP}	=	Peak Coincidence Factor (winter peak)
RR_E	=	Realization Rate for energy (kWh, MMBtu)
RR_{SP}	=	Realization Rate for summer peak kW
RR_{WP}	=	Realization Rate for winter peak kW
NTG	=	Net-to-Gross Ratio
FR	=	Free-Ridership Factor
SO_P	=	Participant Spillover Factor
SO_{NP}	=	Non-Participant Spillover Factor

Calculations of Coincident Peak Demand kW Using "Seasonal Peak" Coincidence Factors

The formulas above for peak demand kW savings use the "on-peak" coincidence factors (CF_{SP}, CF_{WP}), which apply the "on-peak" coincidence methodology as allowed for submission to the FCM. The alternative methodology is the "seasonal peak" methodology, which uses the identical formulas, but substituting the "seasonal peak" coincidence factors for the "on-peak" coincidence factors:

CF_{SSP}	=	Peak Coincidence Factor for Summer Seasonal Peak
CF_{WSP}	=	Peak Coincidence Factor for Winter Seasonal Peak

Appendix 1 - Glossary

This glossary provides definitions as they are applied in this TRM/TRL for Massachusetts' energy efficiency programs. Alternate definitions may be used for some terms in other contexts.

TERM	DESCRIPTION
Adjusted Gross Savings	Gross savings (as calculated by the measure savings algorithms) that have been subsequently adjusted by the application of all impact factors except the net-to-gross factors (free-ridership and spillover). For more detail, see the section on Impact Factors for Calculating Adjusted Gross and Net Savings.
AFUE	Annual Fuel Utilization Efficiency. The measure of seasonal or annual efficiency of a furnace or boiler. AFUE takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.
Baseline Efficiency	The level of efficiency of the equipment that would have been installed without any influence from the program or, for retrofit cases where site-specific information is available, the actual efficiency of the existing equipment.
Btu	British thermal unit. A Btu is approximately the amount of energy needed to heat one pound of water by one degree Fahrenheit.
Coefficient of Performance (COP)	Coefficient of Performance is a measure of the efficiency of a heat pump, air conditioner, or refrigeration system. A COP value is given as the Btu output of a device divided by the Btu input of the device. The input and output are determined at AHRI testing standards conditions designed to reflect peak load operation.
Coincidence Factor (CF)	Coincidence Factors represent the fraction of connected load expected to occur concurrent to a particular system peak period; separate CF are found for summer and winter peaks. The CF given in the TRM includes both coincidence and diversity factors multiplied into one number. Coincidence factors are provided for peak periods defined by the NE-ISO for FCM purposes and calculated consistent with the FCM methodology.
Connected Load kW Savings	The connected load kW savings is the power saved by the equipment while in use. In some cases the savings reflect the maximum power draw of equipment at full load. In other cases the connected load may be variable, which must be accounted for in the savings algorithm.
Deemed Savings	Savings values (electric, fossil fuel and/or non-energy benefits) determined from savings algorithms with assumed values for all algorithm parameters. Alternatively, deemed savings values may be determined from evaluation studies. A measure with deemed savings will have the same savings per unit since all measure assumptions are the same. Deemed savings are used by program administrators to report savings for measures with well-defined performance characteristics relative to baseline efficiency cases. Deemed savings can simplify program planning and design, but may lead to over- or under-estimation of savings depending on product performance.
Deemed Calculated Savings	Savings values (electric, fossil fuel and/or non-energy benefits) that depend on a standard savings algorithm and for which at least one of the algorithm parameters (e.g., hours of operation) is project specific.
Demand Savings	The reduction in demand due to installation of an energy efficiency measure, usually expressed as kW and measured at the customer's meter (see Connected Load kW Savings).
Demand Side Management (DSM)	Strategies used to manage energy demand including energy efficiency, load management, fuel substitution, and load building.
Diversity	A characteristic of a variety of electric loads whereby individual maximum demands occur at different times. For example, 50 efficient light fixtures may be installed, but they are not necessarily all on at the same time. See Coincidence Factor.

TERM	DESCRIPTION
Diversity Factor	This TRM uses coincidence factors that incorporate diversity (See Coincidence Factor), thus this TRM has no separate diversity factors. A diversity factor is typically calculated as: 1) the percent of maximum demand savings from energy efficiency measures available at the time of the company's peak demand, or 2) the ratio of the sum of the demands of a group of users to their coincident maximum demand.
End Use	Refers to the category of end use or service provided by a measure or technology (e.g., lighting, cooling, etc.). For the purpose of this manual, end uses with their PARIS codes include: ALght Lighting HVAC HVAC CMoDr Motors & Drives DRefr Refrigeration EHoWa Hot Water FComA Compressed Air GProc Process* HEUBe Behavior Ienvl Insulation & Air Sealing JGchp Combined Heat & Power KSdhw Solar Hot Water LDmdR Demand Response MPvEl Photovoltaic Panels *For residential measures, "process" is used for products that have low savings, such as consumer electronics, or do not conform to existing end use categories. For commercial and industrial measures, "process" is used for systematic improvements to manufacturing or pump systems, or efficient models of specialty equipment not covered in other end uses.
Energy Efficiency Ratio (EER)	The Energy Efficiency Ratio is a measure of the efficiency of a cooling system at a specified peak, design temperature, or outdoor temperature. In technical terms, EER is the steady-state rate of heat energy removal (i.e. cooling capacity) of a product measured in Btuh output divided by watts input.
ENERGY STAR® (ES)	Brand name for the voluntary energy efficiency labeling initiative sponsored by the U.S. Environmental Protection Agency.
Energy Costing Period	A period of relatively high or low system energy cost, by season. The energy periods defined by ISO-NE are: • **Summer Peak**: 6am–10pm, Monday–Friday (except ISO holidays), June–September • **Summer Off-Peak:** Summer hours not included in the summer peak hours: 10pm–6am, Monday–Friday, all day on Saturday and Sunday, and ISO holidays, June–September • **Winter Peak:** 6am–10pm, Monday–Friday (except ISO holidays), January–May and October–December • **Winter Off-Peak:** Winter hours not included in the sinter peak hours: 10pm–6am, Monday–Friday, all day on Saturday and Sunday, and ISO holidays, January–May and October–December.
Equivalent Full Load Hours (EFLH)	The equivalent hours that equipment would need to operate at its peak capacity in order to consume its estimated annual kWh consumption (annual kWh/connected kW).
Free Rider	A customer who participates in an energy efficiency program, but would have installed some or all of the same measure(s) on their own, with no change in timing of the installation, if the program had not been available.
Free-Ridership Rate	The percentage of savings attributable to participants who would have installed the measures in the absence of program intervention.
Gross kW	Expected demand reduction based on a comparison of standard or replaced equipment and equipment installed through an energy efficiency program.
Gross kWh	Expected kWh reduction based on a comparison of standard or replaced equipment and equipment installed through an energy efficiency program.

TERM	DESCRIPTION
Gross Savings	A saving estimate calculated from objective technical factors. In this TRM, "gross savings" are calculated with the measure algorithms and do not include any application of impact factors. Once impact factors are applied, the savings are called "Adjusted Gross Savings". For more detail, see the section on Impact Factors for Calculating Adjusted Gross and Net Savings.
High Efficiency (HE)	Refers to the efficiency measures that are installed and promoted by the energy efficiency programs.
Horsepower (HP)	A unit for measuring the rate of doing work. One horsepower equals about three-fourths of a kilowatt (745.7 watts).
Heating Seasonal Performance Factor (HSPF)	A measure of the seasonal heating mode efficiencies of heat pumps expressed as the ratio of the total heating output to the total seasonal input energy.
Impact Factor	Generic term for a value used to adjust the gross savings estimated by the savings algorithms in order to reflect the actual savings attributable to the efficiency program. In this TRM, impact factors include realization rates, in-service rates, savings persistence, peak demand coincidence factors, free-ridership, spillover and net-to-gross factors. See the section on Impact Factors for more detail.
In-Service Rate	The percentage of units that are actually installed. For example, efficient lamps may have an in-service rate less than 100% since some lamps are purchased as replacement units and are not immediately installed. The in-service rate for most measures is 100%.
Measure Life	The number of years that an efficiency measure is expected to garner savings. These are generally based on engineering lives, but sometimes adjusted based on observations of market conditions.
Lost Opportunity	Refers to a measure being installed at the time of planned investment in new equipment or systems. Often this reflects either new construction, renovation, remodeling, planned expansion or replacement, or replacement of failure.
Measure	A product (a piece of equipment), combination of products, or process designed to provide energy and/or demand savings. Measure can also refer to a service or a practice that provides savings. Measure can also refer to a specific combination of technology and market/customer/practice/strategy (e.g., direct install low income CFL).
Net Savings	The final value of savings that is attributable to a program or measure. Net savings differs from gross savings (or adjusted gross savings) because it includes adjustments due to free-ridership and/or spillover. Net savings is sometimes referred to as "verified" or "final" savings. For more detail see the section on Impact Factors for Calculating Adjusted Gross and Net Savings.
Net-to-Gross Ratio	The ratio of net savings to the adjusted gross savings (for a measure or program). The adjusted gross savings include any adjustment by the impact factors other than free-ridership or spillover. Net-to-gross is usually expressed as a percent.
Non-Electric Benefits (NEBs)	Quantifiable benefits (beyond electric savings) that are the result of the installation of a measure. Fossil fuel, water, and maintenance are examples of non-electric benefits. Non-electric benefits can be negative (i.e. increased maintenance or increased fossil fuel usage which results from a measure) and therefore are sometimes referred to as "non-electric impacts".
Non-Participant	A customer who is eligible to participate in a program, but does not. A non-participant may install a measure because of a program, but the installation of the measure is not through regular program channels; as a result, their actions are normally only detected through evaluations.
On-Peak kW	See Summer/Winter On-peak kW
Operating Hours	Hours that a piece of equipment is expected to be in operation, not necessarily at full load (typically expressed per year).

TERM	DESCRIPTION
PARIS	Planning And Reporting Information System, a statewide database maintained by the Department of Energy Resources (DOER) that emulates the program administrators' screening model. As a repository for quantitative data from plans, preliminary reports, and reports, PARIS generates information that includes funding sources, customer profiles, program participation, costs, savings, cost-effectiveness and program impact factors from evaluation studies. DOER developed PARIS in 2003 as a collaborative effort with the Department of Public Utilities and the electric program administrators. Beginning with the 2010 plans, PARIS holds data from gas program administrators.
Participant	A customer who installs a measure through regular program channels and receives any benefit (i.e. incentive) that is available through the program because of their participation. Free-riders are a subset of this group.
Prescriptive Measure	A prescriptive measure is generally offered by use of a prescriptive form with a prescribed incentive based on the parameters of the efficient equipment or practice.
Program Administrator (PA)	Those entities that oversee public benefit funds in the implementation of energy efficiency programs. This generally includes regulated utilities, other organizations chosen to implement such programs, and state energy offices. The Massachusetts electric PAs include Cape Light Compact, National Grid, NSTAR, Western Massachusetts Electric Company (WMECo), and Unitil. The Massachusetts natural gas PAs include Bay State Gas, Berkshire Gas, and New England Gas.
Realization Rate (RR)	The ratio of measure savings developed from impact evaluations to the estimated measure savings derived from the TRM savings algorithms. This factor is used to adjust the estimated savings when significant justification for such adjustment exists. The components of the realization rate are described in detail in the section on Impact Factors.
Retrofit	The replacement of a piece of equipment or device before the end of its useful or planned life for the purpose of achieving energy savings. "Retrofit" measures are sometimes referred to as "early retirement" when the removal of the old equipment is aggressively pursued.
Savings Persistence Factor (SPF)	Percentage of first-year energy or demand savings expected to persist over the life of the installed energy efficiency equipment. The SPF is developed by conducting surveys of installed equipment several years after installation to determine the operational capability of the equipment. In contrast, *measure persistence* takes into account business turnover, early retirement of installed equipment, and other reasons the installed equipment might be removed or discontinued. Measure persistence is generally incorporated as part of the measure life, and therefore is not included as a separate impact factor.
Seasonal Energy Efficiency Ratio (SEER)	A measurement of the efficiency of a central air conditioner over an entire season. In technical terms, SEER is a measure of equipment the total cooling of a central air conditioner or heat pump (in Btu) during the normal cooling season as compared to the total electric energy input (in watt-hours) consumed during the same period.
Seasonal Peak kW	See Summer/Winter Seasonal Peak kW, and Summer/Winter On-Peak Peak kW.
Sector	A system for grouping customers with similar characteristics. For the purpose of this manual, the sectors are Commercial and Industrial (C&I), Small Business, Residential, and Low Income.
Spillover Rate	The percentage of savings attributable to the program, but additional to the gross (tracked) savings of a program. Spillover includes the effects of (a) participants in the program who install additional energy efficient measures outside of the program as a result of hearing about the program and (b) non-participants who install or influence the installation of energy efficient measures as a result of being aware of the program.
Summer/Winter On-Peak kW	The average demand reduction during the summer/winter on-peak period. The summer on-peak period is 1pm-5pm on non-holiday weekdays in June, July and August; the winter on-peak period is 5pm-7pm on non-holiday weekdays in December and January.

TERM	DESCRIPTION
Summer/Winter Seasonal Peak kW	The demand reduction occurring when the actual, real-time hourly load for Monday through Friday on non-holidays, during the months of June, July, August, December, and January, as determined by the ISO, is equal to or greater than 90% of the most recent 50/50 system peak load forecast, as determined by the ISO, for the applicable summer or winter season.
Ton	Unit of measure for determining cooling capacity. One ton equals 12,000 Btu.
Watt	A unit of electrical power. Equal to 1/1000 of a kilowatt.