

# Massachusetts Technical Reference Manual (TRM) Status

EEAC Meeting,  
September 14, 2010

## MA TRM – 2011 Plan Version

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- To be filed with PY 2011 Mid-Term Modification
- Describes how PAs plan to count savings for PY 2011
- Does not describe how PY 2011 planned savings were developed
- PY 2011 reported savings will include adjustments based on evaluations to be completed between now and mid-2012

## MA TRM: Development

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- Developed by collaborative working groups including representatives from each PA, consultant group, AG, and DOER
- TRM “core” working group: EEAC Consultant project manager and technical lead, 2 PA reps, DOER, and AG

## MA TRM: Contents

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- Document includes:
  - TRM in context of EE program administration
  - Update schedule for future TRM versions
  - Description of impact factors and how they are applied to adjust gross savings estimates
  - Energy efficiency measure details
  - Term and acronym glossaries
  - MA TRM Library

## MA TRM: Measure Detail Sections

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- For each measure:
  - General characterization: measure description, market, sector, benefit types (electric, gas, other resource, non-resource), end-use, program
  - Description of algorithm and assumptions for estimated gross savings (electric, gas, other NEBS)
  - Description of impact factors to adjust gross savings with referenced evaluations

## HVAC – Single-Package and Split System Unitary Air Conditioners

### Version Date and Revision History

Draft date: 6/4/2010  
Effective date: 1/1/2011  
End date: TBD

### Measure Overview

**Description:** This measure promotes the installation of high efficiency unitary air conditioning equipment in lost opportunity applications. Air conditioning (AC) systems are a major consumer of electricity and systems that exceed baseline efficiencies can save considerable amounts of energy. This measure applies to air, water, and evaporatively-cooled unitary AC systems, both single-package and split systems.

**Primary Energy Impact:** Electric  
**Secondary Energy Impact:** None  
**Non-Energy Impact:** None  
**Sector:** Commercial, Industrial  
**Market:** Lost Opportunity

**End Use:** HVAC  
**Program:** New Construction & Major Renovation Commercial

### Algorithms for Calculating Electric Energy and Demand Savings

For units with cooling capacities less than 65 kBtu/h:

$$\Delta kWh = (kBtu/h) \left( \frac{1}{SEER_{BASE}} - \frac{1}{SEER_{EF}} \right) (EFLH_{Cool})$$

$$\Delta kW = (kBtu/h) \left( \frac{1}{EER_{BASE}} - \frac{1}{EER_{EF}} \right)$$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$$\Delta kWh = (kBtu/h) \left( \frac{1}{EER_{BASE}} - \frac{1}{EER_{EF}} \right) (EFLH_{Cool})$$

$$\Delta kW = (kBtu/h) \left( \frac{1}{EER_{BASE}} - \frac{1}{EER_{EF}} \right)$$

Where:

$\Delta kWh$	= gross annual kWh savings from the measure.
$\Delta kW$	= gross connected kW savings from the measure.
kBtu/h	= capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
$SEER_{BASE}$	= Seasonal Energy Efficiency Ratio of the baseline equipment. See Table 1 for values.
$SEER_{EF}$	= Seasonal Energy Efficiency Ratio of the energy efficient equipment.

$EFLH_{Cool}$	= cooling equivalent full load hours. See Appendix A: Error! Reference source not found. for default values.
$EER_{BASE}$	= Energy Efficiency Ratio of the baseline equipment. See Table 1 for values. Since IECC 2009 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: $EER \approx SEER/1.1$ .
$EER_{EF}$	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual $EER_{EF}$ is unknown, assume the following conversion from SEER to EER: $EER \approx SEER/1.1$ .

### Baseline Efficiency

The Baseline Efficiency assumes compliance with the efficiency requirements as mandated by Massachusetts State Building Code. As described in Chapter 13 of the aforementioned document, energy efficiency must be met via compliance with the International Energy Conservation Code (IECC) 2009 with Massachusetts specific amendments. Table 1 details the specific efficiency requirements by equipment type and capacity.

Table 1: Unitary Air Conditioners Baseline Efficiency Levels<sup>1</sup>

Equipment Type	Size Category	Subcategory or Rating Condition	Baseline Efficiency
Air conditioners, air cooled	<65,000 Btu/h <sup>b</sup>	Split system	13.0 SEER
		Single package	13.0 SEER
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	11.2 EER*
		Split system and single package	11.0 EER*
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	10.0 EER*
Air conditioners, Water and evaporatively cooled	<65,000 Btu/h	Split system and single package	12.1 EER
		Split system and single package	11.5 EER*
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	11.0 EER*
		Split system and single package	11.0 EER*
≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	11.0 EER*	
≥240,000 Btu/h	Split system and single package	11.0 EER*	

a. Deduct 0.2 from the required EERs for units with a heating section other than electric heat<sup>2</sup>.

b. Single-phase air-cooled air conditioners <65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.

<sup>1</sup> 2009 International Energy Conservation Code, International Code Council, 2009, p.43, Table 503.2.3(1)

<sup>2</sup> The PAs do not differentiate between units by heating section types. To be conservative, the highest Baseline Efficiency is assumed for all heating section types in each equipment category.

**High Efficiency**

The high efficiency scenario assumes the HVAC equipments meets or exceeds the Consortium for Energy Efficiency's (CEE) specification. This specification results in cost-effective energy savings by specifying higher efficiency HVAC equipment while ensuring that several manufacturers produce compliant equipment. The CEE specification is reviewed and updated annually to reflect changes to the ASHRAE and IECC energy code baseline as well as improvements in the HVAC equipment technology.

The minimum efficiency requirements for program participation are outlined on the Cool Choice rebate forms. Equipment efficiency is the rated efficiency of the installed equipment for each project.

**Hours**

If site-specific hours are unavailable, the annual equivalent cooling full load hours for unitary AC equipment are determined from the type of facility where the equipment is installed. The assumed cooling full load hours for each facility type are presented in Appendix A: Error! Reference source not found..

**Measure Life**

For lost-opportunity applications, the persistence-adjusted lifetime for this measure is 15 years.<sup>3</sup>

**Algorithms for Calculating Secondary Energy Impacts**

There are no secondary energy impacts counted for this measure.

**Water Resource Impacts**

There are no water resource impacts for this measure.

**Operation and Maintenance Cost Impacts**

There are no operation and maintenance cost adjustments for this measure.

**Impact Factors for Calculating Adjusted Gross Savings**

Measure	Program	PA	ISR	SPF	RR <sub>e</sub>	RR <sub>sp</sub>	RR <sub>wp</sub>	CF <sub>sp</sub>	CF <sub>wp</sub>	CF <sub>bsp</sub>	CF <sub>bsp</sub>
Unitary AC	NC	CLC	1.00	1.00						n/a	n/a
Unitary AC	NC	National Grid	1.00	1.00	1.00	1.00	1.00	0.441	0.000	n/a	n/a
Unitary AC	NC	NSTAR	1.00	1.00	1.009	1.093	1.573	0.82	0.05	n/a	n/a
Unitary AC	NC	Unitil	1.00	1.00	1.00	1.00	1.00	0.82		n/a	n/a
Unitary AC	NC	WMECo	1.00	1.00	1.159	1.159	1.159	n/a	n/a	0.82	0.00

**In-Service Rates**

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

**Savings Persistence Factor**

All PAs use 100% savings persistence factors.

<sup>3</sup> Energy & Resource Solutions, *Measure Life Study prepared for The Massachusetts Joint Utilities*, November 2005; Table 1-1

**Coincidence Factors**

- CLC coincidence factors TBD.
- National Grid CFs from an impact evaluation of 1996 and 1997 unitary AC installations.<sup>4</sup>
- NSTAR coincidence factors source unknown – these CFs are used for all HVAC measures.
- Unitil coincidence factors from generic load shape - source unknown.
- WMECo coincidence factors from a coincidence factor study for HVAC measures and are determined for the seasonal-peak periods.<sup>5</sup>

**Realization Rates**

- Cape Light Compact realization rates TBD.
- National Grid and Unitil energy and demand RRs based on an impact evaluation of 1996 and 1997 unitary AC installations. Energy and RRs set to 1.0 since the program adopted the 777 average EFLH and 0.441 summer CF developed in the evaluation.<sup>4</sup>
- NSTAR energy and demand RRs from impact evaluation of NSTAR's BS/CS Programs 2006 HVAC installations. Energy and demand RRs include documentation, technology, quantity, operational, and coincident adjustments to the energy and demand gross savings estimates.<sup>6</sup>
- WMECo energy realization rate are from 2001 impact evaluation of PY 1999 Express Services Program<sup>7</sup>. Demand realization rates are assumed to be the same as energy realization rate.

<sup>4</sup> SAIC, *National Grid 1998 Impact Evaluation of the Design 2000plus Unitary HVAC Program Final Report*, April 1998.

<sup>5</sup> RLW Analytics, *United Illuminating Company and Connecticut Lighting & Power Final Report, 2005 Coincidence Factor Study*, January 2007; Table 5.

<sup>6</sup> RLW Analytics, *NSTAR Electric & Gas Business & Construction Solutions (Bs/Cs) Programs Measurement & Verification 2006 Final Report*, July 2008; Table 17.

<sup>7</sup> RLW Analytics, *Express Services PY 1999 Impact Evaluation*, June 2001.

## MA TRM: Library

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- Includes all papers and studies referenced in the TRM
- Currently stored on TRM SharePoint site (administered by Optimal) – final location is under discussion
- Includes master “index” document for document searching

## MA TRM: Update Schedule (1)

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- MA TRM PY 2011 – *Plan Version* to be filed with PY 2011 Mid-Term Modification
- MA TRM PY 2011 – *Report Version* to be filed with PY 2011 Annual Reports
- Adjustments to Plan Version include:
  - Updated savings assumptions and/or impact factors based on results of impact evaluations

## MA TRM: Update Schedule (2)

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- MA TRM PY 2012 – *Plan Version* filed with PY 2012 Mid-Term Modification
- Adjustments to previous year Plan Version include:
  - Addition/Removal of measures offered
  - Updates to baselines or equipment efficiency requirements
  - Updated savings assumptions and/or impact factors based on results of impact evaluations

## 2011 Plan Version Status

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- Compiled version handed off by EEAC Consultants to PAs in early August
- PA measure level groups addressing comments and finalizing numbers
- Assembly priorities
  - Numbers
  - Supporting documentation
  - Lookup tables in TRM appendices