# Measure Life Report

# Residential and Commercial/Industrial Lighting and HVAC Measures

*Prepared for*

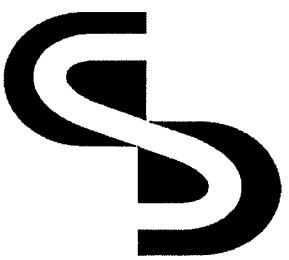
# The New England State Program Working Group (SPWG)

*For use as an*

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

*June 2007*

*Prepared and Submitted by:*

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# I. INTRODUCTION AND RESULTS

The New England State Program Working Group (SPWG)[1] 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.

[1] 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[2] 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

[2] 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.

| Table 1 - Residential Measures [Note 1] | |
|---|---|
| **Measure** | **Measure Life** |
| **Lighting** | |
| 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<br>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 |
| **Lighting Controls** | |
| Occupancy Sensors | 10 years |
| **Heating and Cooling** | |
| Heating & Cooling System | 18 years - replacement/retrofit<br>25 years - new construction (ESTAR Homes) |
| Air Conditioner or Heat Pump Commisioning<br>Air Conditioner or Heat Pump ECM<br>Refrigerant Charge - at time of installation | 18 years |
| Heating & Cooling System repair/tune-up/recharge | 5 years |
| Room/Window AC replacement | 12 years |
| **Ventilation** | |
| 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] |
| **HVAC Controls** | |
| 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

| Table 2 - Commercial & Industrial Measures | | |
|---|---|---|
| Measure* | Measure Life** | |
| | Retrofit | New |
| **Lighting** | | |
| 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 |
| **Lighting Controls** | | |
| Occupancy Sensors | 9 years | 10 years |
| Daylight Dimming | 9 years | 10 years |
| **HVAC** | | |
| Packaged AC/HP | N/A | 15 years |
| Chillers | N/A | 23 years [Note 3] |
| Enthalpy Economizer | 7 years [Note 4] | 10 years |
| **HVAC Controls** | | |
| Programmable Thermostat | 8 years | N/A |
| Energy Management Systems (EMS) | 10 years | 15 years |
| **Motors** | | |
| 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<br>- Retail | 6 years or<br>product specific | 6 years - MA, VT, RI 2003 Residential Lighting Impact Study<br>(based on 3.2 hours/day & 7000 hour bulb life)<br>6.4 years - 3.4 hours/day 8000 hours (NH Retail Sales)<br>8.1 years - 3.4 hours/day 10,000 hours (NH Retail Catalog) |
| Bulb - CFL screw base<br>- 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 persistance and should be calculated as follows:<br>(rated bulb life / annual burn time) * measure persistence<br><br>5 years - CT: 2.6 hours/day is default includes 20% reduction for cycling. Full range of values is 5 years thru 13 years<br>6.4 years - VT: 3 hours/day 7000 hours<br>7.6 years - ME: 2.7 hours/day 7500 hours<br>8.6 years - NH: Energy Star Homes Program)<br>9 years - MA, RI |
| Exit Sign - LED (multifamily installations) | 13 years - retrofit<br>15 years - new construction | Per commercial/industrial sector values documentation |
| Interior Fixture - CFL hardwired | 20 years | 20 years - CT, NH<br>15 years - MA, RI |
| Exterior Fixture - CFL hardwired | 15 years | 15 years - MA, RI<br>20 years - CT, NH<br>16, 20 years - CALMAC |
| Fixture - CFL table lamp | 8 years | 5 years (MA, RI) EL&MP<br>8 years - 3.2 hours/day (CT)<br>10 years (NH, VT)<br>- 16 years DEER |
| Fixture - CFL Torchiere | 8 years | 8 years - CT<br>5 years - MA, RI<br>10 years - NH, VT, ME<br>9 years - DEER; 9.4 years - CALMAC |
| **Residential Lighting Controls** | | |
| Occupancy Sensors | 10 years | 10 years - consistent with C/I sector Retrofit value<br>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<br>18 years - NH, VT: Retrofit Central AC<br>19 years - CT: Heat Pump, Central AC<br>20 years - MA, RI, VT: Furnace, Burner Replacement<br>25 years - VT: Central AC<br>15 years - Skumatz, 16,18 years CALMAC Heat Pump<br>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<br>Cooling: 25 years - MA, RI, NH, VT<br>Cooling: 19 years - CT<br>Hot Water: 25 years - MA, RI, NH, VT<br>Hot Water: 15 years - CT |
| AC or HP Commisioning<br>AC or HP ECM<br>Refrigerant Charge<br>- at time of installation | 18 years | 18 years - MA, RI<br>19 years - CT |
| Heating & Cooling System repair/tune-up/recharge | 5 years | 5 years - MA, RI: reflects estimate of remaining life<br>5 years - NH: for weatherization program |
| Room/Window AC replacement | 12 years | 12 years - MA, RI, NH<br>13 years - VT, CT, NH - Energy Star Program<br>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<br>12 years - NH<br>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)<br>15 years - MA, RI, VT<br>25 years - CT (Single Family, Multi Family) |
| Air Sealing | 15 years | 15 years - MA, RI, NH<br>20 years - VT (Retrofit) |
| Insulation | 25 years | 25 years - MA, RI, CT, NH (Retrofit)<br>20 years - VT (Retrofit)<br>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)<br>25 years - MA, RI<br>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<br>20 years - MA, RI<br>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<br>20 years - CT - Low Income<br>25 years - MA, RI<br>10, 13 years - VT TRM |
| Tank Temperature Turn-Down | 4 years [Note 1] | 4 years - VT (Single Family)<br>5 years - CT (Low Income Retrofit)<br>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<br>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)<br>6 years - MA, RI, NH (mostly small business applications) |
| Fluorescent Fixture | 13 years | 15 years | 13 years (retrofit), 15 years (new) - MA, RI, NH<br>11,16 years - Skumatz, 16 years CALMAC |
| Hardwired CFL | 13 years | 15 years | 13 years (retrofit), 15 years (new) - MA, RI, NH<br>15 years (retrofit and new) - VT and VT TPS<br>10, 16 years - CALMAC |
| LED Exit Signs | 13 years | 15 years | 13 years (retrofit), 15 years (new) - MA, RI, NH<br>10 years (retrofit) - VT and VT TPS<br>15,16 years - CALMAC, 16 years - DEER |
| HID (interior and exterior) | 13 years | 15 years | Retrofit: 13 years (MA, RI, NH)<br>Retrofit: 15 years (VT)<br>New: 15 years (MA, RI, NH, VT) |
| **Commercial & Industrial Lighting Controls** | | | |
| Occupancy Sensors | 9 years | 10 years | 9 years (retrofit) - MA, RI, NH<br>10 years (new) - MA, RI, NH<br>10 years (retrofit and new) - VT<br>15 years (new) - CT<br>8, 10 years - CALMAC |
| Daylight Dimming | 9 years | 10 years | 9 years (retrofit), 10 years (new) - MA, RI, NH<br>10 years (retrofit) - VT<br>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)<br>12 years - CT (new - air source heat pump)<br>15 years - ASHRAE, CALMAC, VT TRM |
| Chillers | N/A | 23 years [Note 1] | 23 years - CT (new - water cooled)<br>18 years - CT (new - air cooled)<br>20 years (new) - MA, RI, NH, CT-07<br>23 years - ASHRAE<br>20 years - CALMAC, DEER (new) |
| Enthalpy Economizer | 7 years [Note 2] | 10 years | 7 years - CT-07 (retrofit)<br>7 years - VT TPS<br>9.8 years (new) - adj from 14 years engineering life VT TRM, 14 years VEIC<br>15 years - DEER |
| **Commercial & Industrial HVAC Controls** | | | |
| Programmable Thermostat | 8 years | N/A | 8 years - MA, RI, NH (retrofit)<br>10 years - VT (retrofit)<br>5 years - VT TPS |
| Energy Management Systems (EMS) | 10 years | 15 years | 10 years - MA, RI, NH, VT (retrofit)<br>15 years - CT-07 (retrofit)<br>15 years - MA, RI, NH, CT-07 (new)<br>15 years - CALMAC, 14, 15 years Skumatz |
| **Commercial & Industrial Motors** | | | |
| Motors | 15 years | 20 years | 15 years - MA, RI, NH (retrofit)<br>13 years - CT-07 (retrofit)<br>20 years - VT (retrofit)<br>20 years - MA, RI, NH, CT-07 (new)<br>17 years - CT (new)<br>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)<br><br>New Construction: EL(=6.4; based on 1,102 operating hrs/yr) & MP(assumed to be 1.0), no source listed<br>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)<br>& 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;<br>RS EL=6.4 8,000 hours at 3.4 hours/day;<br>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] |
| | 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 | 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) |
| | DEER | 9.4 | | EL(=9.4) [6] [32] |
| Fixture - CFL modular | 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) |
| | DEER | 16 | - | EL(=16) [6] [29] [30] [34] |
| Fixture - CFL table lamp | 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] |
| | DEER | 16 | | EL(=16) [6] [29] [34] |
| Fixture - CFL unspecified | 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])<br>& 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 |
| Fixture - Fluorescent | NG | 20 | | EL and Measure Persistence |
| | VEIC | 20 | | New Construction: EL(=20; operating hrs are 1,102/yr) & MP(assumed to be 1.0), no source listed<br>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)<br>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:<br>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)<br><br>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)<br>& 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/timeclock | | | | |
| 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<br>LI SF: 10 | 13<br>LI SF: 10 | Retrofit: EL(=10 [41]) & MP(assumed to be 1.0)<br>New Construction: EL(=13, average life of water heater)<br>& MP(assumed to be 1.0), no source listed<br>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<br>LI SF: 4 | Retrofit: EL(=4) & MP(assumed to be 1.0), no source listed<br>New Construction: EL(=7, average life of water heater) & MP(assumed to be 1.0), no source listed<br>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)<br>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 Progam [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] |
| | VT TRM | LI MF: 25 | | EL(=25) & MP(assumed to be 1.0), no sources listed |
| Ventilation Fan | PSNH | | 19 | Energy Star Homes Progam [17] |
| | VEIC | | 10 | |
| Insulation (ceiling/floor) | 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 Commisioning<br>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<br>LI SF MF: 9 | 9<br>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 |
|---|---|
| NG | [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 |
| CT, DEER | [6] "CFL Metering Study", prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison by Kema Inc, February 25, 2005 |
| CT | [7] Northeast Utilities and United Illuminating Retail/Point of Purchase Lightin gProgram Impact Evaluation, RLW Analytics, April 2003 |
| CT | [8] Home Energy Magazine online September/October 1994 |
| ME | [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 Torchiere Assumptions, EPA Savings Calculator – Torchieres |
| ME | [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 2 |
| 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 |
| VT TPS | [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 |
| DEER | [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 |
| VT TRM | [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 | Utility/Study | Current Value (In Years, or Hours if indicated)* Retrofit | New Construction | Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| 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] [6] [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 Hallide 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 | | Current Value (in Years, or Hours if indicated)* | | Basis and Documentation Source(s)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| | Utility/Study | 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 | | Current Value (In Years, or Hours if Indicated)* | | Basis and Documentation Source(s)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| | Utility/Study | 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)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>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)<br>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])<br>& 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 | Utility/Study | Current Value (in Years, or Hours if indicated)* Retrofit | New Construction | Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| **Lighting Controls** | | | | |
| Occupancy Sensors | NG | 9 | 10 | EL and Measure Persistence [1] |
| | VEIC | 10 | | EL(=10; operating hours are collected from prescriptive application formor 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 formor 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 | Utility/Study | Current Value (in Years, or Hours if indicated)* Retrofit | New Construction | Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| | | | | HVAC |
| Packaged AC/HP | NG | | 15 | EL and Measure Persistence [1] |
| | VEIC | 10 | | |
| | 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] |
| | CALMAC | 10 | | EL(=10 [4] [5] [6] [8]) & MP(persistence value not specified, however sources referenced included numerous persistence and retention studies) |
| Heat Pump (split system or ground source or w/integrated water heating) | 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] |
| | VT TPS | 23 | | EL&MP, no source listed |
| Heat Recovery (rotary) | DEER | 10 | | EL(=10) [23] |
| Kiln/Oven/Furnace (with or without heat recovery) | 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)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>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<br>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 (mainenance) | 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 | Utility/Study | Current Value (in Years, or Hours if indicated)* Retrofit | New Construction | Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| 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] |
| | Sku | 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] |

| C&I Measures | | Current Value (in Years, or Hours if indicated)* | | Basis and Documentation Source(s)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| | Utility/Study | Retrofit | New Construction | |
| Timeclock (for circulation pump, non weather-sensitive) | DEER | 10 | | EL(=10) [23] |
| Timeclock (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 Destratification Fan | CT-07 | 10 | 10 | [48] |
| Duct Type Air Destratification System Air Curtain | 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 | Utility/Study | Current Value (in Years, or Hours if indicated)* Retrofit | New Construction | Basis and Documentation Source(s) Basis = Equipment Life Only or EL and Measure Persistence Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| **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 |
| | PSNH | 10 | | (Small Retrofit Only) EL and Measure Persistence [1] |
| Cooler Shut Off | NG | 10 | | (Small Retrofit Only) EL and Measure Persistence [1] |
| | PSNH | 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 | | Current Value (in Years, or Hours if indicated)* | | Basis and Documentation Source(s)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>Sources: Manufacturer's data, studies, stipulated values, etc. |
|---|---|---|---|---|
| | Utility/Study | 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 |
| | PSNH | 9 | 10 | (Large Retrofit Only) EL and Measure Persistence [1] |
| Commercial Refrig Compressors | NG | 13 | 15 | (Large Retrofit Only) EL and Measure Persistence [1] |
| | VEIC | 13 | | |
| | PSNH | 13 | 15 | (Large Retrofit Only) EL and Measure Persistence [1] |
| | CT-07 | 20 | | [48] |
| 15-75 HP Efficient Compressor | NG | 13 | 15 | (Large Retrofit Only) EL and Measure Persistence [1] |
| | PSNH | 13 | 15 | (Large Retrofit Only) EL and Measure Persistence [1] |
| Dryer | NG | | 15 | EL and Measure Persistence [1] |
| | VEIC | 14 | | |
| | PSNH | | 15 | EL and Measure Persistence [1] |
| Custom Process Cooling | NG | 13 | 15 | EL and Measure Persistence [1] |
| | PSNH | 13 | 15 | EL and Measure Persistence [1] |
| Custom Process Equipment | NG | 5,10,13 | 5,10,15 | EL and Measure Persistence [1] |
| | PSNH | 5,10,13 | 5,10,15 | EL and Measure Persistence [1] |
| VFD - process | VEIC | 10 | | |
| Custom Compressed Air | NG | 13 | 15 | EL and Measure Persistence [1] |
| | PSNH | 13 | 15 | EL and Measure Persistence [1] |
| Custom Non-Lighting Measures | NG | 13 | | EL and Measure Persistence [1] |
| | PSNH | 13 | | EL and Measure Persistence [1] |
| Custom O&M Projects | NG | 5 | | EL and Measure Persistence [1] |
| | PSNH | 5 | | EL and Measure Persistence [1] |
| Custom Building Shell | NG | | 20 | EL and Measure Persistence [1] |
| | PSNH | | 20 | EL and Measure Persistence [1] |
| Custom Comprehensive Design Project | NG | | 11 - 20 | EL and Measure Persistence [1] |
| | PSNH | | 11 - 20 | EL and Measure Persistence [1] |
| Custom Comprehensive Chiller Project | NG | | 11 - 20 | EL and Measure Persistence [1] |
| | PSNH | | 11 - 20 | EL and Measure Persistence [1] |
| VFD - non process | VEIC | 15 | | |
| Energy Star Transformers | VEIC | 30 | | |
| Refrig Case Covers-strip curtains | VEIC | 4 | | |
| Refrig Case Covers-continuous covers | VEIC | 5 | | |
| Refrigeration Economizer | VEIC | 15 | | |
| Commercial Reach-In Refrigerator | VEIC | 9 | | |
| Commercial Reach-In Freezer | VEIC | 9 | | |

| C&I Measures | | Current Value (in Years, or Hours if indicated)* | | Basis and Documentation Source(s)<br>Basis = Equipment Life Only or EL and Measure Persistence<br>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 |
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