|  |  |  |
| --- | --- | --- |
| PUC logo | COMMONWEALTH OF PENNSYLVANIA  PENNSYLVANIA PUBLIC UTILITY COMMISSION  P.O. BOX 3265, HARRISBURG, PA 17105-3265 | **IN REPLY PLEASE REFER TO OUR FILE**  M‑2012-2313373 |

**July 30, 2014**

TO ALL INTERESTED PARTIES:

Re: Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2014 Update

Docket No. M-2012-2313373

On December 19, 2013, the Pennsylvania Public Utility Commission (Commission) entered a TRM Annual Update Order adopting the 2014 Technical Reference Manual (TRM) update in the above-referenced matter. The TRM Annual Update Order and 2014 TRM update are posted on the Commission’s website at: <http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/technical_reference_manual.aspx>.

With this Secretarial Letter, the Commission releases Errata to the 2014 TRM. The Errata correct the following:

* Pagination issues with the 2014 TRM. The pagination has been updated accordingly.
* An error in the default savings value for ground source heat pump (GSHP) desuperheaters. This error occurs in Section 2.1 – Electric HVAC (heating, ventilation and air conditioning). The fixed savings per desuperheater (EDSH) value should be 567 kilowatt-hours (kWh). The 2014 TRM included an EDSH of 576 kWh. This was clearly a transposition error during the 2014 TRM update. Pages 20 and 24 of the 2014 TRM have been updated to reflect the appropriate EDSH value of 567 kWh.
* A rounding error in the unit energy savings for light-emitting diode (LED) nightlights. This error occurs in Section 2.7 – LED Nightlights. The unit energy savings value should be 25.49 kWh. The 2014 TRM rounded that unit energy savings value to 22 kWh. Additionally, subsection 2.7.3 – Deemed Savings provides the delta (Δ) kWh algorithm which includes, after the 25.49 kWh value, language stating “(rounded to 22kWh).” The rounding error and statement are misleading and incorrect. Page 46 of the 2014 TRM has been updated to reflect a unit energy savings value of 25.49 kWh. Page 47 of the 2014 TRM has been updated to remove the “(rounded to 22kWh)” statement.
* An error in the deemed demand savings value for 7-plug power strips for entertainment centers. This error occurs in Section 2.12 – Smart Strip Plug Outlets. The deemed demand savings for a 7-plug power strip for entertainment centers should be 0.0082 kW. The 2014 TRM included, in subsection 2.12.4 – Deemed Savings, a deemed demand savings value of 0.82 kilowatts (kW) for a 7-plug power strip for an entertainment center. The value of 0.82 is incorrect. Page 71 of the 2014 TRM has been updated to reflect, in subsection 2.12.4, a deemed demand savings value of 0.0082 kW for 7-plug power strips for entertainment centers.
* Errors in Section 2.21 – Refrigerator/Freezer Recycling with and without Replacement. The errors are as follows:
  + The omission of replacement unit energy consumption (UEC) values for the replacement of a refrigerator with a non-ENERGY STAR refrigerator and for the replacement of a freezer with a non-ENERGY STAR freezer. The Tentative 2014 TRM proposed a replacement UEC value of 537 kWh for the replacement of a refrigerator with a new non-ENERGY STAR model and a replacement UEC value of 510 for the replacement of a freezer with a new non-ENERGY STAR model.[[1]](#footnote-1) These values were inadvertently omitted from the Final 2014 TRM, adopted in December of 2013. Page 114 of the 2014 TRM has been updated to include replacement UEC values of 537 kWh and 510 kWh for the replacement of refrigerators and freezers, respectively, with new non-ENERGY STAR models.
  + An incorrect intercept value in the UEC equation for an existing freezer that is being recycled. The intercept value for the UEC equation for an existing freezer should be -2.297. The 2014 TRM included an intercept value of 365.25 in the Freezer Unit Energy Consumption Equation table on page 116. This value is actually the value utilized to represent the number of days in a year in a separate part of the UEC equation. The Freezer Unit Energy Consumption Equation table on page 116 of the 2014 TRM has been updated to reflect the accurate -2.297 intercept value.
  + Incorrect information in Table 2-46: Default Savings Values for Residential Refrigerator Recycling Without Replacement With a New Refrigerator and in Table 2-47: Default Savings Values for Residential Freezer Recycling Without Replacement With a New Freezer. In Table 2-46 of the 2014 TRM, a variable exists for the size of the appliance. The 2014 TRM included units of volume in square feet for the sizing variable. The units should be volume in cubic feet. In Table 2-47 of the 2014 TRM, the appliance sizing variable is listed with units of volume in square feet. Again, this unit should be cubic feet. Table 2-47 of the 2014 TRM also contains a variable for the estimated UEC savings, in annual kWh per year, for a removed refrigerator that is not replaced. This language requires amendment to designate that the variable refers to the estimated UEC savings, in annual kWh per year, for a removed freezer that is not replaced as Table 2-47 is in reference to freezers, not refrigerators. Lastly, both Tables 2-46 and 2-47 require the removal of the word “savings” from their titles as the tables provide the equation inputs needed to calculate the UEC for removed refrigerators and freezers, respectively, that are not replaced, as well as the calculation of the default UEC value for refrigerators or freezers for each electric distribution company (EDC). Tables 2-46 and 2-47 on page 117 of the 2014 TRM have been updated accordingly.
  + Incorrect information in Table 2-48: Default Savings Values for Residential Refrigerator Recycling with Replacement with a New ENERGY STAR Refrigerator and in Table 2-49: Default Savings Values for Residential Freezer Recycling with Replacement with a New ENERGY STAR Freezer. In Table 2-48, a variable exists for the size of the appliance. The 2014 TRM included units of volume in square feet for the sizing variable. The units should be volume in cubic feet. Additionally, in Table 2-48, the dummy percentage of single-door appliances for Metropolitan Edison Company (Met-Ed) is stated as 61.00%. This value should be 0.61%. In Table 2-49 of the 2014 TRM, the appliance sizing variable is listed with units of volume in square feet. Again, this unit should be cubic feet. Also, the dummy percentage of chest appliances for West Penn Power Company (West Penn Power) is listed as 410.03%. This value should be 41.0%. Lastly, both Tables 2-48 and 2-49 require the removal of the word “savings” from their titles as the tables provide the equation inputs needed to calculate the UEC for removed refrigerators and freezers, respectively, that are replaced, as well as the calculation of the default UEC value for refrigerators or freezers for each EDC. Tables 2-48 and 2-49 on page 118 of the 2014 TRM have been updated accordingly.
* Errors in Table 2-66: Default Dishwasher Energy Savings. These errors occur in Section 2.26 – ENERGY STAR Dishwashers. The default energy savings in Table 2-66 should be: for electric water heating, 60.0 ΔkWh/year; for non-electric water heating, 26.4 ΔkWh/year; and for the default fuel mix, 40.8 ΔkWh/year. Table 2-66 in the 2014 TRM did not provide the correct default savings when calculated using the provided algorithm and the values to be inputted into that algorithm, as outlined in Table 2-65 on page 140. These were calculation errors that occurred during the 2014 TRM update. Table 2-66 on page 141 of the 2014 TRM has been updated to reflect the appropriate default savings values.
* Errors in the subscript designations in savings algorithms for compact fluorescent lighting (CFL) and LED lighting. These errors occur in Section 2.29 – ENERGY STAR Lighting. The errors are as follows:
  + The ΔkWh equation for ENERGY STAR Indoor CFL Fixtures (hard-wired, pin-based) should not include an LED subscript designation for the HVAC interactive effect for CFL energy variable. The correct variable should appear as IEkWh, instead of as IEkWh-LED, as was included in the 2014 TRM. This was an error during the updating process and may be confusing as it implies that LED information is a necessary input into a CFL algorithm. In the 2014 TRM, the IEkWh variable was already defined as being the HVAC Interactive Effect for CFL energy and, as such, is the appropriate variable to be utilized. Page 149 of the 2014 TRM has been updated to reflect the appropriate subscripting.
  + The ΔkWpeak equation for ENERGY STAR Indoor CFL Fixtures (hard-wired, pin-based) should not include an LED subscript designation for the HVAC interactive effect for CFL demand variable. The correct variable should appear as IEkW, instead of as IEkW-LED, as was included in the 2014 TRM. This was an error during the updating process and may be confusing as it implies that LED information is a necessary input into a CFL algorithm. In the 2014 TRM, the IEkW variable was already defined as being the HVAC Interactive Effect for CFL demand and, as such, is the appropriate variable to be utilized. Page 149 of the 2014 TRM has been updated to reflect the appropriate subscripting.
  + The ΔkWh equation for ENERGY STAR Indoor LED Fixtures (hard-wired, pin-based) should include an LED subscript designation for the HVAC interactive effect for LED energy variable. The correct variable should appear as IEkWh-LED, instead of as IEkWh, as was included in the 2014 TRM. This was an error during the updating process and may be confusing as the definition of IEkWh is the HVAC interactive effect for CFL energy and, therefore, implies that CFL information is a necessary input into an LED algorithm. In the 2014 TRM, the IEkWh-LED variable was already defined as being the HVAC Interactive Effect for LED energy and, as such, is the appropriate variable to be utilized. Page 149 of the 2014 TRM has been updated to reflect the appropriate subscripting.
  + The ΔkWpeak equation for ENERGY STAR Indoor LED Fixtures (hard-wired, pin-based) should include an LED subscript designation for the HVAC interactive effect for LED demand variable. The correct variable should appear as IEkW-LED, instead of as IEkW, as was included in the 2014 TRM. This was an error during the updating process and may be confusing as the definition of IEkW is the HVAC interactive effect for CFL demand and, therefore, implies that CFL information is a necessary input into an LED algorithm. In the 2014 TRM, the IEkW-LED variable was already defined as being the HVAC Interactive Effect for LED demand and, as such, is the appropriate variable to be utilized. Page 149 of the 2014 TRM has been updated to reflect the appropriate subscripting.
* An error in the units in Table 2-92: Residential VFD (variable frequency drives) Pool Pumps Calculations Assumptions. This error occurs in Section 2-39 – Variable Speed Pool Pumps (with Load Shifting Option). In Table 2-92, the units listed for the kWss component, which represents the electric demand of a single speed pump at a given flow rate, are Watts (W). The units should be kW. Page 184 of the 2014 TRM has been updated to reflect the appropriate units.
* Errors in Table 3-32: Refrigeration Case Savings and Table 3-33: Freezer Case Savings. These errors occur in Section 3.8 – High-Efficiency Refrigeration/Freezer Cases. During the 2014 TRM update, the demand coincidence factor (CF) was changed from a value of 1 to a value of 0.772. The CF is a component of the algorithm used to determine demand impacts: ΔkWpeak = [(kWhbase – kWhee) \* (CF/24)]. However, while the CF was updated, the demand impacts for the refrigerators and freezers were mistakenly not recalculated. Table 3-32 on page 250 and Table 3-33 on page 251 have been updated to reflect the correct demand impact values.
* Inconsistencies in measure lives between a protocol in the TRM and in Appendix A of the TRM. This change affects the following protocols:
  + Section 2.2 – Electric Clothes Dryer with Moisture Sensor: The correct measure life for this measure is 13 years. Page 426 of the 2014 TRM has been updated accordingly.
  + Section 2.5 – Furnace Whistle: The correct measure life for this measure is 14 years. Pages 36 and 425 of the 2014 TRM have been updated accordingly.
  + Section 2.12 – Smart Strip Plug Outlets: The correct measure life for this measure is four years. Page 426 of the 2014 TRM has been updated accordingly.
  + Section 2.26 – ENERGY STAR Dishwashers: The correct measure life for this measure is ten years. Page 426 of the 2014 TRM has been updated accordingly.
  + Section 2.29 – ENERGY STAR Lighting: The correct measure life for the compact fluorescent light bulb measure is 5.2 years. This measure life was inadvertently neglected in Appendix A. Page 425 of the 2014 TRM has been updated accordingly.
  + Section 2.33 – ENERGY STAR Televisions: The correct measure life for this measure is six years. Page 426 of the 2014 TRM has been updated accordingly.
  + Section 2.40 – Duct Insulation and Sealing: The correct measure life for this measure is 20 years. Page 425, in which the end use is referred to as “Central Air Conditioner duct sealing,” of the 2014 TRM has been updated accordingly.

This Secretarial Letter, the corrected 2014 TRM and redlined versions of all affected pages are available on the Commission’s website at the aforementioned link.

 Sincerely,

Rosemary Chiavetta

Secretary

## CC: Darren Gill, Deputy Director, TUS

## Joseph Sherrick, Supervisor, TUS

## Megan Good, Analyst, TUS

## Kriss Brown, Attorney, LAW

* Check refrigerant charge level and correct as necessary
* Clean filters as needed
* Inspect and lubricate bearings
* Inspect and clean condenser and, if accessible, evaporator coil

*ΔkWh = ΔkWhcool + ΔkWhheat*

*ΔkWhcool = ((CAPYcool/(1000 X SEERm)) X EFLHcool) X MFcool*

*ΔkWhheat (ASHP Only) = ((CAPYheat/(1000 X HSPFm)) X EFLHheat) X MFheat*

*ΔkWpeak = ((CAPYcool/(1000 X EERm)) X CF) X MFcool*

**Ground Source Heat Pumps (GSHP)**

This algorithm is used for the installation of new GSHP units. For GSHP systems over 65,000 BTUh, see commercial algorithm stated in Section 3.5.1.

*ΔkWh = ΔkWhcool + ΔkWhheat*

*COPsys = COPg x GSHPDF*

*EERsys  = EERg x GSHPDF*

*ΔkWhcool = CAPYcool/1000 X (1/SEERb – (1/(EERsys X GSER))) X EFLHcool*

*ΔkWhheat = CAPYheat/1000 X (1/HSPFb – (1/(COPsys X GSOP))) X EFLHheat*

*ΔkW = CAPYcool/1000 X (1/EERb – (1/(EERsys X GSPK))) X CF*

**GSHP Desuperheater**

This algorithm is used for the installation of a desuperheater for a GSHP unit.

*= 567 kWh*

*ΔkW = EDSH x Energy to Demand Factor*

**Furnace High Efficiency Fan**

This algorithm is used for the installation of new high efficiency furnace fans.

*ΔkWhheat = HFS*

*ΔkWhcool = CFS*

*ΔkWpeak = PDFS*

| **Component** | **Type** | **Value** | **Sources** |
| --- | --- | --- | --- |
| EFLHheat | Default | Allentown Heating = 1,193 Hours  Erie Heating = 1,349 Hours  Harrisburg Heating = 1,103 Hours  Philadelphia Heating = 1,060 Hours  Pittsburgh Heating = 1,209 Hours  Scranton Heating = 1,296 Hours  Williamsport Heating = 1,251 Hours | 4 |
| Optional | An EDC can either use the Alternate EFLH Table or estimate its own EFLH based on customer billing data analysis. | Alternate EFLH Table (See Section 2.1.4); EDC Data Gathering |
| PSF | Fixed | 5% | 5 |
| MFcool | Fixed | 5% | 15 |
| MFheat | Fixed | 5% | 15 |
| CF | Fixed | 70% | 6 |
| HSPF*b* | Fixed | Replace on Burnout: 7.7 | 7 |
| Variable | Early Retirement: EDC Data Gathering | EDC Data Gathering |
| HSPF*e* | Variable | EDC Data Gathering | AEPS Application; EDC’s Data Gathering |
| HSPFm | Fixed | 6.8 | 13 |
| COP*g* | Variable | EDC Data Gathering | AEPS Application; EDC’s Data Gathering |
| GSHPDF | Fixed | 0.885 | 19  (Engineering Estimate – See 2.15) |
| COPsys | Variable | Calculated | Calculated |
| GSOP | Fixed | 3.413 | 8 |
| GSPK | Fixed | 0.8416 | 9 |
| EFDSH | Fixed | 17% | 10, 11 |
| EDSH | Fixed | 567 kWh | Calculated |
| EFbase | Fixed | 0.904 | Table 2-4 |
| HW | Fixed | 50 | Table 2-4 |
| Th | Fixed | 123 | Table 2-4 |
| Tc | Fixed | 55 | Table 2-4 |
| Energy to Demand Factor | Fixed | 0.00008294 | Table 2-4 |

**2.5 Furnace Whistle**

|  |  |
| --- | --- |
| **Measure Name** | **Furnace Whistle** |
| **Target Sector** | Residential Establishments |
| **Measure Unit** | Furnace whistle (promote regular filter change-out) |
| **Unit Energy Savings** | Varies |
| **Unit Peak Demand Reduction** | Varies |
| **Measure Life** | 14 years |

Savings estimates are based on reduced furnace blower fan motor power requirements for winter and summer use of the blower fan motor. This furnace whistle measure applies to central forced-air furnaces, central AC and heat pump systems. Each table in this protocol (2 through 6) presents the annual kWh savings for each major urban center in Pennsylvania based on their respective estimated full load hours (EFLH). Where homes do not have A/C or heat pump systems for cooling, only the annual heating savings will apply.

**2.5.1 Algorithms**

*ΔkWh =ΔkWhheating + ΔkWhcooling*

*ΔkWhheating = MkW X EFLHheating X EI X ISR*

*ΔkWhcooling = MkW X EFLHcoolingX EI X ISR*

*ΔkWpeak = ΔkWhcooling / EFLHcooling X CF*

**2.5.2 Definition of Terms**

*MkW = Average motor full load electric demand (kW)*

*EFLHHeating = Estimated Full Load Hours (Heating ) for the EDC region.*

*EFLHCooling = Estimated Full Load Hours (Cooling) for the EDC region.*

*EI = Efficiency Improvement*

*ISR = In-service Rate*

**2.7 LED Nightlight**

|  |  |
| --- | --- |
| **Measure Name** | **LED Nightlight** |
| **Target Sector** | Residential Establishments |
| **Measure Unit** | LED Nightlight |
| **Unit Energy Savings** | 25.49 kWh |
| **Unit Peak Demand Reduction** | 0 kW |
| **Measure Life** | 8 years |

Savings from installation of LED nightlights are based on a straightforward algorithm that calculates the difference between existing and new wattage and the average daily hours of usage for the lighting unit being replaced. An “installation” rate is used to modify the savings based upon the outcome of participant surveys, which will inform the calculation. Demand savings is assumed to be zero for this measure.

**2.7.1 Algorithms**

Assumes a 1 Watt LED nightlight replaces a 7 Watt incandescent nightlight. The nightlight is assumed to operate 12 hours per day, 365 days per year; estimated useful life is 8 years (manufacturer cites 11 years 100,000 hours). Savings are calculated using the following algorithm:

*ΔkWh = ((Wattsbase – WattsNL) X (NLhours X 365))/1000) x ISR*

*ΔkWpeak = 0 (assumed)*

**2.7.2 Definition of Terms**

*Wattsbase = Wattage of baseline nightlight*

*WattsNL = Wattage of LED nightlight*

*NLhours = Average hours of use per day per Nightlight*

*ISR = In-service rate*

*(The EDC EM&V contractors will reconcile the ISR through survey activities)*

**Table 2-18: LED Nightlight - References**

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Type** | **Value** | **Sources** |
| Wattsbase | Variable | Default = 7 Watts; EDC Data Gathering | EDC Data Gathering |
| WattsNL | Variable | Default= 1 Watt; EDCData Gathering | EDC Data Gathering |
| NLhours | Fixed | 12 | 1 |
| ISR | Fixed | 0.97 or EDC Data Gathering | PA CFL ISR value |
| EUL | Fixed | 8 years | 1 |

**Sources:**

1. Southern California Edison Company, “LED, Electroluminescent & Fluorescent Night Lights”, Work Paper WPSCRELG0029 Rev. 1, February 2009, p. 2 & p. 3.

**2.7.3 Deemed Savings**

The default energy savings is based on a delta watts assumption (Wattsbase – WattsEE) of 6 watts.

*ΔkWh = ((6 X (12 X 365))/1000) X 0.97 = 25.49 kWh*

*0.0064 kW (7-plug power strip, unspecified use, or multiple purchased)*

*0.0068 kW (5-plug power strip, entertainment center)*

*0.0082 kW (7 plug power strip, entertainment center)*

**2.12.5 Measure Life**

4 years[[2]](#footnote-2)55.

**2.12.6 Evaluation Protocols**

The most appropriate evaluation protocol for this measure is verification of installation coupled with assignment of stipulated energy savings.

*Equation 2:*

*NET\_kWhsaved Per Unit = DEEMED kWhsaved Per Unit – (REPLACEMENTUEC \* PART\_USE)*

**2.21.2 Definition of Terms**

*DEFAULT\_kWhsaved* = Annual electricity savings measured in kilowatt hours.

*EXISTING\_UEC* = The average annual unit energy consumption of participating refrigerators and freezers for Program year 4. Table 2-46 to Table 2-49 below provide the equation inputs needed to calculate the UEC for removed refrigerators and freezers respectively as well as the calculation of the default Unit Energy Consumption value for refrigerators or freezers for each EDC.

*PART\_USE* = The portion of the year the average refrigerator or freezer would likely have operated if not recycled through the program. For PY3, the average refrigerator was plugged in 96.9% of the year and the average freezer was plugged in 98.5% of the year.

*REPLACEMENTUEC* = The annual unit energy consumption of the average replacement unit. The appropriate UEC values for replacement refrigerator and freezer units were obtained from the Energy Star calculator and is equal to 417 kWh for a new Energy Star refrigerator, and 537 for a new non Energy Star refrigerator. It is equal to 423 kWh for a new Energy Star freezer, and 510 for a new non Energy Star freezer.

**2.21.3 Default Savings Calculations**

For removed refrigerators, the annual Unit Energy Consumption (UEC) is based upon regression analyses of data from refrigerators metered and recycled through five utilities. The UEC for removed refrigerators was calculated specifically for each utility using data collected from each utility’s Program Year Four (PY4) Appliance Removal programs. Therefore, each UEC represents the average ages, sizes, etc. of the fleet of refrigerators removed in Program Year Four.

Source for refrigerator UEC equation: US DOE Uniform Method Project, Savings Protocol for Refrigerator Retirement, April 2013

|  |  |
| --- | --- |
| **Freezer Unit Energy Consumption Equation** | |
| **Equation Intercept and Independent Variables** | **Estimate Coefficient (Daily kWh)** |
| Intercept | -2.297 |
| Appliance Age (years) | 0.401 |
| Dummy: Manufactured Pre-1993 | 0.067 |
| Appliance Size (cubic feet) | 0.15 |
| % of appliances that are chest freezers | 0.854 |
| Cooling Degree Days (CDD) | 0.1046 |

**Freezer Savings - No Replacement:**

*DEFAULT\_kWhsaved Per Unit* ***NO REP****= EXISTING\_UEC \* PART\_USE =kWh*

**Freezer Savings - Replacement with Energy Star Unit:**

*DEFAULT\_kWhsaved Per Unit****WITH ES REP*** *= DEFAULT kWhsaved Per Unit* ***NO REP*** *– (REPLACEMENTUEC* ***ES*** *\* PART\_USE) = kWh*

**Freezer Savings - Replacement with non-Energy Star Unit:**

*DEFAULT\_kWhsaved Per Unit****WITH NON ES REP*** *= kWhsaved Per Unit* ***NO REP*** *– (REPLACEMENTUEC* ***NON ES*** *\* PART\_USE) = kWh*

The Commission has computed the EDC-specific values that are needed for input to the regression equations for determining the Unit Energy Consumption based on Act 129 PY4 data provided by each EDC for refrigerators and freezers removed in PY4. Once these input values were determined, they were substituted into the above equation in order to estimate the UEC for removed refrigerators and freezers for each EDC.

Table 2-46 to Table 2-49 below provide the equation inputs needed to calculate the UEC for removed refrigerators and freezers respectively as well as the calculation of the default Unit Energy Consumption value for refrigerators or freezers for each EDC. Note that equation inputs in Table 2-46 to Table 2-49 are provided for each appliance (refrigerators, then freezers) depending on whether the units were or were not replaced with a new unit.

**Table 2-46: Default values for Residential Refrigerator Recycling Without Replacement With a New Refrigerator**



**Table 2-47: Default values for Residential Freezer Recycling Without Replacement With a New Freezer**



When calculating default per unit kWh savings for a removed refrigerator or freezer, it is necessary to calculate and apply a “Part-Use” factor. “Part-use” is an appliance recycling-specific adjustment factor used to convert the UEC (determined through the methods detailed above) into an average per-unit deemed savings value. The UEC itself is not equal to the default savings value, because: (1) the UEC model yields an estimate of annual consumption, and (2) not all recycled refrigerators and freezers would have operated year-round had they not been decommissioned through the program.

In Program Year 3, the Commission determined that the average removed refrigerator was plugged in and used 96.9% of the year and the average freezer was plugged in and used 98.5% of the year. Thus, the default value for the part-use factor is 96.9% (and 98.5%) based on program year 3 data for all EDCs. EDCs may elect to calculate an EDC specific part-use factor for a specific program year. In the event an EDC desires to calculate an EDC specific part-use factor, EDCs should use the following methodology. Using participant surveys, evaluators should determine the amount of time a removed refrigerator is plugged in.

Table 2-48 to Table 2-49 below shows the basis for the calculation of default per unit savings for refrigerators and freezers that are removed but then replaced.

**Table 2-48:** **Default values for Residential Refrigerator Recycling With Replacement With a New Energy Star Refrigerator[[3]](#footnote-3)**



**Table2-49: Default values for Residential Freezer Recycling With Replacement With a New Energy Star Freezer[[4]](#footnote-4)**



Per unit kW demand savings are based upon annual hours of use of 5,000 and a peak coincidence factor of 62%.

**2.21.4 Measure Life**

Refrigerator/Freezer Replacement programs: Measure Life = 7 yrs

**Sources:**

1. ENERGY STAR Appliances Calculator. Accessed July 2013.
2. Statewide average for all housing types from Pennsylvania Statewide Residential End-Use and Saturation Study, 2012,Demand savings derived using dishwasher load shape.
3. Coincidence factor already embedded in summer peak demand reduction estimate

The default values for electric and non-electric water heating and the default fuel mix from Table 2-64 are given in Table 2-66.

**Table 2-66: Default Dishwasher Energy Savings**

|  |  |
| --- | --- |
| **Water Heating** | **ΔkWh/yr** |
| Electric (%ElectricDHW = 100%) | 60 |
| Non-Electric (%ElectricDHW = 0%) | 26.4 |
| Default Fuel Mix (%ElectricDHW = 43%) | 40.8 |

**2.26.3 Measure Life**

ENERGY STAR Dishwashers: Measure Life = 10 years[[5]](#footnote-5)

*ΔkWh = (Wattsbase – WattsCFL)/1000 X CFLhours X (1+IEkWh) X 365 X ISRCFL*

*ΔkWpeak = (Wattsbase – WattsCFL)/1000 X CF X (1+IEkW) X ISRCFL*

**ENERGY STAR LED Bulbs (screw-in):**

*ΔkWh = (Wattsbase – WattsLED)/1000 X CFLhours X (1+IEkWh-LED) X 365 X ISRCFL*

*ΔkWpeak = (Wattsbase – WattsLED)/1000 X CF X (1+IEkW-LED) X ISRCFL*

**ENERGY STAR Torchieres:**

*ΔkWh = (Wattsbase - WattsTorch)/1000 X Torchhours X (1+IEkWh) X 365 X ISRTorch*

*ΔkWpeak  = (Wattsbase - WattsTorch)/1000 X CF X (1+IEkW) X ISRTorch*

**ENERGY STAR Indoor CFL Fixture (hard-wired, pin-based):**

*ΔkWh = (Wattsbase – WattsIF)/1000 X IFhours X (1+IEkWh) X 365 X ISRIF*

*ΔkWpeak  = (Wattsbase – WattsIF)/1000 X CF X (1+IEkW) X ISRIF*

**ENERGY STAR Indoor LED Fixture (hard-wired, pin-based):**

*ΔkWh = (Wattsbase – WattsIF)/1000 X IFhours X (1+IEkWh-LED) X 365 X ISRIF*

*ΔkWpeak  = (Wattsbase – WattsIF)/1000 X CF X (1+IEkW-LED) X ISRIF*

**ENERGY STAR Outdoor Fixture (hard wired, pin-based):**

*ΔkWh = (Wattsbase – WattsOF)/1000 X OFhours X 365 X ISROF*

*ΔkWpeak  = (Wattsbase – WattsOF)/1000 X CF X ISROF*

**Ceiling Fan with ENERGY STAR Light Fixture:**

*ΔkWh = (Wattsbase – WattsFan)/1000 X Fanhours X (1+IEkWh) X 365 X ISRFan*

*ΔkWpeak = (Wattsbase - WattsFan)/1000 X CF X (1+IEkW) X ISRFan*

**2.29.3 Definition of Terms**

*Wattsbase = Wattage of baseline case lamp/fixture.*

*WattsCFL = Wattage of CFL*

*CFLhours = Average hours of use per day per CFL*

*IEkWh =HVAC Interactive Effect for CFL energy*

*IEkW =HVAC Interactive Effect for CFL demand*

*ISRCFL = In-service rate per CFL.*

of hours that the pump was set to run between 2 PM to 6 PM, divided by 4. If this information is not available, the recommended daily hours of operation to use are 5.18 and the demand coincidence factor is 0.27. These operation parameters are derived from the 2011 Mid Atlantic TRM.

**2.39.3 Definition of Terms**

The parameters in the above equation are listed below.

*HSS = Hours of operation per day for Single Speed Pump. This quantity should be recorded by the applicant.*

*HVFD = Hours of operation per day for Variable Frequency Drive Pump. This quantity should be recorded by the applicant.*

*Days/yr = Pool pump days of operation per year.*

*kWSS = Electric demand of single speed pump at a given flow rate. This quantity should be recorded by the applicant or looked up through the horsepower in Table 2-93****Error! Reference source not found.****.*

*kWbasepeak = Peak demand of single speed pump*

*kWVFD = Electric demand of variable frequency drive pump at a given flow rate. This quantity should be measured and recorded by the applicant.*

*kWVFD peak = Peak demand of VFD pump.*

*CFSS = Peak coincident factor of single speed pump from 2 PM to 6 PM in summer weekday. This quantity can be deduced from the pool pump timer settings for the old pump.*

*CFVFD = Peak coincident factor of VFD pump from 2 PM to 6 PM in summer weekday. This quantity should be inferred from the new timer settings.*

**Table 2-92: Residential VFD Pool Pumps Calculations Assumptions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Type** | **Values** | **Source** |
| HSS | Variable | Default: 5.18 | 2 |
| HVFD | Variable | Default: 13.00 | 2 |
| Days/yr | Fixed | Default: 100 | 2 |
| kWSS | Variable | EDC Data Gathering  Default: 1.364 kW or See Table 2-93**Error! Reference source not found.** | 1 and Table 2-91 and Table 2-93 |
| kWVFD | Variable | EDC Data Gathering | EDC Data Gathering |
| CFSS | Variable | Default: 0.235 | 3 |

1. Northeast Energy Efficiency Partnerships, Mid Atlantic TRM Version 3.0. March 2013. Calculated from Itron eShapes, which is 8760 hourly data by end use for Upstate New York.

**Table 3-30: Refrigeration Case Efficiencies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Volume (ft3)** | **Glass Door** | | **Solid Door** | |
| **kWhee/day** | **kWhbase/day** | **kWhee/day** | **kWhbase/day** |
| V < 15 | 0.118\*V + 1.382 | 0.12\*V + 3.34 | 0.089\*V + 1.411 | 0.10\*V + 2.04 |
| 15 ≤ V < 30 | 0.140\*V + 1.050 | 0.037\*V + 2.200 |
| 30 ≤ V < 50 | 0.088\*V + 2.625 | 0.056\*V + 1.635 |
| 50 ≤ V | 0.110\*V + 1.50 | 0.060\*V + 1.416 |

**Table 3-31: Freezer Case Efficiencies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Volume (ft3)** | **Glass Door** | | **Solid Door** | |
| **kWhee/day** | **kWhbase/day** | **kWhee/day** | **kWhbase/day** |
| V < 15 | 0.607\*V+0.893 | 0.75\*V + 4.10 | 0.250\*V + 1.25 | 0.4\*V + 1.38 |
| 15 ≤ V < 30 | 0.733\*V - 1.00 | 0.40\*V – 1.00 |
| 30 ≤ V < 50 | 0.250\*V + 13.50 | 0.163\*V + 6.125 |
| 50 ≤ V | 0.450\*V + 3.50 | 0.158\*V + 6.333 |

If precise case volume is unknown, default savings given in tables below can be used.

**Table 3-32: Refrigeration Case Savings**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Volume (ft3)** | **Annual Energy Savings (kWh)** | | **Demand Impacts (kW)** | |
| **Glass Door** | **Solid Door** | **Glass Door** | **Solid Door** |
| V < 15 | 722 | 268 | 0.0636 | 0.0236 |
| 15 ≤ V < 30 | 683 | 424 | 0.0602 | 0.0374 |
| 30 ≤ V < 50 | 763 | 838 | 0.0672 | 0.0739 |
| 50 ≤ V | 927 | 1,205 | 0.0817 | 0.1062 |

**Table 3-33: Freezer Case Savings**

| **Volume (ft3)** | **Annual Energy Savings (kWh)** | | **Demand Impacts (kW)** | |
| --- | --- | --- | --- | --- |
| **Glass Door** | **Solid Door** | **Glass Door** | **Solid Door** |
| V < 15 | 1,901 | 814 | 0.1675 | 0.0717 |
| 15 ≤ V < 30 | 1,992 | 869 | 0.1756 | 0.0766 |
| 30 ≤ V < 50 | 4,417 | 1,988 | 0.3893 | 0.1752 |
| 50 ≤ V | 6,680 | 3,405 | 0.5887 | 0.3001 |

**3.8.3 Measure Life**

12 years

**Sources:**

1. Food Service Technology Center (as stated in ENERGY STAR calculator).

**5 Appendices**

**5.1 Appendix A: Measure Lives**

**Measure Lives Used in Cost-Effectiveness Screening**

**August 2013**

\*For the purpose of calculating the total Resource Cost Test for Act 129, measure cannot claim savings for more than fifteen years.

|  |  |
| --- | --- |
| **Measure** | **Measure Life** |
| **RESIDENTIAL SECTOR** | |
| ***Lighting End-Use*** |  |
| Electroluminescent Nightlight | 8 |
| LED Nightlight | 8 |
| Compact Fluorescent Light Bulb | 5.2 |
| Recessed Can Fluorescent Fixture | 20\* |
| Torchieres | 10 |
| Fixtures Other | 20\* |
| ENERGY STAR LEDs | 14.7 |
| Residential Occupancy Sensors | 10 |
| Holiday Lights | 10 |
|  |  |
| ***HVAC End-Use*** |  |
| Central Air Conditioner (CAC) | 14 |
| Air Source Heat Pump | 12 |
| Central Air Conditioner proper sizing/install | 14 |
| Central Air Conditioner Quality Installation Verification | 14 |
| Central Air Conditioner Maintenance | 7 |
| Central Air Conditioner duct sealing | 20 |
| Air Source Heat Pump proper sizing/install | 12 |
| ENERGY STAR Thermostat (Central Air Conditioner) | 15 |
| ENERGY STAR Thermostat (Heat Pump) | 15 |
| Ground Source Heat Pump | 30\* |
| Room Air Conditioner Retirement | 4 |
| Furnace Whistle | 14 |
| Programmable Thermostat | 11 |
| Room AC (RAC) Retirement | 4 |
| Residential Whole House Fans | 15 |
| Ductless Mini-Split Heat Pumps | 15 |
| Fuel Switching: Electric Heat to Gas Heat | 20\* |
| Efficient Ventilation Fans with Timer | 10 |
| New Construction (NC): Single Family - gas heat with CAC | 20\* |
| NC: Single Family - oil heat with CAC | 20\* |

|  |  |
| --- | --- |
| NC: Single Family - all electric | 20\* |
| NC: Multiple Single Family (Townhouse) – oil heat with CAC | 20\* |
| NC: Multiple Single Family (Townhouse) - all electric | 20\* |
| NC: Multi-Family – gas heat with CAC | 20\* |
| NC: Multi-Family - oil heat with CAC | 20\* |
| NC: Multi-Family - all electric | 20\* |
|  |  |
| ***Hot Water End-Use*** |  |
| Efficient Electric Water Heaters | 14 |
| Heat Pump Water Heaters | 14 |
| Low Flow Faucet Aerators | 12 |
| Low Flow Showerheads | 9 |
| Solar Water Heaters | 15 |
| Electric Water Heater Pipe Insulation | 13 |
| Fuel Switching: Domestic Hot Water Electric to Gas or Propane Water Heater | 13 |
| Fuel Switching: Domestic Hot Water Electric to Oil Water Heater | 8 |
| Fuel Switching: Heat Pump Water Heater to Gas or Propane Water Heater | 13 |
| Fuel Switching: Heat Pump Water Heater to Oil Water Heater | 8 |
| Water Heater Tank Wrap | 7 |
|  |  |
| ***Appliances End-Use*** |  |
| Electric Clothes Dryer with Moisture Sensor | 13 |
| Refrigerator / Freezer Recycling without replacement | 8 |
| Refrigerator / Freezer Recycling with replacement | 7 |
| ENERGY STAR Refrigerators | 12 |
| ENERGY STAR Freezers | 12 |
| ENERGY STAR Clothes Washers | 11 |
| ENERGY STAR Dishwashers | 10 |
| ENERGY STAR Dehumidifers | 12 |
| ENERGY STAR Room Air Conditioners | 9 |
| ENERGY STAR Televisions | 6 |
| ENERGY STAR Water Coolers | 10 |
|  |  |
| ***Office Equipment / Electronics End-Use*** |  |
| Smart Strip Plug Outlets | 4 |
| ENERGY STAR Computer | 4 |
| ENERGY STAR Monitor | 5 |
| ENERGY STAR Fax | 4 |
| ENERGY STAR Multifunction Device | 6 |
| ENERGY STAR Printer | 5 |

1. *See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2014 Update* Tentative Order, at Docket No. M-2012-2313373, entered August 29, 2013, at page 107. [↑](#footnote-ref-1)
2. 55 “Smart Strip Electrical Savings and Usability”, David Rogers, Power Smart Engineering, October 2008. [↑](#footnote-ref-2)
3. kWh use of new refrigerator is average consumption of all ENERGY STAR qualifying models by configuration from ENERGY STAR Residential Refrigerators Qualified Products List. July 5, 2013. [↑](#footnote-ref-3)
4. kWh use of new freezer is average consumption of all ENERGY STAR qualifying models by configuration from ENERGY STAR Residential Freezer Qualified Products List. July 5, 2013. [↑](#footnote-ref-4)
5. [EnergyStar](file:///\\m-ga-fs01\m-ga-projects01\39702\001\TRM%20UPdates%20for%202014%20TRM\Sources%20for%20Updates\EnergyStar) Calculator. Accessed July 2013. [↑](#footnote-ref-5)