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October 31, 2012

VIA OVERNIGHT DELIVERY

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
P.O. Box 3265
400 North Street
Harrisburg, PA 17105-3265

Re: Implementation of the Alternative Energy Portfolio Standards Act of 2004: *Standards for the Participation of Demand Side Management Resources* – Technical Reference Manual 2013 Update
Docket Nos. M-2012-2313373 and M-00051865

Dear Secretary Chiavetta:

Pursuant to the September 13, 2012 Tentative Order in the above-referenced dockets, enclosed please find **PECO Energy Company's Comments on the Proposed Update to the Technical Reference Manual**. The Comments have also been electronically mailed in Word format to Megan G. Good (megagood@pa.gov) and Kriss Brown (kribrown@pa.gov).

Kindly return a time-stamped copy of this letter in the self-addressed envelope that is enclosed.

Please do not hesitate to contact me should you have any questions regarding this filing.

Very truly yours,

Jack R. Garfinkle cv

Jack R. Garfinkle

Enclosures

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2013 Update	:	**Docket Nos. M-2012-2313373 M-00051865**

COMMENTS OF PECO ENERGY COMPANY ON THE PROPOSED UPDATE TO THE TECHNICAL REFERENCE MANUAL

Pursuant to the September 13, 2012 Tentative Order entered by the Pennsylvania Public Utility Commission (the "Commission") in the above-referenced dockets, PECO Energy Company ("PECO") hereby submits comments on the Commission's proposed 2013 update to its Technical Reference Manual ("TRM").

As PECO prepares for Phase II of the Act 129 Energy Efficiency and Conservation Program, it appreciates the Commission's continued efforts to update the TRM and ensure that it serves as an effective tool for validating savings. The Company agrees that data provided by Pennsylvania electric distribution companies ("EDCs") are an appropriate basis for identifying TRM improvements. PECO's limited comments are attached to this document as Appendix A. Overall, PECO believes that great progress has been made through the TRM update process and that the final 2013 TRM Update could serve as an appropriate tool for the entire Phase II period (program years 2013-2015). Additional updates during the Phase II period would be unlikely to significantly improve the TRM, but could impact EDC savings forecasts and potentially EDC compliance with Phase II savings targets.

PECO appreciates the opportunity to comment on this important matter and believes that the Company's recommended revisions can improve the effectiveness of the Technical Reference Manual.

Respectfully Submitted,

Jack R. Garfinkle cv

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Dated: October 31, 2012

For PECO Energy Company

DB1/ 71511228.1

Residential

Electric HVAC

- General – While PECO agrees with the concept of revising the ELFH values, there is concern with the weighting methodology used to determine the cooling EFLH and heating EFLH values for each location. The current methodology weights home characteristics across the state rather than for cities specific to each EDC. For PECO, who would only be using Philadelphia EFLH and would be the only utility likely using those hours, the current weighting methodology significantly penalizes PECO by reducing the Philadelphia EFLH by roughly 9% for both heating and cooling. The SWE is recommending an update for cooling EFLH for Philadelphia to 591, whereas if they did not use the weighting methodology that included cities outside of PECO's service territory the result was an EFLH of 651. For heating, the EFLH value is 1060, compared to 1165 without the weighting of cities outside of PECO's service territory. PECO recommends reconsideration of this weighting methodology and its specific effect on PECO.

Electric Clothes Dryer with Moisture Sensor

- Measure Life – PECO recommends using the average lifetime of 16 years from the DOE analysis in 2010 for clothes dryer standards[1] rather than the 11 years listed in the TRM.

Efficient Electric Water Heaters

- Deemed Savings #1 –PECO calculates 155 kWh not 154 kWh using 0.95 Energy Factor. Also, in Table 2-3, demand savings are listed in reverse—should be 0.0142 for 0.95 EF, 0.0112 for 0.94 EF (correct in redline), and 0.0082 for 0.93 EF. 0.95 EF and 0.93 EF kW are switched.

- Deemed Savings #2 - The TRM hot water measures use 55F as the incoming cold water temperature, however, the water main temperatures for Philadelphia are closer to 57F[2]. PECO recommends revising savings estimates accordingly for all water heating related measures in the TRM.

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[1] U.S. Department of Energy. "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Dryers and Room Air Conditioners", Chapter 8, Table 8.2.39, April 2011. Available online at: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/aham2_dfr_ch08_lcc-pbp_2011-04-13.pdf.

[2] U.S. Department of Energy. *Building America Benchmark Program Database.* 2010.

Electroluminescent Nightlight

- Definition of Terms – The ISR_{NL}: Value is taken from CFL ISR, but the main factor driving the CFL ISR is people putting them in storage[3]. Electroluminescent nightlights are not likely to be put in storage. It would seem more relevant to use the ISR from lighting fixtures. PECO recommends the TRM research such measures and derive an appropriate installation value.

Furnace Whistle

- Table 2-6 – The EFLH values appear to be out of order from the cities. PECO recommends a review of these values to assure each city corresponds to the correct EFLH.

- Sources - Source 1 includes an erroneous calculation. The calculation uses heating and cooling FLH of 2,078 for Pittsburgh when the FLH for Pittsburgh is 1,641 according to the tables. Based on using 2,078 they calculated 1,039 kWh savings, when it should be 0.5kW * 1,641 = 821 kWh savings. PECO recommends revising.

Home Audit Conservation Kits

- Algorithms - The $Savings_{Aerator}$ term in the kWh algorithm is listed distinctly from the $ISR_{Aerator}$ term, yet in the Aerator section of the TRM the $Savings_{Aerator}$ term already has the $ISR_{Aerator}$ incorporated into it. Revise for consistency. Also, delta watts should be expressed as a base watts term minus an efficient watts term to be consistent with the algorithms in other sections of the document

- Definition of Terms – in table 2-16, PECO calculates 48 kWh (not 44 kWh) and 0.0044 kW (not 0.0040) for faucet aerators using the inputs listed. The table should be updated accordingly.

LED Nightlight

- Algorithm - Delta watts should be expressed as a base watts term minus an efficient watts term to be consistent with the algorithms in other sections of the document.

Low Flow Faucet Aerators

- Definition of Terms - In table 2-16, PECO calculates 48 kWh (not 44 kWh) and 0.0044 kW (not 0.0040) using the inputs listed for faucet aerators. The table should be updated accordingly.

Programmable Thermostat

- Table 2-19 – The EFLH HEAT for Philadelphia should be 1,060 rather than 1,106.

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[3] Navigant Consulting, 2012. *Evaluation Report: Residential ENERGY STAR® Lighting – Plan Year 3*. Prepared for Commonwealth Edison Company. May 2012. http://www.icc.illinois.gov/downloads/public/edocket/323818.pdf. Also available on Illinois Commerce Commission website here: http://www.icc.illinois.gov/docket/Documents.aspx?no=11-0593

Solar Water Heaters

- Algorithms -the demand savings algorithm in the TRM correctly uses the "BaseEnergy Usage", however the unit peak demand reduction listed for the measure incorrectly uses the measure energy savings rather than the base energy usage to calculate savings. The demand savings value should be updated to show savings of 0.293 kW instead of 0.149 kW, per the assumption that solar power is expected to fuel hot water heater entirely during peak period.

- The TRM hot water measures use 55F as the incoming cold water temperature, however, the water main temperatures for Philadelphia are closer to 57 F[4]. PECO recommends revising savings estimates accordingly.

Measure 2.15 Electric Water Heater Pipe Insulation

- Definitions – *the definition for kWh savings incorrectly references, "per fixture installed"* should be corrected to read "per 10 feet of installed insulation."

Refrigerator/Freezer Recycling with and without Replacement

- Algorithms – PECO recommends this algorithm include an additional term to the replaced kWh calculation to incorporate the Induced Replacement Ratio. This ratio is the proportion of participants reporting that they purchased a replacement refrigerator as a result of participation in the program and would make this algorithm fully consistent with the protocols of the Uniform Methods Project[5] (UMP). The algorithm as stated is only partially consistent with the UMP.

- Deemed Savings Calculations – PECO recommends revision of this section to incorporate an Induced Replacement Ratio term in the calculation for replaced units.

Residential New Construction

- General - These equations make the assumption that the coincidence factor is constant regardless of the amount of over-sizing of the system. In reality, there is an inverse relationship between amount of system over-sizing and coincidence factor. The example in the following paragraph goes into further detail to describe this concept. System sizing's impact on peak demand savings potential is also addressed in 1999 study[6] where downsizing is only estimated to produce moderate demand savings in 25% of all households.

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[4] U.S. Department of Energy. 2010. *Building America Benchmark Program Database.*

[5] U.S. Department of Energy. 2012. "Uniform Methods Project Protocols," Draft. Page 68.

[6] Neme, C., Proctor, J., & Nadel, S. 1999. *Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems.* American Council for and Energy-Efficient Economy.

To develop a value for coincidence factor, PECO recommends further work should be done to relate level of over-sizing with probability that an air conditioning system is running at any given point during the peak period as defined in Pennsylvania Act 129, and the value for coincidence factor should be listed as "variable" instead of 0.7. The over-size factor for the unit in the qualifying home for each individual case should also be variable depending on the details of the job. Since actual predicted peak load for the new home is already being calculated, there is no reason why over-size factor cannot also be calculated.

One value that still must be assumed is the over-size factor for the HVAC system in the baseline home. As stated currently, the TRM assumes that the baseline HVAC system will be ~45% larger simply due to the fact that the qualifying home is compliant with the EPS's Energy Star for New Homes program. The baseline over-size factor is based on a 1995 study in New Jersey[7] and a 2004 baseline study in Long Island[8] where cooling systems were found to be over-sized by 60% and 57%, respectively when compared to Manual J load calculations. Another study, by Xenergy in New Jersey, discovered that systems for new construction were over-sized by only 23% when compared to Manual J load calculations[9]. This paper suggests that the difference may be due to the age of the systems studied in the 1995 project and that the industry is sizing cooling systems more accurately than it had been in the past. The 2004 study in Long Island puts this conclusion into question after finding a significantly higher level of over-sizing. In general, there doesn't seem to be consensus on how much systems are being over-sized in new construction; with various studies revealing over-sizing ranging from 16%-70%.

Another assumption being made in the TRM algorithm is that the program qualifying home will have a system that is at most 15% oversized compared to a Manual J load calculation, which is the requirement to be compliant with the EPS Energy Star for New Homes program. Nominally this suggests that an Energy Star home would on average have a system that is ~8% smaller than a non-Energy Star home (assuming the new construction over-size factor of 23% from above). What is not considered is that a "best practice" Manual J load calculation may not be the same as the Manual J load calculation performed by the HVAC contractor performing the installation. Due to the customized and fairly complex nature of doing a Manual J calculation, its results can vary significantly depending on the person doing the calculations and whether or not that person is expecting a certain result

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[7] Vermont Energy Investment Corporation and Proctor Engineering Group. 1997. *PSE&G Baseline Survey of Residential New Construction.*.

[8] Faesy, R., Galvin, T., Slote, S., Hill, D., Kallock, B., Neme, C., et al. 2004. *Long Island Residential New Construction Baseline Technical Study.* Prepared for the Long Island Power Authority.

[9] Xenergy. 2001. *New Jersey Residential HVAC Baseline Study.* Washington D.C.: Paper presented to the New Jersey HVAC Working Group.

from the calculation. A field study done in Arizona[10] found that a best practice Manual J calculation was 10-12% smaller than the Manual J method used by the contractor.

There is significant evidence to suggest that in practice, an HVAC system installed in a new home will not vary significantly in size depending on whether or not it qualifies for the Energy Star for New Homes program and likely will not be 45% smaller in an Energy Star vs. baseline home. Additionally, even in cases where a significant reduction in over-sizing results from the program, only 25% of those cases will have a moderate amount of demand savings after the coincidence factor is adjusted to account for changing cycling times of the HVAC system. Until more concrete evidence that the Energy Star program reduces over-sizing and that then reduced over-sizing translates into real demand savings, the baseline over-size factor should be the same as the qualifying home. The over-size factor in the qualifying home should be calculated from the size of the HVAC system being installed and the peak load in the baseline home (which is already being calculated). The only demand savings to be calculated should come from reduced peak load due to insulation up-grades, efficient windows, air sealing, and duct sealing or reduced energy consumption due to efficient HVAC equipment.

Energy Star Refrigerators

- Definition of Terms - The following statement should be modified as follows: "~~**Also,**~~ this table is also provided for planning purposes to compare to the changing federal standards detailed in Table 2-48."

- Table 2.48 – This table defines the maximum energy use for "Compact Refrigerator-Freezers--automatic defrost with bottom-mounted freezer" as 11.80*AV + 423.2. This is the algorithm for "Compact Refrigerator-Freezers--automatic defrost with bottom-mounted freezer **with an automatic icemaker**." The algorithm should be 11.80*AV + 339.2.

- Tables 2-45 and 2-47 – The values in this table are derived from a simple average of consumption estimates for each configuration from the ENERGY STAR Qualified Products List. This method gives equal weighting to all products on the list, regardless of size (the one variable in the algorithm affecting consumption), which skews the estimate to some extent towards low-saturation refrigerator sizes. Market data would show that certain sizes of refrigerators are more common than others. If available, using program or market data to develop weighted average adjusted volume inputs to the algorithm for each configuration would allow for a savings estimate more reflective of actual market conditions. If this data cannot be obtained, the current method is a reasonable proxy.

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[10] Navigant. 2010. *The Sun Devil in the Details: Lessons Learned from Residential HVAC Programs in the Desert Southwest.* Paris, France: Presented at Counting on Energy Programs: It's Why Evaluation Matters, International Energy Program Evaluation Conference.

Energy Star Freezers

- General - The following statement in the introductory narrative is should be modified as follows: "An ENERGY STAR freezer must be at least 10 ***percent*** more efficient than the minimum federal government standard."

- Tables 2-50 – The values in this table are derived from a simple average of consumption estimates for each configuration from the ENERGY STAR Qualified Products List. This method gives equal weighting to all products on the list, regardless of size (the one variable in the algorithm affecting consumption), which skews the estimate to some extent towards low-saturation refrigerator sizes. Market data would show that certain sizes of refrigerators are more common than others. If available, using program or market data to develop weighted average adjusted volume inputs to the algorithm for each configuration would allow for a savings estimate more reflective of actual market conditions. If this data cannot be obtained, the current method is a reasonable proxy.

Energy Star Clothes Washers

- General #1 - The future Federal standards for clothes washers take effect on March 7, 2015, rather than January 1 as listed in the proposed 2013 TRM, although the 2018 standards are effective on January 1 of that year. PECO recommends the TRM clarify that the 2015 standards for front-loading compact and standard clothes washers continue to be applicable in 2018 (rather than listing them as N/A), and that standard clothes washers are those with a capacity of 1.6 cubic feet or greater.

- General #2 - Also, importantly, starting in 2015 the standards will be based on new metrics: Integrated Modified Energy Factor (cubic feet of capacity/kWh) and Integrated Water Factor (gal/cubic feet of capacity). These include measures of standby mode and off mode energy use, as well as changes to various provisions for the per-cycle measurements. The values listed in Table 2-54 of the proposed 2013 TRM are the values that correspond to the old MEF and WF measures. The actual standards in 2015 and 2018 are:

	2015		2018	
	IMEF	**IWF**	**IMEF**	**IWF**
Top-Loading Compact	0.86	14.4	1.15	12.0
Top-Loading Standard	1.29	8.4	1.57	6.5
Front-Loading Compact	1.13	8.3	Same as 2015	Same as 2015
Front-Loading	1.84	4.7	Same as 2015	Same as 2015

Standard				

Source: U.S. Department of Energy, "Energy Conservation Standards for Residential Clothes Washers; Final Rule and Proposed Rule", Federal Register, Vol. 77, pp. 32308-32380, May 31, 2012. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2012-05-31/pdf/2012-12320.pdf.

PECO recommends the TRM Update be revised accordingly.

- Measure Life - DOE's analysis for the Direct Final Rule estimated a mean lifetime of 14.2 years for residential clothes washers[11]. PECO recommends the TRM use this value.

Energy Star Dishwashers

- General - Please note that some additional information regarding percentages of energy use for machine operation and water heating may be available in analysis that DOE published in May 2012 supporting its Direct Final Rule for residential dishwasher standards.
  Please note that the Federal standards listed for dishwashers apply to products manufactured on or after May 30, 2013. The following table also includes the standards for compact units:

	Annual Energy Use (kWh)	Water Consumption (gal/cycle)
Standard	307	5.0
Compact	222	3.5

- Definition of Terms - The definition of D_{SavDW} should refer to an ENERGY STAR dishwasher rather than clothes washer.

- Measure Life - DOE's analysis for the Direct Final Rule estimated a mean lifetime of 15.4 years for residential dishwashers.[12] PECO recommends this value for measure life.

[11] U.S. Department of Energy. "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Washers", Chapter 8, Section 8.2.3, April 2012. Available online at: *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/rcw_dfr_tsd_ch8.pdf.*

[12] U.S. Department of Energy. "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Dishwashers", Chapter 8, Section 8.2.3, April 2012. Available online at: http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/dw_dfr_tsd_ch8_rev.pdf.

Energy Star Dehumidifiers

- Algorithms - The first sentence under the heading for section 2.28.1 should refer to an ENERGY STAR dehumidifier rather than refrigerator.

- Definition of Terms #1 - The capacity in pints/day significantly exceeds the bucket capacity for portable dehumidifiers. Therefore, the energy savings will be overestimated if the annual hours include the time that the unit is not operating due to a full bucket for those units that do not have a continuous drain. PECO recommends revising the energy savings accordingly.

- Definition of Terms #2 – PECO recommends revising the annual operating hours to 1095. The annual hours of operation should not include the amount of time that the unit spends in off-cycle mode because the ambient humidity has reached its set point. In DOE's previous analysis for dehumidifier standards, published in 2006, DOE estimated the number of annual hours as ranging from 875 to 4320. The 1620 hours that were included in the proposed 2013 TRM correspond to data from a 1998 Arthur D. Little study. AHAM submitted data for the 2006 analysis that indicated an average of 1095 annual operating hours[13].

- Measure Life - DOE's 2006 analysis estimated a mean lifetime of 11.0 years for dehumidifiers.[14] PECO recommends this value rather than the current estimate of 12 years.

- Table 2-59 - the Federal standards for the highest capacity product class are not limited to a maximum of 185 pints/day. The standards actually apply to all units with greater than 75 pints/day. PECO recommends the revision of the table accordingly

Energy Star Room Air Conditioners

- Definition of Terms - The formula for per-unit energy savings, the cooling capacity is erroneously described as having units of Btuh. The units for cooling capacity are Btu/h.

- Measure Life - DOE's analysis for the Direct Final Rule estimated an average lifetime of 10.5 years for room air conditioners[15]. PECO recommends using this value rather than the 9 years listed in the TRM.

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[13] U.S. Department of Energy. "Energy Conservation Program: Energy Conservation Standards for Certain Consumer Products (Dishwashers, Dehumidifiers, Electric and Gas Kitchen Ranges and Ovens, and Microwave Ovens) and for Certain Commercial and Industrial Equipment (Commercial Clothes Washers); Proposed Rule", Federal Register, Vol. 72, pp. 64432-64515, November 15, 2007. Available online at: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/home_appl_anopr_fr.pdf.

[14] *Ibid.*

[15] U.S. Department of Energy. "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Dryers and Room Air Conditioners", Chapter 8, Table 8.2.39, April 2011. Available online at:

- Future Standards Changes - There are several corrections to be made in this section
  - The new standards become effective on April 21, 2014.
  - The Federal standards for all product classes are based on a new metric, Combined Energy Efficiency Ratio (CEER). This metric is comparable to EER, but with the inclusion of standby mode and off mode energy use as well as energy use in active cooling mode. This correction should be made in Tables 2-65 through 2-67.
  - Table 2-67 contains several errors in the listed values (other than, as previously noted, the Federal Standard EER should be titled as Federal Standard CEER). The correct values for the table are shown in italics below:

Table 0-1: Reverse-Cycle RAC Federal Minimum Efficiency Standards and ENERGY STAR Version 3.0 Standards (effective 2014 TRM)

Capacity (Btu/h)	Federal Standard EER, with louvered sides	ENERGY STAR EER, with louvered sides	Federal Standard EER, without louvered sides	ENERGY STAR EER, without louvered sides
< 14,000	n/a	n/a	*≥ 9.3*	≥ 9.8
≥ 14,000			*≥ 8.7*	≥ 9.2
< 20,000	*≥ 9.8*	≥ 10.4	n/a	n/a
≥ 20,000	*≥ 9.3*	*≥ 9.8*		

Although the room air conditioner protocol states that ENERGY STAR room air conditioners must be at least 10 percent more efficient than the minimum Federal standards, that statement does not hold true for the reverse-cycle product classes under the 2014 standards, as shown in the above table.

Energy Star Lighting

- Algorithms #1 – The In-service rate is not sufficiently well defined and should be more specific regarding the following:
  - Does it include bulbs leaked out of the service territory?
  - Does it include residential program bulbs that end up in commercial sockets?
  - What is the protocol for counting past years' stored program bulbs that get put into sockets during the current program year?
- Algorithms#2 - There is no lighting-HVAC interactive effects term or discussion in any of the residential lighting measures of this document but this term is incorporated and discussed fairly extensively in the C&I measures section. A growing number of TRMs (including CA, IL, Mid-Atlantic, NY, OH, and MN) have lighting-HVAC interactive effects

http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/aham2_dfr_ch08_lcc-pbp_2011-04-13.pdf.

terms in their res lighting savings algorithms. PECO recommends the TRM provide a full discussion of interactive effects for residential lighting measures.

- Algorithms #3 - There is incomplete agreement in the evaluation field about the best government information source to use for establishing baseline wattage, however it may make the most sense to move from the lumen bins shown in the current TRM to an approach that differentiates lumen bins for directional and non-directional bulbs. Energy Star has an emerging specification for lamps to qualify as ES that goes into more detail and differentiates the lumen output requirements driving the incandescent equivalent bins for directional vs non-directional lamps. See pp.8-12 here: http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/lamps/V1.0_Draft_2_Specification.pdf?4749-8e30

- Algorithms #3 - The TRM refers to baseline wattage as a step change in which EISA-compliant incandescent bulbs become the new baseline. However, according to the EPA's Next Generation Lighting report[16] de facto base wattage will be a smoother transition based on bin jumping, hoarding, time delay for manufacturers and retailers to sell product after it is no longer manufactured, and switching to exempted incandescent lamp types. The report provides a table of recommended base wattages by lumen bin and by year based on the combination of all of these factors. A memo from the Navigant SLD evaluation team to PECO in January 2012 generally corroborates the EPA NGL findings based on shelf surveys and secondary literature search. PECO recommends the TRM to be revised accordingly.

- Table 2-68 #1 - References to peak kWh in the default savings tables should be peak kW.

Energy Star Televisions

- General #1 - Footer for this section reference Version 4.1 and 5.1, should be updated to just version 5.3

- General #2 - On September 9, 2012 EPA released Version 6.0 which goes into effect on June 1, 2013
  - The reference to the Energy Star website should be updated to reflect the above date.
  - Version 6.0 limits the scope to a product with a diagonal screen size of 15" or greater. PECO recommends updating this section accordingly.

- General #3 - Version 5.3 uses the term On Mode rather than Active Mode, and Sleep Mode rather than Standby Mode.

- Table 2-76 and 2-77 - These tables should be updated to Version 5.3 instead of 5.1.

- Table 2-74 should be updated to P_{ON_MAX} rather than P_{MAX}

[16] U.S. EPA, 2011. Next Generation Lighting Programs: Opportunities to Advance Efficient Lighting for a Cleaner Environment. EPA 430-R-11-015. www.energystar.gov/lightingresources.

- P_{ON_MAX} should be defined as the maximum allowable On Mode power consumption in watts.

Residential Occupancy Sensors

- Algorithms - Peak kW: Peak kW savings are assumed to be zero. The TRM should provide justification for this assumption.

Holiday Lights

- Table 2- 84 - The terms W_{Mini}, W_{C7} and W_{C9} are not in the eligibility algorithms or the Definition of Terms. The TRM should include clarification or the terms should be deleted.

Commercial Measures

Lighting Equipment Improvements

- General - The redlined TRM does not seem to follow the update order advice on adding the ability to calculate demand savings for the lighting controls adjustments[17]. PECO recommends that the TRM be revised to allow demand savings claims from non-residential lighting improvements.

- Appendix E - For the new construction lighting projects the redline version seems to be referring to Appendix E, which currently provides a hyperlink to an inactive webpage.

- 3.2.6 Quantifying Annual Hours of Operation - In the absence of Pennsylvania specific data, the SWE has chosen to use the mid-Atlantic TRM although that reference is not based on metered data. Subject to value of information considerations, PECO recommends metered research in the future to make these assumptions more robust.

Ductless Mini Split Heat Pumps – Commercial <5.4 Tons

- 3.19.2 Algorithms #1 – PECO recommends using SEER instead of EER for ΔkWh-cool calculations and using HSPF instead of COP for ΔkWh-heat calculations.

- 3.19.2 Algorithms #2 - PECO recommends a review of calculating savings using a Load Factor of 25%, essentially reducing savings by 75%. Most TRMs do not differentiate mini-splits from other packaged and split systems and therefore do not have this factor. The Connecticut 2010 TRM has a measure for residential mini-splits and does not use a Load

[17] From TRM Update Order (p.42) - In addition, the lighting protocol was constructed in such a way to account for energy savings only for lighting control retrofits. The savings algorithms do not account for demand savings. The Commission proposes to modify the savings algorithms to allow the EDCs to claim demand savings for lighting control retrofits in addition to the energy savings.

Factor. While it is reasonable to expect mini-splits to have less EFLH than a ducted system, reducing by ¾ is excessive. It is likely that the original intent was a load factor equal to 75% rather than 25%. This measure should be reviewed to determine what the correct load factor should be.

Office Equipment – Net Work Power Management Enabling

- General #1 - PECO recommends including HVAC interactive effects in the TRM for this measure. Workstations controlled by this measure are usually located in conditioned spaces and there will be additional impacts due to the changes in HVAC equipment operation as a result of this measure; these values must be quantified where possible.

- General #2 - Use of Pacific Northwest's Non-Res Network Power Management System (NPMS) study seems appropriate as it is recent than most of the studies cited in the 2012 TRM and based on measured data. However, this study has an expiration date of 2013-07-01[18] due to the variable nature of technology evolution and the TRM may require further updates.

Refrigeration – Evaporator Fan Controllers

- Table 3 – 83 #1 - PECO recommends a Load Factor of feel that a load factor of 0.80 or 0.85 rather than 0.9 based on PSC of Wisconsin, Focus on Energy Evaluation, Business Programs: Deemed Savings Manual V1.0, p. 4-103 to 4-106.

- Table 3 – 83 #2 – PECO recommends a Power Factor of 0.75 to 0.9 rather than 0.6. Most walk in evaporative motors are greater than 1 HP but case evaporators will be much less than 1 HP. This estimate is based on 15 years of NRM field observations and experience.

- Table 3 – 83 #3 – PECO recommends reconsideration of %Off of 46% as it seems very high. Most evaporators run 8760 unless special controls are installed to turn off the fans. This measure installs these controls but usually fans are never turned off completely but instead *are set at half speed or less to keep air mixed and air temperature even in the walk-in space.* The system must have solenoid valves (shut off valves) to be eligible for this measure, otherwise if the system is using expansion valves without solenoids a constant load must be maintained to prevent liquid from reaching the compressors by means of 8760 fan operation. PECO would expect a time % of reduced fan operation (half or third run speed) at around 15 to 30% depending on load. This estimate is based on Select Energy (2004). *Analysis of Cooler Control Energy Conservation Measures. Pre*pared for NSTAR.

- Table 3 – 83 #4 – The TRM should provide justification for the Hours$_{CP}$. As currently written, this value assumes significant "average" oversizing/ weather/ load etc. EFLH was *determined by multiplying annual available operation hours of 8,760 by overall duty cycle*

[18] http://www.nwcouncil.org/energy/rtf/measures/measure.asp?id=95&decisionid=117

factors. Duty cycle is a function of compressor capacity, defrost and weather factor. The units are assumed to be operating 24/7, 8760 hrs/yr.

Energy Star Clothes Washer

- General - The target sector for this protocol is multifamily common area laundries. Both the ENERGY STAR qualification criteria and Federal energy conservation standards differentiate between residential and commercial clothes washers. The Federal standards for both are currently the same (a minimum Modified Energy Factor (MEF) of 1.26 and a maximum Water Consumption Factor (WF) of 9.5); however, on January 8, 2013, the commercial clothes washer standards will become as follows. (Residential clothes washer standards will change to different levels starting in 2015.)

Class	MEF (cubic feet/kWh)	WF (gal/cubic feet)
Top-Loading	1.60	8.5
Front-Loading	2.00	5.5

As of February 1, 2013, commercial clothes washers must meet MEF = 2.2 and WF = 4.5 to be ENERGY STAR-qualified.

At this time, there are no top-loading commercial clothes washers which have been certified to DOE as meeting the 2013 standards. Thus, all ENERGY STAR-qualified commercial clothes washers in 2013 are likely to be front-loading units.

- 3.27.2 Algorithms – PECO recommends changing the algorithm to that used for residential clothes washers. However, the following comments are provided on the algorithm that is currently included in the proposed 2013 TRM. The energy savings are determined in part by the volume (presumably capacity) of the clothes washer. It appears in the equation that a fixed volume is used for both the baseline and ENERGY STAR qualified unit. However, a common approach to increasing MEF that manufacturers take is to increase capacity. Therefore, higher efficiency clothes washers tend to have larger capacities. For that reason, PECO recommends using separate average capacities for the baseline and higher efficiency units.

- 3.27.4 Deemed Savings - PECO recommends that the number of cycles be increased from 950 to 1,241. This recommendation is based on the most recent analysis supporting energy conservation standards for commercial clothes washers, which DOE published in December 2009. DOE estimated that units in multi-family applications are run an average of 1241 cycles per year, rather than the 950 that is attributed to the ENERGY STAR calculator.

- 3.27.5 Measure Life – PECO recommends using the DOE estimated average lifetime of 11.3 years rather than 10 years.

Electric Resistance Water Heaters

- General - there appears to be an error in the algorithms and savings estimates in the TRM. Using the algorithm for ΔkWh in section 3.28.2, and the default values for the variable "Load" from Table 3-86 given in "kBTU", and the other default values listed in Tables 3-87 and 3-88, we cannot replicate the default savings listed in Table 3-88.
- Default Variables - The TRM hot water measures use 55F as the incoming cold water temperature, however, the water main temperatures for Philadelphia are closer to 57F[19]. PECO recommends revising savings estimates accordingly for all water heating related measures in the TRM.

LED Channel Signage

- 3.30.2 Algorithms - PECO does not believe that the proposed algorithm will add to the accuracy of the savings estimates significantly. It may make the algorithm more straightforward for customers, assuming they know the exact length of the lighting modules in the sign. However, if they do not, then there is no added benefit to changing the algorithm and it may actually detract from the accuracy of the savings estimates.

Low Flow Pre-Rinse Sprayers

- General - The proposal to add an additional option for a Time of Sale/Retail program for Low Flow Pre-Rinse Sprayers is reasonable. It is technically correct that the current Federal standard for pre-rinse sprayers is a maximum of 1.6 GPM. When used in the 2012 TRM algorithm, the savings estimated between a baseline pre-rinse sprayer representative of currently available, Federal-standard compliant models and the purchased model with a lower rated flow will provide a reasonable estimate of savings.

  At issue is whether the current Federal standard represents the market baseline of GPM flow in the absence of a program. Navigant was not able to find a study that estimated a current market baseline based on product sales, however, it is Navigant's opinion that a flow rate of 1.6 GPM will overestimate the expected savings for a Time of Sale/Retail program. Navigant's check of the performance rating results of 29 models listed on the Food Service Technology Center Website found the highest rated flow was 1.51 GPM.[20] A brief check of manufacturer on-line product catalogs[21] did not uncover a model rated higher than 1.51 GPM, with higher flow models often in the 1.40 GPM to 1.50 GPM range.

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[19] U.S. Department of Energy. *Building America Benchmark Program Database.* 2010.

[20] Food Service Technology Center, 12949 Alcosta Blvd., Suite 101, San Ramon, CA 94583. Web address: http://www.fishnick.com/equipment/sprayvalves/, Accessed September 21, 2012. Sprayer by T&S Brass Model JetSpray B-0108 was rated at 1.48 GPM, and tested at 1.51 GPM.

[21] Global Industrial. Web address: http://www.globalindustrial.com/g/plumbing/faucets/food-service-faucets/TS-Brass-Pre-Rinse-Hose-Reels. Listings for 27 models from multiple manufacturers. Highest ratings were 1.42 GPM. Two models by Zurn listed on the summary table at 1.6 GPM were found to be rated at 1.24 GPM upon checking. Accessed September 21, 2012.

We recommend a market baseline adjustment factor be added to the algorithm to adjust the Federal standard of 1.6 GPM to a lower, more likely value for market baseline in the absence of a program. We propose a market baseline adjustment factor of 0.95. Applying this value to 1.60 GPM yields a market baseline of 1.52 GPM. PECO recommends that the market baseline adjustment factor be reviewed and updated annually.

To ensure estimated savings occur, PECO recommends that a Time of Sale/Retail program include a requirement for cleanability performance of 26 seconds per plate or less, based on FEMP guidelines.[22] Pre-rinse sprayer models with cleanability performance that does not meet the 26 second requirement creates a risk that post-measure sprayer usage time will increase relative to better performing models and the pre-retrofit conditions, reducing *anticipated savings.*

Small C/I HVAC Refrigerant Charge Correction

- Table 3-95 - *Small C&I Refrigerant Charge Correction* should use SEER and HSPF for energy calculations under 65,000 Btu/hr. For larger system energy calculations should use EER and COP.

[22] Federal Energy Management Program (FEMP). Cleanability performance of 26 seconds per plate or less based on ASTM F2324-03: Standard Test Method for Pre-Rinse Spray Valves. Web address: http://www1.eere.energy.gov/femp/technologies/eep_low-flow_valves.html Accessed September 21, 2012.

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