

**Measure Life Report**

**Residential and Commercial/Industrial  
Lighting and HVAC Measures**

*Prepared for*

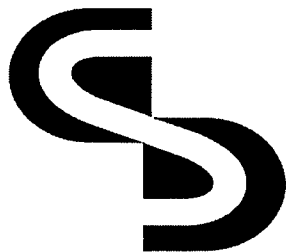
**The New England State Program  
Working Group (SPWG)**

*For use as an*

**Energy Efficiency Measures/Programs  
Reference Document for the ISO Forward  
Capacity Market (FCM)**

*June 2007*

*Prepared and Submitted by:*



**GDS Associates, Inc.**  
Engineers and Consultants

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# **I. INTRODUCTION AND RESULTS**

The New England State Program Working Group (SPWG)<sup>1</sup> contracted with GDS Associates, Inc. (GDS) to research current practices and develop and document a set of measure life values for selected measures that could be consistently applied to energy efficiency programs in any of the New England states for use by the SPWG members in the ISO-NE's Forward Capacity Market (FCM) and for any other relevant contexts. As directed by the SPWG, the focus of this effort was on residential and commercial/industrial (C&I) lighting measures and heating, ventilation and air conditioning (HVAC) measures.

Resulting measure life values presented in this report were developed to meet the following conditions:

- Satisfy any ISO-NE requirements (e.g. for definition and documentation sources);
- Work as common values, accepted by all New England states for the FCM; and
- Accurately reflect conditions for measures installed by energy efficiency programs in the New England states that have supported this research effort.

Key SPWG members reviewed previous and proposed measure life definitions and provided information and supporting documentation regarding HVAC and lighting measure life values currently being used for their residential and C&I programs. GDS then compiled this New England state program administrator-specific information and provided supplemental values and supporting documentation from multiple other relevant data and reporting sources. Preliminary recommendations were distributed to all SPWG members for vetting and refinement. Following multiple review sessions and feedback calls, a final definition and set of common measure life values were developed. This report is structured as follows:

Section I (the Introduction) – provides a brief overview of the project. It presents the definition of measure life that was developed and tables of results that show the common measure life values for all residential and C&I lighting and HVAC measures currently addressed in SPWG members' energy efficiency programs.

Section II (Methodology) – provides more information regarding data sources and collection approaches.

Appendix A (Background Detail) – presents a compilation of data tables and documentation sources for all targeted residential and C&I measures by program administrator and other potentially relevant data sources. More information on the data sources used is included in Appendix B. Although not the focus of this current effort, during the project, measure life values for a number of non-lighting or HVAC measures were also collected and are presented in table format as Appendix C of this report.

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<sup>1</sup> Represented by the state regulatory agencies (CT DPUC, Maine PUC, MA DOER, NH PUC, RI PUC, and VT PSB) and associated energy efficiency program administrators (Cape Light Compact, Efficiency Maine, Efficiency Vermont, National Grid – MA, NH & RI, Northeast Utilities – CT & MA, NStar, PSNH, United Illuminating, and Unitil – MA & NH).

## **A. Measure Life Definition**

Based on a critical review of previous definitions<sup>2</sup> by GDS and discussion with the SPWG, the following measure life definition was agreed on for use in this report:

For programs delivered by program administrators in New England, Measure Life includes equipment life and measure persistence (not savings persistence).

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

For retrofit/early retirement programs, the measure life will take into account both the expected remaining life of the measure being replaced and the expected changes in baselines over time.

## **B. Recommended Measure Life Values – Residential and C&I Lighting and HVAC Measures**

Based on a critical review of all state program administrator-specific values, values from other sources compiled in the course of this study, , and discussion with the SPWG, final measure life values for residential and C&I lighting and HVAC measures were developed and are summarized in the following tables:

Table 1 – Residential Measures

- Lighting
- Lighting Controls
- Heating and Cooling
- Ventilation
- HVAC Controls

Table 2 – Commercial and Industrial (C&I) Measures

- Lighting
- Lighting Controls
- HVAC
- HVAC Controls
- Motors

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<sup>2</sup> One key source for the SPWG's measure life definition came from the October 10, 2005 *Measure Life Study Report prepared for The Massachusetts Joint Utilities*, by ERS (energy & resource solutions). Pgs 2-5 through 2-7.

<b>Table 1 - Residential Measures</b> [Note 1]	
<b>Measure</b>	<b>Measure Life</b>
<b>Lighting</b>	
Bulb (CFL screw base) - Retail	6 years or product specific
Bulb (CFL screw base) - Direct Install	Site specific values to be used where known
Exit Sign - LED (multifamily installations)	13 years - retrofit 15 years - new construction
Interior Fixture - CFL hardwired	20 years
Exterior Fixture - CFL hardwired	15 years
Fixture - CFL table lamp	8 years
Fixture - CFL Torchiere	8 years
<b>Lighting Controls</b>	
Occupancy Sensors	10 years
<b>Heating and Cooling</b>	
Heating & Cooling System	18 years - replacement/retrofit 25 years - new construction (ESTAR Homes)
Air Conditioner or Heat Pump Commissioning	18 years
Air Conditioner or Heat Pump ECM	
Refrigerant Charge - at time of installation	
Heating & Cooling System repair/tune-up/recharge	5 years
Room/Window AC replacement	12 years
<b>Ventilation</b>	
Fans - whole house	25 years
Attic Ventilation Fan (thermostatically controlled)	19 years
Duct Sealing	20 years
Air Sealing	15 years
Insulation	25 years
Weatherization (includes combination of duct sealing, air sealing, and insulation)	20 years
Duct Insulation - heating/cooling; heating; cooling; oil heat	20 years
Windows - low SHGC, or high performance	25 years
Dehumidifier	12 years
Pipe Wrap	15 years
Tank Temperature Turn-Down	4 years [Note 2]
<b>HVAC Controls</b>	
AC Timers	5 years
Programmable Thermostat	10 years

Note 1: For measures shown in Table 1 where there is a single value specified, the value applies to both new and retrofit program situations

Note 2: Candidate for further research/study

<b>Table 2 - Commercial &amp; Industrial Measures</b>		
<b>Measure*</b>	<b>Measure Life**</b>	
	<b>Retrofit</b>	<b>New</b>
<b>Lighting</b>		
Bulb - CFL screw base [Note 1]	5 years [Note 2]	N/A
Fluorescent Fixture	13 years	15 years
Hardwired CFL	13 years	15 years
LED Exit Signs	13 years	15 years
HID (interior and exterior)	13 years	15 years
<b>Lighting Controls</b>		
Occupancy Sensors	9 years	10 years
Daylight Dimming	9 years	10 years
<b>HVAC</b>		
Packaged AC/HP	N/A	15 years
Chillers	N/A	23 years [Note 3]
Enthalpy Economizer	7 years [Note 4]	10 years
<b>HVAC Controls</b>		
Programmable Thermostat	8 years	N/A
Energy Management Systems (EMS)	10 years	15 years
<b>Motors</b>		
Motors	15 years	20 years

\* Also applies for installation in common areas of multifamily buildings

\*\* Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05

Note 1: Measure not included in the ERS 10/10/05 Measure Life Study

Note 2: Candidate for further research/study

Note 3: Value = 20 years in ERS 10/10/05 Measure Life Study

Note 4: Value = "N/A" in ERS 10/10/05 Measure Life Study

As noted previously, although not the focus of this current effort, during the project, measure life values for a number of non-lighting/HVAC measures were compiled along with associated source documentation. For reference and potential future consideration, this additional measure life information is included and summarized in table format as Appendix C of this report.

## **II. METHODOLOGY**

The measure life values presented in this report were developed to meet the following conditions:

- Satisfy any ISO-NE requirements (e.g. for definition and documentation sources);
- Work as common values, accepted by all New England states for the FCM; and
- Accurately reflect conditions for measures installed by energy efficiency programs in the New England states that have supported this research effort.

The following activities were performed in the development of these measure life values:

- Data Collection
- Review and Analysis
- Development of Proposed Draft and Final Default Measure Life Values

More information regarding the approach for conducting each of these activities is presented below.

### **A. Data Collection**

GDS identified and assembled reference measure life values for a broad array of residential and C&I lighting, HVAC, and other measures currently delivered to customers through the energy efficiency programs of each SPWG member, using a variety of local and nationally recognized data sources including:

- Measure Life Study for the Massachusetts Joint Utilities – ERS, October 10, 2005
- Vermont Electric Energy Efficiency Potential Study – GDS Associates
- Efficiency Vermont Technical Reference User Manual (RTM) No. 2006-41, June 14, 2006
- Efficiency Maine Technical Reference User Manual (TRM) No. 2006-1
- UI and CL&P Program Savings Documentation for 2006 Program Year
- California Measurement Advisory Council (CALMAC) database
- Database for Energy Efficient Resources (DEER), sponsored by the CA Energy Commission and the CPUC
- Revised/Update EULs Based on Retention and Persistence Studies Results, Revised Report – SERA July 8, 2005
- A more complete list of relevant data sources is itemized and presented in Appendix B

## ***B. Data Review and Analysis, and Propose Draft and Final Default Measure Life Values***

GDS reviewed all secondary data collected and developed a preliminary list of potentially applicable residential and C&I measures. This list was then distributed to program administrator staff within the SPWG for review and to obtain additional program-specific measure life values and associated documentation sources. GDS compiled all responses and developed initial measure life recommendations for SPWG member consideration.

Written feedback from the SPWG regarding these draft measure life value recommendations was provided along with verbal input during two scheduled measure life document review teleconferences. Following receipt of all feedback, and SPWG confirmation regarding the appropriateness of all recommended values, GDS prepared final default measure lives in annotated summary tables, by sector and end use. A summary of these tables was presented in the Introduction and Results section of this report. Appendix A provides the background detail from these tables showing the individual states' initial values and source documentation. Where applicable, all tables include notes to identify specific measures that might be good candidates for further research or a targeted measure life/persistence study.

Appendix B provides more comprehensive reference information for the documented data sources for each of the residential and C&I lighting and HVAC measures that are the subject of this report. In addition, Appendix C provides background detail and documentation on a number of other residential and C&I measures collected and compiled during the course of this project. The information in Appendix C should provide SBWG members with an excellent starting point for development of common default measure life values for measures other than HVAC and lighting end uses, in the expectation that common values may be of interest or importance to the region's electric energy efficiency program administrators in the future.



## **APPENDIX A**

### **Background Detail Considered in Development of Common Measure Life Values**

The following tables provide the source information on the residential and C&I lighting and HVAC measures that were the subject of this report. As described above, the source information was reviewed and discussed by members of the SPWG and GDS, to establish the measure life value for each measure (or two values if there was a basis for separate values for new construction and retrofit situations). In each case the source data were considered, along with the underlying information that supported the values (eg., daily hours of use, location), to arrive at a set of measure life values that reflected the most reasonable circumstances under which the measures would be installed.

## 1. Residential Lighting and Lighting Controls

Table A-1 Residential Lighting		
Measure	Measure Life	Comments
Bulb - CFL screw base - Retail	6 years or product specific	6 years - MA, VT, RI 2003 Residential Lighting Impact Study (based on 3.2 hours/day & 7000 hour bulb life) 6.4 years - 3.4 hours/day 8000 hours (NH Retail Sales) 8.1 years - 3.4 hours/day 10,000 hours (NH Retail Catalog)
Bulb - CFL screw base - Direct Install (site specific)	Site specific values to be used where known	This measure life requires knowledge of the rated bulb life and site specific daily burn time, and consideration of measure persistence and should be calculated as follows: (rated bulb life / annual burn time) * measure persistence  5 years - CT: 2.6 hours/day is default includes 20% reduction for cycling. Full range of values is 5 years thru 13 years 6.4 years - VT: 3 hours/day 7000 hours 7.6 years - ME: 2.7 hours/day 7500 hours 8.6 years - NH: Energy Star Homes Program) 9 years - MA, RI
Exit Sign - LED (multifamily installations)	13 years - retrofit 15 years - new construction	Per commercial/industrial sector values documentation
Interior Fixture - CFL hardwired	20 years	20 years - CT, NH 15 years - MA, RI
Exterior Fixture - CFL hardwired	15 years	15 years - MA, RI 20 years - CT, NH 16, 20 years - CALMAC
Fixture - CFL table lamp	8 years	5 years (MA, RI) EL&MP 8 years - 3.2 hours/day (CT) 10 years (NH, VT) - 16 years DEER
Fixture - CFL Torchiere	8 years	8 years - CT 5 years - MA, RI 10 years - NH, VT, ME 9 years - DEER; 9.4 years - CALMAC
Residential Lighting Controls		
Occupancy Sensors	10 years	10 years - consistent with C/I sector Retrofit value 15 years - VT

## 2. Residential Heating and Cooling and HVAC Controls

Table A-2 Residential Heating and Cooling		
Measure	Measure Life	Comments
Heating & Cooling System Replacement	18 years	18 years - MA, RI: Heat Pump Retrofit, Central AC 18 years - NH, VT: Retrofit Central AC 19 years - CT: Heat Pump, Central AC 20 years - MA, RI, VT: Furnace, Burner Replacement 25 years - VT: Central AC 15 years - Skumatz, 16, 18 years CALMAC Heat Pump 15, 18 years - Skumatz, 18 years CALMAC, VT TPS Central AC
Heating, Cooling and Hot Water Savings in the ES Homes Program New Construction	25 years	Heating: 25 years - MA, RI, NH, VT, CT Cooling: 25 years - MA, RI, NH, VT Cooling: 19 years - CT Hot Water: 25 years - MA, RI, NH, VT Hot Water: 15 years - CT
AC or HP Commissioning AC or HP ECM Refrigerant Charge - at time of installation	18 years	18 years - MA, RI 19 years - CT
Heating & Cooling System repair/tune-up/recharge	5 years	5 years - MA, RI: reflects estimate of remaining life 5 years - NH: for weatherization program
Room/Window AC replacement	12 years	12 years - MA, RI, NH 13 years - VT, CT, NH - Energy Star Program 12 years - VT TRM, 11, 15 years CALMAC
Residential HVAC Controls		
AC Timers	5 years	5 years - MA, RI, NH
Programmable Thermostat	10 years	10 years - MA, RI, CT 12 years - NH 10 years - VT TPS, 12 years CALMAC, DEER

### 3. Residential Ventilation and Other Measures

Table A-3 Residential Ventilation and Other Measures		
Measure	Measure Life	Comments
Fans - whole house	25 years	25 years - MA, RI
Attic Ventilation Fan (thermostatically controlled)	19 years	19 years - CT, NH (New Construction)
Duct Sealing	20 years	20 years - CT (Low Income) 15 years - MA, RI, VT 25 years - CT (Single Family, Multi Family)
Air Sealing	15 years	15 years - MA, RI, NH 20 years - VT (Retrofit)
Insulation	25 years	25 years - MA, RI, CT, NH (Retrofit) 20 years - VT (Retrofit) 25 years - CALMAC, VT TRM, 20 years DEER
Weatherization (includes combination of duct sealing, air sealing, and insulation)	20 years	20 years - CT (Low Income) 25 years - MA, RI 20 years - VT TPS, 13 years DEER
Duct Insulation - heating/cooling; heating; cooling; oil heat	20 years	20 years - MA, RI, CT
Windows - low SHGC, or high performance	25 years	25 years - NH 20 years - MA, RI 25 years - CALMAC, 35 years VT TPS Retrofit, 20 yrs DEER Retrofit
Dehumidifier	12 years	12 years - MA, RI, CT-07
Pipe Wrap	15 years	15 years - CALMAC, DEER 20 years - CT - Low Income 25 years - MA, RI 10, 13 years - VT TRM
Tank Temperature Turn-Down	4 years [Note 1]	4 years - VT (Single Family) 5 years - CT (Low Income Retrofit) 7 years - VT (Low Income New)

Note 1: Candidate for further research/study

#### 4. Commercial and Industrial Lighting

Table A-4 Commercial & Industrial Lighting			
Measure*	Measure Life**		Comments
	Retrofit	New	
Bulb - CFL screw base [Note 1]	5 years [Note 2]	N/A	5 years - CT 3.4 years - VT (based on 9.6 hours/day 12,000 hours where higher bulb life is due to less cycling for a commercial application) 6 years - MA, RI, NH (mostly small business applications)
Fluorescent Fixture	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 11,16 years - Skumatz, 16 years CALMAC
Hardwired CFL	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 15 years (retrofit and new) - VT and VT TPS 10, 16 years - CALMAC
LED Exit Signs	13 years	15 years	13 years (retrofit), 15 years (new) - MA, RI, NH 10 years (retrofit) - VT and VT TPS 15,16 years - CALMAC, 16 years - DEER
HID (interior and exterior)	13 years	15 years	Retrofit: 13 years (MA, RI, NH) Retrofit: 15 years (VT) New: 15 years (MA, RI, NH, VT)
Commercial & Industrial Lighting Controls			
Occupancy Sensors	9 years	10 years	9 years (retrofit) - MA, RI, NH 10 years (new) - MA, RI, NH 10 years (retrofit and new) - VT 15 years (new) - CT 8, 10 years - CALMAC
Daylight Dimming	9 years	10 years	9 years (retrofit), 10 years (new) - MA, RI, NH 10 years (retrofit) - VT 16 years - DEER

\* Also applies for installation in common areas of multifamily buildings

\*\* Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05

Note 1: Measure not included in the ERS 10/10/05 Measure Life Study

Note 2: Candidate for further research/study

## 5. Commercial and Industrial HVAC and Motors

Table A-5 Commercial & Industrial HVAC			
Measure	Measure Life *		Comments
	Retrofit	New	
Packaged AC/HP	N/A	15 years	15 years - MA, RI, NH, CT (new - water and ground source heat pump, CT-07) 12 years - CT (new - air source heat pump) 15 years - ASHRAE, CALMAC, VT TRM
Chillers	N/A	23 years [Note 1]	23 years - CT (new - water cooled) 18 years - CT (new - air cooled) 20 years (new) - MA, RI, NH, CT-07 23 years - ASHRAE 20 years - CALMAC, DEER (new)
Enthalpy Economizer	7 years [Note 2]	10 years	7 years - CT-07 (retrofit) 7 years - VT TPS 9.8 years (new) - adj from 14 years engineering life VT TRM, 14 years VEIC 15 years - DEER
Commercial & Industrial HVAC Controls			
Programmable Thermostat	8 years	N/A	8 years - MA, RI, NH (retrofit) 10 years - VT (retrofit) 5 years - VT TPS
Energy Management Systems (EMS)	10 years	15 years	10 years - MA, RI, NH, VT (retrofit) 15 years - CT-07 (retrofit) 15 years - MA, RI, NH, CT-07 (new) 15 years - CALMAC, 14, 15 years Skumatz
Commercial & Industrial Motors			
Motors	15 years	20 years	15 years - MA, RI, NH (retrofit) 13 years - CT-07 (retrofit) 20 years - VT (retrofit) 20 years - MA, RI, NH, CT-07 (new) 17 years - CT (new) 15 years - CALMAC, DEER (new)

\* Primary Source: Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 10/10/05

Note 1: Value = 20 years in ERS 10/10/05 Measure Life Study

Note 2: Value = "N/A" in ERS 10/10/05 Measure Life Study

## APPENDIX B – Relevant Data Sources

### Residential Sources

Utility	Primary Source
National Grid	Extended Residential Logging Results Memo from RLW and Nexus Market Research to National Grid, May 2, 2005.
Vermont Energy Investment Corporation	EVT TRM User Manual #41, dated 6/14/06
Connecticut - UI and CLP	Connecticut - UI and CLP Programs Savings Documentation - 2006
Efficiency Maine	Efficiency Maine TRM 2006-1
PSNH	Extended Residential Logging Results Memo from RLW and Nexus Market Research to National Grid, May 2, 2005.
Connecticut - UI and CLP -2007	Connecticut - UI and CLP Programs Savings Documentation - 2007 Table 1.4 Commercial and Industrial Lifetimes Page 222
Study	Primary Source
CALMAC Public Workshops	CALMAC Public Workshops on PY Energy Efficiency Programs, Appendix C2, "Proposed Effective Useful Life for Measures for PY2001 Program Elements" by PG&E, Edison, SDG&E, and SoCalGas, September 2000
Vermont Technical Potential Study	GDS Associates, Inc., "Vermont Electric Energy Efficiency Potential Study, Final Report", prepared for the VT DPS, May 10, 2006
California Public Utilities Commission (CPUC) and California Energy Commission	Database Energy Efficient Resource Database
Skumatz and Gardner	Skumatz, Woods, and Dimetrosky, "Review of Retention and Persistence Studies for the California Public Utilities Commission (CPUC)", October 2004, prepared for California Public Utilities Commission, San Francisco, CA.
Efficiency Vermont	Efficiency Vermont TRM Users Manual 2006-41

### Commercial & Industrial Sources

Utility	Primary Source
National Grid	Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
Vermont Energy Investment Corporation	EVT TRM User Manual #41, dated 6/14/06
Connecticut - UI and CLP	UI/CL&P C&LM Program Savings Documentation -2006
Public Service of New Hampshire	Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
Connecticut - UI and CLP -2007	Connecticut - UI and CLP Programs Savings Documentation - 2007 Table 1.4 Commercial and Industrial Lifetimes Page 222
Study	Primary Source
CALMAC Public Workshops	CALMAC Public Workshops on PY Energy Efficiency Programs, Appendix C2, "Proposed Effective Useful Life for Measures for PY2001 Program Elements"
Vermont Technical Potential Study	GDS Associates, Inc., "Vermont Electric Energy Efficiency Potential Study, Final Report", prepared for the VT DPS, May 10, 2006
California Public Utilities Commission (CPUC) and California Energy Commission	Database Energy Efficient Resource Database
Skumatz and Gardner	Skumatz, Woods, and Dimetrosky, "Review of Retention and Persistence Studies for the California Public Utilities Commission (CPUC)", October 2004, prepared for California Public Utilities Commission, San Francisco, CA.
Efficiency Vermont	Efficiency Vermont TRM Users Manual 2006-41

## **APPENDIX C – Additional Documentation on Targeted Measures and Preliminary Measure Life Value Data for Other Residential and C&I End Use Equipment**



Residential Measures	Current Value (in Years, or Hours if Indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Interior Lighting				
Bulb - CFL screw base	NG	9		EL and Measure Persistence
	VEIC	6.4		Retrofit: EL(most CFL's have a rated lifetime of 10,000 hrs but actual operating hrs based on site-specific data; daily burn time presented in "CFL Life by Daily Burn Time" table on p. 384 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0)  New Construction: EL(=6.4; based on 1,102 operating hrs/yr) & MP(assumed to be 1.0), no source listed  LI SF MF: EL(daily burn time presented in "CFL Life by Daily Burn Time" table on p. 203 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0), no source listed
	CT	5 - 13 LI, SF, MF		EL (=5 - 13 years based on rated hours with 20% reduction based on effects of cycling, in a situation where the bulb life for an Energy Star bulb is unknown, assume the minimum average life of 5 years; operating hours 2.6 hours/day [5.6]) & MP (assumed to be 1.0); no source listed
	ME	7.6 years		EL(=7.6 years or 7500 hours [9]; based on 986 operating hrs/yr) & MP(assumed to be 1.0)
	PSNH	RC 8.1; RS 6.4; 8.6 ES Homes		RC EL=8.1 10,000 hours at 3.4 hours/day; RS EL=6.4 8,000 hours at 3.4 hours/day; New Const EL=8.6 for Energy Star Homes Program
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	7.6		EL, manufacturer data and stipulated values [23]
	Sku	9.4; 9.4-16		EL(=9.4 based on 8,000 hr manufacturer rated life and average operating hrs of 2.34/day [40]; 9.4-16 [38])
Exit Sign - LED	VEIC	10		EL(=10; based on 8,760 operating hrs/yr) & MP(assumed to be 1.0)
Fixture - CFL	NG	20		EL and Measure Persistence
	PSNH	20		Home Energy Solutions/Home Energy Assistance Programs [17]
	CT-07	20		[16]
	VT TPS	10.87 - 12.08		EL, manufacturer data and stipulated values, 10.87 for homes withouth CFL installation, 12.08 for homes with partial CFL installation [23]
	Sku	16		EL(=16 [37] [38] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL hardwired	NG	20		EL and Measure Persistence
	CT	20 LI, SF, MF		EL (=20 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	PSNH	20		Home Energy Solutions/Home Energy Assistance Programs [17]
Fixture - CFL integral	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	NG	20		EL and Measure Persistence
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL modular	DEER	9.4		EL(=9.4) [6] [32]
	NG	20		EL and Measure Persistence
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL table lamp	DEER	16		EL(=16) [6] [29] [30] [34]
	NG	5		EL and Measure Persistence
	VEIC	10		
	CT	8 LI, SF, MF		EL (=8 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	PSNH	10		Energy Star Lighting Program [17]
Fixture - CFL unspecified	DEER	16		EL(=16) [6] [29] [34]
	NG	5		EL and Measure Persistence
	Sku	16		EL(=16 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - CFL Torchiere	NG	5		EL and Measure Persistence
	VEIC	10		EL(=10, based on lamp life of 6.26 yrs and ballast life of 32.88 yrs from "Component Costs and Lifetimes Used in Computing O&M Savings Residential Applications" table on p. 306 of VT TRM, and annual usage of 3.4 hrs/day) & MP(assumed to be 1.0), no source listed
	CT	8 LI, SF, MF		EL (=8 years; operating hours 3.2 hours/day [7]) & MP(assumed to be 1.0); no source listed
	ME	10 years		EL(=10 years [13]; based on 912.5 operating hrs/yr [14]) & MP(assumed to be 1.0)
	PSNH	10		[17]
	CALMAC	9.4		EL(=9.4 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	9		EL(=9) [6] [29] [34]

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Fixture - Circline	NG	20		EL and Measure Persistence
	ME	10 years		EL(=10 years [15]; based on 1,460 operating hrs/yr [12]) & MP(assumed to be 1.0)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Common Area	NG	20		EL and Measure Persistence
Fixture - Flood	NG	20		EL and Measure Persistence
	NG	20		EL and Measure Persistence
Fixture - Fluorescent	VEIC	20		New Construction: EL(=20; operating hrs are 1,102/yr) & MP(assumed to be 1.0), no source listed LI MF: EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0) LI SF: EL(=20, based on lamp life of 6.26 yrs and ballast life of 25.05 yrs from "Component Costs and Lifetimes Used in Computing O&M Savings Residential Applications" table on p. 304 of VT TRM, and annual usage of 3.4 hrs/day) & MP(assumed to be 1.0), no source listed
	ME	20 years		EL(=20 years [10]; based on 766.5 operating hrs/yr [11]) & MP(assumed to be 1.0) [10]
	CALMAC	17		EL(=17 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	SKU	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - HID High Pressure Sodium (HPS)	NG	20		EL and Measure Persistence
	DEER	16	-	EL(=16) [33]
Fixture - HID Metal Halide (MH)	NG	20		EL and Measure Persistence
	DEER	16	-	EL(=16) [33]
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Med Cabinet	NG	20		EL and Measure Persistence
Fixture - Sconce	NG	20		EL and Measure Persistence
Floor Lamp	VEIC	10		
Ceiling Fan w/ Energy Star Light Fixture	VEIC	20		
Generic Linear Fluorescent Tube Fixture	VEIC		20	
Indoor Fixture Unspecified	CALMAC	14; 20		EL(=14 [19]; 20 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Lighting Package Reinstall	VT TRM	LI MF: 6.2		EL(=6.2, based on life of standard CFL, 10,000 hrs and annual operating hours of 1,372; varying daily hours of usage from 1 to 24 changes the lifetime hours from 3,000 to 12,000, and this information is presented in Table A on page 211 of VT TRM) & MP(assumed to be 1.0), no source listed

Residential Measures	Current Value (In Years, or Hours If Indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Exterior Lighting				
Bulb - CFL	NG	9		EL and Measure Persistence
	PSNH	8.1		EL=8.1 10,000 hours at 3.4 hours/day
	VEIC	3.9		Retrofit: New Construction: EL(=3.9; based on 2,190 operating hrs/yr or 6 hrs/day assumed usage [52]) & MP(assumed to be 1.0)  LI SF MF: EL(daily burn time presented in "CFL Life by Daily Burn Time" table on p. 202 of VT TRM allows for variation in lifetime hours from 3,000 to 12,000) & MP(assumed to be 1.0), no source listed
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	9.4; 9.4-16		EL(=9.4 based on 8,000 hr manufacturer rated life & average operating hrs of 2.34/day [40]; 9.4-16 [38])
Fixture - CFL hardwired	NG	15		EL and Measure Persistence
	CT	20 LI		EL (=20 years; operating hours 3.2 hours/day [7] for general exterior lighting and 12 hour/day for security exterior lighting) & MP(assumed to be 1.0); no source listed
	PSNH	20		
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - CFL integral	NG	15		EL and Measure Persistence
	CALMAC	6; 7.2; 9		EL(=6 [22]; 7.2 [19]; 9 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	7.1		EL(=7.1) [6] [32]
Fixture - CFL modular	NG	15		EL and Measure Persistence
	CALMAC	16; 20		EL(=16 [18]; 20 [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	16	-	EL(=16) [6] [29] [30] [34]
Fixture - CFL unspecified	NG	15		EL and Measure Persistence
	PSNH	16		Energy Star Lighting Program [17]
	Sku	16		EL(=16 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	LI MF: 20		EL(=20 [41] [42], rated lifetime of most ballasts is 40,000 hrs and most CFL bulbs is 10,000 hrs; using Table A on p. 207 of VT TRM a more accurate lifetime can be found based on daily burn time of the fixture) & MP(assumed to be 1.0)
Fixture - Flood	NG	15		EL and Measure Persistence
Fixture - Fluorescent	NG	15		EL and Measure Persistence
	VEIC	20		
	CALMAC	17		EL(=17 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fixture - HID HPS; HID MH	NG	15		EL and Measure Persistence
	VEIC	20		EL(=20; operating hrs are 2,920/yr) & MP(assumed to be 1.0), no source listed
	DEER	16	-	EL(=16) [33]
Fixture - Sconce	NG	15		EL and Measure Persistence
Outdoor Fixture - unspecified	CALMAC	20		EL(=20 [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Other/Unspecified				
Electronic Ballast (non-dimming or dimming)	DEER	11		EL(=11) [34]
	Sku	10; 11; 16		EL(=10 [39]; 11 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting - RCP	CALMAC	16		EL(=16 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Ballast - Fluorescent	Sku	11; 15; 16		EL(=11 [39]; 15 [37]; 16 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting Controls				
Daylighting				
Occupancy Sensor - plug loads	DEER	10		EL(=10) [33]
Occupancy Sensor - wall box	DEER	8		EL(=8) [33]
Occupancy Sensors	VEIC	15		
Photocell w/timerlock				
Timeclock				
Controls - unspecified	VT TRM	LI SF: 10		EL(=10 [42]) & MP(assumed to be 1.0)
Exterior Motion Sensor	VT TRM	-	15	EL(=15 [51]; based on 650 reduced operating hrs/yr) & MP(assumed to be 1.0)

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Heating				
Burner replacement	NG	20		EL and Measure Persistence [1]
ECM Air Furnace	NG	18		EL and Measure Persistence [2]
	VEIC	18		
	CT-07	19		[16]
Furnace replacement	NG	20		EL and Measure Persistence [1]
	VEIC	20		
	DEER	18		EL(=18) [34]
	Sku	18; 20	18; 20	EL(=18 [37] [39]; 20 [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Heat Pump replacement	NG	18		EL and Measure Persistence [2]
	CT	19		EL (=19 years 8.5 or higher HSPF; operating hours 1500) & MP(assumed to be 1.0); no source listed
	CALMAC	16; 18		EL(=16 [18]; 18 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	15		EL(=15 [37] [38]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Heating System replacement	NG	20		EL and Measure Persistence [1]
Heating System repair/service	NG	5		
HP flow/charge	NG	18		EL and Measure Persistence [2]
Pipe Wrap	NG	25		EL and Measure Persistence [3]
	VEIC	6		
	CT	20 LI		EL (=20 years) & MP(assumed to be 1.0); no source listed
	CALMAC	15		EL(=15 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	13		EL, stipulated values [24]
	DEER	15		EL(=15) no source listed
	VT TRM	10 LI SF: 10	13 LI SF: 10	Retrofit: EL(=10 [41]) & MP(assumed to be 1.0) New Construction: EL(=13, average life of water heater) & MP(assumed to be 1.0), no source listed LI SF: EL(=10) & MP(assumed to be 1.0), no source listed
Tank Wrap	VEIC	6		EL(=6 [41]) & MP(assumed to be 1.0)
	VT TPS	7	-	EL, market driven [4]
Tank Temperature Turn-Down	VEIC	4	7 LI SF: 4	Retrofit: EL(=4) & MP(assumed to be 1.0), no source listed New Construction: EL(=7, average life of water heater) & MP(assumed to be 1.0), no source listed LI SF: EL(=4) & MP(assumed to be 1.0), no source listed
	CT	5 LI		EL (=5 years since the water heater is not a new one and it will have a limited life, page 181 [1])
Shell Heating Savings	VEIC		25	
Efficient Space Heating - Oil, LP Boilers	VEIC	25		EL(=25 [49]) & MP(assumed to be 1.0) LI MF: EL(=25) & MP(assumed to be 1.0), no sources listed
Efficient Space Heating - Space Heaters (Oil, LP, Kero)	VEIC	15		EL(=15 [49]) & MP(assumed to be 1.0)
Fossil Fuel Water Heater	VEIC		25	
Hot Water Fuel Switch-Oil-Water Heater	VEIC	10		EL(=10 [48]) & MP(assumed to be 1.0)
Hot Water Fuel Switch-Oil-(or NG or LP or Kero) Storage Tank & Instantaneous	VEIC	15		EL(=15 [48]) & MP(assumed to be 1.0)
Hot Water Fuel Switch-NG-(or LP) Water Heater	VEIC	13		EL(=13 [48]) & MP(assumed to be 1.0)
Waterbed Insulation	NH	10		[17]
Water Heater (gas)	CALMAC	12.2; 13; 15		EL(=12.2 [18]; 13 [21] [22]; 15 [20]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	13	EL(=13) [31] [34] [35]
Water Heater (point of use)	DEER	20		EL(=20) [36]
Water Heater (electric)	DEER	-	15	EL(=15) [31] [34] [35]
Water Heater (heat pump)	DEER	-	10	EL(=10) [31] [34] [35]
Solar Water Heating	VT TPS	20	-	EL [27]
Water Heater	PSNH		13	Energy Star Homes Program [17]
	VT TPS	13		EL [27]
Furnace Fan Motor	VT TPS	18		EL, stipulated values [24]
	VT TRM	18	18	EL(=18 [45]; operating hrs are 375/yr [44] [46]) & MP(assumed to be 1.0)
Furnace Replacement	VT TRM	20	-	EL(=20 [49]) & MP(assumed to be 1.0)

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Cooling				
Central AC replacement	NG	18		EL and Measure Persistence [2]
	VEIC	18	25	Retrofit: EF=18; based on operating hrs of 375/yr [50]) & MP(assumed to be 1.0) New Construction: EF=25; based on operating hrs of 200 hrs/yr [47]) & MP(assumed to be 1.0)
	CT	19 LI, SF, MF		EL (=19 years SEER 14; operating hours 500) & MP(assumed to be 1.0); no source listed
	PSNH	18		EL and Measure Persistence [2]
	CALMAC	18		EL(=18 [18] [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	18		EL, market driven [4]
	SkU	15; 18		EL(=15 [38]; 18 [37] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Cooling System	NG	18		EL and Measure Persistence [2]
	PSNH	18		EL and Measure Persistence [2]
Evaporative Cooler	CALMAC	7		EL(=7 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	15		EL(=15) [34]
	SkU	15		EL(=15 [37] [38] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Refrigerant Charge	NG	18		EL and Measure Persistence [2]
	CT-07	5		AC System Tune-up [16]
	PSNH	18		EL and Measure Persistence [2]
	DEER	10		EL(=10) [29]
Room AC replacement	NG	12		EL and Measure Persistence [4]
	VEIC	13		
	CT	13 LI, SF, MF		EL (=13 years; operating hours 500) & MP(assumed to be 1.0); no source listed
	PSNH	12; 13		EL and Measure Persistence [4]; EL=13 for Energy Star Appliance Program
	CALMAC	11; 15		EL(=11 [20]; 15 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	12		EL, market driven [4]
	VT TRM	LI MF: 10		EL(=10, based on 500 operating hrs/yr [44]) & MP(assumed to be 1.0), no sources listed
Shell Cooling Savings	VEIC		25	
AC (gas)	CALMAC	25		EL(=25 [21] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Split System AC	DEER	18		EL(=18) [34]
AC (unspecified)	SkU	15; 18		EL(=15 [38]; 18 [37] [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Ventilation				
Fans - whole house	NG	25		EL and Measure Persistence [3]
	VT TRM	LI MF: 10	10 LI MF: 10	EL(=10; based on operating hrs of 2,817/yr [43]) & MP(assumed to be 1.0)
Insulation	NG	25		EL and Measure Persistence [3]
	VEIC	20		EL(=20) & MP(assumed to be 1.0), no source listed
	CT	25 LI, SF, MF		EL (=25 years) & MP(assumed to be 1.0); no source listed
	PSNH	25		Home Energy Solutions; Home Energy Assistance Programs [17]
	CALMAC	25		EL(=25 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	20	-	EL, studies [26]
	DEER	20		EL(=20) [33]
Ventilation Fan	VT TRM	LI MF: 25		EL(=25) & MP(assumed to be 1.0), no sources listed
	PSNH		19	Energy Star Homes Program [17]
Insulation (ceiling/floor)	VEIC		10	
	CALMAC	25		EL(=25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Insulation (walls)	CALMAC	20; 25		EL(=20 [20]; 25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC Controls				
AC Timers	NG	5		
	PSNH	5		Home Energy Solutions; Home Energy Assistance Programs [17]
Programmable Thermostat	NG	10		EL and Measure Persistence [1]
	CT	10 LI, SF, MF		EL (=10 years) & MP(assumed to be 1.0); no source listed
	PSNH	12		[17]
	CALMAC	12		EL(=12 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL [28]
	DEER	12		EL(=12) [33]
Water Heater Controls	CALMAC	15		EL(=15 [21] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

Residential Measures	Current Value (in Years, or Hours if indicated)* May Vary by: Retail Store (RS), Retail Catalog (RC), Installed, Multifamily (MF), Single family (SF), Low- Income (LI)			Basis and Documentation Source(s) Basis: Equipment Life (EL) or EL and Measure Persistence (EL&MP) Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Other				
AC or HP Commissioning AC or HP ECM	NG	18		EL and Measure Persistence [2]
	CT	19		EL (=19 years; operating hours 500 cooling, 1500 heating) & MP(assumed to be 1.0); no source listed
AC/Heat Pump	NG	18		EL and Measure Persistence [2]
	CT-07	19		[16]
	DEER	15		EL(=15) [34]
Air Sealing	NG	15		EL and Measure Persistence [3]
	VEIC	20		EL(=20) & MP(assumed to be 1.0), no source listed
	PSNH	15		
Dehumidifier	NG	12		EL and Measure Persistence [4]
	CT-07	12		[16]
Duct Insulation - heating/cooling; heating; cooling; oil heat	NG	20		EL and Measure Persistence [3]
	CT	20 LI		EL (=20 years) & MP(assumed to be 1.0); no source listed
Duct Sealing - heating/cooling	NG	15		EL and Measure Persistence [3]
	VEIC	15		
	DEER	18		EL(=18) [34]
Duct Sealing - heating	NG	15		EL and Measure Persistence [3]
	CT	25 SF, MF; 20 LI		LI EL (=20 years) SF, MF EL (=25 years) & MP(assumed to be 1.0); no source listed
	VT TRM	15	-	EL(=15) & MP(assumed to be 1.0), no source listed
Duct Sealing - cooling	NG	15		EL and Measure Persistence [3]
Refrigerant Charge w/duct sealing	NG	18		EL and Measure Persistence [2]
	DEER	15		EL(=15) [29]
Weatherization	NG	25		EL and Measure Persistence [3]
	CT	5 LI; 20 LI		EL (=5 year) - Weatherstrip window, door sweep or kit; EL (=20 year) - default custom weatherization measure; & MP(assumed to be 1.0); no source listed
	VT TPS	20	-	EL studies [26]
	DEER	LI: 13		EL(=13) [35]
Windows - low SHGC, or high performance	NG	20		EL and Measure Persistence [1] shows measure life of 35 adjusted to 20 for MA common assumptions.
	PSNH	25		
	CALMAC	20; 25		EL(=20 [20]; 25 [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	35	-	EL [25]
	DEER	20		EL(=20) [33]
Windows - single pane clear	DEER	10	-	EL(=20) [33]
AC Tuneup	CT	5		EL (=5 years; operating hours 500) & MP(assumed to be 1.0); no source listed
Waterbed Cover	CT	3 LI		EL (=3 years) & MP(assumed to be 1.0); [8]
Caulking & Sealing	CT	10 LI		EL (=10 year) & MP(assumed to be 1.0); no source listed
AC (w/integrated water heating)	CALMAC	15		EL(=15 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Advanced HVAC tune-up	CALMAC	18		EL(=18 [18] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Advanced HVAC diagnostic tune-up	CALMAC	15		EL(=15 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Basic HVAC diagnostic tune-up	CALMAC	10		EL(=10 [18] [19] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Duct Testing (and sealing)	CALMAC	20; 25		EL(=20 [20]; 25 [18] [19] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	-	15; 18; 25	EL(=15 [38]; 18 [37]; 25 [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Refrigeration - RCP	CALMAC	20		EL(=20 [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Low Flow Showerhead	CALMAC	10		EL(=10 [18] [20] [22]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	10	-	EL(=10) [31] [34] [35]
	VT TRM	9 LI SF MF: 9	9 LI SF MF: 9	EL(=9 [41]) & MP(assumed to be 1.0)
Room AC (turn-in)	VT TPS	6		EL, turn-in measure so measure life divided by two [4]
Windows - default w/sunscreen	DEER	10		EL(=20) [33]
High Efficiency Ducts	Sku	-	15; 18; 25	EL(=15 [38]; 18 [37]; 25 [39]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

\* Measure life values may vary by type of installation (i.e., retrofit/early replacement, new construction/replace on burnout)

## Residential Data Sources

Utility/Study	Detail
	[1] B/C Screening Results for Regional Natural Gas Energy Efficiency Programs prepared by GDS for Gas Networks, March 25, 2004, page C-17.
NG	[2] Harvey Sachs study, Jan. 2003, p. 11.
NG	[3] Directive of MA NUP consultants.
NG, VT TPS	[4] Measure Life from Energy Star.gov Savings Calculator.
CT	[5] UI/CL&P C&LM Program Savings Documentation -2006
	[6] "CFL Metering Study", prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison by Kema Inc, February 25, 2005
CT, DEER	[7] Northeast Utilities and United Illuminating Retail/Point of Purchase Lighting Program Impact Evaluation, RLW Analytics, April 2003
CT	[8] Home Energy Magazine online September/October 1994
	[9] Impact evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs. Nexus Market Research & RLW Analytics. October 1, 2004. Pages 11-12.
ME	[10] Assumptions for Residential Lighting Fixtures, EPA Savings Calculator – Lighting Fixtures
ME	[11] Massachusetts, Rhode Island and Vermont Impact Evaluation Report, 2004
ME	[12] Assumptions for Residential Lighting Fixtures, EPA Savings Calculator – Lighting Fixtures; Massachusetts, Rhode Island and Vermont Impact Evaluation Report
ME	[13] Residential Torchierie Assumptions, EPA Savings Calculator – Torchieries
	[14] Engineering estimate of wattage savings and annual hours use of 912.5 hours from October 1, 2004 Massachusetts, Rhode Island and Vermont Impact Evaluation Report
ME	[15] Assumptions for Ceiling Fans with Lighting, EPA Savings Calculator – Ceiling Fans, 2005
CT-07	[16] UI/CL&P C&LM Program Savings Documentation -2007 Table 1.4 Lifetimes Residential Program Measure Lives Page 22
PSNH	[17] PSNH Weatherization Program; Home Energy Solutions Program; Home Energy Assistance Program
CALMAC	[18] Original EUL: Pacific Gas & Electric Company (PG&E)
CALMAC	[19] Original EUL: Southern California Edison Company (SCE)
CALMAC	[20] Original EUL: San Diego Gas and Electric Company (SDG&E)
CALMAC	[21] Original EUL: Southern California Gas Company (SoCalGas)
CALMAC	[22] Proposed EUL
	[23] manufacturer data: product package gave useful life in hours, and hourly usage is from Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs, October 2004, GDS Associates
VT TPS	[24] Efficiency Vermont Residential Master Technical Reference User Manual No. 2005-37
VT TPS	[25] "Selecting Targets for Market Transformation Programs", August 1998, ACEEE report
VT TPS	[26] GDS calculation based on program incentive figures from KeySpan Weatherization program completed in
VT TPS	[27] "Consumer Guide to Home Energy Savings" 8th ed., 2003, ACEEE
VT TPS	[28] phone call with Honeywell by Dick Spellman in 2001
DEER	[29] engineering judgement
	[30] "Evaluation of Pacific Gas & Electric Company's 1997 Commercial Energy Efficiency Incentives Program: Lighting Technologies", prepared by Quantum Consulting, Inc., for Pacific Gas & Electric Company, March 1,
DEER	[31] "Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector Lighting Technologies", prepared by Quantum Consulting, Inc., for Pacific Gas & Electric
DEER	[32] DEER
DEER	[33] CALMAC Effective Useful Life Report, September 2000
DEER	[34] "Revised/Updated EULs Based on Retention and Persistence Studies Results", July 2005, SERA Inc.
DEER	[35] DEER 4.0 1996
DEER	[36] US DOE Technical Brief: "Demand (Tankless or Instantaneous) Water Heaters", January, 2004
Sku	[37] DEER Newly Adopted EUL (2005)
Sku	[38] Interim/previous DEER EUL
Sku	[39] A Priori Protocols EUL
Sku	[40] CFL_EUL.xls from Gary Cullen, Itron, 5/12/05
VT TRM	[41] DPS screening of Efficiency Utility Core programs
VT TRM	[42] previous REEP program reporting and screening
VT TRM	[43] DPS screening of RNC program
VT TRM	[44] Air Conditioning and Refrigeration Institute data for Vermont, www.ari.org
VT TRM	[45] Sachs and Smith, 2003
	[46] VEIC experience in other states suggest that ARI estimates for AC tend to be overstated; to compensate, EVT applied a 0.75 multiplier
VT TRM	[47] Vermont State Cost Effectiveness Screening Tool
VT TRM	[48] EVT estimate
VT TRM	[49] previous estimates used by EVT in the state screening tool
VT TRM	[50] U.S. Climate Cooling Region 2 Full Load Hours; EVT applied 25% adjustment factor
VT TRM	[51] DPS core program screening
VT TRM	[52] based on estimate developed through EVT communications with VT Department of Service and Residential

C&I Measures		Current Value (in Years, or Hours if Indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Lighting				
Fluorescent	NG	13	15	EL and Measure Persistence [1]
	VEIC	3.4		
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	CALMAC	16		EL(=16 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	SkU	11; 16		EL(=11 [17] [36]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Hardwired CFL	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 56 of VT TRM [44]) & MP(assumed to be 1.0)
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	CALMAC	10; 16		EL(=10 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	15		EL&MP, manufacturer data, studies [9]
LED Exit Signs	NG	13	15	EL and Measure Persistence [1]
	VEIC	10		EL(=10, operating hours of 8,760/yr, no source listed)
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5]; 16 [4] [8] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [9]
	DEER	16		EL(=16) [19] [20]
HID	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or default of 3,338 hrs is used [45])
	PSNH	13	15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	VT TPS	15		EL&MP, manufacturer data, studies [9]
T8 Fixture w/ electronic ballast	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or by using "operating hours by building type" table on page 53 of VT TRM [44]) & MP(assumed to be 1.0)
Electronic Ballast (non-dimming or dimming)	CT-07	13		[48]
	CALMAC	10; 16		EL(=10 [5]; 16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
LED Traffic/Pedestrian Signals	VEIC	10		EL(operating hrs based on type of signal from page 67 of VT TRM [46]) & MP(assumed to be 1.0); 100,000 hrs, capped at 10 yrs
Metal Halide track	VEIC	15		EL(=15; operating hours are collected from prescriptive application form or from "operating hours by building type" table on page 73 of VT TRM [44]) & MP(assumed to be 1.0)
Metal Halide (MH)	DEER	16	-	EL(=16) [19] [20] [21]
Lighting Power Density	VEIC	15		EL(=15; operating hours determined on a site-specific basis, or by building type using "interior lighting operating hours by building type" table on page 108 of VT TRM [44]) & MP(assumed to be 1.0)
	CALMAC	10; 16		EL(=10 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Lighting	CT	15	20	Retrofit: EL (=15 years, Operating hours are determined on a case by case basis or taken from Table 2.0.0 page 233 [3]) New: EL (=20 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed



C&I Measures	Utility/Study	Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
		Retrofit	New Construction	
CFL Lamp (screw-in replaceable)	CALMAC	7.7; 10		EL(=7.7 [4] [6] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Bulbs (integral)	VT TPS	3.4		EL&MP, manufacturer data, studies [9]
Delamping/fixture modification/remove lamps	CALMAC	16		EL(=16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Exit Signs (CFL hardwire kit, LED, or electroluminescent)	CALMAC	15; 16		EL(=15 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Halogen Lamp	CALMAC	0.6		EL(=0.6 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Halogen Bulbs (infra-red)	VT TRM	4,000 hrs (rated)		EL(most IR halogens have a rated lifetime of 4,000 hrs; depending on hrs of operation, lifetime can differ according to "operating hours by building type" table on page 112 of VT TRM [44]) & MP(assumed to be 1.0)
HID Fixture	CALMAC	10; 16		EL(=10 [5]; 16 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID Fixture (w/electronic ballast)	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "operating hours by building type" table on page 121 of VT TRM [44]) & MP(assumed to be 1.0)
Induction Lamps	CALMAC	1.7		EL(=1.7 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Induction Fixture	CALMAC	16		EL(=16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Indoor/Outdoor System Modification	CALMAC	15; 16		EL(=15 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
SPC Lighting	CALMAC	16		EL(=16 [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Electronic Ballast (for display case)	CALMAC	16		EL(=16 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
CFL Fixture (vapor-proof)	VT TPS	10.05		EL(=15 without MP, 10.05 with MP) & MP(=0.67), manufacturer data, studies [9]
Fluorescent Fixture	VT TPS	15		EL&MP, manufacturer data, studies [9]
Ballast (integrated metal halide)	VT TPS	3.4		EL&MP, manufacturer data, studies [10]
Metal Halide Fixture	VT TPS	15		EL&MP, manufacturer data, studies [9]
Halogen Bulb (infrared)	VT TPS	1.3		EL&MP, manufacturer data, studies [10]
High Pressure Sodium (HPS)	DEER	16	-	EL(=16) [19] [20]
Low Pressure Sodium (LPS)	DEER	16	-	EL(=16) [19] [20]
Fluorescent Fixture (w/electronic ballast)	DEER	-	11	EL(=11) [19] [20] [21]
Fluorescent Fixture (w/dimming electronic ballast)	DEER	-	11	EL(=11) [19] [20] [21]
De-lamp (from fixture)	DEER	11	-	EL(=11) [19] [20] [21]
Electroluminescent Exit Signs	DEER	16		EL(=16) [19] [20]

C&I Measures	Utility/Study	Current Value (in Years, or Hours if Indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
		Retrofit	New Construction	
Integral CFL (Education - Primary School)	DEER	5.6		EL(=5.6) [33] [35]
Integral CFL (Education - Secondary School)	DEER	3.5		EL(=3.5) [33] [35]
Integral CFL (Education - Community College)	DEER	2.1		EL(=2.1) [33] [35]
Integral CFL (Education - University)	DEER	2.6		EL(=2.6) [33] [35]
Integral CFL (Grocery)	DEER	1.4		EL(=1.4) [33] [35]
Integral CFL (Health/Medical - Hospital)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Health/Medical - Nursing Home)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Hotel)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Motel)	DEER	0.9		EL(=0.9) [33] [35]
Integral CFL (Lodging - Guest Rooms)	DEER	7		EL(=7) [33] [35]
Integral CFL (Manufacturing - Light Industrial)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Office - Large)	DEER	2.9		EL(=2.9) [33] [35]
Integral CFL (Office - Small)	DEER	3.2		EL(=3.2) [33] [35]
Integral CFL (Restaurant - Sit-Down)	DEER	2.3		EL(=2.3) [33] [35]
Integral CFL (Restaurant - Fast-Food)	DEER	1.3		EL(=1.3) [33] [35]
Integral CFL (Retail - 3-Story Large)	DEER	1.9		EL(=1.9) [33] [35]
Integral CFL (Retail - Single-Story Large)	DEER	1.8		EL(=1.8) [33] [35]
Integral CFL (Retail - Small)	DEER	2.1		EL(=2.1) [33] [35]
Integral CFL (Storage - Conditioned)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Storage - Unconditioned)	DEER	2.8		EL(=2.8) [33] [35]
Integral CFL (Warehouse - Refrigerated)	DEER	3.1		EL(=3.1) [33] [35]
Modular CFL	DEER	12	-	EL(=12) [20] [23] [33] [34]
CFL Fixture	Sku	12; 16		EL(=12 [17] [36]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Electronic Ballast (non-dimming or dimming)	Sku	10; 11; 16		EL(=10 [36]; 11 [17]; 16 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fluorescent Lamps	Sku	5		EL(=5 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

C&I Measures	Current Value (in Years, or Hours if indicated)*			Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Delamp/reflectors	Sku	11		EL(=11) [17] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Optical Reflectors	Sku	10	12	Retrofit: EL(=10 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies) New Construction: EL(=12 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID (interior)	Sku	16		EL(=16) [17] [18] [36] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HID Fixture Upgrade (pulse start Metal Halide)	CT-07	13	15	[48]
	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or from "operating hours by building type" table on page 73 of VT TRM [44]) & MP(assumed to be 1.0)
CFL Bulb	Sku	5-9.4; 5.8-14		EL(=5-9.4 [18]; 5.8-14 [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TRM	10,000 hrs (rated)		EL(most CFL's have a rated lifetime of 10,000 hrs; depending on hrs of operation, lifetime can differ according to prescriptive application form or from reference tables on page 78 of VT TRM [44]) & MP(assumed to be 1.0)
CFL Bulb (Education - Primary School)	Sku	5.56		EL(=5.56 based on 1,440 operating hrs) [37]
CFL Bulb (Education - Secondary School)	Sku	3.47		EL(=3.47 based on 2,305 operating hrs) [37]
CFL Bulb (Education - Community College)	Sku	2.11		EL(=2.11 based on 3,792 operating hrs) [37]
CFL Bulb (Education - University)	Sku	2.6		EL(=2.6 based on 3,073 operating hrs) [37]
CFL Bulb (Grocery)	Sku	1.37		EL(=1.37 based on 5,824 operating hrs) [37]
CFL Bulb (Health/Medical - Hospital)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Health/Medical - Nursing Home)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Hotel)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Motel)	Sku	0.92		EL(=0.92 based on 8,736 operating hrs) [37]
CFL Bulb (Lodging - Guest Rooms)	Sku	6.99		EL(=6.99 based on 1,145 operating hrs) [37]
CFL Bulb (Manufacturing - Light Industrial)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Office - Large)	Sku	2.92		EL(=2.92 based on 2,739 operating hrs) [37]
CFL Bulb (Office - Small)	Sku	3.21		EL(=3.21 based on 2,492 operating hrs) [37]
CFL Bulb (Restaurant - Sit-Down)	Sku	2.32		EL(=2.32 based on 3,444 operating hrs) [37]
CFL Bulb (Restaurant - Fast-Food)	Sku	1.29		EL(=1.29 based on 6,188 operating hrs) [37]
CFL Bulb (Retail - 3-Story Large)	Sku	1.88		EL(=1.88 based on 4,259 operating hrs) [37]
CFL Bulb (Retail - Single-Story Large)	Sku	1.83		EL(=1.83 based on 4,368 operating hrs) [37]
CFL Bulb (Retail - Small)	Sku	2.15		EL(=2.15 based on 3,724 operating hrs) [37]
CFL Bulb (Storage - Conditioned)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Storage - Unconditioned)	Sku	2.8		EL(=2.8 based on 2,860 operating hrs) [37]
CFL Bulb (Warehouse - Refrigerated)	Sku	3.08		EL(=3.08 based on 2,600 operating hrs) [37]
Dairy Farm Hard-wired Vapor-Proof CFL Fixture (w/electronic ballast)	VT TRM	10		EL(=10 adjusted for persistence from engineering measure life of 15 yrs; operating hours of 2,679 [38]) & MP(assumed to be 67%)
Dairy Farm Vapor-Proof Fluorescent Fixture (w/electronic ballast)	VT TRM	15		EL(=15; operating hrs of 2,679 [38]) & MP(assumed to be 1.0)
Fluorescent High-Bay Fixtures (T5)	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 97 of VT TRM [44]) & MP(assumed to be 1.0)
T5 Fixtures and Lamp/Ballast Systems	VT TRM	15		EL(=15; operating hours are collected from prescriptive application form or by using "interior lighting operating hours by building type" table on page 127 of VT TRM [44]) & MP(assumed to be 1.0)
Low-Voltage Tungsten Halogen Fixtures	CT-07	13	15	[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Lighting Controls				
Occupancy Sensors	NG	9	10	EL and Measure Persistence [1]
	VEIC	10		EL(=10; operating hours are collected from prescriptive application form by using "interior lighting operating hours by building type" table on page 66 of VT TRM [44]) & MP(assumed to be 1.0)
	CT		15	EL(=15 years Operating Hours taken from Table 2.0.0 page 233 [3]); no source listed
	CT-07	9	10	[48]
	PSNH	9	10	EL and Measure Persistence [1]
	CALMAC	8; 10		EL(=8 [4] [6] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [9]
Daylight Dimming	NG	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		EL(=10; operating hours are collected from prescriptive application form by using "interior lighting operating hours by building type" table on page 66 of VT TRM [44]) & MP(assumed to be 1.0)
	PSNH	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	9	10	[48]
	VT TPS	10		EL&MP, manufacturer data, studies [9]
	DEER	16		EL(=16) [32]
Photocell	CALMAC	8; 10		EL(=8 [4] [8]; 10 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Timeclock	CALMAC	8		EL(=8 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	8		EL(=8) [20] [22]
Lighting Controls	CALMAC	15; 16		EL(=15 [5]; 16 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Other Lighting Controls	VT TPS	10		EL&MP, manufacturer data, studies [9]
Day Lighting Controls	CALMAC	10; 16		EL(=10 [5]; 16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Plug Load Sensor	CALMAC	10		EL(=10 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Bi-level Switching	VT TPS	10		EL&MP, manufacturer data, studies [9]
More Efficient Lighting Design	VT TPS	20		EL&MP, manufacturer data, studies [11]
Occupancy Sensor (wall box)	DEER	8		EL(=8) [19] [20] [22]
Occupancy Sensor (plug loads)	DEER	10		EL(=10) [20] [22]
Photocell (w/timeclock)	DEER	8		EL(=8) [19] [20] [22]
Sweep Controls	CT-07	10	15	[48]

C&I Measures	Current Value (in Years, or Hours If Indicated)*			Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Packaged AC/HP	NG		15	HVAC
	VEIC	10		EL and Measure Persistence [1]
	CT	12	12; 15	EL (=12 years Air source heat pump =15 years Water and Ground source heat pump; 6,000 Operating Hours for heat pump from Table 2.0.0 page 233 [3]); no source listed
	PSNH		15	EL and Measure Persistence [1]
	CT-07	13	15	[48]
	VT TRM		15	EL(=15; operating hours are 800 cooling full load hours and 1600-2200 heating full load hours according to page 37 in VT TRM) & MP(assumed to be 1.0), no source listed
Chillers	NG		20	EL and Measure Persistence [1]
	VEIC	25		EL(=25; operating hours are site-specific based on engineering estimates according to page 37 of VT TRM) & MP(assumed to be 1.0), no source listed
	CT		18; 23	EL (=23 years Water cooled, =18 years Air cooled; Operating Hours are custom based on Customer Load Profile); no source listed
	PSNH		20	EL and Measure Persistence [1]
	CT-07	9	10	[48]
	VT TPS	-	25	EL&MP, manufacturer data, studies [9]
	DEER	-	20	EL(=20) [32]
Enthalpy Economizer	CT-07	10	15	[48]
	VEIC	14		
	VT TPS		7	EL(=10 without MP, 7 with MP) & MP(=0.7), manufacturer data, studies [9]
	DEER		15	EL(=15) [30] [31]
	VT TRM		9.8	EL(=9.8, adjusted for persistence from 14 yrs engineering measure life; typical annual hours of savings is 4,438 [42]) & MP(assumed to be 70% [43])
Custom HVAC Equipment or Systems	NG	13		EL and Measure Persistence [1]
	PSNH	13		EL and Measure Persistence [1]
Unitary	VEIC	15		
	CT		14	EL (=14 years 6,000 Operating Hours for heat pump from Table 2.0.0 page 233 [3]); no source listed
Ventilation CO2 Controls	CT		14; 15	EL (=14 years Unitary HVAC, =15 Air Handling Units installation; Operating Hours are site specific); no source listed
Heat Exchangers (liquid suction)	CALMAC		16	EL(=16 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
AC	CALMAC		15; 15.4	EL(=15 [4] [6] [8]; 15.4 [5]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Boiler	CALMAC		19.5; 20	EL(=19.5 [4]; 20 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Cooling Tower/Evap Condenser	CT-07	13	15	[48]
	CALMAC		15	EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Furnace	CALMAC		25	EL(=25 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Window Glazing (high VLT and high shade coefficient)	CALMAC		24	EL(=24 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Space Heating/Efficient Design (gas)	CALMAC		15	EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Insulation	CALMAC		20	EL(=20 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Reflective Window Film/Window Treatment	CT-07		10	[48]
Heat Pump (split system or ground source or w/integrated water heating)	CALMAC		10	EL(=10 [4] [5] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	CALMAC		15	EL(=15 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Packaged HVAC Systems	CALMAC		15; 16	EL(=15 [5] [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Chillers (water-cooled)	CALMAC		20	EL(=20 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Evaporative Coolers	CT-07	13	15	[48]
	CALMAC		15	EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
HVAC/Refrigeration - SPC	CALMAC		20	EL(=20 [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
AC (gas)	CALMAC		20	EL(=20 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Water Heater (gas)	CALMAC		15	EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	13 or 15	EL(=13 for lower efficiencies less than 70%, and 15 for higher efficiencies) [32]
DHW Boiler (gas)	CALMAC		24	EL(=24 [4] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Central AC	VT TPS		15	EL&MP, manufacturer data, studies [9]
	Sku		15	EL(=15) [17] [18] [36] & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Chiller (tune-up/diagnostics)	VT TPS		10	EL&MP, manufacturer data, studies [11]
Heat Pump (air to air or ground source)	VT TPS		15	EL&MP, manufacturer data, studies [12]
Heat Pump (hydronic)	VT TPS		20	EL&MP, manufacturer data, studies [13]
Solar Water Heating System	CT-07		20	[48]
	VT TPS		15	EL&MP, manufacturer data, studies [14]
Heat Recovery	CT-07		15	[48]
Heat Recovery (rotary)	VT TPS		23	EL&MP, no source listed
Kiln/Oven/Furnace (with or without heat recovery)	DEER		10	EL(=10) [23]
	CALMAC		25	EL(=25 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)

C&I Measures	Utility/Study	Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
		Retrofit	New Construction	
Point of Use Water Heater	CT-07	12		[48]
	VT TPS	10		EL&MP, manufacturer data, studies [12]
Heat Pump Water Heater	CT-07	12		[48]
	VT TPS	14		EL&MP, manufacturer data, studies [12]
Demand Controlled Ventilation	VT TPS	10		EL&MP, manufacturer data, studies [9]
Water Heater (point of use)	DEER	20		EL(=20) [26] [27]
Water Heater (electric)	DEER	-	15	EL(=15) [20] [26]
Water Heater (heat pump)	DEER	-	10	EL(=10) [32]
Low Flow Aerators	DEER	9	-	EL(=9) [29]
Low Flow Showerheads	DEER	10	-	EL(=10) [32]
Pipe Wrap	DEER		15	EL(=15) [32]
VAV Variable Speed Drive VAV System Components	CT-07	13	15	[48]
Ventilation or Box Fans or High Volume Low Speed Fans	DEER		10	EL(=10) [28]
Variable Air Volume Box	DEER		10	EL(=10) [23]
Fans (high volume low speed)	VT TPS		12	EL&MP, manufacturer data, studies [11]
Insulation (ceiling/roof/floor)	CT-07		25	[48]
	DEER	20	-	EL(=20) [32]
Tank Wrap	DEER		10	EL(=10) [23]
Windows (low SHGC or high performance glass)	CT-07		20	[48]
	DEER		20	EL(=20) [32]
Windows (double pane low-e)	VT TPS		30	EL&MP, manufacturer data, studies [12]
Chilled or Hot Water Loop Pump (variable flow or w/VSD)	DEER		10	EL(=10) [23]
Indirect Evap Cooling (central or packaged system)	DEER		15	EL(=15) [32]
Heat Exchanger (air to air)	DEER		10	EL(=10) [23]
Economizer (maintenance)	DEER		3	EL(=3) [23]
Split/Packaged AC/HP	DEER		15 or 20	EL(=15 for <760k, 20 for >=760k) [32]
Room AC	VT TRM		10	EL(=10; operating hours are 800 cooling full load hours) & MP(assumed to be 1.0), no source listed
Proper HVAC Sizing (comprehensive track)	VT TRM		15 ; 25	EL(=same measure life as HVAC equipment measures such as packaged AC/HP and chillers) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone oil)	VT TRM		10	EL(=10) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone gas)	VT TRM		13	EL(=13) & MP(assumed to be 1.0), no source listed
Hot Water Heater (stand-alone kerosene)	VT TRM		15	EL(=15) & MP(assumed to be 1.0), no source listed
Hot Water Heater (Indirect-fired Storage Tank)	VT TRM		15	EL(=15) & MP(assumed to be 1.0), no source listed
Hot Water Heater (Instantaneous)	VT TRM		13	EL(=13) & MP(assumed to be 1.0), no source listed
Boiler	VT TRM		25	EL(=25) & MP(assumed to be 1.0), no source listed
Furnace	VT TRM		20	EL(=20) & MP(assumed to be 1.0), no source listed
Room Space Heater	VT TRM		15	EL(=15) & MP(assumed to be 1.0), no source listed
Envelope Measures	VT TRM		30	EL(=30) & MP(assumed to be 1.0), no source listed
Chiller Strainer	CT-07		20	[48]
Movable Window Insulation	CT-07		10	[48]
Roof Spray Cooling	CT-07		15	[48]
Plenum/Attic Insulation	CT-07		14	[48]
Plate/Heat Pipe Type Heat Recovery System	CT-07		18	[48]
Rotary Type Heat Recovery System	CT-07		14	[48]
Economizer -Air/Water	CT-07	10	15	[48]
Low-Leakage Damper	CT-07		12	[48]

C&I Measures		Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
HVAC Controls				
Programmable Thermostat	NG	8		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	PSNH	8		(Small Retrofit Only) EL and Measure Persistence [1]
	VT TPS	5		EL&MP, manufacturer data, studies [11]
EMS	NG	10	15	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	PSNH	10	15	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07	15		[48]
	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	VT TPS	10		EL&MP, manufacturer data, studies [15]
	Skv	14; 15		EL(=14 [17] [36]; 15 [18]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Dual Enthalpy Economizer Controls	NG		10	EL and Measure Persistence [1]
	CT		14; 15	EL (=14 years rooftop DX, =15 years air handler); no source listed
	PSNH		10	EL and Measure Persistence [1]
Hotel Occupancy Sensors	NG	10		EL and Measure Persistence [2]
	PSNH	10		EL and Measure Persistence [2]
Bypass/Delay Timer	CALMAC	15; 16		EL(=15 [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Set-Back Thermostat	CALMAC	10; 11		EL(=10 [5]; 11 [4] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Timeclock	CT-07	10		[48]
	CALMAC	10		EL(=10 [4] [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Reduce Internal Load	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Energy Reduction	CALMAC	10		EL(=10 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Water Heater Controls	CALMAC	15		EL(=15 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
EMS (optimization)	VT TPS	5		EL&MP, manufacturer data, studies [16]
Retrocommissioning	VT TPS	7		EL&MP, manufacturer data, studies [15]
Variable Speed Drive Control (VSD)	VT TPS	20		EL&MP, manufacturer data, studies [11]
Heat Pump Variable Speed Drive	CT-07	13	15	[48]

<u>C&amp;I Measures</u>	Utility/Study	Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
		Retrofit	New Construction	
Timedclock (for circulation pump, non weather-sensitive)	DEER	10		EL(=10) [23]
Timedclock (for circulation pump, weather-sensitive)	DEER	15		EL(=15) [32]
Chilled Water Reset	DEER	10	-	EL(=10) [23]
Hot Water Reset	DEER	10		EL(=10) [23]
Reducing Overventilation	DEER	10		EL(=10) [23]
2-Speed Motor Control in Rooftop Units	CT-07	15	20	[48]
Energy Efficient Packaged Terminal Units	CT-07	13	15	[48]
Dehumidifiers	CT-07	13	15	[48]
Induced Draft Cooling Towers	CT-07	13	15	[48]
Cooling Tower Fan Pony Motor	CT-07	13	15	[48]
Variable Frequency Pump Drive (Solid State)	CT-07	13	15	[48]
Zoned Circulator Pump System	CT-07	15	15	[48]
Make-up Air Unit for Exhaust Hood	CT-07	15	15	[48]
Pipe and Duct Systems	CT-07	20	20	[48]
Paddle Type Air De-stratification Fan	CT-07	10	10	[48]
Duct Type Air De-stratification System	CT-07	15	15	[48]
Electric Spot Radiant Heat	CT-07	10	10	[48]
Automatic Energy Management Controls	CT-07	10	15	[48]
Occupancy Sensor Ventilation Control	CT-07	10	15	[48]
Variable Inlet Vane Control	CT-07	10	15	[48]



C&I Measures		Current Value (in Years, or Hours if Indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Other Measures				
Motors	NG	15	20	EL and Measure Persistence [1]
	VEIC	20		EL(=20 [39]; a more accurate lifetime can be found if customer provides annual operating hours or if not available then refer to "annual motor operating hours" table on p.17 of VT TRM to find operating hours by building type [47]; for all unlisted motors use 4,500 hrs [40]) & MP(assumed to be 1.0)
	CT		17	EL (=17 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed
	PSNH	15	20	EL and Measure Persistence [1]
	CT-07	15	20	[48]
	CALMAC	15; 15.3		EL(=15 [5] [6] [8]; 15.3 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	DEER	-	15	EL(=15) [19] [26] [27]
VFD on HVAC Fans	NG	13	15	EL and Measure Persistence [1]
	VEIC	15		
	CT		15	EL (=15 years, Operating Hours taken from Table 2.0.0 page 233 [3]), no source listed
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5] [8]; 16 [6]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
	Sku	16		EL(=16 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on non-HVAC Fans	NG	13	15	EL and Measure Persistence [1]
	VEIC	10		
	PSNH	13	15	EL and Measure Persistence [1]
	CALMAC	15; 16		EL(=15 [5] [8]; 16 [6]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on CT/Chilled Water Pump	NG	13		EL and Measure Persistence [1]
	VEIC	15 (HVAC) 10 (Process)		EL(=15 for non-process VFD; 10 for process) & MP(assumed to be 1.0; National Grid evaluated persistence and estimated a factor of 97% but given that the discounted value of a 3% degradation in 5 years is minimal, no persistence reduction has been applied; footnote 3 on page 22 in VT TRM [41])
	PSNH	13		EL and Measure Persistence [1]
	CALMAC	16; 20		EL(=16 [4]; 20 [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Fan Control	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	15		
	PSNH	10		(Small Retrofit Only) EL and Measure Persistence [1]
Door Heater Control	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
	VEIC	10		
	CT		15	EL (=15 years); no source listed
Cooler Shut Off	PSNH	10		(Small Retrofit Only) EL and Measure Persistence [1]
	NG	10		(Small Retrofit Only) EL and Measure Persistence [1]
Vending Machine	NG	5		(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	15		
	PSNH	5		(Large Retrofit Only) EL and Measure Persistence [1]
	DEER	10		EL(=10) [24] [25]
Vending Machine (non-refrig)	NG	5		(Large Retrofit Only) EL and Measure Persistence [1]
	PSNH	5		(Large Retrofit Only) EL and Measure Persistence [1]
	DEER	10		EL(=10) [24] [25]

C&I Measures	Utility/Study	Current Value (in Years, or Hours if indicated)*		Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
		Retrofit	New Construction	
Industrial Refrig Compressors	NG	18	20	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	13		
	PSNH	18	20	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07		20	[48]
Refrigeration Controls	NG	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	CT-07		10	[48]
	VEIC	10		
	CT		15	EL (=15 years evaporator fan); no source listed
Commercial Refrig Compressors	PSNH	9	10	(Large Retrofit Only) EL and Measure Persistence [1]
	NG	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	13		
	PSNH	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
15-75 HP Efficient Compressor	CT-07		20	[48]
	NG	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	PSNH	13	15	(Large Retrofit Only) EL and Measure Persistence [1]
	VEIC	14		EL and Measure Persistence [1]
Dryer	PSNH		15	EL and Measure Persistence [1]
	NG	13	15	EL and Measure Persistence [1]
Custom Process Cooling	PSNH	13	15	EL and Measure Persistence [1]
	NG	5,10,13	5,10,15	EL and Measure Persistence [1]
Custom Process Equipment	PSNH	5,10,13	5,10,15	EL and Measure Persistence [1]
	VEIC	10		
VFD - process	NG	13	15	EL and Measure Persistence [1]
Custom Compressed Air	PSNH	13	15	EL and Measure Persistence [1]
	NG	13		EL and Measure Persistence [1]
Custom Non-Lighting Measures	PSNH	13		EL and Measure Persistence [1]
	NG	5		EL and Measure Persistence [1]
Custom O&M Projects	PSNH	5		EL and Measure Persistence [1]
	NG		20	EL and Measure Persistence [1]
Custom Building Shell	PSNH		20	EL and Measure Persistence [1]
	NG		11 - 20	EL and Measure Persistence [1]
Custom Comprehensive Design Project	PSNH		11 - 20	EL and Measure Persistence [1]
	NG		11 - 20	EL and Measure Persistence [1]
Custom Comprehensive Chiller Project	PSNH		11 - 20	EL and Measure Persistence [1]
	VEIC	15		
VFD - non process	VEIC	30		
Energy Star Transformers	VEIC	4		
Refrig Case Covers-strip curtains	VEIC	5		
Refrig Case Covers-continuous covers	VEIC	15		
Refrigeration Economizer	VEIC	9		
Commercial Reach-In Refrigerator	VEIC	9		
Commercial Reach-In Freezer	VEIC			

C&I Measures	Current Value (in Years, or Hours if indicated)*			Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc.
	Utility/Study	Retrofit	New Construction	
Permanent Split Capacitor Motors & ECM	VEIC	15		
Vending Machine Occupancy Controls	CT		10	EL (=10 years); no source listed
Audit	CALMAC	3		EL(=3 [7] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Pump Test	CALMAC	15		EL(=15 [5] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
ASD	CALMAC	15; 16		EL(=15 [5] [8]; 16 [4]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD on Dairy Vacuum Pump	DEER	10	-	EL(=10), no source listed [23]
VSD on Supply Fan Motors	DEER	10		EL(=10) [23]
VFD (unspecified application)	Sku	10		EL(=10 [17] [36]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
Pump Repair	Sku	9;11	-	EL(=9 [36]; 11 [17]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies)
VFD for Environmental Remediation Projects	VT TRM	12		EL(=12; each project's expected life is 4 yrs but VFD's will be used for multiple projects, expected engineering life of 15 yrs reduced for expected downtime between projects) & MP(assumed to be 1.0; National Grid evaluated persistence and estimated a factor of 97% but given that the discounted value of a 3% degradation in 5 years is minimal, no persistence reduction has been applied; footnote 7 on page 26 in VT TRM [41])
Heat Pump VSD	CT-07	13	15	[48]
Cool Thermal Storage	CT-07	15		[48]
Refrigeration - Central Air Cooled	CT-07	20		[48]
Refrigeration - Central Water Cooled	CT-07	20		[48]
Mechanical Subcooling	CT-07	15		[48]
Ambient Subcooling	CT-07	15		[48]
Auto Cleaning System for Condensor Tubes	CT-07	10		[48]
Hot Gas Bypass Defrost	CT-07	10		[48]
Defrost Control Optimization	CT-07	10		[48]
Open or Enclosed Display Cases	CT-07	10		[48]
Case Cover	CT-07	10		[48]
Polyethylene Strip Curtain	CT-07	3		[48]
Vertical Door Levelers	CT-07	15		[48]
High-Low Freezer/Cooler Dimmers	CT-07	10		[48]
Oversized Condensers	CT-07	15		[48]
Low Case HVAC Returns	CT-07	10		[48]
Demineralized Water for Ice	CT-07	10		[48]
Low Emissivity Ceiling Surface	CT-07	15		[48]
Ice Temp Sensor	CT-07	10		[48]
Hot Gas Regeneration	CT-07	10		[48]
Air Compressor	CT-07	13	15	[48]
Refrigerated Air Dryer	CT-07	13	15	[48]

\* Measure life values may vary by type of installation (i.e., retrofit/early replacement, new construction/replace on burnout)

# Commercial/Industrial Data Sources

Utility/Study	Detail
NG	[1] Measure Life Study, prepared for The Massachusetts Joint Utilities by ERS, 11/17/05, p. 1-4.
NG	[2] Deemed value
CT	[3] UI/CL&P C&LM Program Savings Documentation -2006
CALMAC	[4] Original EUL: Pacific Gas & Electric Company (PG&E)
CALMAC	[5] Original EUL: Southern California Edison Company (SCE)
CALMAC	[6] Original EUL: San Diego Gas and Electric Company (SDG&E)
CALMAC	[7] Original EUL: Southern California Gas Company (SoCalGas)
CALMAC	[8] Proposed EUL
VT TPS	[9] Efficiency Vermont Technical Reference User Manual (TRM) No. 2004-31
VT TPS	[10] Efficiency Vermont Technical Reference User Manual (TRM) Update - Portfolio of New and Revised Measures - Portfolio Update No. 38
VT TPS	[11] Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region, June 2004, GDS Associates
VT TPS	[12] Energy Efficiency and Renewable Energy Resource Development Potential in New York State - Final Report, Volume 5 Energy Efficiency Technical Appendices, August 2003
VT TPS	[13] Northeast Utilities, Action Program C&I Persistence Study, October 2001
VT TPS	[14] KeySpan Energy, 2005. Cost benefit analysis conducted for solar measures.
VT TPS	[15] The Maximum Achievable Cost Effective Potential for Natural Gas Energy Efficiency In the Service Territory of PNM, May 2005, GDS Associates
VT TPS	[16] CALIFORNIA STATEWIDE COMMERCIAL SECTOR NATURAL GAS ENERGY EFFICIENCY POTENTIAL STUDY, Study ID #SW061, May 2003, Prepared by Mike Rufo and Fred Coito KEMA-XENERGY Inc., Prepared
Sku	[17] DEER Newly Adopted EUL (2005)
Sku	[18] Interim/previous DEER EUL
DEER	[19] 2001 DEER Update, prepared for the California Energy Commission by Xenergy Inc., August 2001
DEER	[20] "Evaluation of Pacific Gas & Electric Company's 1997 Commercial Energy Efficiency Incentives Program: Lighting Technologies", prepared by Quantum Consulting, Inc., for Pacific Gas & Electric Company, March 1,
DEER	[21] "Energy Data Sourcebook for the US Residential Sector", Lawrence Berkeley Laboratory (LBL-40297 UC-1600), September, 1997
DEER	[22] "Review of Survey Data to Support Revisions to DOE's Dishwasher Test Procedure", Arthur D. Little Inc.,
DEER	[23] engineering judgement
DEER	[24] Memo from Gary Fernstrom, Pacific Gas & Electric, July, 2004
DEER	[25] "Final Report on Technology Energy Savings (DEER)", prepared by NEOS Corporation for the California Conservation Inventory Group, May 1994
DEER	[26] "Consortium for Energy Efficiency Residential Clothes Washer Initiative, 1996", revised 2002 by the Consortium for Energy Efficiency
DEER	[27] US DOE Technical Brief: "Demand (Tankless or Instantaneous) Water Heaters", January, 2004
DEER	[26] "Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program", prepared for Southern California Edison by Kema-Xenergy, February 13, 2004
DEER	[27] The Pacific Northwest's Regional Technical Forum as of November, 2003 ( <a href="http://rtf.nwppc.org/">http://rtf.nwppc.org/</a> )
DEER	[28] Design of High Volume Low Speed Fan Supplemental Cooling System in free stall barns, Kammel, David, et al. 2003. Wisconsin: Wisconsin Public Service
DEER	[29] "Measure Savings Algorithms and Cost Assumptions: Technical Reference Manual", Efficiency Vermont, Jan.
DEER	[30] ASHRAE manuals
DEER	[31] DEER 4.0 1996
DEER	[32] CALMAC Effective Useful Life Report, September 2000
DEER	[33] "CFL Metering Study", prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison by Kema Inc, February 25, 2005
DEER	[34] "Revised/Updated EULs Based on Retention and Persistence Studies Results", July 2005, SERA Inc.
DEER	[35] DEER
Sku	[36] A Priori Protocols EUL
Sku	[37] CFL_EUL.xls from Gary Cullen, Itron, 5/12/05
VT TRM	[38] Vermont State Screening Tool
VT TRM	[39] BPA Measure Life Study II, Skumatz
VT TRM	[40] E Source Technology Atlas Series Volume IV, Drivepower, p.32
VT TRM	[41] Persistence Study by National Grid, 1999
VT TRM	[42] bin hours at Burlington, VT
VT TRM	[43] agreement between DPS and EVT
VT TRM	[44] Impact Evaluation of Orange & Rockland's Small Commercial Lighting Program, 1993
VT TRM	[45] 5 yrs of metering on 235 outdoor circuits in New Jersey
VT TRM	[46] A Market Transformation Opportunity Assessment for LED Traffic Signals, 1998, by American Council for an Energy-Efficient Economy (ACEEE)
VT TRM	[47] Southeastern NY audit data
CT-07	[48] Commercial UI/CL&P C&LM Program Savings Documentation -2007 Table 1.4 C&I Lifetimes, Pg 222-224