**Janet M. Audunson, P.E., Esq.**
Senior Counsel II

June 30, 2016

**VIA ELECTRONIC DELIVERY**

Honorable Kathleen H. Burgess
Secretary to the Commission
New York State Public Service Commission
Three Empire State Plaza, 19th Floor
Albany, New York 12223-1350

**RE: Case 14-M-0101 – Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision**

**Case 15-M-0252 – In the Matter of Utility Energy Efficiency Programs**

**Matter 15-01319 – In the Matter of the New York State Technical Resource Manual New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures, Version 4**

**Measure Updates**

Dear Secretary Burgess:

In accordance with the requirements set forth in the Order Adopting Regulatory Policy Framework and Implementation Plan issued by the Commission on February 26, 2015 in Case 14-M-0101, Niagara Mohawk Power Corporation d/b/a National Grid, The Brooklyn Union Gas Company d/b/a National Grid NY and KeySpan Gas East Corporation d/b/a National Grid (collectively "National Grid"), Central Hudson Gas and Electric Corporation, Consolidated Edison Company of New York, Inc., National Fuel Gas Distribution Corporation, New York State Electric & Gas Corporation, Orange and Rockland Utilities, Inc., and Rochester Gas and Electric Corporation (collectively the "Joint Utilities") assumed responsibility for maintaining the New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs–Residential, Multi-Family, and Commercial/Industrial Measures ("NY TRM") on June 1, 2015.

The TRM Management Committee ("MC") has met regularly, and in the course of so doing, has reviewed and unanimously approved the addition of one (1) new measure, Residential Gas Clothes Dryer, effective immediately and three (3) measure updates attached hereto to Version 4 of the NY TRM to be effective January 1, 2017. It should be noted that if a measure

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or technology is included in or added to the NY TRM, it does not mean that such measure or technology is expressly supported or endorsed by the member companies of the TRM MC. In addition, it should be noted that there is no guarantee that measures or technologies included in the NY TRM will be offered by utility energy efficiency programs prospectively.

Respectfully submitted,

/s/ *Janet M. Audunson*
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Enc.

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Debra LaBelle, DPS Staff, w/enclosure (via electronic mail)
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Paul Romano, Con Edison, w/enclosure (via electronic mail)
Rosanna Jimenez, Con Edison, w/enclosure (via electronic mail)
Steve Mysholowsky, Con Edison, w/enclosure (via electronic mail)
John Zabliski, NYSEG/RG&E, w/enclosure (via electronic mail)
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Sandra Eason-Perez, Orange&Rockland, w/enclosure (via electronic mail)
Jeremy Scott, Orange & Rockland, w/enclosure (via electronic mail)
Evan Crahen, National Fuel, w/enclosure (via electronic mail)
Ty Holt, National Fuel, w/enclosure (via electronic mail)

## Table of Revisions/Changes

| Revision Number | Addition/ Revision | Issue Date | Effective Date | Measure | Description of Change | Location/Page in TRM |
|---|---|---|---|---|---|---|
| 6-16-1 | A | 6/30/2016 | 6/30/2016 | Res - Clothes Dryer | New measure added | Pg. 5 |
| 6-16-2 | R | 6/30/2016 | 1/1/2017 | Res - Blower Fan - with electronically commutated (EC) motor, For Furnace Distribution | Update EFLH factors | Pg. 90 |
| 6-16-3 | R | 6/30/2016 | 1/1/2017 | Appendix P - EUL Updates for Furnaces and Boilers | EUL Updates | Pg. 535 |
| 6-16-4 | R | 6/30/2016 | 1/1/2017 | Res - HVAC Boiler Reset Controls | Update the “units” variable | Pg. 119 |

**Note:** Revisions and additions to the measures listed above were undertaken by the Joint Utilities Technical Resource Manual (TRM) Management Committee between April 1, 2016 – June 30, 2016.

## CLOTHES DRYER

### Measure Description

This section describes the energy savings attributable to a residential clothes dryer meeting the criteria established under the Energy Star® Program, Version 1.0, effective January 1, 2015[1]. Energy Star® clothes dryers have a higher combined energy factor (CEF) and save energy through a combination of more efficient drying and reduced runtime of the drying cycle. More efficient drying is achieved through increased insulation, modifyied operating conditions, improvedair circulation, and greater efficiency of motors. Reduced dryer runtime is achieved through automatic termination of the dryer cycles based on temperature and moisture sensors. Clothes dryers originally qualified for the Energy Star® label in May 2014. Clothes dryers that have earned this label are approximately 20% more efficient than non-qualified models.[2]

The algorithms, inputs, and savings presented below assume a normal replacement scenario.

### Method for Calculating Annual Energy and Peak Coincident Demand Savings

*Annual Electric Energy Savings*

$$\Delta\text{kWh} = \text{Cycles}_{\text{annual}} \times \left(\frac{\text{Load}_{\text{weight, base}} \times \text{Percent}_{\text{Electric, base}}}{\text{CEF}_{\text{base}}} - \frac{\text{Load}_{\text{weight, eff}} \times \text{Percent}_{\text{Electric, eff}}}{\text{CEF}_{\text{eff}}}\right)$$

*Peak Coincident Demand Savings*

$$\Delta\text{kW} = \frac{\Delta\text{kWh}}{\text{Hours}} \times \text{CF}$$

*Annual Gas Energy Savings*

$$\Delta\text{therms} = \text{Cycles}_{\text{annual}} \times \left(\frac{\text{Load}_{\text{weight, base}} \times \text{Percent}_{\text{Gas, base}}}{\text{CEF}_{\text{base}}} - \frac{\text{Load}_{\text{weight, eff}} \times \text{Percent}_{\text{Gas, eff}}}{\text{CEF}_{\text{eff}}}\right) \times 3{,}412 \times \frac{1}{100{,}000}$$

**Where:**

| Variable | Description |
|---|---|
| $\text{Load}_{\text{weight base}}$ | The average total weight (in pounds) of clothes per drying cycle. If unknown, assume standard size. |
| $\text{Load}_{\text{weight eff}}$ | The average total weight (in pounds) of clothes per drying cycle. If unknown, assume standard size. |
| $\text{Cycles}_{\text{annual}}$ | Number of dryer cycles per year. |
| $\text{Percent}_{\text{Gas base}}$ | The percentage of energy consumed by the baseline unit derived from gas. |
| $\text{Percent}_{\text{Gas eff}}$ | The percentage of energy consumed by the efficient unit derived from gas. |

[1] Energy Star® Program Requirements Product Specification for Clothes Dryers, Eligibility Criteria Version 1.0. https://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Final%20Version%201%200%20Clothes%20Dryers%20Program%20Requirements.pdf

[2] Efficiency of Energy Star® products. https://www.energystar.gov/products/appliances/clothes_dryers

| | |
|---|---|
| $Percent_{Electric\ base}$ | The percentage of energy consumed by the baseline unit derived from electricity. |
| $Percent_{Electric\ eff}$ | The percentage of energy consumed by the efficient unit derived from electricity. |
| $CEF_{base}$ | Combined energy factor (CEF) in pounds per kWh of the baseline unit. Based on federal standard and adjusted based on the DOE's 2013 Notice of Proposed Rulemaking, in accordance with the Energy Star savings calculator. |
| $CEF_{eff}$ | Combined energy factor (CEF) in pounds per kWh of the efficient unit. Based on and in accordance with the Energy Star requirements. |
| 3,412 | Conversion factor from kWh to Btu. There are 3,412 Btu per kWh. |
| 100,000 | Conversion factor from Btu to therms. There are 100,000 Btu per therm. |
| Hours | Annual run hours of clothes dryer. |
| CF | Summer peak coincidence factor for measure. |

**Summary of Variables and Data Sources**

**Coincidence Factor (CF)**

The recommended value for the coincidence factor is 0.042.[3]

**Baseline Efficiencies from which Savings are Calculated**

The Energy Star® combined energy factors (CEF) in pounds per kWh of the baseline unit, based on federal standard and adjusted based on the DOE's Final Rule regarding Test Procedures for Residential Clothes Dryers, are shown in the table below.[1]

| **Variable** | **Dryer Type** | | | | |
|---|---|---|---|---|---|
| | *Vented Gas Dryer* | *Ventless or Vented Electric, Standard ≥ 4.4 $ft^3$* | *Ventless or Vented Electric, Compact (120V) < 4.4 $ft^3$* | *Vented Electric, Compact (240V) < 4.4 $ft^3$* | *Ventless Electric, Compact (240V) < 4.4 $ft^3$* |
| $CEF_{eff}$ | 3.48 | 3.93 | 3.80 | 3.45 | 2.68 |
| $CEF_{base}$ | 2.84 | 3.11 | 3.01 | 2.73 | 2.13 |
| $Load_{weight}$ | 8.45 | 8.45 | 3.00 | 3.00 | 3.00 |
| $Cycles_{annual}$ | 283 | 283 | 283 | 283 | 283 |
| $Percent_{Gas\ Base}$ | 0.95 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Percent_{Gas\ eff}$ | 0.95 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Percent_{Electric\ Base}$ | 0.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| $Percent_{Electric\ eff}$ | 0.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hours | 290 | 290 | 290 | 290 | 290 |

[3] Pennsylvania Technical Reference Manual, State of Pennsylvania, 2016. Based on an 8,760 analysis of electric clothes dryers. The coincidence factor is calculated according to the PJM peak definition. http://www.puc.pa.gov/pcdocs/1370278.docx

**Compliance Efficiency from which Incentives are Calculated**

The installed equipment must be on the Energy Star® qualified product list. Savings will be calculated using the algorithm above and information collected in the rebate application.

**Operating Hours**

Operating hours for residential clothes dryers are outlined in the preceding section "Baseline Efficiencies from which Savings are Calculated."

**Effective Useful Life (EUL)**

Years: 14
Source: Based on an average estimated range of 12-16 years. ENERGY STAR Market & Industry Scoping Report. Residential Clothes Dryers. November 2011.

**Ancillary Fossil Fuel Savings Impacts**

**Ancillary Electric Savings Impacts**

**References**


1. Energy Star® Program Requirements Product Specification for Clothes Dryers, Eligibility Criteria Version 1.0. https://www.energystar.gov/sites/default/files/specs//ENERGY%20STAR%20Final%20Version%201%200%20Clothes%20Dryers%20Program%20Requirements.pdf
2. Test Procedures for Residential Clothes Dryers; Final Rule. Federal Register, Department of Energy (DOE). August 14, 2014. http://www.regulations.gov/contentStreamer?documentId=EERE-2011-BT-TP-0054-0024&disposition=attachment&contentType=pdf
3. Savings Calculator for Energy Star® Qualified Appliances. http://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
4. Dryer Field Study, Northwest Energy Efficiency Alliance (NEEA), 2014. https://www.neea.org/docs/default-source/reports/neea-clothes-dryer-field-study.pdf


Note: Clothes dryer installations must adhere to the requirements set forth in the Mechanical Code of New York State, Section 504.

**Record of Revision**

| Record of Revision Number | Issue Date |
|---|---|
| 6-16-1 | 6/30/2016 |
| | |
| | |

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## BLOWER FAN - WITH ELECTRONICALLY COMMUTATED (EC) MOTOR, FOR FURNACE DISTRIBUTION

### Measure Description

This section covers the electricity savings associated with electronically commutated (EC) motors used on gas furnace distribution system supply fans. Energy savings are realized through reductions in fan power due to improved motor efficiency and variable flow operation.

### Method for Calculating Annual Energy and Peak Coincident Demand Savings

*Annual Electric Energy Savings*

$$\Delta kWh = \text{units x (Deemed Annual Electric Energy Savings)}$$

*Peak Coincident Demand Savings*

$$\Delta kW = N/A$$

*Annual Gas Energy savings*

$$\Delta therms = N/A$$

**where:**

| | |
|---|---|
| ΔkWh | = Annual electric energy savings |
| ΔkW | = Peak coincident demand electric savings |
| Δtherms | = Annual gas energy savings |
| units | = The number of measures installed under the program |

### Summary of Variables and Data Sources

The deemed annual electric energy savings are determined for each New York location by scaling the energy savings from the 2014 Wisconsin ECM metering study using heating degree days and cooling degree days for each location. The Wisconsin study metered furnaces in 67 homes in Wisconsin in 2012 and 2013.

The total energy savings for each New York location are provided in the "Total" columns below. The energy savings are determined by summing the savings attributed to each furnace mode: circulation, heating and cooling. Homes with a central A/C receive the savings in the "Total (with Central A/C)" column. Homes without a central A/C receive the savings in the "Total (without Central A/C)": these savings exclude the "Cooling Mode" savings.

| City | Energy Saved (kWh) | | | | | HDD | CDD |
|---|---|---|---|---|---|---|---|
| | Total (with Central A/C) | Total (without Central A/C) | Circulation Mode | Heating Mode | Cooling Mode | | |
| Albany | 416 | 342 | 211 | 131 | 74 | 6,680 | 597 |
| Binghamton | 399 | 352 | 211 | 141 | 47 | 7,193 | 382 |
| Buffalo | 408 | 341 | 211 | 130 | 67 | 6,617 | 544 |
| Massena | 417 | 372 | 211 | 161 | 45 | 8,196 | 363 |
| Poughkeepsie | 416 | 333 | 211 | 122 | 83 | 6,210 | 671 |
| NYC | 446 | 303 | 211 | 92 | 143 | 4,671 | 1,160 |
| Syracuse | 412 | 342 | 211 | 131 | 70 | 6,651 | 570 |
| Madison, WI | 425 | 355 | 211 | 144 | 70 | 7,332 | 568 |

Peak savings are not reported in the Wisconsin ECM metering study, and as such are assumed to be zero. The HDD and CDD values are based on 30-year averages of U.S annual climate normals between 1981 and 2010 using base 65° F.[1]

The unadjusted savings from the 2014 WI ECM metering study are provided here for reference:

| WI Furnace Operating Mode | ΔkWh |
|---|---|
| Circulation | 211 |
| Heating | 144 |
| Cooling | 70 |
| **Total** | 425 |

## Coincidence Factor (CF)

The recommended value for the coincidence factor is 0.0

## Baseline Efficiencies from which Savings are Calculated

Baseline efficiency calculated from existing baseline furnace with split-capacitor blower motor on distribution system.

## Compliance Efficiency from which Incentives are Calculated

## Operating Hours

[1] Annual/Seasonal Normals at http://www.ncdc.noaa.gov/cdo-web/datatools/normals.

## Effective Useful Life (EUL)

Years: 15
Source: DEER

## Ancillary Fossil Fuel Savings Impacts

## Ancillary Electric Savings Impacts

## References


1. Cadmus, June 4, 2014, ECM Metering Results Memo. Delivered to Carol Stemrich, PSC of Wisconsin.


**Record of Revision**

| Record of Revision Number | Issue Date |
|---|---|
| 0 | 10/15/2010 |
| 1 | 3/31/2016 |
| 6-16-2 | 6/30/2016 |

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# APPENDIX P

## *EFFECTIVE USEFUL LIFE (EUL)*

### SINGLE AND MULTI-FAMILY RESIDENTIAL MEASURES

| Category | Single and Multi-family Residential Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| **Appliance** | Clothes Washer | Single-family | 11 | DEER |
| | | Multi-family | 14 | NWPPC |
| | Clothes Dryer | Residential | 14 | ENERGY STAR Market&Industry Scoping Report[125] |
| | Dehumidifier | Residential | 12 | US EPA[126] |
| | Dishwasher | Residential | 11 | DEER |
| | Refrigerator Replacement | Residential | 17 | NYS DPS |
| **Appliance Recycling** | Air Conditioner - Room (RAC), Recycling | Residential | 3 | DEER[127] |
| | Refrigerator Recycling | Residential | 5 | DEER[128] |
| | Freezer Recycling | Residential | 4[129] | DEER[130] |
| **Building Shell** | Air Leakage sealing | Residential | 15 | GDS[131] |
| | Hot Water Pipe Insulation | Residential | 13 – Electric<br>11 – Natural Gas | DEER |
| | Opaque Shell Insulation | Residential | 30 | Energy Trust of Oregon and CEC[132] |
| | Window & Through the wall AC cover and Gap Sealer | Residential | 5 | See note below[133] |
| | Windows Replacement | Residential | 20 | DEER |
| **Domestic Hot Water** | Domestic Hot Water Tank Blanket | Residential | 10 | NYSERDA[134] |
| | Heat Pump Water Heater – Air Source (HPWH)[135] | Residential | 10 | DEER[136] |

125 ENERGY STAR Market & Industry Scoping Report: Residential Clothes Dryer, November 2011.
126 ENERGY STAR Dehumidifier Calculator. www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDehumidifier.xls
127 *Ibid.*
128 DEER 2008 RUL assumptions, based on 1/3 of DEER EUL.
129 The hypothetical remaining years of use in the absence of removal of the appliance by the program.
130 DEER 2008 RUL assumptions, based on 1/3 of DEER.
131 *Ibid.*
132 http://energytrust.org/library/reports/resource_assesment/gasrptfinal_ss103103.pdf
133 At least one manufactures warranty period.. www.gss-ee.com/products.html
134 NYSERDA Energy Smart Program Deemed Savings Database. Rev 9 – 062006.
135 Electric heat pump used for service hot water heating.
136 Effective Useful Life tables to be used by California IOUs for 2009-2011 program cycle planning from the California DEER website: www.deerurces.com.

| Category | Single and Multi-family Residential Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| | Indirect Water Heater | Residential | 13 | DEER[137] |
| | Storage Tank Water Heater | Residential | 15 | DEER |
| | Instantaneous Water Heater | Residential | 20 | DEER |
| **Category** | **Single and Multi-family Residential Measures** | **Sector** | **EUL (years)** | **Source** |
| **Domestic Hot Water - Control** | Faucet- Low flow Aerator | Residential | 10 | DEER |
| | Shower Restriction Valve | Residential | 9 | UPC[138] |
| | Shower Head – Low flow | Residential | 10 | DEER |
| **Heating, Ventilation and Air Conditioning (HVAC)** | Air Conditioner and Heat pump – Refrigerant charge correction | Residential | 10 | DEER |
| | Air Conditioner and Heat pump – Right sizing | Residential | 15 | DEER[139] |
| | Air Conditioner, Central (CAC) | Residential | 15 | DEER[140] |
| | Air Conditioner – Room (RAC) | Residential | 9 | DEER |
| | Boiler, Hot Water – Steel Water Tube | Residential | 24 | ASHRAE Handbook, 2015 |
| | Boiler, Hot Water – Steel Fire Tube | Residential | 25 | ASHRAE Handbook, 2015 |
| | Boiler, Hot Water – Cast Iron | Residential | 35 | ASHRAE Handbook, 2015 |
| | Boiler, Steam – Steel Water Tube | Residential | 30 | ASHRAE Handbook, 2015 |
| | Boiler, Steam – Steel Fire Tube | Residential | 25 | ASHRAE Handbook, 2015 |
| | Boiler, Steam – Cast Iron | Residential | 30 | ASHRAE Handbook, 2015 |
| | Circulator – with Electronically Commuted Motor (ECM) for Hydronic distribution | Residential | 15 | DEER[141] |
| | Duct sealing and Insulation | Residential | 18 | DEER |
| | Fan Motor – with Electronically Commuted Motor (ECM) for Furnace Distribution | Residential | 15 | DEER |
| | Furnace, Gas Fired | Residential | 18 | ASHRAE Handbook, 2015 |
| | Furnace Tune-up | Residential | 5 | See note below[142] |
| | Heat Pump - Air Source (ASHP) | Residential | 15 | DEER[143] |

137 Based on EUL of unfired (electric) water heater tank from DEER

138 UPC certification under the International Association of Plumbing and Mechanical Officials standard IGC 244-2007a. This standard includes a lifecycle test consisting of 10,000 cycles without fail. 10,000 cycles is the equivalent of three users showering daily for more than nine years.

139 Savings assumed to persist over EUL of air conditioner or heat pump.

140 Effective Useful Life tables to be used by California IOUs for 2009-2011 program cycle planning. From the California DEER website: www.deeresidentialsources.com.

141 Based on DEER value for furnace fans.

142 Reduced from DEER value of 10 years.

| Category | Single and Multi-family Residential Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| | Heat Pump – Ground Source (GSHP) | Residential | 20 | US DOE |
| | Unit Heater, Gas Fired | Residential | 13 | ASHRAE Handbook 2015 |
| **HVAC - Control** | Outdoor Reset Control for Hydronic Boiler | Residential | 15 | ACEEE[144] |
| | Thermostat – Programmable Setback | Residential | 11 | DEER |
| | Thermostatic Radiator Valve | Multi-family | 12 | NYS DPS |

143 Effective Useful Life tables to be used by California IOUs for 2009-2011 program cycle planning. From the California DEER website: www.deeresidentialsources.com.

144 Potential for Energy Efficiency, Demand Response and Onsite Solar Energy in Pennsylvania, ACEEE report number E093, April 2009.

| Category | Single and Multi-family Residential Measures | | Sector | EUL (years) | Source |
|---|---|---|---|---|---|
| **Lighting** | Compact Fluorescent Lamp (CFL) | | Residential | Coupon – 5 | GDS |
| | | | | Direct Install – 7 | GDS |
| | | | | Markdown - 7 | GDS |
| | | | Multi-family Common area | 9,000 hrs/ annual lighting operating hrs | See note below[145] |
| | Light Fixture | Linear Fluorescent | Residential / Multi-family Common area | 70,000 hrs / annual lighting operating hrs, or 20 yrs (whichever is less) | DEER[146] |
| | | CFL | Residential / Multi-family Common area | 22,000 hrs / annual lighting operating hrs, or 20 yrs (whichever is less) | See note below[147] |
| **Lighting Control** | Stairwell Dimming Light Fixture/Sensor | | Multi-family | 12 | GDS[148] |

145 Multi-family common areas tend to have longer run hours than dwelling units. The default value from C&I lighting table is 7,665 hours per year.
146 A basis value of 70,000 hours, capped at 20 years, is common given redecoration patterns.
147 A basis value of 22,000 hour ballast life per US EPA, capped at 20 years as above (2.5 hours per day average lamp operation).
148 GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures, prepared for The New England State Program Working Group.

## COMMERCIAL AND INDUSTRIAL MEASURES

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| **Agricultural** | Engine Block Heater Timer | C&I | 8 | See note below[149] |
| **Appliance** | Electric Cooking Equipment (Oven, Fryer, Steamer) | C&I | 12 | DEER |
| | Gas Fired Cooking Equipment (Oven, Griddle, Fryer, Steamer) | C&I | 12 | DEER |
| | Refrigerator Replacement | C&I | 12 | DEER |
| **Appliance Control** | Vending Machine/ Novelty Cooler Time clock | C&I | 5 | DEER |
| **Building Shell** | Cool Roof | C&I | 15 | DEER |
| | Hot Water Pipe Insulation | C&I | 13 – Electric<br>11 – Natural Gas | DEER |
| | Window - Film | C&I | 10 | DEER |
| | Window - Glazing | C&I | 20 | DEER |
| | Opaque Shell Insulation | C&I | 30 | Energy Trust and CEC[150] |
| **Compressed Air** | Air Compressor Upgrade | C&I | 15 | Ohio TRM[151] |
| | Refrigerated Air Dryer | C&I | 15 | Ohio TRM |
| | Engineered Air Nozzle | C&I | 15 | PA Consulting for Wisconsin PSC[152] |
| | No Air Loss Water Drain | C&I | 15 | Ohio TRM[153] |
| **Domestic Hot Water (DHW)** | Domestic Hot Water Tank Blanket | C&I | 7 | DEER |
| | Indirect Water Heater | C&I | 15 | DEER[154] |
| | Storage Tank Water Heater | C&I | 15 | DEER |
| | Tankless Water Heater | C&I | 20 | DEER |
| | Heat Pump Water Heater - Air Source (HPWH) | C&I | 10 | DEER |
| **DHW - Control** | Faucet- Low Flow Aerator | C&I | 10 | DEER |
| | Showerhead – Low Flow | C&I | 10 | DEER |
| | Pre-rinse Spray Valve | C&I | 5 | GDS |

149 Based on EUL's for similar control technology.
150 Energy Trust uses 30 years for commercial applications. http://energytrust.org/library/reports/Residentialource_assesment/gasrptfinal_ss103103.pdf. CEC uses 30 years for insulation in Title 24 analysis.
151 Ohio Technical Reference Manual (TRM), which is based on a review of TRM assumptions from Vermont, New Hampshire, Massachusetts, and Wisconsin. Estimates range from 10 to 15 years. www.OhioTRM.org.
152 PA Consulting Group (2009). *Business Programs: Measure Life Study*, prepared for the State of Wisconsin Public Service Commission.
153 EUL for this measure is not available. Default to air compressor upgrade EUL from Ohio: TRM. www.OhioTRM.org.
154 EUL for commercial central water heater used.

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| Heating, Ventilation and Air Conditioning (HVAC) | | | | |
| | Air Conditioner and Heat Pump – Refrigerant Charge Correction | C&I | 10 | DEER |
| | Air Conditioner – Package (PTAC) | C&I | 15 | DEER |
| | Chiller – Air & Water cooled | C&I | 20 | DEER |
| | Chiller – Cooling Tower | C&I | 15 | DEER |
| | Combination Boiler and Water Heater | C&I | 20 | DEER[155] |
| | Condensing Gas-Fired Unit Heater for space heating | C&I | 18 | Ecotope[156] |
| | Duct Sealing and Insulation | C&I | 18 | DEER |
| | ECM Motors on HVAC Equipment, including fan powered terminal boxes, fan coils, and HVAC supply fans. | C&I | 15 | DEER[157] |
| | Economizer – Air Side, w/dual enthalpy control | C&I | 10 | DEER |
| | Boilers, Hot Water – Steel Water Tube | C&I | 24 | ASHRAE Handbook, 2015 |
| | Boilers, Hot Water – Steel Fire Tube | C&I | 25 | ASHRAE Handbook, 2015 |
| | Boilers, Hot Water – Cast Iron | C&I | 35 | ASHRAE Handbook, 2015 |
| | Boilers, Steam – Steel Water Tube | C&I | 30 | ASHRAE Handbook, 2015 |
| | Boilers, Steam – Steel Fire Tube | C&I | 25 | ASHRAE Handbook, 2015 |
| | Boilers, Steam – Cast Iron | C&I | 30 | ASHRAE Handbook, 2015 |
| | Furnace, Gas Fired | C&I | 18 | ASHRAE Handbook 2015 |
| | Heat Pump – Air Source, Package (PTHP) | C&I | 15 | DEER |
| | Infrared Gas Space Heater | C&I | 17 | GDS |
| | Unit Heater, Gas Fired | C&I | 13 | ASHRAE Handbook 2015 |
| HVAC - Control | Thermostat – Programmable Setback | C&I | 11 | DEER |
| | Boiler Reset Control | C&I | 15 | See note below[158] |
| | Demand Controlled Ventilation | C&I | 10 | DEER |
| | Energy Management System | C&I | 15 | DEER |

155 Based on DEER value for high efficiency boiler.
156 Ecotope Natural Gas Efficiency and Conservation Measure Resource Assessment (2003).
157 DEER value for HVAC fan motors.
158 Set to 15 years, consistent with Energy Management System (EMS) value in DEER.

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| | Hotel Occupancy Sensors for PTAC and HP Units | C&I | 8 | DEER[159] |
| | Steam Traps Repair/Replace | C&I | 6 | DEER |

159 DEER value for occupancy sensor controls. Hardwired (not battery powered) controls only.

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| Lighting | CFL Lamp | C&I | 9,000 hours /annual lighting operating hours | See note below[160] |
| | CFL Light Fixture | C&I | 12 | DEER |
| | Interior & Exterior, including linear fluorescent | C&I | 70,000 hours /annual lighting operating hours or 15 years, whichever is less | DEER[161] |
| | Interior Dry Transformers | C&I | 25 | See note below[162] |
| | LEDs Fixtures and Screw-In Lamps (other than refrigerated case) | C&I | 35,000 or 50,000 hours | DLC[163] |
| | | | 35,000 hours | Energy Star[164] |
| | | | 15,000 hours for decorative, or 25,000 for all other | Energy Star[165] |
| | | | 25,000 hours | Uncertified |
| | Refrigerated Case LED | C&I | 6 | NW RTF[166] |
| Lighting - Control | Interior & Exterior Lighting Control | C&I | 8 | DEER |
| | Stairwell Dimming Light Fixture/Sensor | C&I | 12 | GDS[167] |
| | Plug-Load Occupancy Sensor | C&I | 8 | DEER[168] |
| Motors and drives | Motor replacement (with HE motor) | C&I | 15 | DEER |
| | Variable Frequency Drive – | C&I | 15 | DEER |

160 Based on reported annual lighting operating hours; default value by space type in the technical manual (pp. 109-110).
161 Basis Value of 70,000 hours, capped at 15 years, to reflect C&I redecoration and business type change patterns.
162 25 yrs for new transformers is a conservative estimate based on literature review: DOE assumes typical service lifespan of 32 yrs; ASHRAE lists typical service life of 30 yrs.
163 Placed on the Qualified Products List by the Design Light Consortium ("DLC"); 35,000 or 50,000 hours according to the appropriate Application Category as specified in the DLC's Product Qualification Criteria, Technical Requirement Table version 2.0 or higher.
164 Placed on the Qualified Fixture List by Energy Star, according to the appropriate luminaire classification as specified in the Energy Star Program requirements for Luminaires, version 1.2. Divided by estimated annual use, but capped at 15 years regardless (consistent with C&I redecoration and business type change patterns.
165 Placed on the Qualified Lamp Products List by Energy Star, according to the appropriate lamp classifications as specified in the Energy Star Program Requirements for Integral LED Lamps, version 1.4. Divided by estimated annual use, but capped at 15 years regardless (consistent with C&I redecoration and business type change patterns)
166 Northwest Regional Technical Forum (RTF) value.
167 GDS Associates, Inc. (2007). Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures prepared for The New England State Program Working Group.
168 DEER value for lighting occupancy sensors.

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| | Fan and Pump | | | |

| Category | Commercial & Industrial Measures | Sector | EUL (years) | Source |
|---|---|---|---|---|
| **Refrigeration** | Air Cooled Refrigeration Condenser | C&I | 15 | DEER |
| | Equipment (Condensers, Compressors, and Sub-cooling) | C&I | 15 | DEER |
| | Fan Motor – Refrigerated Case and Walk-In Cooler, with ECM | C&I | 15 | DEER |
| | Refrigerated Case Night Cover | C&I | 5 | DEER |
| | Auto/Fast Close Door Walk-In Coolers/Freezers | C&I | 8 | DEER |
| | Strip Curtains and Door Gaskets for Reach-In or Walk-In Coolers/Freezers | C&I | 4 | DEER |
| **Refrigeration - Control** | Anti-Condensation Heater control | C&I | 12 | DEER |
| | Evaporator Fan Control | C&I | 16 | DEER |
| | Condenser Pressure and Temperature Controls | C&I | 15 | DEER |

**Record of Revision**

| Record of Revision Number | Issue Date |
|---|---|
| EUL's originally listed in July 18, 2011 Order | 7/18/2011 |
| Additional EUL's posted on web site | Subsequent to 7/18/2011 Order |
| 7-13-28 | 7/31/2013 |
| 6-14-1 | 6/19/2014 |
| 6-14-2 | 6/19/2014 |
| 6-15-4 | 6/1/2015 |
| 6-16-3 | 6/30/2016 |

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## *HEATING, VENTILATION AND AIR CONDITIONING (HVAC) – CONTROL*

### OUTDOOR RESET CONTROL, FOR HYDRONIC BOILER

**Measure Description**

Reset of hot water set point in single and multi-family residential buildings with zone thermostat control. The measure is assumed to be applied to existing non-condensing boiler systems. One outdoor reset control measure may be applied to each boiler unit.

**Method for Calculating Annual Energy and Peak Coincident Demand Savings**

*Annual Electric Energy Savings*

$$\Delta kWh = N/A$$

*Peak Coincident Demand Savings*

$$\Delta kW = N/A$$

*Annual Gas Energy Savings*

$$\Delta therms = units \times \left(\frac{kBTUh_{in}}{unit}\right) \times \left(\frac{EFLH_{heating}}{100}\right) \times F_{savings}$$

**where:**

| | |
|---|---|
| ΔkWh | = Annual electric energy savings |
| ΔkW | = Peak coincident demand electric savings |
| Δtherms | = Annual gas energy savings |
| units | = Number of reset controls installed under the program |
| EFLH | = Equivalent full-load hours |
| in | = Input capacity |
| heating | = Heating |
| CF | = Coincidence factor |
| KBTUh | = Annual gas input rating per unit in kBTU/hr |
| $F_{savings}$ | = Savings factor |
| 100 | = Conversion factor, (kBTUh/therm) |

**Summary of Variables and Data Sources**

| Variable | Value | Notes |
|---|---|---|
| $kBTUh_{in}$/unit | | From application. Use deemed value of 110 kBTU/hr if data not available. If vintage not known, use vintage weighted values. |
| $EFLH_{heating}$ | | Lookup by vintage and city. If vintage not known, use vintage weighted values. |

| Variable | Value | Notes |
|---|---|---|
| $F_{savings}$ | 0.05 | Recommended Energy Factor for boiler reset controllers in residential applications |

The input capacity (in 1,000 BTU/hr) of the boiler should be taken from the application. If the input capacity is not known, then use the following default values:

1. Single-family residential buildings, 110 kBTU/hr;
2. Multi-family buildings, input capacity can be estimated from the building type (low-rise or high-rise) and the building heated floor area using the data in the table below.

| City and Vintage | Boiler Size (BTU/hr-SF) | |
|---|---|---|
| | High-rise (more than 3 stories) | Low-rise (3 stories or less) |
| Albany old vintage | 20.2 | 26.0 |
| Albany average vintage | 15.4 | 17.0 |
| Albany new vintage | 9.9 | 10.0 |
| Buffalo old vintage | 18.0 | 23.5 |
| Buffalo average vintage | 13.8 | 14.9 |
| Buffalo new vintage | 8.8 | 9.1 |
| Massena old vintage | 22.7 | 28.8 |
| Massena average vintage | 17.7 | 18.8 |
| Massena new vintage | 11.3 | 11.2 |
| NYC old vintage | 13.7 | 19.2 |
| NYC average vintage | 10.6 | 11.8 |
| NYC new vintage | 6.8 | 7.6 |
| Syracuse old vintage | 18.6 | 24.6 |
| Syracuse average vintage | 14.3 | 15.8 |
| Syracuse new vintage | 9.1 | 9.5 |
| Binghamton old vintage | 19.0 | 24.6 |
| Binghamton average vintage | 14.6 | 15.9 |
| Binghamton new vintage | 9.3 | 9.5 |
| Poughkeepsie old vintage | 17.1 | 22.6 |
| Poughkeepsie average vintage | 13.2 | 14.4 |
| Poughkeepsie new vintage | 8.4 | 8.8 |

**Coincidence Factor (CF)**

The recommended value for the coincidence factor is: N/A.

**Baseline Efficiencies from which Savings are Calculated**

Constant hot water set point temperature of 180F$^{o}$.

**Compliance Efficiency from which Incentives are Calculated**

Reset hot water temperature to 160F$^{o}$.
Energy Factor ($F_{savings}$) of 0.05 shall be used.

### Operating Hours

Heating equivalent full-load hours for residential buildings were calculated from DOE-2.2 simulations of prototypical single-family buildings. See Appendix G.

### Effective Useful Life (EUL)

Years: 15
Source: ACEEE

### Ancillary Fossil Fuel Savings Impacts

### Ancillary Electric Savings Impacts

Lower set point temperature may cause hot water circulator to run longer cycles. Minor impact not accounted for in this procedure.

### References

1. Energy savings factor for residential applications taken from an article published by the Energy Solutions Center, a consortium of natural gas utilities, equipment manufacturers and vendors. www.energysolutionscenter.org/BoilerBurner/Eff_Improve/Efficiency/Boiler_Reset_Control.asp

### Record of Revision

| Record of Revision Number | Issue Date |
|---|---|
| 0 | 10/15/2010 |
| 6-16-4 | 6/30/2016 |

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