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|  | **PENNSYLVANIA****PUBLIC UTILITY COMMISSION**Harrisburg, PA. 17105-3265 |  |

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|  | Public Meeting held December 15, 2011 |
| Commissioners Present: |  |

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| Robert F. Powelson, ChairmanJohn F. Coleman, Jr., Vice ChairmanWayne E. GardnerJames H. CawleyPamela A. Witmer |  |
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| Implementation of the Alternative Energy PortfolioStandards Act of 2004: Standards for the Participationof Demand Side Management Resources – TechnicalReference Manual 2012 Update | Docket No. M‑00051865 |

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**2012 TRM ANNUAL UPDATE ORDER**

**BY THE COMMISSION:**

As explained in our prior Orders at this docket, in implementing the Alternative Energy Portfolio Standards Act (“AEPS Act”), as amended,[[1]](#footnote-1) this Commission had adopted an *Energy‑Efficiency and DSM Rules for Pennsylvania’s Alternative Energy Portfolio Standard, Technical Reference Manual* (“TRM”).[[2]](#footnote-2) In adopting the original version of the TRM, this Commission directed the Bureau of Conservation, Economics and Energy Planning (“CEEP”)[[3]](#footnote-3) to oversee the implementation, maintenance and periodic updating of the TRM.[[4]](#footnote-4) Additionally, in the Act 129 *Energy Efficiency and Conservation Program Implementation Order*,[[5]](#footnote-5) this Commission adopted the TRM as a component of the Energy Efficiency and Conservation (“EE&C”) Program evaluation process. In that *Implementation Order*, this Commission also noted that “as the TRM was initially created to fulfill requirements of the AEPS Act, it will need to be updated and expanded to fulfill the requirements of the EE&C provisions of Act 129.”[[6]](#footnote-6) Soon after the adoption of the EE&C Program *Implementation Order*, Commission staff initiated a collaborative process to review and update the TRM with the purpose of supporting both the AEPS Act and the Act 129 EE&C program that culminated in the

adoption of the 2009 version of the TRM at the May 28, 2009 Public Meeting.[[7]](#footnote-7) In adopting the 2009 version of the TRM, the Commission recognized the importance of updating the TRM on an annual basis.[[8]](#footnote-8) With this Order, the Commission completes the fourth annual update of the TRM for 2012, to be applied beginning with the 2012‑2013 AEPS Act and Act 129 EE&C programs compliance year from June 1, 2012 to May 30, 2013.

**BACKGROUND**

Act 129 of 2008, P.L. 1592, specifically directed this Commission to establish an evaluation process that monitors and verifies data collection, quality assurance and the results of each electric distribution company’s (“EDC”) EE&C plan and the EE&C program as a whole.[[9]](#footnote-9) To assist in meeting this obligation, the Commission contracted with GDS Associates, Inc. in August 2009 to perform these duties as the Act 129 Statewide Evaluator (“SWE”). As part of its duties, the SWE is to review the TRM and the Total Resource Cost Test Manual (“TRC”) and to provide suggestions for possible revisions and additions to these manuals. A Technical Working Group (“TWG”)[[10]](#footnote-10) was formed to provide guidance to the SWE in clarifying savings measurement protocols and plans by recommending improvements to the existing TRM and other aspects of the EE&C programs.

The SWE, in collaboration with the TWG and Commission staff, reviewed the 2011 version of the TRM and proposed several changes and additions that were released for comment with the Commission’s adoption of a Tentative Order on September 22, 2011.[[11]](#footnote-11) A Notice of the Tentative Order and proposed 2012 TRM update was published in the *Pennsylvania Bulletin* on October 8, 2011.[[12]](#footnote-12) Comments were due on October 28, 2011, with reply comments due November 7, 2011.

The following parties filed comments to the proposed 2012 TRM update: The Energy Association of Pennsylvania (“EAP”); EnerNOC, Inc. (“EnerNOC”); Metropolitan Edison Co., Pennsylvania Electric Co., Pennsylvania Power Co., and West Penn Power Co. (collectively “FirstEnergy”); PECO Energy Co. (“PECO”); Pennsylvania Ski Area Assoc. (“PSAA”); PPL Electric Utilities Corp. (“PPL”); and UGI Utilities, Inc. – Gas Division, UGI Penn Natural Gas, Inc., and UGI Central Penn Gas, Inc. (collectively, “UGI”). The following parties filed reply comments: Citizen Power and PECO.

**DISCUSSION**

The changes and improvements to the TRM are based on more recent research and data, as well as the needs and experiences of the EDCs. The EDCs provided, through the SWE evaluation and verification process, much of the data that forms the basis of the changes and improvements being adopted in the 2012 version of the TRM. Specifically, the current changes were the result of SWE site inspections, Conservation Service Provider (“CSP”) comments, independent evaluations and EDC proposals for new EE&C measures. The adopted changes focus on protocols for additional residential, and commercial and industrial (“C&I”) EE&C measures and clarify when the TRM is to be used and applied. The Commission believes that these adopted changes will make the TRM a more effective and professional tool for validating energy savings and providing support for the Act 129 goals. The major goals of the adopted changes are as follows:

* To add protocols for EE&C measures being implemented by the EDCs and to broaden the scope of the TRM;
* To appropriately balance the integrity and accuracy of claimed energy savings estimates with costs incurred to measure and verify the claimed energy savings;
* To clarify existing calculation methods;
* To minimize the number of EE&C measures that must be evaluated through custom protocols;
* To provide additional reasonable methods for measurement and verification of incremental energy savings associated with EE&C measures without unduly burdening EDC EE&C program and evaluation staff; and
* To provide guidance regarding the implementation and evaluation of demand response (“DR”) programs.

Below, we will discuss in detail the more significant TRM changes and updates that are being adopted. Minor administrative and uncontested changes will not be discussed.

# A. Additional Residential EE&C Measure Protocols

The Commission understands that the expansion of the residential section of the TRM is essential for the accurate, timely and cost-effective measurement and verification of the EDCs’ EE&C programs. In its *Tentative Order*, the Commission included the addition of ten new residential EE&C measure protocols, many of which were measures that constitute a large portion of the EDCs’ reported energy and demand savings. The EDCs’ independent evaluators, in collaboration with the SWE, produced, reviewed and edited the proposed new residential EE&C measure protocols.

In its comments, PECO noted that the Commission’s *Tentative Order* did not include the ENERGY STAR Office Equipment measure in its list of new residential measures. PECO Comments Appendix at 1.

The Commission recognizes this omission and has included ENERGY STAR Office Equipment in its list of new residential EE&C measures, totaling 11 new residential measure protocols.

 The following new residential EE&C measures and associated protocols[[13]](#footnote-13) were proposed (including ENERGY STAR Office Equipment) in the 2012 TRM update:

* ENERGY STAR Light-Emitting Diodes (“LED”);
* Residential Occupancy Sensors [Occupancy Sensors];
* Appliance Recycling and Replacement with non-ENERGY STAR Refrigerators;
* Holiday Lights;
* Low-Income Lighting;
* Pool Pump Load Shifting [Pool Pump with Load Shifting];
* Pool Pump with Variable Frequency Drive (“VFD”) Motor and Load Shifting;
* Pool Pump with VFD Motor;
* High Efficiency Two-Speed Pool Pump [Pool Pump with Two-Speed Motor];
* Water Heater Tank Wrap [Water Heater Tank Insulation]; and
* ENERGY STAR Office Equipment.

Of the 11 new residential measures proposed in the *Tentative Order*, comments were received on four of them, the Energy Star LEDs, Holiday Lights, Pool Pump Load Shifting and Pool Pump with VFD Motor and Load Shifting, and will be discussed below. The Pool Pump Load Shifting and Pool Pump with VFD Motor and Load Shifting protocols will be addressed together as the comments received on each were identical.

The Commission adopts without modification the remaining seven new residential measures and associated protocols for which no comments were received.[[14]](#footnote-14)

## 1. ENERGY STAR Light-Emitting Diodes

The ENERGY STAR LED protocol documents the energy and demand savings attributed to replacing standard incandescent lamps and fixtures in residential applications with ENERGY STAR LED lamps, retrofit kits, and fixtures. LEDs provide an efficient alternative to incandescent lighting. This protocol is designed to be generic and replace earlier protocols that were specific to a particular make and model of LED lamp.

### Comments

PECO proposed a variety of edits to this protocol. Initially, PECO suggests that the last sentence of the opening paragraph be removed as there were no earlier TRM protocols for ENERGY STAR LEDs. PECO Comments Appendix at 8.

Next, PECO suggests that Table 2-52: General Service Lamps be modified to match Table 2-43 Baseline Wattage by Lumen Output of CFL [compact fluorescent light bulb, “CFL”] as they are similar. Specifically, PECO suggests that Table 2-52 reflect that the Energy Independence and Security Act of 2007 (“EISA 2007”)[[15]](#footnote-15) set the compliance year for 60 watt-equivalent lamps as 2014, not 2013, as shown in Table 2-52. PECO Comments Appendix at 8.

PECO also suggests a correction to the definition of coincidence factor (“CF”). PECO states that the “TRM currently shows: CF = Demand Coincidence Factor, percentage of load connected during peak hours.” It is requested that this language be revised to reflect the following, “CF = Coincidence Factor, defined as the fraction of the technology demand that is coincident with the utility peak.” PECO requested that the amended definition for CF be used consistently throughout the TRM. PECO Comments Appendix at 8.

Lastly, PECO recommends that the reported measure life for reflector CFLs be changed from 13 to either 13.7 or 14 as the footnote associated with measure life states “that all LEDs that qualify for ENERGY STAR have a minimum lifetime of 15,000 hours and that at 3 hours of use per day this equates to 13.7 years.” PECO Comments Appendix at 8.

In its comments, PPL recommends the removal of Footnote 107 from the protocol. PPL Comments at 16. Footnote 107 applied to the in-service rate (“ISR”) value for LEDs. The *Tentative Order* proposed an ISR of 95 percent in footnote 107, but then stated that the 95 percent value was “Subject to verification through evaluation.”[[16]](#footnote-16) PPL suggests that the ISR value be updated, if necessary, in future TRMs and that the TWG would be an appropriate forum for setting this determination. PPL Comments at 16.

### Disposition

The Commission agrees with PECO that the language referencing earlier LED protocols should be removed as previous TRMs did not contain LED protocols. In addition, we corrected the error regarding the 60-watt equivalent compliance year. Specifically, the compliance year for the 60-watt equivalent was corrected to 2014 to be consistent with EISA 2007.

We also adopted a revised definition for CF based on PECO’s suggestion to clarify the definition such that it references the demand of the technology as a whole, compared to a utility’s summer system peak, as defined by Act 129. Our revised definition adds clarity to PECO’s suggestion by specifically referencing Act 129’s definition of a utility’s summer system peak. The definition in the 2011 did not state how the system peak was defined. The definition of CF has been updated in all appropriate sections of the 2012 TRM for consistency.

We corrected the measure life error for LED replacements of incandescent reflector lamps from 13 to 13.7 as suggested by PECO.

The Commission does not agree with PPL’s request to remove footnote 107, which states that the 95 percent ISR is “subject to verification through evaluation.” The Commission believes that the option should be available if EDC evaluation resources are allocated to discern program-specific ISR for this measure and that a value in the TRM can be updated through evaluation to more accurately reflect market conditions. Given that this measure is a new protocol with limited penetration in the residential sector, the Commission believes that the footnote is appropriate.

## Holiday Lights

LED holiday lights reduce energy consumption by up to 90 percent compared to incandescent holiday lights. This protocol documents the energy savings attributed to the installation of indoor and outdoor LED holiday lights.

### Comments

PECO requests that the following language be removed from the Eligibility section of this protocol: “Typical requirements for applicants to receive incentives for this measure are as follows:

• A deadline for purchase and installation.

• Provide proof of purchase and installation.

• An incentive form where customer is to provide information (name, address *etc.*)”[[17]](#footnote-17)

PECO states that the bullet points represent program design elements, not eligibility requirements and, as such, may vary by EDC. PECO Comments Appendix at 9.

 PECO further requests that the reference to cost estimates in the Key Assumptions section be removed as no other algorithms or comments refer to cost and are not necessary. PECO Comments Appendix at 9. PECO also recommends that the definition of “# Strands” be modified by the addition of “per package” at the end. PECO asserts that a single package of LED holiday lights is the operative unit of the energy savings calculation. PECO Comments Appendix at 9. Finally, PECO recommends the removal of the three Weight factor terms from the Definition of Terms section as they are not used in any algorithm. PECO Comments Appendix at 9. The three Weight factor terms in the proposed 2012 TRM were: “*WMini = Weight factor of mini bulbs*,” “*WC7 = Weight factor of C7 bulbs*,” and “*WC9 = Weight factor of C9 bulbs.”[[18]](#footnote-18)*

### Disposition

 The Commission agrees that the eligibility comments, referenced by PECO, should be removed and that the only eligibility requirement should be that the LED holiday lights replace traditional style incandescent lights. PECO was correct to note that the other proposed eligibility requirements were program design elements and not eligibility requirements. We also updated the eligibility requirement language in the TRM and replaced “traditional-style holiday lights” with “traditional incandescent holiday lights” for clarity.

 In addition, we removed any language referencing cost estimates from this protocol since no energy saving algorithms or comments reference cost. The TRM is limited to the determination of the per unit resource savings in physical terms at the customer meter and, therefore, any language that references cost without cost directly factoring into energy savings algorithms should not be included in the TRM.

 Furthermore, we agree with PECO that the operative unit of the energy savings calculation for holiday lights is a single package of holiday lights. The average savings is based on a weighted average of three different bulb sizes for a 25-bulb strand of LED holiday lights. EDC data tracking and gathering would likely collect information based on the number of packages of LED holiday lights. As such, the definition of “# of strands” was updated to incorporate PECO’s suggestion by adding “per package” to the end of the proposed definition. By modifying the definition of “# of strands,” the protocol algorithms now reflect savings on a per package basis.

 Finally, we accept PECO’s recommendation to remove the Weight factor terms as they are not used in the algorithms. By removing the Weight factors, the algorithms allow savings to be calculated by lamp type, if the lamp type is known or set by program design. Otherwise, the protocol states that if the lamp type is not known “the savings for the “mini,” “C7,” and “C9” varieties should be weighted by 0.5, 0.25 and 0.25 respectively.”[[19]](#footnote-19)

## Pool Pump Load Shifting & Pool Pump with VFD Motor and Load Shifting

The Pool Pump Load Shifting protocol documents the energy savings attributed to the scheduling of residential single-speed pool pumps to avoid running during the peak hours from noon to 8 PM. The residential pool pump reschedule measure is intended to produce demand savings not consumption reductions. The demand savings result from not running pool pumps during the peak hours from noon to 8PM on weekdays.

The Pool Pump with VFD Motor and Load Shifting measure has two potential components. The first component is the VFD on a pool pump that is installed on a residential pool. VFDs on pool pumps can adjust the flow rate so that the minimal required flow is achieved for each application, resulting in energy savings. The second component is that the variable speed pool pump may be commissioned such that it does not operate from noon to 8 PM on weekdays. This second, optional step is referred to as load shifting. Since the only difference between the VFD pool pump without load shifting and VFD pool pump with load shifting measures pertains to the pool pump operation schedule, this protocol is written such that it may support both measures at once.

### Comments

PECO recommends that the CFpre[[20]](#footnote-20) value for both the Pool Pump Load Shifting measure and the Pool Pump VFD Motor and Load Shifting measure should be 0.235 instead of 0.27 as is listed in the proposed 2012 TRM. Specifically, PECO states that “[u]sing the peak period of noon to 8 pm, only the inland hourly coincidence percentages, and the approved non-weather dependent Pennsylvania Coincident Peak Demand calculator for all utilities results in an average CFpre value of 0.235 using the same data source.” PECO also asserts that the 0.27 value is artificially inflated through the use of high coincidence factors from the desert areas of California. PECO Comments Appendix at 9.

### Disposition

The Commission agrees with PECO’s recommendation to adjust the CF from 0.27 to 0.235. Where possible, we believe that using secondary data is more practical than using tertiary data. Therefore, rather than accepting the CF stated in the Mid-Atlantic TRM,[[21]](#footnote-21) which uses PJM Interconnection, LLC’s summer peak window of 2 PM to 6 PM to determine the CF, the Commission agrees that using the non-weather dependent peak demand calculator is most appropriate.[[22]](#footnote-22) In addition, the Commission agrees that use of data from desert and coastal areas does not accurately represent Pennsylvania. Therefore only inland valley data will be used. Based on these assumptions, the calculated statewide average CF has been changed to 0.235 as recommended by PECO.

# Additional Commercial and Industrial EE&C Measure Protocols

The Commission understands that the expansion of the C&I section of the TRM is essential for the accurate, timely and cost-effective measurement and verification of the EDCs’ EE&C programs. In its *Tentative Order*, the Commission included the addition of 17 new C&I EE&C measure protocols, many of which were measures that constitute a large portion of the EDCs’ reported energy and demand savings. The EDCs’ independent evaluators, in collaboration with the SWE, produced, reviewed and edited the proposed new C&I EE&C measure protocols.

In its comments, PECO noted that the Commission’s *Tentative Order* did not list the Geothermal Heat Pumps and ENERGY STAR Room Air Conditioner measures in its list of new C&I measures. PECO Comments Appendix at 3.

The Commission recognizes this omission and has included the Geothermal Heat Pumps and ENERGY STAR Room Air Conditioner measures in its list of new C&I EE&C measures, totaling 19 new C&I measure protocols.

The following new C&I EE&C measures and associated protocols[[23]](#footnote-23) were proposed (including Geothermal Heat Pumps and ENERGY STAR Room Air Conditioner) in the 2012 TRM update:

* Exterior Lighting for New Construction,
* LED Channel Signage [LED Signage],
* Ductless Mini-Split Heat Pumps – Commercial <5.4 tons [Ductless Heat Pumps],
* Small C&I HVAC (Heating, Ventilation and Air Conditioning) Refrigerant Charge Correction [Heat Pump Refrigerant Charge Correction],
* Office Equipment – Network Power Management Enabling [Network Power Management Enabling for Office Equipment],
* Refrigeration – Night Covers for Display Cases [Refrigeration – Night Cover],
* Refrigeration – Strip Curtains for Walk-In Freezers and Coolers [Refrigeration – Strip Curtains for Walk-In Unit],
* Refrigeration – Auto Closers,
* Refrigeration – Door Gaskets for Walk-In Coolers and Freezers [Refrigeration – Door Gaskets],
* Refrigeration – Suction Pipes Insulation [Refrigeration – Bare Suction Pipe Insulation],
* Refrigeration – Evaporator Fan Controller,
* Refrigeration – Special Doors with Low or No Anti-Sweat Heat for Low Temp Case [Refrigeration – Special Doors for Low Temperature],
* ENERGY STAR Electric Steam Cooker [Electric Steam Cooker],
* ENERGY STAR Clothes Washer (Electric Water Heater, Electric Dryer) [Clothes Washer],
* Electric Resistance Water Heaters [Electric Water Heater],
* Heat Pump Water Heaters,
* Low Flow Pre-Rinse Sprayers,
* Geothermal Heat Pumps, and
* ENERGY STAR Room Air Conditioner.

Of the 19 new C&I measures proposed in the *Tentative Order*, substantive comments were received on 17 of them.

The Commission adopts without modification the two new C&I measures and associated protocols for which no comments were received.[[24]](#footnote-24)

The Comments addressing the Small C&I HVAC Refrigerant Charge Correction, Office Equipment – Network Power Management Enabling, and Refrigeration – Night Covers for Display Cases measures were non-substantive and editorial and are adopted. The TRM has been updated accordingly.

The Comments addressing the Refrigeration –Special Doors with Low or No Anti-Sweat Heat for Low Temp Case protocol reflect the acceptance of the protocol, and as such, the Commission adopts this measure and its associated protocol without modification.

The Comments addressing Geothermal Heat Pumps will be addressed in the Clarification of HVAC Protocols section of this Order, as the comments relate to other protocols, as well.

## LED Channel Signage

Channel signage refers to the illuminated signs found inside and outside shopping malls to identify store names. Lighting for these signs is most commonly provided by single or double strip neon lamps, powered by neon sign transformers. This measure involves the replacement of incandescent-lighted or neon-lighted channel letter signs with LED lighting. Retrofit kits or complete replacement LED signs are eligible. Replacement LED signs cannot use more than 20 percent of the actual input power of the sign that is replaced.

### Comments

PECO requests that the algorithms for this measure be modified to either use sign length or number of letters, as the proposed measure only provides for savings per letter, not savings per sign. PECO Comments Appendix at 28.

PECO also requests that the savings values in Table 3-93: LED Channel Signage Calculation Assumptions be split into two categories: channel signs greater than two feet tall and those two feet tall or less, as the savings could vary significantly depending on the distribution of signs being retrofit. PECO Comments Appendix at 29.

### Disposition

The Commission accepts PECO’s suggestion to modify the savings algorithm to account for the number of letters in signs. We also support PECO’s recommendation that the savings for this measure be split into two categories: channel signs greater than two feet tall and those two feet or less. However, this change requires further research before it can be incorporated into the TRM. Therefore, we direct the TWG to address this modification in subsequent TRM updates.

## Ductless Mini-Split Heat Pumps (“DHP”) – Commercial <5.4 tons

ENERGY STAR ductless mini-split heat pumps utilize high efficiency Seasonal Energy Efficiency Ratio (“SEER”)/Energy Efficiency Ratio (“EER”) and Heating Seasonal Performance Factors (“HSPF”) of 14.5/12 and 8.2, respectively or greater. This technology typically converts an electric-resistance heated space into a space heated/cooled with a single or multi-zonal ductless heat pump system.

### Comments

PECO requests the addition of CF to the definition of terms list, the spelling out of acronyms in Table 3-66: DHP – Values and References, and a footnote reference to Appendix F: Zip Code Mapping. PECO Comments Appendix at 20.

PPL approves of the addition of a DHP protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission accepts PECO’s recommendation to add the definition for CF to the Definition of Terms section. The Commission also accepts PECO’s suggestion to add a footnote reference to Appendix F to provide clarification with respect to use of the Table 3-67. We, however, will keep the acronyms in Table 3-66, as all acronyms are spelled out in the measure description.

## Refrigeration – Strip Curtains for Walk-In Freezers and Coolers

Strip curtains are used to reduce the refrigeration load associated with the infiltration of non-refrigerated air into the refrigerated spaces of walk-in coolers or freezers.

### Comments

PECO requests that the sentence, “To the extent that evaluation findings are able to find more accurate assumptions, they may be used in place of the default per square foot savings using the following equation,”[[25]](#footnote-25) be amended to say, “To the extent that evaluation findings are able to provide more reliable site specific inputs, they may be used in place of the default per square foot savings using the following equation.” PECO Comments Appendix at 19. PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission accepts PECO’s suggestion to modify Section 3.17. In the TRM, Section 3.17, the third sentence of the Algorithms section has been modified as suggested by PECO.

## Refrigeration – Auto Closers

Auto-closers on freezers and coolers can reduce the amount of time that doors are open, thereby reducing infiltration and refrigeration loads. These measures are for retrofit of doors not previously equipped with auto-closers and assume the doors have strip curtains. This protocol documents the energy savings attributed to installation of auto closers in walk-in coolers and freezers.

### Comments

PECO states that auto closers can also apply to reach-in units and, as such, this protocol should be expanded in the next TRM update. PECO Comments Appendix at 21. PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission supports the expansion of the Refrigeration – Auto Closers protocol to include reach-in units. We therefore direct the TWG to address this protocol in future TRM updates.

## Refrigeration – Door Gaskets for Walk-In Coolers and Freezers

Tight-fitting gaskets inhibit infiltration of warm, moist air into the cold refrigerated space, thereby reducing the cooling load. Aside from the direct reduction in cooling load, the associated decrease in moisture entering the refrigerated space also helps prevent frost on the cooling coils. Frost build-up adversely impacts the coil’s heat transfer effectiveness, reduces air passage (lowering heat transfer efficiency) and increases energy use during the defrost cycle. As such, replacing defective door gaskets reduces compressor run time and improves the overall effectiveness of heat removal from a refrigerated cabinet and providing energy usage reductions.

### Comments

PECO states that door gaskets can also apply to reach-in units and, as such, this protocol should be expanded in the next TRM update. PECO Comments Appendix at 21. PECO also requested that the first paragraph of the protocol be amended per its comments to improve the clarity of the measure description. PECO Comments Appendix at 21. PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission supports the expansion of the Refrigeration – Door Gaskets protocol to include applications to reach-in units. We therefore direct the TWG to address this protocol in future TRM updates. We also accept PECO’s suggestion to modify the introductory paragraphs to Section 3.24 and have updated the TRM accordingly.

## Refrigeration – Suction Pipes Insulation

This measure applies to the installation of insulation on existing bare suction lines that are located outside of the refrigerated space. Insulation impedes heat transfer from the ambient air to the suction lines, thereby reducing undesirable system superheat. This decreases the load on the compressor, resulting in decreased compressor operating hours and energy usage.

### Comments

PECO requests the removal of the following language from the first paragraph of the Algorithms section: “According to a survey carried out in the study, approximately 70% of refrigerated cases in audited grocery stores are medium temperature cases and 30% are low-temperature cases. As a result, the energy savings shown in this report are the weighted average energy savings (70% medium-temperature, 30% low-temperature).”[[26]](#footnote-26) PECO states that this text is irrelevant as it applies to a different source than the data referenced in Table 3-82: Insulate Bare Refrigeration Suction Pipes Savings per Linear Foot. PECO Comments Appendix at 22.

Additionally, PECO suggests that the “Coolers” and “Freezers” headings of Table 3-82: Insulate Bare Refrigeration Suction Pipes Savings per Linear Foot, be changed to “Medium-Temperature” and “Low-Temperature,” respectively, to be more general and include lines to walk-in boxes and cases. PECO Comments Appendix at 22. Lastly, PECO suggests the addition of a reference to Appendix F: Zip Code Mapping. PECO Comments Appendix at 22. PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission accepts PECO’s suggestion to remove irrelevant language from Section 3.25 and has modified this Section consistent with PECO’s suggestion. We also accept PECO’s recommendation to rename the headers in Table 3-82, thus removing any unintended restriction to the applicability of this protocol and allow other similar measures to be addressed by this protocol. Finally, we accept PECO’s suggestion to add a footnote reference to Appendix F to provide clarification with respect to use of the Table 3-67: DHP – Values and References.

## Refrigeration – Evaporator Fan Controller

This measure is for the installation of evaporator fan controls in medium-temperature walk-in coolers with no pre-existing controls. Evaporator fans run constantly to provide cooling when the compressor is running and to provide air circulation when the compressor is not running. The controller reduces air flow rather than turning fans off completely when the compressor is not operating, as minimum airflow is required to provide defrosting and to prevent the air in the cooler from stratifying into layers of higher and lower temperature. These fan controllers saves energy by reducing fan usage, by reducing the refrigeration load resulting from the heat given off by the fan and by reducing compressor energy usage resulting from the electronic temperature control.

### Comments

PECO requests that the applicability of evaporator fan controls be more fully explained. PECO states that there are a variety of evaporator fan controller systems that operate in different manners, such as adding a smaller fan to cycle the air while the evaporator fans are off, by adding a VFD or by cycling the fans on and off. PECO notes that the equations specified in this section are for fans that are turned off and/or cycled only. PECO Comments Appendix at 22. PECO also requests that the following be removed from the first paragraph of the protocol: “The controller reduces air flow rather than turning fans off completely when the compressor is not operating because a minimum airflow is required to provide defrosting and prevent the air in the cooler from stratifying into layers of higher and lower temperature.”[[27]](#footnote-27) PECO asserts that this is not appropriate for the equations in the protocol as the fans do turn off but can also cycle to prevent air stratification. PECO Comments Appendix at 22.

In addition, PECO requests the addition of the language “(See Table 3-83 for power factor)” to the definitions of kWFan and kWCP.[[28]](#footnote-28) PECO Comments Appendix at 23. PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

 The Commission adopts the suggestions provided by PECO regarding this protocol, to include adding language to the TRM that more fully explains which evaporator fan control applications are covered by this protocol.

## ENERGY STAR Electric Steam Cooker

This measure applies to the installation of electric ENERGY STAR steam cookers as either a new item or as replacement for an existing unit. A qualifying steam cooker must meet a minimum cooking efficiency of 50 percent and meet idle energy rates specified by pan capacity. The baseline equipment is a unit with efficiency specifications that do not meet the minimum ENERGY STAR efficiency requirements.

### Comments

PPL requests clarification of this measure. Specifically, PPL requests that the Commission clarify the use of 26 percent for a baseline as opposed to 30 percent, or that the Commission revise Table 3-70 to include the 30 percent value. PPL Comments at 8.

### Disposition

 The Commission agrees with PPL’s proposal to change the Eff rating value for a baseline model in Table 3-70 to 30 percent in order to be consistent with ENERGY STAR values. The TRM has been updated accordingly.

## ENERGY STAR Clothes Washer

This protocol documents the energy savings attributed to efficient clothes washers meeting ENERGY STAR or Consortium for Energy Efficiency (“CEE”) Tier 1 standards[[29]](#footnote-29) or better in small commercial applications. This protocol is limited to clothes washers in multi-family establishments.

### Comments

PECO recommends the inclusion of clothes washers with gas as a fuel source. PECO asserts that the residential protocol for clothes washers allows savings to be claimed for gas fuel sources and that the commercial protocol should as well. PECO Comments Appendix at 23. PECO also requests that the second sentence of the Figure 3-1 section be modified by changing the 1,144 value to 950. PECO Comments Appendix at 23.

### Disposition

The Commission supports the expansion of the ENERGY STAR clothes washer protocol to include clothes washers with gas as a fuel source. Specifically, we agree with PECO that the commercial protocol should allow savings to be claimed for gas fuel sources in a manner similar to the residential protocols. The energy and demand savings for different combinations of water heater and dryer types have been added to the protocol based on the values taken from the ENERGY STAR calculator developed for commercial clothes washers, similar to how energy and demand savings are calculated for clothes washers in the residential sector. This modification eliminates the need to estimate the number of loads per year; thus eliminating the need to change the value in Figure 3-1, as suggested by PECO.

## Electric Resistance Water Heaters

Efficient electric resistance water heaters use resistive heating coils to heat water. Premium efficiency models generally use increased tank insulation to achieve energy factors ranging from 0.93 to 0.96. This protocol documents the energy savings attributed to efficient electric resistance water heaters with a minimum energy factor of 0.93 compared to a baseline electric resistance water heater with an energy factor of 0.90.

### Comments

PECO requests that the measure description be corrected to reflect a standard water heater efficiency value of 0.904 and that the algorithm be adjusted to match all other water heater measures in the TRM. PECO Comments Appendix at 24. PECO also asserts that the use of kBtu loads from DEER[[30]](#footnote-30) in the current algorithm results in incorrect units of kWh\*°F. PECO provides a revised algorithm for converting DEER gas use data to average annual gallons of use. PECO Comments Appendix at 24. Additionally, PECO provides a revised version of Table 3-86: Typical water heating loads, using DEER baseline end-use loads and a variety of other factors for determining the table’s values. PECO Comments Appendix at 24. PECO requests that Table 3-87: Electric Resistance Water Heater Calculation Assumptions be amended to reflect the exact calculation of 0.904 for the EFbase[[31]](#footnote-31) value. Additionally, PECO requests that the “Load” parameter in Table 3-87 be replaced with “annual gallons of use.” PECO Comments Appendix at 25. Finally, PECO requests that Table 3-88: Energy Savings and Demand Reductions be amended based on the comments noted above. PECO Comments Appendix at 25.

### Disposition

The Commission accepts PECO’s proposal to change the standard water heater efficiency value to 0.904 in the protocol. Where appropriate, the TRM has been modified to ensure adherence to the federal standards.

The Commission agrees with PECO that the algorithm should be adjusted to be consistent with all other water heater measures in the TRM. The Commission also accepts the methodology suggested by PECO for converting DEER gas use data to average annual gallons of use. The Commission revised Table 3-86 based on PECO’s comments, but modified the average annual use in gallons values to reflect a cold water temperature of 55°F and a baseline gas EF of 0.594 to be consistent with other protocols and standard assumptions in the TRM. We also added the value for Resistive Heating Discount Factor[[32]](#footnote-32) in Table 3-87 after noticing that the value was missing in the current protocol. For this protocol, the appropriate value is one. This does not modify savings but does make the algorithm consistent with other similar water-related protocols. We also amended Table 3-88 based on the comments provided.

The Commission rejects PECO’s proposed domestic cold water and domestic hot water supply temperatures and maintains the existing temperatures, consistent with other water-related protocols in the TRM. The Commission uses a baseline gas energy factor value of 0.594 instead of 0.54 recommended by PECO. The latest U.S. Department of Energy (“DOE”) energy efficiency (“EE”) standards, effective in 2006, require that the minimum baseline efficiency for this equipment be 0.594[[33]](#footnote-33). Furthermore, the Commission modified the algorithm to remove the factor “365” from the savings algorithm as the average annual gallons of use values already account for annual usage.

## Heat Pump Water Heaters

Heat pump water heaters take heat from the surrounding air and transfer it to the water in the tank, unlike conventional electrical water heaters which use resistive heating coils to heat the water. This measure involves a direct retrofit of a resistive electric water heater with a heat pump water heater. It does not cover systems where the heat pump is a pre-heater or is combined with other water heating sources.

### Comments

PECO requests that the measure description be corrected to reflect a standard water heater efficiency value of 0.904 and that the algorithm be adjusted to match all other water heater measures in the TRM. PECO Comments Appendix at 26. PECO notes that the use of kBtu loads from DEER in the current algorithm results in incorrect units of kWh\*°F. PECO provides a revised algorithm for converting DEER gas use data to average annual gallons of use. PECO Comments Appendix at 26. Additionally, PECO provides a revised version of Table 3-89: Typical water heating loads, using DEER baseline end-use loads and a variety of other factors for determining the table’s values. PECO Comments Appendix at 27. PECO further requests that Table 3-91: Electric Resistance Water Heater Calculation Assumptions be amended to reflect the exact calculation of 0.904 for the EFbase value. Additionally, PECO requests that the “Load” parameter in Table 3-91 be replaced with “annual gallons of use.” PECO Comments Appendix at 27.Lastly, PECO requests that Table 3-92: Energy Savings and Demand Reductions be amended based on the comments noted above. PECO Comments Appendix at 28.

PPL approves of the addition of this protocol for the C&I sector. PPL Comments at 8.

### Disposition

The Commission accepts PECO’s proposal to change the standard water heater efficiency value of 0.90 to 0.904 in the protocol. Where appropriate, the TRM has been modified to ensure adherence to the standards. The Commission agrees with PECO that the algorithm should be adjusted to be consistent with all other water heater measures in the TRM. The Commission also accepts the methodology suggested by PECO for converting DEER gas use data to average annual gallons of use. Finally, we accept PECO’s request of amending Table 3-92 based on the comments provided.

The Commission, however, disagrees with PECO in terms of the assumptions made for some of the key variables. The Commission uses a baseline gas EF value of 0.594 instead of 0.54 recommended by PECO. The latest U.S. DOE EE standards, effective in 2006, require that the minimum baseline efficiency for this equipment be 0.594.[[34]](#footnote-34) The Commission uses cold water temperature of 55°F instead of 67°F suggested by PECO. These assumptions have been modified to remain consistent with all the other water heater measures in the TRM.

## Low Flow Pre-Rinse Sprayers

This protocol documents the energy savings and demand reductions attributed to efficient low flow pre-rinse sprayers in grocery and non-grocery (primarily food service) applications. The most likely areas of application are kitchens in restaurants and hotels. Only premises with electric water heating may qualify for this incentive. Low flow pre-rinse sprayers reduce hot water usage and save energy associated with water heating.

### Comments

PECO requests that the protocol be amended to contain algorithms consistent with other water heater-related measures. PECO Comments Appendix at 29 and 30. PECO also suggests that the Definition of Terms be clarified to show that the cold water temperature is for incoming water and that the hot water temperature is for water coming from the spray nozzle. Suggesting that these values should have been 55°F for Tc,[[35]](#footnote-35) and 107°F and 97.6°F for non-grocery and grocery applications, respectively. PECO Comments Appendix at 30. PECO further requests that the measure description be corrected to reflect a standard water heater efficiency value of 0.904 and that the algorithm be adjusted to match all other water heater measures in the TRM. PECO Comments Appendix at 30. Finally, PECO requests clarification regarding the EnergyToDemandFactor in Table 3-94: Low Flow Pre-Rinse Sprayer Calculations Assumptions. The proposed 2012 TRM provided an EnergyToDemandFactor of 0.000193885.[[36]](#footnote-36) PECO states that it was unclear whether or not the EnergyToDemandFactor was updated for commercial applications from the residential measures And if not it should be corrected to match the 0.00009172 as listed in the residential sections, or 0.0001916 as listed in measure 3.28. If it was updated, measures 3.27, 3.28, 3.29, and 3.31 should all be reviewed for internal consistency. PECO Comments Appendix at 31.[[37]](#footnote-37)

### Disposition

The Commission agrees with PECO that the algorithm should be modified to be consistent with all other water heater measures in the TRM. The Commission, however, rejects PECO’s request to combine both the algorithms for grocery and non-grocery applications into a single algorithm. The Commission believes that the algorithms currently in the TRM clearly differentiates between these applications and is consistent with the Definition of Terms section and Table 3-94.

The Commission accepts PECO’s suggestion to modify the definitions for terms including Thot and Tcold, thereby clarifying that the cold water temperature is for incoming water and that the hot water temperature is for water coming from the spray nozzle. The Commission also agrees with PECO that these values should be updated to 55°F for Tcold and 107°F and 97.6°F for Thot for non-grocery and grocery applications, respectively. The TRM has been updated accordingly.

The Commission reject's PECO's request to modify the Definition of Terms section for a variety of other variables to remain consistent with the acronyms listed in Table 3-87: Electric Resistance Water Heater Calculation Assumptions.

The Commission accepts PECO’s proposal to change the standard water heater efficiency value of 0.90 to 0.904 in the protocol. Where appropriate, the TRM has been modified to ensure adherence to the standards.

The Commission confirms that the values for EnergyToDemandFactor for

sections 3.27, 3.28, 3.29, and 3.31 in the TRM have been updated for commercial applications from the residential measures. After review, the Commission changed the value from 0.000193885 to 0.0001916 to be consistent with sections 3.28 and 3.29.

Furthermore, based on the incorporation of the above-mentioned changes into the 2012 TRM, the Commission revised the values for unit energy savings and unit peak demand reductions in the protocol.

# General Improvements

 Several issues not particular to a measure were identified by the TWG as overarching TRM issues and were addressed in Section 1: Introduction of the TRM. Additionally, some issues from the 2011 TRM update were referred to the TWG for resolution. Discussions of each issue and associated resolutions are presented in this section.

## Mapping Zip Codes to Reference Cities for Weather-Dependent Measures

 The *Tentative Order* stated that savings for weather-dependent measures are driven in part by weather-related variables that differ in different parts of Pennsylvania. Previous iterations used several Pennsylvania cities as reference cities to reasonably estimate weather-dependent variables without needing to define such variables for every city. To provide more clarity, the Commission proposed three improvements in the *Tentative Order*. First, the Commission proposed the addition of Allentown as a reference city, which was previously not used for C&I protocols and would be consistent with residential protocols. Second, the Commission proposed the use of a mapping table to assign a reference city for each zip code in Pennsylvania. Lastly, the Commission proposed the use of a mapping table to assign a California climate zone for each reference city.

### Comments

PPL agrees with the addition of Allentown as a reference city for weather- dependent [HVAC] measures, noting that it would result in a more accurate ex-ante savings estimate. PPL also supports the addition of the proposed zip code mapping table for mapping each Pennsylvania zip code to one of the reference cities. Furthermore, PPL agrees with using a mapping table to assign a California climate zone for each reference city, stating that the added flexibility to the protocols would enable the use of the Database for Energy Efficient Resources for determining savings for weather-dependent measures using California-based models. PPL Comments at 9 and 10.

PECO suggests that identifying the associated American Society of Heating, Refrigerating and Air Conditioning Engineers (“ASHRAE”) climate zone with each zip code would be helpful in the future. PECO Comments Appendix at 33.

### Disposition

 The Commission adopts the three proposals as set forth in the *Tentative Order*. We do not, however, adopt PECO’s suggestion to identify the associated ASHRAE climate zones at this time. The Commission agrees with PECO that identifying the ASHRAE climate zone for each zip code could be helpful in the future, however, we believe that the mapping table that assigns each zip code to a reference city is currently adequate.

## Determination of Baselines for Measures Replaced Upon Failure or at End of Useful Life

The *Tentative Order* stated that annual savings and lifetime savings for a measure are highly dependent on what is considered the baseline for that measure. Differences primarily exist between the “burnout” and “early replacement” scenarios. The Commission proposed that these scenarios be defined for TRM protocols on a measure-by-measure basis starting with the highest priority measures.

### Comments

PPL agrees that the baseline condition (burnout or early replacement) needs to be determined correctly to provide the most accurate estimate of savings, but notes practical concerns with determining whether equipment was replaced on burnout or early replacement. Specifically, PPL asserts that the additional information may not be available, may be unreliable, may confuse customers or may add a level of complexity that ultimately will increase tracking and evaluation costs. PPL recommends that the Commission provide EDCs with the discretion to determine if they want to assume replace on burnout (and claim lower savings), or incur the additional cost and complexity to determine if the equipment was an early replacement (and claim higher savings). PPL Comments at 10-12.

### Disposition

The Commission agrees with PPL that practical concerns and limitations that affect the implementation of EE and DR programs should be considered. We, however, do not agree that information regarding existing equipment is always difficult to acquire. For example, some measures may only require the efficiency ratings of the existing unit(s), which may require some additional work on the part of the participant but should hardly impact the overall cost of program implementation. Therefore, we will adopt PPL’s recommendation to allow EDCs the discretion to assume replace on burnout scenarios and claim lower savings or collect additional customer data to determine when early replacement scenarios are appropriate and claim higher savings. We do not believe that PPL’s recommendation is contrary to the initial proposal stated in the *Tentative Order* but rather adds more clarity. TRM protocols that already differentiate between replace on burnout and early replacement scenarios (e.g. motors and HVAC protocols) assume the replace on burnout scenario as the default. EDCs may claim savings per the early replacement scenario only if that information is available. As such, we direct the TWG to prioritize measures, for which a distinction between early replacement and replace on burnout scenarios are needed to help determine more accurate estimates of savings, based on impacts and overall contribution to the Act 129 programs and address them in future TRM updates. The TWG is to provide recommendations to the Commission regarding updated savings protocols for both scenarios that take into account program delivery methods, federal standards, market trends, and other factors while considering unintended implementation barriers.

## Eligibility of Fuel Switching (Non-Electric to Electric)

 In the *Tentative Order*, we proposed to allow EDCs to continue to offer fuel switching programs based on both electric and non-electric sources as part of their Act 129 EE&C plans, noting, however, that improperly constructed incentives could unfairly impact non-electric energy suppliers. As such, we stressed that the focus of the rebates should be to encourage the purchase of high-efficiency appliances by those customers who had already made the decision to change energy sources, noting that our review of proposed rebates will be based on such a premise.

* + - 1. **Comments**

PPL agrees that rebates should encourage the purchase of higher efficiency appliances by customers who have already decided to change energy sources. PPL Comments at 12.

 UGI welcomes the inclusion of standards for measuring efficiency gains designed to encourage electric to gas water heating and electric heating to gas space heating. UGI comments that since the Commission has allowed for fuel switching in that respect, the Commission should develop and include standards for C&I water heating conversions in the 2012 TRM. UGI Comments at 4. Additionally, UGI avers that Section 1.1: Purpose of the TRM should expand applicability of the TRM standards to smaller EDC and natural gas distribution company (“NGDC”) EE&C programs. UGI Comments at 5. Furthermore, UGI asserts that the TWG membership should be expanded to include NGDC and small EDC representatives who wish to participate. UGI Comments at 5. UGI states that it would be helpful to establish uniform standards for making electric and gas price projections, that are based on publicly available information and to include these standards in future TRM editions. UGI comments at 5. Finally, UGI states that the requirements regarding the EDCs’ tracking and reporting of customers participating in EE&C programs in which they are switching to electric from a non-electric fuel source are neither being adhered to, nor enforced.[[38]](#footnote-38) UGI maintains that this information has not been made publicly available despite requirements to do so, as documented in previous Act 129 orders. UGI comments at 5 and 6.

 In response, FirstEnergy, states that the TWG is not closed to any party but that active participation by the gas utilities in the TWG would be more appropriate when EE targets and programs are mandated for NGDCs. FirstEnergy Reply Comments at 2.

* + - 1. **Disposition**

 UGI’s assertion that the Commission has approved the inclusion of standards related to electric to gas water heating and electric heating to gas space heating in the TRM for the purpose of encouraging fuel switching is incorrect. These items are included in the TRM because they were deemed cost-effective by the EDCs and Commission and guidance on their measurement was necessary in the TRM. UGI’s contention that the Commission should develop and include standards for C&I water heating conversions in the 2012 TRM is without merit, as no EDC has proposed either measure.

The Commission does not support UGI’s recommendation to expand the TRM’s applicability to include standards for smaller EDCs, as well as NGDCs. The TRM is a tool designed to be used by utilities that are required to comply with Act 129, as well as determining alternative energy credits to be attributed to demand-side management in accordance with the Alternative Energy Portfolio Standards Act. The Commission encourages NGDCs and small EDCs to utilize the TRM as a guide when crafting their own EE&C plans. However, since smaller EDCs, as well as NGDCs, are not included in the Act 129 mandate, the Commission rejects the proposal to expand the current TRM’s applicability to these groups at this time, as such an effort would require the expenditure of already limited resources with little or no immediate public benefit. It must be noted that, at the moment, the costs associated with the TWG and the development of the TRM are being born by the large EDC electric ratepayers.

Therefore, until such time that NGDCs or small EDCs develop or are required to develop comprehensive and robust energy (natural gas or electric) efficiency programs, funded by their ratepayers, we will not expand applicability of the TRM or the efforts of the TWG to include specific natural gas efficiency measures, NGDCs nor small EDCs. The Commission, however, agrees with FirstEnergy that the TWG is not closed to any party, to the extent that the focus of their participation is on establishing appropriate and reliable protocols for implementing and measuring the effectiveness of electric EE and DR programs that relate to approved EDC EE&C plans. Neither the TRM, nor the TWG are the appropriate forum for entities to advocate for, promote or market their products. The Act 129 Stakeholder groups and evidentiary hearings are a more appropriate forum to advocate, promote or market for the incorporation of new measures or technology into an EDC’s EE&C portfolio.

UGI has suggested that uniform standards for price projections be established and then included in the TRM. This suggestion was previously addressed by the Commission’s TRC Test order, adopted July 28, 2011. [[39]](#footnote-39) Specifically, we state in that order that

PECO, FirstEnergy and PPL point out that the Tentative Order did not provide instruction on how to value the increased fuel costs due to fuel switching. We will adopt the suggestions of PECO and PPL to define the increased fuel costs as the NYMEX gas costs for the first 10 years and the EIA gas cost projections thereafter.[[40]](#footnote-40)

Additionally, this TRC Order reaffirmed previously established electric avoided cost projection methodologies.[[41]](#footnote-41)

UGI’s assertion that Act 129 electric to non-electric fuel source reporting requirements are not being adhered to or enforced is incorrect. The EDCs have reported to the TWG that there have been no such switching and therefore, there is nothing to report. However, the Commission understands and agrees with UGI’s request to have the amount of switching in writing, even if the answer is that no such switching has occurred. Therefore, the Commission directs the EDCs to report this information in their annual reports beginning with their program year three (June 1, 2011 – May 30, 2012) preliminary annual reports due July 15, 2012.

## Use of Residential Protocols in Commercially Metered Spaces

Protocols in the residential sector quantify savings for measures typically found in residential areas under residential meters. Likewise, protocols in the C&I sector quantify savings for measures typically found in C&I areas under C&I meters. However, there is some overlap where measure type, usage and the sector do not match. Therefore, in the *Tentative Order*, we proposed that EDCs use protocols from the residential or C&I sectors according to usage characteristics rather than the sector under which the account is metered.

### Comments

PPL agrees that EDCs should use measures from the residential or C&I section according to usage characteristics, rather than the sector under which the account is metered, asserting that such clarification will result in simplified implementation and encourage customer participation. In addition, PPL proposes that this discussion be moved and labeled separately under a subsection of Section 1 to ensure that the use of residential measures for commercially metered spaces is fully described and identifiable in the 2012 TRM. PPL Comments at 13 and 14.

### Disposition

The Commission adopts the proposed language that specifies the appropriate protocol to use relative to usage characteristics. In addition, this section has been relabeled under Section 1.17: Measure Applicability Based on Sector, per PPL’s recommendation. The previous Section 1.17: Algorithms for Energy Efficient Measures has been renumbered Section 1.18.

# Improvements to Existing Residential EE&C Measure Protocols and Processes

 The following sections describe clarifications and modifications to Residential protocols:

## Clarification of Electric HVAC Protocols

This section relates to the residential electric HVAC protocols contained in Section 2.1 of the 2012 TRM. These protocols contain savings algorithms for a variety of HVAC measures, such as air conditioners, heat pumps, and ground source heat pumps.

### Heating Savings for Heat Pumps

 The method for determining residential high-efficiency cooling and heating equipment energy impact savings is based on algorithms that determine a heat pump’s cooling and heating energy use and peak demand contribution. Included in this protocol are algorithms for measures that provide services to maintain, service or tune-up air source heat pump (“ASHP”) units and measures that improve duct systems by reducing air leakage. Whereas the 2011 TRM only accounted for the cooling energy savings from maintenance and duct sealing, the proposed protocol for the 2012 TRM includes additional algorithms that account for the heating savings that result from implementing these measures.

#### Comments

 PPL agrees with the changes to account for heating savings from the installation of high-efficiency heat pumps. PPL also notes that the change to incorporate heating savings applies only to maintenance and duct sealing. PPL Comments at 14.

#### Disposition

 The Commission adopts the changes to the protocol related to heating savings for heat pumps. PPL’s comment that heating savings only applying to maintenance and duct sealing is noted by the Commission. Consistent with PPL’s comment “Proper sizing” and “quality installation” were removed in the proposed protocol. As such, maintenance and duct sealing are the only electric HVAC system improvement measures included in the protocol to which heating savings could apply. Any language referencing energy savings from proper sizing was removed.

## Clarification of Lighting Protocols

### CFL Hours of Operation per Day

In its 2009,[[42]](#footnote-42) 2010,[[43]](#footnote-43) and 2011[[44]](#footnote-44) TRMs, the Commission defined an hours of usage (“HOU”) value for CFLs of 3.0. However, during the 2011 TRM update, the Commission recognized that the 3.0 value may not be accurate for Pennsylvania and subsequently, directed the TWG to discuss and develop CFL HOU study proposals to be submitted to the Commission by June 1, 2011.[[45]](#footnote-45) These proposals were to include a variety of factors including, but not limited to, market penetration, light metering, light logging, estimated costs and funding methodologies.

This direction led the SWE and Commission staff to further research CFL lighting studies conducted in other jurisdictions. During this research, the SWE and Commission staff determined that geographic location plays a large role in the hours of usage of lighting and as such, would be a primary factor in reviewing studies. Two studies were chosen for more thorough review by Commission staff, the SWE and the TWG.

The first study was conducted by Nexus Market Research, Inc., RLW Analytics, Inc. and GDS Associates and submitted to the Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island and Vermont in 2009. The study concluded that an average HOU value for CFLs purchased through the markdown programs in these states should be 2.97 hours of use per day for CFLs installed in kitchens, living rooms, family rooms, dining rooms and offices, and 2.05 hours of use per day for all other rooms.[[46]](#footnote-46)

The second study was conducted by Navigant Consulting and presented to Baltimore Gas and Electric, Potomac Electric Power Company, Delmarva Power and Light, Southern Maryland Electric Cooperative and Allegheny Power. This study was completed in 2011 and concluded that a “mean-annualized HOU estimate of 2.98” was an appropriate value for CFL HOU.[[47]](#footnote-47)

In its *Tentative Order*, the Commission proposed the continued use of the 3.0 value for CFL HOU in the 2012 TRM. The Commission stated that, as the Maryland market, geographic attributes, weather and other factors are similar to Pennsylvania, the Commission believed the values found in the latter study, presented by Navigant Consulting in 2011, were also representative of conditions in Pennsylvania and confirm the applicability of the existing 3.0 CFL HOU value for use in the 2012 TRM. The Commission requested comments on its proposal.

#### Comments

PECO and PPL agree with the Commission’s proposed usage of 3.0 as the CFL HOU value. PECO Comments at 3 and PPL Comments at 15. Additionally, PECO suggests that the SWE and TWG should continue to monitor and review HOU studies in relevant markets moving forward. PECO Comments at 3.

#### Disposition

The Commission agrees with PECO that the SWE and the TWG should continue to monitor and review studies related to CFL HOU values in markets similar to Pennsylvania’s and provide recommendations for future TRM updates. The Commission adopts the continued use of the 3.0 CFL HOU value.

### Methodology for Determining Delta Watts for CFLs

Savings from installation of screw-in ENERGY STAR CFLs, ENERGY STAR fluorescent torchieres, ENERGY STAR indoor fixtures and ENERGY STAR outdoor fixtures 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. The 2012 TRM includes Table 2-43: Baseline Wattage by Lumen Output of CFL, which maps the baseline wattage of incandescent bulbs by lumen output of CFLs. In the *Tentative Order* we proposed that the delta watts be determined by calculating the difference between the CFL wattage and the equivalent incandescent bulb wattage, which is defined as the incandescent bulb with similar lumen output as the new bulb.

#### Comments

 PPL recommends that additional clarity be added to the 2012 TRM to distinguish between specialty and non-specialty CFL lamps. PPL notes that the proposal referenced a mapping table for determining baselines for "specialty" bulbs.[[48]](#footnote-48) PPL requests that more information be provided on this table, as it appears to be missing from the 2012 TRM. PPL states that if the Commission intended to reference Table 2-43 in the 2012 TRM for "non-specialty" bulbs, PPL recommends that the language in the *Tentative Order* be revised accordingly. PPL Comments at 15 and 16.

#### Disposition

 The Commission agrees with PPL’s recommendation to add clarity to the definition of specialty bulbs and has added language to the protocol in a footnote. A non-specialty CFL is considered to be any lamp that does not replace one of the 22 incandescent lamps exempt from the EISA 2007 standards. A reference to the 22 exempt incandescent lamps has been provided in the footnote. The Commission intended to reference Table 2-43 in the 2012 TRM for “non-specialty” CFLs and has ensured that the language in the 2012 TRM is consistent with the Commission’s intent.

### Implementation of Federal Legislation and Regulations Related to Residential Lighting

Table 2-43: Baseline Wattage by Lumen Output of CFL in the proposed 2012 TRM, which determines baselines of CFL replacements, incorporates changing baselines consistent with the EISA 2007 standards. The Commission proposed that the baseline for CFLs be updated per the EISA 2007 standards. This baseline change would coincide with the TRM updates.

#### Comments

 PPL supports implementing the EISA 2007 standards, but asserts that this change should not be adopted until June 1, 2013, because time must be allotted to address stockpiling and reduced savings in the fourth year of a four-year program. PPL asserts there is insufficient time to modify its plan to make-up any shortfall that may occur due to this change. PPL Comments at 16 and 17.

#### Disposition

The Commission adopts changes to the baseline starting in June 1, 2012. Baseline changes are implemented six months after the effective date of the EISA 2007 standards, accounting, to some degree, the effect of stockpiling. This change will account for the transformation of customer standard practice related to residential lighting due to code changes. Regarding PPL’s assertion that there is insufficient time to modify its plans, the Commission refers to Section J of this Order.

## Refrigerator and Freezer Retirement and Recycling

This measure involves the recycling and replacement, before end of life, of an existing refrigerator or freezer with a new refrigerator or freezer. This protocol quantifies savings where the replacement refrigerator or freezer is either ENERGY STAR or non-ENERGY STAR qualified.

 In previous versions of the TRM,[[49]](#footnote-49) the deemed energy savings values were based on estimates. These estimates relied on averages that may or may not accurately reflect conditions in Pennsylvania. As such, the Commission proposed that the TWG review the applicability of the California Appliance Recycling Program’s regression model (“model”), [[50]](#footnote-50) based on in situ metering data, to update deemed savings values every year. The TWG compiles appliance characteristics from each EDC and calculates statewide averages that feed into the model’s independent variable inputs. Each year, the averages are recalculated using up-to-date information collected from the EDCs. The TWG will then determine if the deemed savings values, as calculated using the model, are more accurate and reflective of Pennsylvania. The Commission requested recommendations regarding the use of the model to determine deemed savings values for the refrigerator and freezer retirement and recycling protocols for future TRM updates.

### Comments

PPL generally agrees with the idea of updating deemed savings to be more accurate. PPL asserts, however, that savings values should only be updated if there is reason to believe the current savings are significantly inaccurate, the measure is a significant contributor to portfolio savings, the cost to determine more accurate savings does not exceed the benefit of more-accurate information and the updated savings become effective with the beginning of an EE&C planning cycle. PPL Comments at 17 and 18. PPL also recommends that all recycled refrigerators and freezers have a deemed gross savings of 1,659 kWh, no matter the replacement scenario. PPL Comments at 6 and 7. FirstEnergy echoes PPL’s comments and emphasizes that the focus should be removal from the grid. FirstEnergy Reply Comments at 2 and 3. Finally, PPL believes that language should be included to note that these protocols apply to residential as well as non-residential sectors. PPL Comments at 6 and 7.

Citizen Power disagrees with PPL, noting that a refrigerator or freezer that is recycled and replaced with a new unit should have the usage of the new unit reflected in the savings calculations. Citizen Power Reply Comments at 1.

### Disposition

 The Commission believes that there is reason to investigate this savings protocol. Based on a review of evaluation reports from other jurisdictions,[[51]](#footnote-51) the Commission found that there is wide variation between savings claims. Such variation can be attributable to a number of factors, including program maturity (which is tied to the age of refrigerators and freezers that are likely to be recycled), type and configuration of refrigerators and freezers, location, demographics, and most notably, customer behavior.

 Therefore, we direct the TWG to investigate and evaluate alternative savings protocols used in other jurisdictions to inform the possibility of a future update to the savings associated with this protocol. In particular, the Commission recognizes that the regression models developed in California for the 2004-2005 and 2006-2008[[52]](#footnote-52) statewide evaluations are commonly used to determine savings in other states. Specifically, we direct the TWG evaluate the applicability of the California regression model to Pennsylvania to improve savings estimates and propose any applicable changes to this protocol in future TRM updates.

 The Commission does not agree with PPL that all recycled refrigerators and freezers should have a deemed gross savings of 1,659 kwh, irrespective of the scenario. The Commission stated in its 2011 TRM Final Order that “the deemed savings value for refrigerators/freezers that are removed then replaced with new equipment must be added [to the TRM] to accurately reflect all potential scenarios and the savings they produce.”[[53]](#footnote-53) As such, the Commission maintains the values of 1,659 and 1,205 for the Refrigerator/Freezer Retirement (and Recycling) and the Refrigerator/Freezer Recycling and Replacement scenarios, respectively. The Commission, however, is in agreement with PPL’s suggestion to note that the retirement protocol applies to both residential and non-residential sectors and has incorporated this into the introductory paragraph of the retirement protocol.

# Improvements to Existing Commercial and Industrial EE&C Measure Protocols and Processes

## Clarification of Lighting Protocols

### Implementation of Federal Legislation and Regulations Related to Commercial Lighting

 The Energy Policy Act of 2005 (“EPACT 2005”)[[54]](#footnote-54) and EISA 2007 standards introduced new efficacy standards for linear fluorescent bulbs and ballasts, effectively phasing out magnetic ballasts (already in place) and most T-12 bulbs starting July 14, 2012. This induces a shift in what a participant would have purchased in the absence of the program because T-12 bulbs on magnetic ballasts are no longer viable options and therefore, adjusts the baseline assumption. In the *Tentative Order*, we proposed that the TWG monitor and discuss these standards and protocols and provide recommendations for their implementation in future TRM updates.

#### Comments

PPL agrees with the Commission’s recommendation that the lighting standards be monitored in the TWG and that no immediate change take effect due to the early replacement nature of C&I lighting and customer and retail stockpiles of bulbs. PPL Comments at 19.

#### Disposition

The Commission directs the TWG to investigate the impacts of the new lighting standards and to recommend future adjustments to the TRM when necessary.

### Modification of Usage Group Thresholds

Rather than defining hours of use by the whole building, usage groups provide granularity when defining hours of use by specific characteristics within a building. This is particularly useful in facilities where lighting schedules differ in different parts of the facility. Previous TRMs required usage groups for all lighting projects with savings above 50 kW in connected load.[[55]](#footnote-55) In the *Tentative Order*, we proposed to eliminate requirements for usage groups and that EDC implementers determine when usage groups are most appropriate for each participant.

#### Comments

PPL and PECO both support removing the requirement for having usage groups, but also indicate that additional changes may be needed to ensure that revisions are comprehensive. PPL recommends that additional language be added to the TRM to clearly indicate that usage groups should be considered, but are not required. PPL Comments at 20.

PECO recommends that the table of stipulated hours of use values for usage groups[[56]](#footnote-56) be reinstated for use when actual HOU for usage groups cannot be readily determined by the implementer or evaluator but not require their use when more reliable values can be determined. PECO Comments Appendix at 13.

#### Disposition

The Commission agrees with PPL and PECO that removing the requirement of usage groups will improve program implementation and facilitate customer participation. Any outstanding language in the TRM regarding mandatory use of usage groups was stripped from the TRM. The Commission adopts PPL’s recommendation to indicate that usage groups should be considered and used at the discretion of the EDCs’ implementation and evaluation contractors but are not required.

The Commission rejects PECO’s recommendation to keep the previous Table 3-2: Hours of Use for Usage Groups, because of comments received during previous TRM updates describing apparent discrepancies between the two HOU tables. For example, PECO noted in its 2011 comments that “Table 3-2 (which provides stipulated hours of use for certain ‘usage areas’ which are acceptable for projects with connected load savings of 50 kW or greater) is not comprehensive and the hours for some usage areas appear to be overly conservative.” PECO 2011 Comments Appendix A at 6 and 7. The Commission believes that there is sufficient flexibility in the 2012 TRM for EDCs to appropriately determine hours for usage groups without Table 3-2.

### Determination of Hours of Use and Coincidence Factor

The HOU value is one of the main drivers for calculating energy savings for lighting projects. Since the first TRM update, major modifications were required for the lighting protocol to ensure that proper HOU values are used by EDCs when reporting and verifying lighting savings. In addition, the CF is one of the main drivers for calculating demand savings for lighting projects. In the *Tentative Order*, we proposed that additional flexibility be built into the C&I lighting protocol such that sufficient means of documentation could serve as an alternative source for determining hours of usage for a particular building. Additionally, we proposed that flexibility be introduced to calculate custom CFs, if hours of operation are determined for a site, using the non-weather dependent coincident peak demand calculator.

#### Comments

PPL and PECO support the Commission’s proposal to add flexibility to the lighting protocol such that alternative HOU and CF values can be used. However, they noted that such flexibility, though described in the *Tentative Order*, was not reflected in the TRM. PECO recommends that additional language be added to Section 3.2.7: Calculation Method Descriptions by Project Classification of the TRM to clarify this flexibility. PPL Comments at 20 and PECO Comments Appendix at 14 and 15.

#### Disposition

The Commission adopts the changes proposed by PPL and PECO and updated the TRM to add flexibility to the lighting protocol so that HOU and CF can be determined by alternate means.

### Modification of Metering Requirement for Lighting Projects

 Quantifying hours of usage by direct measurement, which is typically considered to be the most reliable source of data, can identify where the stipulated tables have misrepresented the hours of usage and generate more accurate estimates but also requires additional resources beyond normal verification activities. The bulk of these direct measurement activities should target projects with high impacts and uncertainty. The Commission proposed metering requirements for the evaluation of C&I lighting projects for high impact and high uncertainty projects. High impact projects are considered to be projects with connected load savings of over 200 kW. High uncertainty projects are considered to be projects where hours are variable and/or are difficult to ascertain and can be determined at the discretion of the evaluator.

#### Comments

PECO supports the metering requirements for projects with over 200 kW of connected load savings but asserts that there are still points of minor confusion. PECO requests that sampling specifications be added. PECO also asserts that it is not clear if metering is required for reported savings or verified savings. Finally, PECO asserts that if the EDC is able to provide metering data and the EDC independent evaluator reviews the data and determines it to be reliable, that data should be sufficient. PECO Comments at 14 and 15.

 PPL agrees with limiting metering to projects with high-savings impact or HOU that differ significantly from TRM default values given the high cost, logistical complications and the inconvenience to the customer caused by metering. PPL Comments at 21.

#### Disposition

The Commission adopts the metering requirement for projects in the verification sample that have savings over 200 kW in connected load. If available and determined reliable, the EDC independent evaluator may leverage metering data conducted by the implementation team. In addition, projects with high uncertainty, *i.e.* variable operating schedules, should receive metering. The exact determination of “high uncertainty” will be at the discretion of the EDCs’ independent evaluators with input from the SWE, as necessary. The exact sampling methodology within a site will also be at the discretion of the EDC’s independent evaluator, based on the specific characteristics of the target facility.

### Appendix C: Lighting Audit & Design Tool

Appendix C is a lighting inventory designed for use with Act 129 lighting programs and standardizes calculation of energy and demand savings for all lighting projects.

#### Comments

PPL recommends adding new fixture codes to the Appendix C Wattage Table for those fixtures not currently in Appendix C that are commonly submitted by contractors, stating that it can provide the additional examples upon request. PPL Comments at 22. PPL also recommends updating the building type list with the latest additions. PPL Comments at 22. Finally, PPL recommends updating the language contained in Appendix C such that it is consistent with the updates of the 2012 TRM. PPL Comments at 22.

#### Disposition

The Commission agrees with PPL and adopts all editorial changes related to consistency with the 2012 TRM. The Commission directs PPL to provide to the TWG its additional information to inform the update of the Appendix C Wattage Table during a future TRM update.

### Other Modifications

Other miscellaneous changes to the lighting protocols were proposed by EDCs.

#### Comments

PECO recommends that the EDCs’ independent evaluators have the ability to modify HOU values for projects under 20 kW in connected load savings if the perceived difference is greater than 10 percent. PECO Comments at 13. PPL asserts that the use of verified hours should be an option, not a requirement. PPL Reply Comments at 4. Furthermore, PECO recommends the rewording of several paragraphs to add clarity to the New Construction, Prescriptive Lighting Improvements and Lighting Controls sections. PECO also suggests revising the temperature range of the lighting interactive factors to cover freezer spaces between 0°F and 32°F. PECO Comments at 13-15.

PPL recommends several miscellaneous changes, including the removal of outdated notes, clarifying the applicability of lighting controls, non-fluorescent fixtures, and clarifying the use of HOU and CF values for dusk-to-dawn lighting. PPL Comments 21-23.

#### Disposition

The Commission accepts PECO’s recommendation to allow the EDCs’ independent evaluators to modify verified HOU if the perceived difference is greater than 10 percent. Per PPL’s suggestion, this is adopted as an option, not a requirement.

The Commission also accepts PECO’s modifications to clarify the intent of the lighting protocol. We also expanded the temperature ranges in Table 3-5: Interactive Factors and Other Lighting Variables to ensure that all temperatures are covered by the TRM as suggested by PECO.

Specifically, we removed the outdated footnote 125, modified the note for Table 3-4: Lighting HOU and CF by Building Type or Function to eliminate language referring to a decision made in January 2011,[[57]](#footnote-57) removed the restriction in the Lighting Controls section that limited controls to only fluorescent fixtures, and clarified the note related to dusk-to-dawn lighting.

## Clarification of Motor and Variable Frequency Drive Protocols

### Determination of Energy Savings Factor and Demand Savings Factor Values for Baseline Conditions for Non-Constant Volume Systems

 In the *Tentative Order*, we expanded the VFD protocol such that savings for other baseline systems, such as inlet guide vane and discharge damper systems, could be quantified using the TRM. In the absence of primary data collection, we proposed that the EDC research secondary sources to inform the stipulated energy and demand savings variables.

#### Comments

PECO notes that the energy savings factors and demand savings factors adopted from the Mid-Atlantic TRM[[58]](#footnote-58) that references UI and CL&P Program Savings Documentation for the 2009 Program Year, be confirmed to ensure that savings are being calculated appropriately. PECO Comments Appendix at 16.

PPL agrees with the modification and expansion of the VFD protocol to include additional baselines. PPL Comments at 23.

#### Disposition

The Commission confirmed the use of constants from secondary sources and adopts the expanded VFD protocol to include additional baselines.

### Metering Requirement for Motors and VFD Projects

 Usage characteristics of VFD improvement projects, which generally drive energy savings, are captured for typical motor functions in the form of stipulated equivalent full load hour (“EFLH”) values. The 2011 TRM states that all other motor functions not directly listed in the TRM are to be treated as custom measures, which limits the applicability of the TRM protocol for small process motors.[[59]](#footnote-59) This may have the unintended consequence of requiring metering for a plethora of projects that have relatively small contributions to the program and the overall portfolio.

In the *Tentative Order*, we proposed that all motors under a certain threshold be eligible for deemed savings according to the TRM protocols to appropriately balance cost and rigor. An average value may serve as a reasonable and conservative value that could be corrected through the evaluation.

#### Comments

PPL agrees that simplifying the metering requirement for motors and VFDs will reduce the need to process projects with small savings following a custom methodology, but believes that the metering threshold levels should be determined at the discretion of the EDC evaluator. PPL Comments at 23 and 24.

PECO offers a revision through a different approach, asserting that the evaluator does not need to use metering in the event that the motors in question are constant speed and hours can be easily verified through a building automation system schedule that clearly shows motor run time. PECO Comments Appendix at 15 and 16.

#### Disposition

The Commission adopts PECO’s suggestion to allow evaluators additional flexibility to use methodologies other than metering for certain situations, outlined in the TRM. The Commission believes that this additional provision allows the evaluators the needed flexibility that PPL requested, without modifying the metering threshold.

## Clarification of HVAC Protocols

Parties submitted additional comments regarding miscellaneous issues for the HVAC protocols. Specifically, this section addresses comments regarding the HVAC Systems and Geothermal Heat Pumps sections of the proposed 2012 TRM.

#### Comments

FirstEnergy states that the reference to Table 3-21: Cooling EFLH for Pennsylvania Cities in Table 3-62: Geothermal Heat Pump - Values and References should be changed to a reference to Table 3-20: HVAC Baseline Efficiencies. FirstEnergy Comments at 7.

PECO also suggests that the definition of the term CAPYcool in Table 3-62: Geothermal Heat Pump – Values and References be included in the Definition of Terms section of the protocol. Additionally, PECO suggests that the references to Table 3-20: HVAC Baseline Efficiencies and Table 3-21: Cooling EFLH for Pennsylvania Cities be changed to reference Table 3-65: Default Baseline Equipment Efficiencies. PECO Comments Appendix at 20. Both PECO and PPL assert that the source for the component η eepump[[60]](#footnote-60) be changed from “See Table 2” to “See Table 3-64.” PECO Comments Appendix at 20 and PPL Comments at 26.

PPL recommends that “CAPYcool” be changed to “BtuHcool”[[61]](#footnote-61) prevent confusion as “CAPYcool” is not used in the measure. PPL Comments at 26. PPL also recommends that the references in Table 3-62 to Table 3-21: Cooling EFLH for Pennsylvania Cities for the SEER, EER, HSPF and Coefficient of Performance (“COP”) values be changed to Table 3-20: HVAC Baseline Efficiencies. PPL Comments at 26. PPL recommends that the default “HOURSbasepump” and “HOURSeepump”[[62]](#footnote-62) values of 8,760 hours be replaced with “EFLHcool+EFLHheat”[[63]](#footnote-63) in Table 3-62 to provide a more accurate estimate of *ex ante[[64]](#footnote-64)* savings. PPL Comments at 26. PPL further recommends indicating the ASHP baseline for geothermal systems in Table 3-65: Default Baseline Equipment Efficiencies and thatit apply to all TRM sections utilizing this table. PPL Comments at 25 and 26. Lastly, PPL suggests adding all three types of geothermal systems (ground source, groundwater source, and water source) to the definitions of EER and COP to prevent confusion. PPL Comments at 26.

PECO requests that the summation symbol, Σ, be removed in the Algorithms section to be consistent with other measures. PECO also recommends that sources be added to Table 3-63: Federal Minimum Efficiency Requirements for Motors and Table 3-64: Ground Loop Pump Efficiency. PECO Comments Appendix at 20.

#### Disposition

 The Commission adopts the editorial comments to improve readability and clarity of the protocol, including:

* Changes to clarify variable (BtuHcool) in Table 3-62;
* Changes to clarify references in Table 3-62 for a variety of variables including SEER, EER, HSPF, COP and η eepump;
* Removal of summation symbol for all equations in the Algorithms section;
* Addition of sources for Tables 3-63 and 3-64; and
* Addition of all types of geothermal heat pumps to definitions of EER and COP in the definition of terms section.

The Commission also adopts PPL’s recommendation to change the default values of 8,760 hours for components “HOURSbasepump” and HOURSeepump” in Table 3-62 to “EFLHcool+EFLHheat” to provide a better conservative estimate in the absence of logging or modeling data.

The Commission rejects PPL’s request to add a note to indicate ASHP as the baseline for geothermal systems in Table 3-65 (and other similar tables). The Commission believes that the definition of baseline equipment and assumptions used for different scenarios, including new construction and retrofit, are clearly explained in the Eligibility section of the protocol.

# Demand Response

In the *Tentative Order*, we proposed the inclusion of a new DR or peak load reduction section in the 2012 TRM update. This TRM section addressed three specific DR-related topics: the determination of customer baselines, the determination of the 100 hours of highest peak load, and PJM Business Rules.

## Determination of Customer Baselines (“CBLs”)

In the *Tentative Order*, we proposed that total hourly Act 129 peak load reductions be a summation of peak load reductions from Load Control, Critical Peak Pricing, Direct Load Control DR Measures, and Constant Load Reductions from non-dispatchable measures.

### Comments

 EnerNOC requests additional clarity into how the CBL adjustments will be calculated under Step 1a in Section 4.1: Determination of Act 129 Peak Load Reductions and notes that an issue could arise if a customer participates in an Act 129 DR event and a PJM economic or emergency event on the same day. For example, EnerNOC describes a scenario where a PJM event is dispatched one hour earlier than an Act 129 event, asserting that this could negatively impact the CBL and reduce the calculated load reduction. EnerNOC proposes two solutions, that the ‘start of the event’ be interpreted to mean the start of the earliest dispatch event on an event day, or that the ‘day of adjustment’ be considered optional. EnerNOC Comments at 5and 6.

Similarly, PPL states that when PJM and Act 129 events are called on the same day, but not at the same time, steps need to be taken to assure that activation of one program in the adjustment window of the other program does not cause that program’s performance to be reduced. PPL Comments at 26 and 27.

 EnerNOC also notes that, in order to exclude PJM events from a customer’s baseline, as described in Step 1a in Section 4.1, EDCs need to know that a customer is participating in a PJM economic or emergency event. In order to do so, EDCs will need to be notified by third party Curtailment Service Providers (“DR CSP”) when a customer is participating in such an event. To alleviate this situation, EnerNOC suggests that the third party DR CSP provide standard reports to the EDC and/or the EDC’s Act 129 DR CSP contractor, that document when a customer participates in a PJM DR event. EnerNOC Comments at 5 and 6.

### Disposition

The Commission agrees with EnerNOC that if a customer participates in multiple events in a single day, determining CBL may become problematic. The major issue lies in the fact that if a day-of adjustment is used to account for usage patterns on the day of the event, such as symmetric additive adjustment, the later event will negatively adjust the baseline and reduce savings potential. The Commission believes that any hour during which a DR event occurred should not be included in this adjustment because the CBL will be artificially lowered. To account for this overlap, the Commission directs that the day-of adjustment period should be defined as the hours prior to the first event called for that customer on any given day.

 The Commission also notes that the TRM allows the EDCs to use PJM-approved measurement and verification protocols in CBL determinations. The Commission believes that there are enough accepted methodologies that the EDCs will be able to select an appropriate protocol should the day-of adjustment be unreliable.

 The Commission agrees that EDCs must be aware of PJM events in order to exclude them. However, the Commission does not exercise authority over third party DR CSPs and can only recommend that Act 129 DR CSPs strategize with their customers to best identify PJM events. In situations where it is not possible for DR CSPs to identify PJM events, they will be unknowingly included in the CBL. This will provide a conservative estimate of savings.

## Determination of the 100 Hours of Highest Peak Load

In the *Tentative Order*, we proposed the inclusion of guidance as to how the EDCs will determine the load curve reconstructions associated with these 100 hours of highest peak load, as well as addressing the subject of “add-backs,” pre-cooling and snapback effects and the calculation of customer baselines.

### Comments

EAP proposes additional language to Section 4.2: Determine the “Top 100 Hours” (100 hours of highest peak load) of the TRM that would add clarity to the definition of the top 100 hours. Specifically, EAP suggests language that would closely mirror the PJM definition and exclude weekends, holidays, and all hours outside of the on-peak period defined in Section 1: Introduction of the TRM. EAP Comments at 2 and 3. FirstEnergy and PPL support EAP’s recommendation. FirstEnergy Comments at 4 and PPL Comments at 27.

### Disposition

The Commission rejects EAP’s suggestion to revise the definition of the top 100 hours. Demand reduction goals set by the Commission were based on the top 100 summer peak hours, not excluding holidays, weekends and hours outside of the on-peak window and therefore, should not be excluded from the top 100 hours.

## PJM Business Rules

In the *Tentative Order*, we proposed guidance providing the EDCs with the calculation procedure necessary to determine the average peak load reduction.

### Comments

FirstEnergy suggests the addition of a footnote to clarify that the reference to “PJM Business Rules” is intended to address use and review of protocols for calculation of customer baselines and hourly load impacts during Act 129 events. FirstEnergy Comments at 4 and 5.

### Disposition

The Commission agrees with FirstEnergy and accepts the footnote addition to clarify the purpose of referencing PJM Business Rules.

# Verified Gross Adjustments

The Commission acknowledges that, in some cases, the number of EE&C measures found on-site during an evaluation may differ from the number stated on the incentive application. In the *Tentative Order*, we proposed to adjust savings downward when the number of widgets found on-site is less than what is stated on the application. If, however, the number of widgets found on-site is greater than what is stated on the application, the savings will be based on what is stated on the application and not be adjusted upward.

### Comments

 PECO states that in the context of projects with a high volume of measures, savings should be adjusted to reflect the actual, onsite measure count – whether that count is above or below the number on the incentive application, as installation decisions are typically made at a project level, not a fixture or widget level. PECO Comments at 2. PPL agrees with PECO, stating that the savings should be adjusted to reflect the actual, on-site measure count, regardless of whether that count is *above* or *below* the number on the incentive application. PPL Reply Comments at 2 and 3. PECO agrees with the Commission, however, that measure numbers that are within 5% of the application number do not require savings adjustments. PECO Comments at 2.

PECO also states that the SWE should have discretion to make savings adjustments when appropriate, e.g. a systematic error identified at all instances of a measure type. PECO Comments at 2. PPL agrees with PECO that the SWE, as a part of its standard review process, should have the ability to evaluate any adjustment. PPL Reply Comments at 2 and 3. PPL similarly suggests that discretion also be given to the EDCs’ independent evaluators to determine if the excess quantity is due to spillover (which would be handled via the net-to-gross analysis) or if it is due to customer error in filling out the rebate application. PPL Comments at 27 and 28. Lastly, PPL states that it would be more appropriate to place this discussion in the Audit Plan as estimation of verified gross adjustments is primarily an impact evaluation issue. PPL Reply Comments at 2 and 3.

### Disposition

The Commission does not agree with PECO and PPL that savings should be adjusted based on actual on-site measure counts if those measures were not incented through the program.  Our disposition requires a downward adjustment of savings if incentives were paid for measures that did not get installed and requires that there not be an upward adjustment of savings if incentives were not paid for measures that a customer installed.

The Commission and PPL[[65]](#footnote-65) recognize that installation of energy efficient measures above the amount for which incentives are paid is considered “spillover,” and a net-to-gross issue. The Commission decided, in its 2011 TRC Order,[[66]](#footnote-66) that it will not consider net-to-gross issues when determining energy savings relating to compliance.  Because the Commission is not considering “free-riders,” also a net-to-gross issue, when determining compliance, it will not credit installation of measures resulting from spillover either. However, the Commission recognizes there may be data reporting errors and directs the SWE to consider reporting errors when calculating realization rates. However, the measure counts credited for compliance may not exceed the number of measures for which incentives were paid. The Commission maintains that situations where on-site measure counts differ by five percent or less are within reasonable error ranges and do not require adjusting. However, as stated above, this does not allow additional savings to be credited above what was paid.

Finally, the Commission disagrees with PPL that the section on “Verified Gross Adjustment” in Section 1.11 of the 2012 TRM be moved to the SWE’s Audit Plan, as the TRM is used to determine both reported gross and verified gross savings for Act 129. It is, therefore, appropriate to include this discussion in the TRM and was included in the 2012 update.

# Transmission and Distribution System Losses

Consistent with the manner in which energy and demand savings goals were established, energy savings are reported at the meter level and demand savings are reported at the system level. The TRM provides estimates of energy and demand savings only at the meter level. Therefore, demand savings resulting from EE measures per TRM protocols must be grossed up to appropriately represent system level savings, which can be achieved by multiplying total demand savings by transmission and distribution system losses, also called system line losses.

### Comments

PECO notes that in the compliance context, the electric line loss factor applied to demand savings should be specific to the reporting EDC and not the statewide value of 1.11. PECO Comments at 3.

### Disposition

 The Commission agrees with PECO that EDC-specific electric line loss factors should be applied to gross-up demand savings rather than the statewide value of 1.11. The 1.11 value in the TRM was not intended for Act 129 but rather for AEPS and therefore, should be ignored for Act 129 purposes. EDC demand reduction goals were set based on each EDC’s system peak, which factors in each of the EDC’s own electric line loss factors, not the statewide average. The Commission directs the SWE to develop guidance, in collaboration with the TWG, to determine the appropriate system line loss factor to apply for each EDC. As a default, the Commission directs EDCs to use the line loss factor filed in its Commission-approved EE&C plan until further guidance is issued.

# High-Efficiency Snowmaking Equipment

### Comments

In its comments, PSAA proposes the inclusion of high-efficiency snowmaking equipment in the 2012 TRM update. PSAA suggests a protocol with the associated energy savings algorithms. PSAA asserts that efficient snow guns use less compressed air than conventional models, resulting in electric savings at the air compressor motors. PSAA also asserts that the savings can be verified using snowmaking unit testing, seasonal water pump flow data, compressor hours and correlation of the compressor plant with electric meter data. PSAA Comments at 3.

FirstEnergy states that PSAA’s proposed protocol seems to be reasonable and would be consistent with custom measures. Additionally, FirstEnergy states it would be willing to work through the details within the protocol with any customers who apply with such a project. FirstEnergy Reply Comments at 1 and 2.

PPL comments similar to FirstEnergy by noting that due to the site-specific nature of the proposed measure, it should be treated as a custom measure and not included in the TRM. PPL Reply Comments at 5.

### Disposition

The Commission agrees with FirstEnergy and PPL that this protocol would be more appropriately used as a custom measure, as opposed to a measure included in the 2012 TRM. Energy efficiency organizations, such as the Efficiency Maine Trust and Efficiency Vermont, also treat high-efficiency snowmaking equipment as a custom measure.[[67]](#footnote-67) As such, the Commission directs the TWG to review PSAA’s proposed high efficiency snowmaking equipment protocol to confirm the methodologies. This protocol will then be available, should an EDC wish to include such a measure in its EE&C Plan.

# Application of the TRM

 As we have previously stated, the Commission will continue to update the TRM, after providing a notice and comment opportunity, on an annual basis, “based on sound, accurate and credible studies and data and apply these new and updated TRM values at the beginning of each subsequent AEPS Act and EE&C Program compliance years.”[[68]](#footnote-68) The Commission performs this update on an annual basis as part of its efforts to fulfill its obligation under Act 129 “to establish an evaluation process that monitors and verifies data collection, quality assurance and the results of each EDC’s EE&C plan and the EE&C program as a whole, throughout the entirety of the program.”[[69]](#footnote-69) In fact, as we stated previously, “Act 129 requires the Commission to conduct this evaluation process every year, as each EDC is to submit an annual report documenting the effectiveness of its plan, the energy savings measurement and verification, an evaluation of the cost-effectiveness of expenditures and any other information the Commission requires.”[[70]](#footnote-70) With the *Tentative Order*, we again embarked on this annual requirement by releasing proposed changes to the TRM with supporting data and documentation or cites to such

data and documentation, and allowing any interested party, to include the EDCs, to comment on the correctness, credibility and validity of such proposals.

### Comments

PPL comments that while it generally supports the proposed changes included in the 2012 TRM, it maintains its previously presented legal arguments relative to the use of the TRM process to modify PPL’s approved EE&C Plan and the potential adverse effect that the TRM process could have on an EDC’s compliance with Act 129. PPL incorporates by reference its legal arguments on this issue previously asserted in its December 27, 2010 Comments and Petition for Review of the 2011 TRM Update Order. PPL asserts that the Commission may not require that subsequent revisions to the TRM be applied to previously approved EE&C Plans without following established procedures, particularly where any proposed revision would jeopardize an EDC’s ability to comply with Act 129. PPL Comments at 28.

### Disposition

The Commission previously addressed the issues raised by PPL in the *2011 TRM Update Order*,[[71]](#footnote-71) which we again adopt and will reiterate key points here. To begin with, we reiterate that the EDCs’ original plans were based on many estimates and assumptions, to include the amount of savings each measure would obtain, based on the TRM values, custom EM&V protocols, custom measurement, the potential customer participation rates, the proper incentives, and the costs to implement each measure. The EDC savings estimates based on custom EM&V and custom measurement will change, and have likely changed, over time due to incorrect assumptions about existing equipment technology or changes in available technology. In changing the TRM to reflect credible and accurate energy savings, the Commission is not changing any EDC plan; just one of the many assumptions the EDC relied upon in developing its plan. All of these changes or miscalculations in assumptions and estimates affect the results of the EDCs’ plans and will likely require EDCs to adjust their plans. We stress though that assumptions used to develop an EE&C plan cannot determine the results of a plan.

As we stated in the *2011 TRM Update Order*, “the TRM is merely guidance or a statement of policy that is not binding regulation.”[[72]](#footnote-72) We continued by stating that

a final determination of an EDC’s EE&C Plan’s energy savings will be determined in an adjudicatory proceeding where the EDC will be afforded the opportunity to present evidence demonstrating what energy savings its plan obtained and the credibility of that evidence. An EDC is free to use any method to determine the energy savings produced by its plan, in place of the TRM, provided it can support such determinations with substantial credible evidence, if necessary. Furthermore, by updating the TRM methods and values based on the most recent credible and accurate data and facts, as they become known, is likely to reduce challenges to the credibility of the energy savings attributable to the EDCs’ Plans in any future proceeding.[[73]](#footnote-73)

We stress that while the TRM is a tool EDCs can use to estimate the amount of energy savings a program offering can potentially provide to its plan as a whole, the TRM is first and foremost a measurement tool used to determine, in a reasonably cost-effective way, the actual energy savings achieved by specific measures after they have been installed or implemented. To be credible, these energy savings measurements must

be based on current, reliable and accurate data, not pre-program implementation estimates. Again, as we noted in the *2011 TRM Update Order*,

[t]he original TRM was established based on the best available studies and data at that time. These studies and data, however, will become less reliable as the science and energy efficient equipment technology advances, and that technology gets deployed. As such, in order to remain credible and relevant, the TRM must continually be updated to reflect the changing energy conservation science and technology, and the level of deployment of that science and technology. Indeed, it would be unreasonable for the Commission to ignore more up-to-date and accurate information regarding the energy efficiency values of various programs, appliances and equipment. As such, after providing a notice and comment opportunity, the Commission will continue to update the TRM on an annual basis, based on sound, accurate and credible studies and data and apply these TRM values at the beginning of each subsequent AEPS Act and EE&C Program compliance years.[[74]](#footnote-74)

**CONCLUSION**

 This Order represents the Commission’s continuing efforts to establish a comprehensive TRM that supports the purposes of the AEPS Act and the EE&C program established by Act 129. We extend our thanks to all who provided comments. **THEREFORE,**

 **IT IS ORDERED:**

* + 1. That the 2012 Technical Reference Manual update, as modified by this Order, is adopted and replaces all prior versions of the Technical Reference Manual as of June 1, 2012.

2. That any change to the Technical Reference Manual suggested by a Commenter that was not adopted or expressly rejected in the 2012 Technical Reference Manual update be referred to the Technical Working Group for further review and discussion for inclusion in future Technical Reference Manual updates.

3. That the Technical Working Group to investigate the impacts of the new lighting standards and to recommend future adjustments to the Technical Reference Manual when necessary.

4. That PPL Electric Utilities Corporation to provide to the Technical Working Group additional information to inform changes to the Appendix C Wattage Table during a future Technical Reference Manual update.

5. That the Statewide Evaluator develop guidance, in collaboration with the Technical Working Group, to determine the appropriate system line loss factor to apply for each electric distribution company.

6. That a copy of this Order shall be served upon the Office of Consumer Advocate, the Office of Small Business Advocate, the Bureau of Investigation and Enforcement, all jurisdictional electric distribution companies, the Pennsylvania Department of Environmental Protection and all parties who filed comments.

7. That the Secretary shall deposit a notice of this Order and the 2012 Technical Reference Manual update with the Legislative Reference Bureau for publication in the *Pennsylvania Bulletin*.

8. That this Order and the 2012 Technical Reference Manual update, as well as supporting data be published on the Commission’s website.



**BY THE COMMISSION**

Rosemary Chiavetta

Secretary

(SEAL)

ORDER ADOPTED: December 15, 2011

ORDER ENTERED: December 16, 2011

1. *See* 73 P.S. §§ 1648.1-1648.8 and 66 Pa. C.S. § 2814. [↑](#footnote-ref-1)
2. Order entered on October 3, 2005, under the above-referenced caption and Docket Number. [↑](#footnote-ref-2)
3. As of August 11, 2011, the Bureau of CEEP was eliminated and its functions and staff transferred to the newly created Bureau of Technical Utility Services. *See Implementation of Act 129 of 2008; Organization of Bureaus and Offices*, Final Procedural Order, entered August 11, 2011, at Docket No. M-2008-2071852, at page 4. [↑](#footnote-ref-3)
4. *See* Order entered on October 3, 2005, under the above-referenced caption and Docket Number at page 13. [↑](#footnote-ref-4)
5. *See* Order entered on January 16, 2009, at Docket No. M‑2008‑2069887, at page 13 (*Implementation Order*). [↑](#footnote-ref-5)
6. *Implementation Order* at page 13. [↑](#footnote-ref-6)
7. *See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual Update* Order at Docket No. M‑00051865, entered June 1, 2009. [↑](#footnote-ref-7)
8. *Id*. at pages 17 and 18. [↑](#footnote-ref-8)
9. *See* 66 Pa. C.S. § 2806.1(a)(2). [↑](#footnote-ref-9)
10. The TWG is chaired by the SWE and is comprised of representatives from the EDCs, Commission staff and other interested parties for the purpose of encouraging discussion of the technical issues related to the evaluation, measurement and verification of savings programs to be implemented pursuant to Act 129. [↑](#footnote-ref-10)
11. *See* *Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2012 Update*,Tentative Order entered on September 23, 2011, at Docket No. M-00051865 (“*Tentative Order*”). [↑](#footnote-ref-11)
12. <http://www.pabulletin.com/secure/data/vol41/41-41/1749.html> [↑](#footnote-ref-12)
13. The Commission has amended the protocol titles from the *Tentative Order* to accurately reflect the titles used in the TRM. The titles used in the *Tentative Order* are located in brackets []. [↑](#footnote-ref-13)
14. The seven adopted protocols are as follows: Residential Occupancy Sensors, Appliance Recycling and Replacement with non-ENERGY STAR Refrigerators, Low-Income Lighting, Pool Pump with VFD Motor, High Efficiency Two-Speed Pool Pump, Water Heater Tank Wrap and ENERGY STAR Office Equipment. [↑](#footnote-ref-14)
15. The Energy Independence and Security Act of 2007 can be found at <http://www1.eere.energy.gov/femp/regulations/eisa.html>. [↑](#footnote-ref-15)
16. *See* Section 2.32: ENERGY STAR LEDs, pp. 123-127, of the proposed 2012 TRM Update. [↑](#footnote-ref-16)
17. *See* Section 2.34: Holiday Lights, pp. 129-131, of the proposed 2012 TRM update. [↑](#footnote-ref-17)
18. *Id.* at page 130. [↑](#footnote-ref-18)
19. *Id.* at page 130. [↑](#footnote-ref-19)
20. CFpre is the peak coincident factor of a single speed pump from noon to 8PM in a summer weekday prior to pump rescheduling. This quantity should be inferred from the timer settings. [↑](#footnote-ref-20)
21. *See* <http://neep.org/uploads/EMV%20Forum/EMV%20Products/Mid%20Atlantic%20TRM_V1d_FINAL.pdf> [↑](#footnote-ref-21)
22. *See* <https://sp.gdsassociates.com/sites/39701/Documents/Evaluation%20Compliance%20and%20Guidelines%20Documents/Guidance%20Memos/>. [↑](#footnote-ref-22)
23. The Commission has amended the protocol titles from the *Tentative Order* to accurately reflect the titles used in the TRM. The titles used in the *Tentative Order* are located in brackets []. [↑](#footnote-ref-23)
24. The two adopted protocols are the Exterior Lighting for New Construction and ENERGY STAR Room Air Conditioner. [↑](#footnote-ref-24)
25. *See* Section 3.17: Strip Curtains for Walk-In Freezers and Coolers, pp. 227, of the proposed 2012 TRM update. [↑](#footnote-ref-25)
26. *See* Section 3.25: Refrigeration – Suction Pipe Insulation, pp. 261-262, of the proposed 2012 TRM update. [↑](#footnote-ref-26)
27. *See* Section 3.26: Refrigeration – Evaporator Fan Controllers, pp. 264-265, of the proposed 2012 TRM update. [↑](#footnote-ref-27)
28. kWfan refers to the power demand of the evaporator fan calculated from equipment nameplate data and estimated power factor/adjustment. kWCP refers to the total power demand of a compressor motor and condenser fan calculated from nameplate data and estimated power factor. [↑](#footnote-ref-28)
29. Consortium for Energy Efficiency: <http://www.cee1.org/resid/seha/rwsh/reswash_specs.pdf>. [↑](#footnote-ref-29)
30. DEER = Database for Energy Efficient Resources available at <http://www.deeresources.com/>. [↑](#footnote-ref-30)
31. EFbase is the Energy Factor of a baseline water heater. [↑](#footnote-ref-31)
32. The resistive heating discount factor attempts to account for possible increased reliance on back-up resistive heating elements during peak usage conditions. [↑](#footnote-ref-32)
33. Federal Standards are 0.67 -0.0019 x Rated Storage in Gallons. For a 40-gallon tank this is 0.594. “Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters” US Department of Energy Docket Number: EE–2006–BT-STD–0129, p. 30. [↑](#footnote-ref-33)
34. Federal Standards are 0.67 -0.0019 x Rated Storage in Gallons. For a 40-gallon tank this is 0.594. “Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters” US Department of Energy Docket Number: EE–2006–BT-STD–0129, p. 30. [↑](#footnote-ref-34)
35. Tc represents the cold water temperature for non-grocery applications. [↑](#footnote-ref-35)
36. *See* Section 3-31: Low Flow Pre-Rinse Sprayers, pp. 288, of the proposed 2012 TRM update. [↑](#footnote-ref-36)
37. Measures 3-27, 3-28, 3-29, and 3-31 are ENERGY STAR Clothes Washer (Electric Water Heater, Electric Dryer), Electric Resistance Water Heaters, Heat Pump Water Heaters, and Low Flow Pre-Rinse Sprayers, respectively. [↑](#footnote-ref-37)
38. *See, e.g., Petition of West Penn Power Company d/b/a Allegheny Power for Approval of its Energy Efficiency and Conservation Plan, Approval of Recovery of its Costs through a Reconcilable Adjustment Clause and Approval of Matters Relating to the Energy Efficiency and Conservation Plan, Opinion and Order* at Docket No. M-2009-2093218 (entered October 23, 2009) at 51, 52 and 104; and *Petition of PPL Electric Utilities Corporation for Approval of its Energy Efficiency and Conservation Plan, Opinion and Order* at Docket No. M-2009-2093216 (entered October 26, 2009) at 90. [↑](#footnote-ref-38)
39. *See Implementation of Act 129 of 2008 – Total Resource Cost (TRC) Test - 2011 Revisions*, Final Order at Docket No. M 2009-2108601, entered August 2, 2011. [↑](#footnote-ref-39)
40. *Id*. at 28. [↑](#footnote-ref-40)
41. *Id*. at 40. [↑](#footnote-ref-41)
42. *See* Residential ENERGY STAR Lighting, pages 24-26, of the *2009 Technical Reference Manual.* [↑](#footnote-ref-42)
43. *See* Section 4.2: Residential ENERGY STAR Lighting, pages 24-26, of the *2010 Technical Reference Manual.* [↑](#footnote-ref-43)
44. *See* Section. 2.26: ENERGY STAR Lighting, pages 106-108, of the *2011 Technical Reference Manual.* [↑](#footnote-ref-44)
45. *See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual Update Order* at Docket No. M 00051865, entered February 28, 2011, at page 36. [↑](#footnote-ref-45)
46. “Residential Lighting Markdown Impact Evaluation” by Nexus Market Research, Inc., RLW Analytics, Inc., and GDS Associates. Submitted to the Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island and Vermont on January 20, 2009. [↑](#footnote-ref-46)
47. “EmPOWER Maryland 2010 Interim Evaluation Report – Chapter 5: Lighting and Appliances” by Navigant Consulting. Presented to Baltimore Gas and Electric, Potomac Electric Power Company, Delmarva Power and Light, Southern Maryland Electric Cooperative, and Allegheny Power. Originally submitted January 15, 2011, and updated March 9, 2011. [↑](#footnote-ref-47)
48. *See Tentative Order* at page 18. [↑](#footnote-ref-48)
49. *See* Section 4.5: Refrigerator/Freezer Retirement, pages 29 and 30, of the 2010 *Technical Reference Manual*. *See also* Section 2.23: Refrigerator/Freezer Retirement (and Recycling), pages 94 and 95, of the 2011 *Technical Reference Manual*. [↑](#footnote-ref-49)
50. See <http://calmac.org/publications/FinalResidentialRetroEvaluationReport_11.pdf>, page 138. [↑](#footnote-ref-50)
51. Including studies from the CPUC Evaluation Study of the 2004-05 Statewide Residential Appliance Recycling Program, CPUC 2006-08 Residential Retrofit High Impact Measure Evaluation Report, OPA 2008 and 2009 Great Refrigerator Roundup Program, AEP Ohio Appliance Recycling Program Evaluation Report (PY1), ComEd Evaluation Report: Residential Appliance Recycling for PY1 and PY2, Rocky Mountain Power Utah Refrigerator and Freezer Recycling Program 2006-2008 and Rocky Mountain Power Idaho Refrigerator and Freezer Recycling Program 2006-2008. [↑](#footnote-ref-51)
52. The CA 2004-05 and 2006-08 regression models can be found within their respective evaluation reports at www.calmac.org. [↑](#footnote-ref-52)
53. *See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual Update Order* at Docket No. M 00051865, entered February 28, 2011, at page 39. [↑](#footnote-ref-53)
54. *See* 42 U.S.C.A. § 6295(g)(8) (West Supp. 2011). [↑](#footnote-ref-54)
55. *See* Section 3.2.6: Quantifying Annual Hours of Operation, page 28, of the *2011* *Technical Reference Manual*. [↑](#footnote-ref-55)
56. *See* Table 3-2: Hours of Use for Usage Groups, page 29, of the *2011 Technical Reference Manual*. [↑](#footnote-ref-56)
57. Footnote 125 stated “This value was agreed upon by the Technical Working Group convened to discuss updates to the TRM. This value is subject to adjustment for the 2012 Update based on implementation feedback during PY2 and PY3.” The note for Table 3-4 stated “Coincidence Factors were not agreed upon prior to release of this document in January 2011. 0.77 represents the simple average of all existing coincidence factors (16.19 divided by 21).” [↑](#footnote-ref-57)
58. *See Massachusetts Statewide Technical Reference Manual for Estimating Savings from Energy Efficiency Measures*, Version 1.0, at <http://www.ma-eeac.org/docs/MA%20TRM_2011%20PLAN%20VERSION.PDF>. [↑](#footnote-ref-58)
59. *See* Section 3.3: Premium Efficiency Motors, pages 144-150, of the 2011 *Technical Reference Manual*. [↑](#footnote-ref-59)
60. η eepump refers to the efficiency of retrofit case ground loop pumps at design point. [↑](#footnote-ref-60)
61. BtuHcool refers to the rated cooling capacity of the energy efficient unit in BtuHcool /hour. [↑](#footnote-ref-61)
62. HOURSbasepump and HOURSeepump refer to the run hours of base case ground loop pump motors and the run hours of retrofit case ground loop pump motors, respectively. [↑](#footnote-ref-62)
63. EFLHcool and EFLHheat represent the cooling and heating annual equivalent full load hours for commercial HVAC for different occupancies, respectively. [↑](#footnote-ref-63)
64. *Ex ante* savings are also known as “claimed savings” and result directly from completed program-related actions taken by participants. *Ex post* savings are also known as “verified savings” and are based on an independent assessment of the reliability of the *ex-ante* savings. [↑](#footnote-ref-64)
65. *See* PPL Comments at 27 and 28. [↑](#footnote-ref-65)
66. *See Implementation of Act 129 of 2008 – Total Resource Cost (TRC) Test - 2011 Revisions*, Final Order, at Docket No. M 2009-2108601, entered August 2, 2011, page 26. [↑](#footnote-ref-66)
67. The high efficiency snow-making equipment information from Efficiency Maine was obtained via a phone interview on November 21, 2011 with Timothy Clark, Field Staff Director for the Efficiency Maine Business Program (phone: 207-622-6887, ext. 2701). Similar information for Efficiency Vermont was obtained from the Efficiency Vermont web site at [www.efficiencyvermont.com](http://www.efficiencyvermont.com). [↑](#footnote-ref-67)
68. *See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2011 Update*, TRM Annual Update Order (*2011 TRM Update Order*), at Docket No. M-00051865, entered February 28, 2011, at 47. [↑](#footnote-ref-68)
69. *See* *Id*. at 46, citing 66 Pa. C.S. § 2806.1(a)(2). [↑](#footnote-ref-69)
70. *See* *Id*. at 46, citing 66 Pa. C.S. § 2806.1(i)(1). [↑](#footnote-ref-70)
71. *2011 TRM Update Order* at 46-50. [↑](#footnote-ref-71)
72. *Id*. at 49. [↑](#footnote-ref-72)
73. *Id*. at 49 and 50. [↑](#footnote-ref-73)
74. *2011 TRM Update Order* at 47. [↑](#footnote-ref-74)