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| PUC logo | COMMONWEALTH OF PENNSYLVANIA  PENNSYLVANIA PUBLIC UTILITY COMMISSION  400 NORTH STREET, HARRISBURG, PA 17120 | **IN REPLY PLEASE REFER TO OUR FILE**  M-2019-3006867 |

September 24, 2020

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 2021 Update

Docket No. M-2019-3006867

On August 8, 2019, the Pennsylvania Public Utility Commission (Commission) entered an Order adopting the 2021 Technical Reference Manual (TRM) update in the above-referenced matter. The TRM Final Order and 2021 TRM volumes 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 an Errata to the 2021 TRM. Attached to the letter is a detailed, itemized account of errata changes (Attachment 1: Errata Details).

Approximately fifty separate errata were identified and addressed following the release of the 2021 TRM on August 8, 2019. The errata typically fit into one of the following broad categories:

* + typographical errors;
  + inconsistencies between assumptions or inputs;
  + algorithm/equation/unit errors (missing parentheses, or inappropriate conversion factors);
  + broken hyperlinks in source references;
  + Appendix C - Lighting Audit & Design Tool for C&I Projects functionality.

Most errata are minor and will have little or no impact on savings estimates or program administration.

Clean and redlined versions of the corrected 2021 TRM volumes, and Appendix C - Lighting Audit & Design Tool for C&I Projects are being posted on the Commission’s website at the aforementioned link in conjunction with this Secretarial Letter.

**** Sincerely,

Rosemary Chiavetta

Secretary

**Attachment 1: Errata Details**

All page numbers refer to the 2021 TRM pre-updates.

**TRM Section 1.3 – Using the TRM. The errors are as follows:**

* Corrected measure number ranges for some Volume 1 Residential categories in Table 1-1 on page 3.

**TRM Section 2.1.1 – ENERGY STAR Lighting. The errors are as follows:**

* Normalized *HOUnon-res* variable in Table 2-1 on page 2 to daily use instead of annual use.
* Corrected misspelling of “retrofitted” on page 3.

**TRM Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP. The errors are as follows:**

* Corrected Source 3 on page 15 to include URL of cited document which refers to the original source.
* Corrected misspelling of “efficiency” in Source 4 on page 15.

**TRM Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option. The errors are as follows:**

* Corrected Source 3 on page 22 to include URL of cited document which refers to the original source.
* Corrected misspelling of “efficiency” in Source 4 on page 22.

**TRM Section 2.2.5 – Air Conditioner and Heat Pump Maintenance. The errors are as follows:**

* Added note to permit use of default *EERbase* to Table 2-21 on page 29, by extension of existing default option for *SEERbase*.

**TRM Section 2.2.7 – ENERGY STAR Room Air Conditioners. The errors are as follows:**

* *CAPY* in Table 2-23 on page 34 was listed as BTU/hr rather than the kBTU/hr implied by the algorithm and used for other Volume 2 HVAC. Revised variable units and default value to match. Tables 2-24 and 2-26 plus the Default Savings description (all on page 35), were also revised to match.

**TRM Section 2.2.8 –Room AC (RAC) Retirement. The errors are as follows:**

* Corrected value of default *CAPY* to match units (kBTU/hr) in Table 2-28 on page 39.

**TRM Section 2.2.9 – Duct Sealing & Duct Insulation. The errors are as follows:**

* Corrected misspelling of “system” on page 41.

**TRM Section 2.2.11 – ENERGY STAR Certified Connected Thermostats. The errors are as follows:**

* Corrected misspelling of “operating” on page 47.
* For the “Professional” installation type rows of Table 2-35 on page 48, the capacity term is listed as EDC Data Gathering. However, in Table 2-39, 2-40, and 2-41 default savings are provided for profession installation. These tables are conflicting because if HVAC capacity must be collected on a customer-specific basis, there should be no default savings. To correct the misalignment, Table 2-35 is updated to specify “default” as an optional source for the capacity term(s).
* Corrected the units for the default values of *CAPY* terms in Table 2-36 on page 49 to BTU/hour, which were mistakenly listed as kBTU/hour.
* Removed typo in Source 12 on page 53.

**TRM Section 2.3.1 – Heat Pump Water Heaters. The errors are as follows:**

* Corrected misspelling of “minimum” on page 58.
* Updated URL of Source 3 on page 60.
* Expanded abbreviation of “versus” for Source 7 on page 61.

**TRM Section 2.3.4 – Water Heater Tank Wrap. The errors are as follows:**

* *Rbase* units lacked a degree symbol on page 69; was F instead of ℉.

**TRM Section 2.3.7 – Low Flow Faucet Aerators. The errors are as follows:**

* *Tperson-day* was missing a per person factor in Table 2-58, on page 78; minutes/day instead of minutes/(person×day).
* Source 11 on page 81 is defunct after a redesign of the Census Bureau’s website, updated URL to point to new website.

**TRM Section 2.3.8 – Low Flow Showerheads. The errors are as follows:**

* *Nshower-day* on page 83 restructured to match other variables, including *Nshower-day* for 2.3.9 Thermostatic Shower Restriction Valves.
* Source 11 on page 85 is defunct after a redesign of the AHRI’s website, updated URL to point to new location.
* Adjusted case and formatting of variables in Source 12 on page 86 to match those in Table 2-71 on page 83.

**TRM Section 2.3.9 – Thermostatic Shower Restriction Valves. The errors are as follows:**

* Clarified that the default in-service rate is only permissible for direct-install on pages 87 and 88.
* *Nshower-day* was missing a division by person on page 88; showers/day instead of showers/(person×day).
* Clarified Default ISR of 100% only applies to direct install.

**TRM Section 2.4.3 – Fridge/Freezer Replacement with and without Recycling. The errors are as follows:**

* Changed reference from draft variable name of *REPLACEMENTUEC* to *kWhee* on page 108.

**TRM Section 2.4.6 – Heat Pump Clothes Dryers. The errors are as follows:**

* Updated Source 1 and measure life on page 120 to match 2.4.5 ENERGY STAR Clothes Dryers.
* Corrected misspelling of Pennsylvania on page 121.

**TRM Section 2.4.7. – Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer. The errors are as follows:**

* Removed ungrammatical plural from introduction on page 123.

**TRM Section 2.6.1 – Residential Air Sealing. The errors are as follows:**

* Moved single-family restriction notice to top of Eligibility section on page 146.
* Added text to the Algorithm section on page 147 clarifying the definition and purpose of the prototype variables *ηproto* and *Ductproto*.
* Although we do not anticipate application of the algorithm to yield greater than 100% savings, the original algorithm did not expressly preclude this. We have added a cap to prevent any such occurrence per FirstEnergy’s request. This measure’s savings are now restricted to be less than or equal to 40% each of a home’s heating and cooling loads. Supporting variables for this change were added to Table 2-109, as well as Source 6 in support of this threshold.
* Corrected misspelling of “Residential” in Source on page 150.

**TRM Section 2.6.1 – Residential Air Sealing. The errors are as follows:**

* Corrected misspelling of “permissible” in Source on page 157.

**TRM Section 2.6.6 – Residential Window Repair. The errors are as follows:**

* Added missing Watts to Kilowatts conversion factor to savings equation on page 170.
* Combined savings equation on page 170 with supporting equation below it to avoid confusion about CFM versus CFM/ft2 units. Remove obsolete *CFM* variable from table 2-125 on page 171.
* Corrected reference to climate data in Table 2-125 on page 171 from Appendix F to Appendix A.
* Removed duplicated “the” from page 171.
* Corrected misspelling of “weatherstripped” in Table 2-126 on page 172.

**TRM Section 2.7.1 – Residential New Construction. The errors are as follows:**

* Corrected misspelling of “occupiable” on page 173.
* Changed outdated electric hot water efficiencies in Table 2-129 on page 176 and Table 2-131 on page 178 to refer to Table 2-47.
* Added table of modern gas-fired water heater Uniform Energy Factors (UEF) below Table 2-131 on page 178.
* Changed outdated gas-fired hot water efficiencies in Table 2-129 on page 176 and Table 2-131 on page 178 to refer to Table 2-131.
* Moved *Vs* definition from Tables 2-129 and 2-131 to Table 2-127 on page 175.
* Altered storage volume variable from *Vs* to *Vr* in Table 2-129 on page 176 and in Table 2-131 on page 178 to match UEF equations.
* Updated Source 9 on page 179 to match section 2.3.1 Heat Pump Water Heaters.
* Corrected misspelling of “efficiency” in Source 4 on page 179.
* Updated defunct Source 12 on page 179.

**TRM Section 2.7.2 – ENERGY STAR Manufactured Homes. The errors are as follows:**

* Corrected two misspellings of “estimated” in Table 2-132 (now Table 2-133) on page 181.
* Updated Source 11 on page 184 to match section 2.3.1 Heat Pump Water Heaters and removed redundant Source 12.
* Changed outdated electric hot water efficiencies in Table 2-132 (now Table 2-133) on page 183 to refer to Table 2-47.
* Changed outdated gas-fired hot water efficiencies in Table 2-132 (now Table 2-133) on page 183 to refer to new Table 2-132 added to 2.7.1 Residential New Construction.
* Altered storage volume variable from *Vs* to *Vr* on page 183 to match UEF equations.
* Moved *Vs* definition from Table 2-133 (now Table 2-134) on page 183 to Table 2-132 (now Table 2-133) on page 181.

**TRM Section 2.7.3 – Home energy Reports. The errors are as follows:**

* Corrected misspelling of “flexibility” on page 186.

**TRM Section 2.9.1 – Direct Load Control and Behavior Response Programs. The errors are as follows:**

* Corrected table number on page 194, which was mislabeled as 2-2.

**TRM Section 3.1.1 – Lighting Improvements. The errors are as follows:**

* Corrected abbreviation of lumens on page 3.

**TRM Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs. The errors are as follows:**

* Corrected abbreviation of lumens on page 43.

**TRM Section 3.2.1 – HVAC Systems. The errors are as follows:**

* Corrected misspelling of “section” on page 44.
* Corrected the heating baseline equation for Packaged Terminal Heat Pump systems in new construction applications to align with IECC 2015 (Source 5) on page 48 in Table 3-26.

**TRM Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 Tons. The errors are as follows:**

* Corrected the heating baseline equation for Packaged Terminal Heat Pump systems in new construction applications to align with IECC 2015 in Table 3-39 on page 69.

**TRM Section 3.2.10 – Computer Room Air Conditioner. The errors are as follows:**

* Corrected the hyperlink in Source 1 on page 93.

**TRM Section 3.3.1 – Premium Efficiency Motors. The errors are as follows:**

* Updated the unit value for the 0.746 conversion from kWh/HP to kW/HP in Table 3-64 on page 105.
* Corrected the hyperlink in Source 2 on page 114.

**TRM Section 3.3.3 – ECM Circulating Fan. The errors are as follows:**

* Corrected the formula for motor wattage on page 120. The conversion from horsepower to Watts is 746, not 0.746.
* Updated the conversion factor in Table 3-76 on page 121 to reflect the W/HP conversion value and units.

**TRM Section 3.3.4 – VSD on Kitchen Exhaust Fan. The errors are as follows:**

* Corrected the work paper reference in the ‘Algorithms’ section to refer to San Diego Gas and Electric (SDG&E) on page 123.
* Deleted source 2 (PG&E work paper) on page 124. The PG&E work paper referenced is not used in the measure. As a result of this deletion, source 3 becomes source 2.
* Corrected the source number for the coincident peak demand savings per exhaust fan horsepower to source 2 in Table 3-78 on page 123.

**TRM Section 3.3.5 – ECM Circulator Pump. The errors are as follows:**

* Replaced the Savings Factor term (*SF*) with the term *R* for consistency with the updated Source 2 (2018 Wisconsin TRM).
* Corrected the formula for motor wattage on page 126. The conversion from horsepower to Watts is 746, not 0.746.
* Updated the conversion factor in Table 3-79 on page 127 to reflect the W/HP conversion value and units.

**TRM Section 3.3.6 – High Efficiency Pumps. The errors are as follows:**

* Updated the unit value for the 0.746 conversion from kWh/HP to kW/HP in Table 3-80 on page 130.

**TRM Section 3.5.6 – Controls: Evaporator Coil Defrost Control. The errors are as follows:**

* Updated the hyperlink for Source 1 on page 162 to a functioning URL and amended document title to match Source 2.
* Updated the hyperlink for Source 2 on page 162 to a functioning URL.

**TRM Section 3.5.7 – Variable Speed Refrigeration Compressor. The errors are as follows:**

* Updated the hyperlink for Source 2 on page 164 to the Database for Energy Efficiency Resources home page, which is a functioning URL.

**TRM Section 3.6.1 – ENERGY STAR Clothes Washer. The errors are as follows:**

* Updated the Eligibility section of this measure on page 191 to specify the eligible volume range and note that the measure is limited to front-loading models per the ENERGY STAR product specification and footnote 48, respectively.
* Corrected the units for the *MEFJ2* terms in Table 3-125 on page 194.
* Corrected the source reference for the *DEF* term in Table 3-125 on page 194. The value of 0.5 kWh/lb comes from the Test Procedures for Clothes Washers (source 3).

**TRM Section 3.7.4 – ENERGY STAR Electric Steam Cooker. The errors are as follows:**

* Corrected the unit value for the *CAPYbase* term in Table 3-140 on page 211 to specify that production capacity is on a per-pan basis.
* Corrected the unit value for the *CAPYee* term in Table 3-140 on page 211 to specify that production capacity is on a per-pan basis.
* Clarified that the ‘Parameter’ values for production capacity (*CAPY*) in Table 3-141 are pounds per hour per pan*.*
* Updated the hyperlink for Source 1.

**TRM Section 3.7.8 – ENERGY STAR Commercial Hot Food Holding Cabinet. The errors are as follows:**

* Corrected the default internal volume of the holding cabinet to 15 cubic feet in Table 3-154 on page 225. This aligns the default values with Source 1 and the inputs used to compute the default savings for measure.

**TRM Section 3.9.4 – ENERGY STAR Servers. The errors are as follows:**

* Replaced the hyperlink for Source 1a with working URL of newer version on page 251.
* Replaced the hyperlink for Source 1c with working URL on page 251.

**TRM Section 3.9.5 – Server Virtualization. The errors are as follows:**

* Corrected the definition of the *kWsa,idle* term in Table 3-174 on page 254.
* Replaced the hyperlink for Source 1a with working URL of newer version on page 255.
* Replaced the hyperlink for Source 1c with working URL on page 255.

**TRM Appendix C: Lighting Audit & Design Tool for Commercial and Industrial Projects (Microsoft Excel workbook):**

* In the Fixture Identities tab row 540, corrected the sub-category assignment of the F42GL fixture to “T5 Linear Fluorescent” and updated the baseline fixture code to F42GL. The F42GL fixture is compliant with EPACT 2005 and EISA 2007 standards so the baseline wattage should not be over-written to reflect code minimum.