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October 15, 2013

**VIA ELECTRONIC FILING**

Rosemary Chiavetta, Secretary  
Pennsylvania Public Utility Commission  
Commonwealth Keystone Building  
400 North Street  
Harrisburg, PA 17120

Re: Implementation of the Alternative Energy Portfolio Standards Act of 2004:  
Standards for the Participation of Demand Side Management Resources –  
Technical Reference Manual 2014 Update  
Docket No. M-2012-2313373; M-00051865

Dear Secretary Chiavetta:

Enclosed please find joint comments from Citizens for Pennsylvania's Future (PennFuture) and the Keystone Energy Efficiency Alliance (KEEA) on the above-referenced proceeding.

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

Sincerely,

Sincerely,

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Enclosures

**BEFORE THE  
PENNSYLVANIA PUBLIC UTILITY COMMISSION:**

Implementation of the Alternative Energy : M-2012-2313373  
Portfolio Standards Act of 2004: Standards : M-00051865  
for the Participation of Demand Side  
Management Resources – Technical  
Reference Manual 2014 Update

**JOINT COMMENTS OF**

**CITIZENS FOR PENNSYLVANIA’S FUTURE (PENNFUTURE) AND THE  
KEYSTONE ENERGY EFFICIENCY ALLIANCE (KEEA)**

**Section I – Introduction**

Citizens for Pennsylvania’s Future (PennFuture) is a statewide, non-profit (501(c)(3)) public interest organization, working to enhance Pennsylvania’s environment and economy, with offices in Harrisburg, Philadelphia, Pittsburgh and Wilkes-Barre.

The Keystone Energy Efficiency Alliance (KEEA) is a nonprofit, tax-exempt 501(c) (6) trade association of 64 businesses and nonprofits dedicated to promoting the energy efficiency and renewable energy industries in Pennsylvania.

On September 13, 2013, the Pennsylvania Public Utility Commission (“PUC” or “Commission”) released a Tentative Order in the above-captioned proceeding seeking comments on the Technical Reference Manual (TRM) 2013 Annual Update. These comments are filed jointly by KEEA and PennFuture. We received analytical support and policy advice to develop these comments from Energy Futures Group and Optimal Energy, Inc. We appreciate the opportunity to submit comments on the Technical Reference Manual (TRM), Docket No. M-2012-2313373.

We thank you for undertaking annual updates to the TRM as information gained from program implementation each year will inform more accurate savings estimates. Our comments below reflect a deep analysis of measures and technologies present in the TRM. We generally found most of the measure characterizations well thought out and well documented. There are inherent limitations in developing deemed savings estimates for measures, even those that rely on engineering algorithms and customer and project specific inputs. It is expected that over time the electric distribution companies’ (EDCs) programs will

complete an increasing number of Pennsylvania-specific evaluations and market research projects. The findings from these projects will inform subsequent generations of the TRM and lead to more robust savings estimates.

## **Section II - Overview of the Review Process**

Two expert consultants assisted PennFuture and KEEA in the review of the Draft TRM. Energy Futures Group (EFG) focused on cross sector and residential comments and Optimal Energy, Inc. reviewed the commercial and industrial (C&I) and agricultural measure characterizations. EFG and Optimal concentrated their efforts on those measures likely to have the largest impact on annual savings. For residential these were the lighting and heating, ventilation and air-conditioning (HVAC) measures. For C&I these were lighting, HVAC, and motor measures.

With this focused review and the large number of individual measures addressed in the TRM (over 90), not all measures were reviewed or reviewed at the same level of detail. The TRM comments below are organized as follows:

- **Cross-sector Comments** that apply to multiple residential and C&I comments
- **Key Residential Comments:** comments that apply to multiple residential measures and to key measures and/or end uses such as lighting and HVAC
- **Other Residential Measure Comments**
- **Key C&I Comments:** comments that apply to multiple C&I measures and to key measures and/or end uses such as lighting, motors, and HVAC
- **Other C&I Measure Comments**

## **Section III - Cross-Sector Comments**

**Issue A - Baseline efficiencies:** The savings for nearly all lost opportunity measures are based on the difference in efficiency (or usage) between a presumed baseline unit and the high efficiency measure installed as a result of program intervention. For baselines the TRM typically defaults to federal standards minimums for nearly all appliances, DHW domestic hot water and HVAC equipment. In reality, however, the baseline is some blended average of units *at or above* this minimum, or as the TRM refers to it: “the prevailing level of efficiency in the marketplace” (p9). From ENERGY STAR shipment data (attached for 2012) one can ascertain that the market share for many covered products at or above the ENERGY STAR level is very high. This strongly argues for measure baselines above the federal minimum for nearly all of these measures.

For example, several years ago EPA did not update the ENERGY STAR dishwasher specification on a timely basis. ENERGY STAR dishwashers attained a near 100% market saturation. Clearly the federal minimum standard level was not “the prevailing efficiency level in the market place.” Yet with the current TRM characterization approach the full gross savings from the federal minimum would be claimed for a rebated ENERGY STAR dishwasher. Failure to properly account for the current high saturations of efficient products in the market, i.e., “the prevailing level of efficiency in the marketplace” will lead to overstatement of gross savings; in some cases by significant amounts. The table below provides select 2012

ENERGY STAR shipment market shares. Note that for some products the ENERGY STAR specification has been revised since 2012 (room air conditioners) or will be revised in 2014 (refrigerators). However, for those products for which the ENERGY STAR specification remains unchanged, the market share at the ENERGY STAR level will likely only increase further raising the baseline and reducing gross savings estimates.

<b>Product</b>	<b>2012 ENERGY STAR Market Share</b>
Refrigerators	76%
Clothes Washer	66%
Dishwashers	89%
Room Air Conditioners	58%
Dehumidifiers	99%
TV	84%
Central Air Conditioner	20%
Air Source Heat Pump	32%
Geothermal Heat Pumps	28%

Note that while equipment gross savings will nearly always be reduced if more market informed baselines are used, the opposite will likely be the case for new construction program efforts. Unlike with federal equipment standards, building energy code compliance is much less certain. While Pennsylvania has not yet adopted the most current version (2012) of the International Energy Conservation Code (IECC 2012), experience in other jurisdictions indicates that full compliance to IECC 2009 is still unlikely. New construction baseline and code compliance studies nearly always show that current construction practices are, on average, below those mandated by code. EDC new construction program efforts should be allowed to claim the savings increment of getting new homes and commercial buildings to code, as well as the assumed above code savings.

**Issue A Recommendation:** For this comment there are two distinct recommendations.

At a minimum, the baselines for all key lost opportunity measures should be revisited, informed by ENERGY STAR market share and other data, and revised accordingly. For those measures requiring revised baselines the gross savings should be similarly modified. From a program design and implementation perspective higher levels of program eligibility, e.g., Most Efficient or Top Ten USA should be considered either in addition to or in place of ENERGY STAR. This will allow the EDCs to maintain higher per unit gross savings if baselines are revised. The EDCs may also want to better track the efficiencies of program supported equipment. The average efficiencies of these measures will also, on average, exceed the minimum program edibility criteria.

To assess the status of code compliance and to develop better new construction baselines and savings estimates the Statewide Evaluator (SWE) should fast track the completion of residential and commercial new construction baseline and code compliance studies. Until Pennsylvania-specific new construction baseline and code compliance studies are completed, the SWE should perform a survey of recently completed code compliance and new

construction baseline studies in other jurisdictions. This survey could inform an estimate as to what, if any, additional savings increment should be applied to the EDCs' new construction program efforts.

**Issue B - Measure interactions:** The TRM introduction (p11) specifies which measures and/or programs are to have measure interactions considered. Only the following programs or measures are specified as having measure interactions considered:

- Residential New Construction program
- Commercial lighting interaction with cooling loads
- C&I custom measures

We note, however, that the residential lighting measure descriptions (CFLs and LEDs) include specific factors for the inclusion of interactive impacts on heating and cooling loads. The lighting demand savings arising from these interactive effects are probably larger than the total demand savings for nearly any non-HVAC cooling measure. Conversely, the Home Performance program description contains no such explicit adjustments. As these program/measure impacts appear to be modeled, such building lighting/envelope/HVAC system interactions should be considered as part of the modeling process and the EDCs explicitly required to estimate these impacts. For C&I programs there should also be similar consideration of lighting impacts on heating loads, new construction program measure interactions, as well as retrofit shell/HVAC interactions.

**Issue B Recommendation:** Expand the number and types of programs for which building interactions must be considered. In particular, measure interactions should be considered for any program or for any measure for which savings are modeled.

**Issue C - Determination of HVAC Energy Savings:** nearly all of the energy savings for HVAC measures are determined based on the measures heating or cooling capacity and an estimate of equivalent full load hours (EFLHs). The EDC/city-specific EFLHs for most HVAC measures were developed based on heating degree adjustments to EFLH estimates from another state. The TRM does not give the base temperature for these heating degree day adjustments, and therefore we cannot evaluate the reasonableness of the EFLH tables.

**Issue C Recommendation:** The TRM should provide additional documentation regarding the EFLH data and degree day adjustments and how they were developed. Alternatively, these measure savings could be modeled.

## Section IV - Key Residential Comments

**Issue A - HVAC Measure Savings.** In addition to the above Cross-Sector comments on measure interactions and EFLHs, we note the following concerns as to the estimate of residential HVAC measure savings

- There is wide variation in sizing practices by HVAC contractors. The tendency is for contractors to oversize units which will typically overstate savings given the proposed HVAC measure algorithms.

- What is the appropriate capacity rating to use for heat pumps? While rated heated capacities are given at 47°, in Pennsylvania most heat pump operation will be at lower temperature bins where the capacity and efficiency will be less. Further, the heat pump efficiency metric: heating seasonal performance factor (HSPF) fails to consider the typical need for supplementary heat to meet a home's full heating needs. Few heat pumps are sized to fully meet a home's heating needs at design temperature without some type of supplementary heat; often resistance space heat for homes that previously had a ducted air source heat pump.
- While most heat pumps will have reduced outputs and operate at lower efficiencies when operating below their rated capacity at 47°, a growing number of cold climate heat pumps, particularly ductless split units, maintain their rated capacity at or below 0° degrees. The superior performance of these units should be recognized in whatever revised measure characterization for heat pumps is developed.

**Issue A Recommendation:** Revise all of the heat pump characterizations to address actual heat pump output given Pennsylvania weather conditions and degree day distributions and the need for supplementary heat. Also address variations in equipment performance at lower outdoor temperatures so as to not penalize cold climate heat pumps.

**Issue B - Cooling Demand Coincidence Factor:** For most cooling related measures a 70% summer coincidence factor is assumed. The cited reference is a review by Proctor Engineering of six utility programs. Better documentation is needed as to why these references are relevant to Pennsylvania given the significant effect that local weather conditions, equipment sizing practices, typical building envelope characteristics, etc. have on cooling coincident demand.

**Issue B Recommendation:** Better justify and document the proposed use of 70% cooling coincidence factor. Provide the specific citation(s) and or utility names for the six utility programs reviewed.

**Issue C - ENERGY STAR Lighting (LEDs and CFLs).** In aggregate lighting measures are the single largest contributors to residential sector savings. While the measure characterization provides a large amount of detail on lighting, including 2012-2014 EISA impacts, it is not completely clear as to how this information, including some of the details in the footnotes, are then used to develop lamp-specific savings estimates.

- The TRM is proposing to use the 2014 EISA wattages in 2014. There is strong evidence of stock carry-over past the effective date for the initial 2012 EISA standard. We expect the same to occur with the 2014 standard and would suggest not to use the proposed 2014 EISA wattage baseline values for 60 and 40 watt equivalent lamps.
- Are the baseline wattages for all lamps EISA covered general service lamps (GSLs) assigned to one of the four lumen/wattage bins in Tables 2-74 (for CFLs) and 2-87 (for LEDs)? Why not assign a wattage savings factor to the actual high efficiency lamp installed, with possibly different factors for CFLs and LEDs.
- How are bulbs of less than 310 lumens addressed?
- Are any and all EISA-exempt reflector bulbs rebated by the EDCs assigned to one of the 20 bulb types in Table 2-75? Is this workable?

- Cooling interactive effects seem high (up to 30%) and vary by a factor of three across EDCs, though the actual demand impact is significantly reduced by the 9.1% lighting coincidence factor.
- It is not clear as to whether and how the 3.95 CFL to incandescent wattage ratio referenced in footnote 161 is applied. Is it EISA adjusted and hence declining in each year?

There is also no consideration of the impact of the 2020 EISA 45 lumen/watt backstop standard. This will significantly reduce or even negate (for CFLs) the savings claimed at some point post-2020 (allowing for some inventory clearance period). Currently LEDs have a proposed 14.7 lifetime. Full gross savings should not be claimed for that entire period.

**Issue C Recommendation:** There are several recommendations related to the TRM lighting measures.

- Revise the baseline for 2014 EISA covered lamps to account for delayed inventory clearance. Retailer shelf surveys in Massachusetts found that non-compliant bulbs covered by the 2012 EISA standard were still available well into 2012.
- Consider alternatives to the four lumen/wattage bins in Tables 2-74 and 2-87 to achieve better accuracy and granularity for baseline wattages.
- Reduce post-2020 savings and/or measure life estimates for all EISA covered CFLs and LEDs, including fixtures that use such EISA covered lamps, to account for the 2020 45 lumen/watt backstop standard.

**Issue D - Home Performance with ENERGY STAR:** There is a detailed discussion of CSG's HomeCheck software, which has now been replaced with EnergyMeasure HOME. However, it is not clear as to the need or rationale for a detailed discussion of a particular software product. There is no context or discussion as to the proper modeling of homes in PA's Home Performance program.

**Issue D Recommendation:** The TRM's Home Performance with ENERGY STAR measure characterization should clearly enumerate the minimum requirements for any Home Performance software model. If the SWE wants to continue to also include an example of a Home Performance software package, please see the attached description of CSG's EnergyMeasure HOME software.

**Issue E - TV and Office Equipment.** The TV and Office Equipment measures were not fully updated to reflect recent changes in ENERGY STAR specifications for these products. It appears that the TV characterization was partially updated, but there are tables referring to a previous ENERGY STAR specification (version 5.3), while the text refers to the new one (version 6.0).

TV savings estimates are much too high, in large part due to out-of date-baseline assumptions. TV efficiency has improved greatly and using ES v3.0 significantly overestimates baseline energy use and savings. 84% of national TV shipments were ENERGY STAR compliant in 2012 to the v5.3 specification. The recent NEEP Business and Consumer electronics report provides more current savings estimates that are a fraction of those proposed.

**Issue E Recommendation:** Update and revise the TV and office equipment measure characterizations. Consider the recent NEEP report to help define measure baselines and savings estimates: [http://neep.org/Assets/uploads/files/market-strategies/BCE/2013%20BCE%20Strategy\\_FINAL.pdf](http://neep.org/Assets/uploads/files/market-strategies/BCE/2013%20BCE%20Strategy_FINAL.pdf)

**Issue F - Behavioral Programs.** There is no OPower-type behavioral program characterization, even if only to specify the protocol by which a contractor would develop their savings estimates. In aggregate annual, though probably not lifetime, savings potential behavioral program activities could be second only to lighting in their contribution to residential sector savings.

**Issue F Recommendation:** If there are any plans on the part of the EDC's to add such programs to their residential portfolios in 2014 then the TRM should provide some guidance as to measuring and reporting program savings and as to measure life claims.

**Issue G - Measure Lives.** There are several measure lives where the value in the upfront summary tables do not match those in the text discussion.

**Issue G Recommendation:** Please check measure life estimates.

### Section V - Other Residential Measure Comments

The below measures are listed in order of their occurrence in the draft TRM.

- 1. Central A/C (Proper Sizing):** While demand savings may be expected, energy savings, even at 5% are less certain and possibly overstated.
- 2. CAC and ASHP Duct Sealing:** There are two duct sealing measures. One should be deleted. Currently only two methods of estimating duct leakage are allowed: BPI look-up table and the modified blower door subtraction method. The first approach is somewhat subjective and imprecise and should not be allowed. There are also other approaches, e.g., use of a blower door and a duct blaster that are commonly used but not recognized in the TRM. The measure characterization should reference ASTM E1554 or equivalent.
- 3. Ground Source Heat Pumps (GSHPs):** Rated efficiencies between air source heat pumps (ASHPs) and GSHPs are not fully comparable. AHRI rated GSHP COPs and EERs do not include fan and pumping energy. As a result, GSHP efficiency metrics typically overrate GSHP efficiency compared to the ASHP they are often meant to replace. We recommend that any GSHP COPs and EERs be adjusted as per the RESNET consensus standard:  
[http://www.resnet.us/standards/Auxiliary\\_Electric\\_Energy\\_of\\_Ground\\_Source\\_Heat\\_Pumps\\_Amendment.pdf](http://www.resnet.us/standards/Auxiliary_Electric_Energy_of_Ground_Source_Heat_Pumps_Amendment.pdf) (in particular the adjusted EER and COP equations at the top of p2).
- 4. GSHP Desuperheater:** Savings of 1842 kWh is much too high. This estimate assumes that the desuperheater will cut the hot water heating energy by about half. However, desuperheaters only work when there is a coincident demand for hot water and HVAC (heat or cooling)--they are not "on-demand" water heating. Even when there is coincident demand, the electric water heater element is still heating water even while the much lower capacity desuperheater is also contributing to meeting the water

heating load. CSG analysis suggests at most a 20-25% hot water savings for standard desuperheater installation, and National Grid research on five desuperheater installations showed savings ranging from 32% to slight negative savings – the average savings was only 342 kWh. The demand savings estimate is also correspondingly too high.

5. **Electric Clothes Dryer with Moisture Sensor:** Estimated savings of 136 kWh are generally in line with current ENERGY STAR estimates of 20% savings of 160 kWh. An ENERGY STAR specification is expected in early 2014. Note that the recently released Samsung Emerging Technology Award winner dryer promoted by the Super-Efficient Dryer Initiative (SEDI) is expected to have savings of 241 kWh.
6. **Efficient Electric Water Heaters:** This measure should be deleted. The savings are small and there are no data to support the baseline at the federal minimum. Further, this measure competes with the much larger savings opportunity from HPWHs.
7. **Furnace Whistle:** There are no evaluated savings to reference for this measure and the current savings estimate is not well documented and likely to be significantly overstated from an engineering perspective. Further, any savings are entirely predicated on user response. The in-service rate (ISR) estimate is over ten years old and is from a Schools Program study.
8. **Heat Pump Water Heater:** Assumed attic or garage location is unlikely given freezing conditions. The TRM needs to consider space heat interactions, i.e., penalties, as well as cooling interactions (benefits) when located in conditioned space.
9. **RAC Retirement/RAC:** The default capacity of 10,000 Btuh seems high as does both the 58% coincidence factor and the 9.07 default for retired EER. Can the default capacity be informed by EDC program activity? Note that a new ENERGY STAR specification became effective in October 2013. Further, there is a new Federal RAC efficiency standard on June 1, 2014 that uses a revised efficiency metric (CEER) that includes stand-by loss.
10. **Smart Strips:** References may be dated. Has the idle/stand-by kW decreased as overall efficiency of TVs and computers has increased? If so, what is the impact on savings?
11. **Fuel Switching: Electric Heat to Gas/Propane/Oil Heat:** The DHW fuel switching measures specifies that ENERGY STAR compliant equipment be installed: *Commission Order requires fuel switching to ENERGY STAR measures*. Does this also apply to space heating measures? If so, then why are gas and propane baseline furnace efficiencies at 90%; given that ENERGY STAR is at 95%. Similarly, gas and propane boilers should be at 85%, not 82%.
12. **Fuel Switching: Heat Pump Water Heater to Gas, Oil or Propane Water Heater:** What is rationale for this measure? Does it screen from a TRC perspective and provide significant savings to the consumer, particularly for oil DHW? What are its carbon impacts? How can this measure and a standalone HPWH rebate both be offered by the EDCs?
13. **Ceiling / Attic and Wall Insulation:** There is no consideration of possible cooling load impacts of attic insulation. These savings should be modeled using approved Home Performance software. This would then allow capture of any interactive effects.
14. **Refrigerator / Freezer Recycling with and without Replacement:** The derivation of replaced kWh in Tables 2-48 and 2-49 are not clear nor consistent with the text discussion on page 107.

- 15. Residential New Construction:** As noted above, there is the need for a Pennsylvania-specific baseline to allow EDC's to properly claim credit for typical construction practices that are often below code; e.g., basement insulation. Table 2-52: why are there different ACHs based on windows/doors? What is it for the home? Is the duct leakage number consistent with IRC/IEEC 2009? The lighting baseline appears to reflect an overly restrictive and incorrect interpretation of the 2009 IRC: 50% efficient lighting is only required for homes showing compliance through the prescriptive path. While the federal furnace standard was delayed, the proposed furnace baseline is too low, most furnace shipments and sales are above 90%. Coincidence factor seems high for cooling, particularly if proper sizing is not enforced.
- 16. ENERGY STAR Refrigerators:** Would be useful to know the assumed volumes used with the kWh calculations. Are these informed by actual program data? There is also the potentially larger concern as to using the current fed standard as baseline given high ENERGY STAR market share and the September 2014 federal standard upgrade.
- 17. Clothes Washers:** Do the EDC rebate forms collect DHW and dryer fuel? The measure characterization is not clear as to the basis for the percentage of total wash cycle energy use allocated to dryer use. The cited reference is not relevant. There is no consideration of any homeowners using line drying.
- 18. ENERGY STAR Dishwashers:** Savings seem inconsistent when comparing values in Table 2-64 (355-295=60 kWh) and Table 2-66 (25 for electric DHW).
- 19. ENERGY STAR Dehumidifiers:** Dehumidifier energy use (and savings) is heavily dependent on usage patterns. Does the SWE have any data to inform a better a Pennsylvania-specific HOU estimate?
- 20. Residential Occupancy Sensors:** Do referenced utility programs have any evaluations to support the TRM citing them for the estimated 30% reduction in hours of use (HOU)?
- 21. ENERGY STAR Windows:** The measure characterizations is not well developed nor well documented. There is no information on assumed heating and cooling efficiencies, nor on the baseline and high efficiency glass U-values. Further, there is no consideration of improved solar heat gain coefficient (SHGC) impacts on cooling.
- 22. Holiday Lights:** Haven't these sufficiently saturated the market that they no longer require EDC support? This measure should be eliminated from the TRM.
- 23. Water Heater Tank Wrap:** The baseline default assumes one inch of polyurethane foam with an R12. Polyurethane foam has a lower R value; about 6.5 per inch. The higher assumed baseline R-value generates a more conservative savings estimate.
- 24. Pool Pumps:** Why do the coincidence factors vary so much between the two pool pump measures? The assumed default pump size of 1 HP is likely too small. VFD pumps are expensive and will likely only be installed in in-ground pools with a higher average pump size, though 1 HP would be conservative. The key pump kW variable for a VFD pump is EDC gathered, but this variable is entirely dependent on the pump speed selected. Even if known, the EDC would then need the power curve for the particular pump. This does not seem practical. Is a default pump kW needed, varying by pump HP, informed by over a decade of pool pump programs in California?

## Section VI - Key C&I Comments

**Issue A - Inconsistency of Peak Period Definitions:** The definition of the peak period for demand savings seems to be inconsistent across measures. For example, the domestic hot water fuel switch measure (#3.38) defines peak as summer weekdays from noon to 8 PM; the ENERGY STAR Office Equipment measure (#3.12) used the top 100 system hours; and the lighting algorithm (measure #3.2) references the Mid-Atlantic TRM, which used the peak period definition from PJM: summer weekdays between 2 PM and 6 PM. As noted above, the premium efficiency motors measure (#3.3) references a California data source for coincidence factor without defining the peak period. This calls into question the accuracy and comparability of peak demand savings estimates developed from the TRM.

We also note that the TRM assumes a uniform coincidence factor for all air-source cooling and air source and packaged terminal heat pump measures. The deemed value of this factor is said to be the average of coincidence factors from nine different sources including Massachusetts and Minnesota.

**Issue A Recommendation:** Given the significant effect that local weather conditions, equipment sizing practices, typical building envelope characteristics, etc. have on cooling coincident demand, as well as the likely differences in peak period definition among the various jurisdictions, better documentation should be provided to confirm the relevance of these values to Pennsylvania.

**Issue B - Lighting Retrofit Baselines:** The TRM includes savings adjustment factors for lighting retrofits (Measure 3.2) that are affected by the federal minimum standard for linear fluorescent lamps. The standard that took effect on July 14, 2012 ban the import and manufacture of most T12 lamps. A savings adjustment factor or a reduced effective measure life are two accepted methods for addressing the baseline shift that occurs when existing lighting is retired before the end of its useful life but after the effective date of the standard. In these cases, it is appropriate to count savings from the existing equipment until such time as it would have reached the end of its useful life and a fixture meeting the new federal standards was installed.

The assumption that T12 equipment being retrofit during PY6 would have continued to be in service, on average, through June of 2015, nearly three years after the effective date of the standard, appears to be based on an assumed lamp life of roughly 6 years in typical service. This appears to be an appropriate assumption. The TRM for Program Year 2015 should see a corresponding decrease in the savings adjustment factors and adjusted effective useful life.

While the treatment of the baseline shift for retrofit measures appears to be appropriate, it is important to note the effect these assumptions have on the EDCs achievement of first-year savings targets. Because first year savings are unaffected, T12 retrofits may be 'over-valued' by PAs as compared to other lighting measures with lower first-year savings but greater lifetime savings.

Furthermore, there are additional technologies for which a baseline adjustment may be appropriate. For example, incandescent lamps appear in the Lighting Inventory Tool even though recent changes in federal minimum efficacy render many of these obsolete. The

relatively short life of these lamps means that baseline shifts would happen fairly rapidly, yet no adjustment factors or measure life adjustments are presented. Appendix A of the TRM provides only a single measure life value for C&I non-solid state (SSL) lighting measures. This is not sufficient to address the variety of lighting technologies that are otherwise covered by the TRM, not does it address those technologies and retrofit situations where a baseline shift may be appropriate other than for linear fluorescent retrofits (more on this below).

**Issue B Recommendation:** Consider including savings adjustment factors for other retrofit measures that should account for a baseline shift in the next few years.

**Issue C - Sub-optimal Lighting Upgrades:** The tool includes some technologies that in some cases may be considered an efficient upgrade from baseline while in others may be considered baseline themselves. This is particularly true of standard T8 lighting. The Prescriptive Lighting Table included with the tool provides savings values for retrofitting existing T12 fixtures with standard efficiency T8. This is a sub-optimal technology selection, because high-performance T-8 technology provides additional savings for very little additional cost, particularly in retrofit situations where the act of changing the fixtures is a fixed and substantial portion of the total project cost.

**Issue C Recommendation:** SWE should take care to ensure that the savings algorithms and the Lighting Inventory Tool do not result in the promotion of measures that are sub-optimal.

**Issue D - HVAC Baseline Efficiencies:** The reported baseline efficiencies are 'correct' in that they accurately reflect the current Pennsylvania energy code (IECC 2009), but the current federal standards for PTACs and PTHPs, which took effect Sept. 30, 2012, are now higher than the IECC 2009 requirements.

**Issue D Recommendation:** Because federal standards dictate the equipment that can be manufactured and imported, the characterization should use the federal standard baseline rather than the IECC 2009 values for these types of equipment.

**Issue E - Baseline for Ductless Heat Pumps:** As noted in Measure 3.19, a ductless "mini-split" heat pump (DHP) is often used to convert an electric resistance heated space into a space heated/cooled with a single or multi-zonal ductless heat pump. The measure characterization provides data for several baseline systems and notes that for several situations including an existing space without cooling the assumed baseline for cooling is a standard central AC SEER. The failing here is that when a DHP is installed in such a space the measure characterization will generate cooling energy savings (assuming the DHP SEER rating exceeds the standard) even though there will be an actual energy INCREASE. The fact that an efficiency program promotes DHPs as efficient heating and cooling measures likely serves to increase cooling energy consumption, because some portion of those units will be installed in areas where no previous cooling exists. The measure characterization does not provide any guidance on whether or how to account for this possibility on a case-by-case basis or as an average effect across all installations.

**Issue E Recommendation:** The measure characterization for the same technology installed by residential customers includes some guidance as to the nature of the installation based on

the type of space being conditioned. SWE should consider using a similar approach for the C&I version of the characterization to address the possibility of increased consumption resulting from DHP installation. Furthermore, evaluation efforts should attempt to understand customer motivation and likely baseline behavior to more accurately characterize the savings from this measure.

**Issue F - Premium Efficiency Motors:**

Just as with some commercial lighting, recent changes in federal minimum standards for motor efficiency have created the need to address a baseline shift. The TRM does not include any information to support such a calculation. It sets the baseline efficiency of an early replacement motor at nameplate rating, but provides no guidance for determining the point at which the motor would have reached the end of its useful life and therefore been replaced with a motor meeting the current standard. Again, this does not affect the EDCs' achievement of first-year energy savings targets, but does affect the calculation of cost-effectiveness.

The measure characterization uses a default load factor datapoint from California dated 2005. The coincidence factor is also from this reference, but no information is provided to determine if there are any differences in peak period definitions between California and Pennsylvania, or whether the peak period in California has remained the same since 2005.

The stipulated hours of use are inconsistent. Hours of use for heating pumps are constant regardless of building type but ventilation and cooling vary considerably. The heating hours of use are also surprisingly high. The characterization only provides one CF, regardless of which mechanical system the motor serves. Given the wide range of operating hours by building type and function within the system as demonstrated by Table 3-17, it is unlikely that this CF suffices for heating, cooling, and ventilation.

**Issue F Recommendation:** Load factor and coincidence factor data from California should be updated and demonstrated to be valid for Pennsylvania. Hours of use data should be revisited and revised if necessary, particularly those for heating. Additional detail in coincidence factor data should be sought.

**Issue G - Room Air Conditioners:** The measure characterization does not reflect the new federal standard for room air conditioners that will take effect June 1, 2014. Therefore, savings from this measure will be overstated. On the other hand, the characterization does not distinguish between early replacement and new/replace on burnout installations. In the case of the former, the savings may be understated by using the stated baseline efficiency of a unit purchased in 2010 or later, as room air conditioners have a lifetime exceeding 4 years (Appendix A).

**Issue G Recommendation:** The characterization should be revised to incorporate the new federal standard that will take in June of 2014. It should also attempt to distinguish between new units and early replacement units.

**Section VII - Other C&I Measure Comments**

1. **Office Equipment** – As with the residential version, savings are based on a 2010 version of an ENERGY STAR savings calculator which does not appear to reflect the most recent version of the standard. Furthermore, the market share of ENERGY STAR office equipment is likely very high. As with efficient residential products, this means that savings for these products are likely overstated.
2. **Network Power Management for Office Equipment** – This measure estimates savings from a software-enabled centrally controlled power management strategy for office computer workstations. Many of the controller workstations are likely to include ENERGY STAR components. Because some of the savings from ENERGY STAR units are attributable to power savings features, this raises the possibility of double-counting savings from this measure.
3. **Fuel-switching Heat Pump Water Heaters to Gas / Oil / Propane** – As with residential version of this measure, it is unclear why this measure is included given the support of HPWH and its associated measure characterization. In addition, the characterization assumes a baseline replacement fossil fuel fired water heater rather than an efficient version. Promoting such a switch does not seem to have any value for the customer or society other than to promote first year electric energy savings that would contribute to an EDC's goal.
4. **LED Traffic Lights** – For new fixtures these are baseline and for retrofit these are likely to have a very high level of free-ridership. They should not be supported by the EDCs and excluded in the TRM.
5. **Table 3-3** shows the allowable Lighting power Density for new construction and major renovation. In its original document, several of the rows are indented to show their relationship with a particular space type. This has been lost in the TRM, and as a result the table is hard to understand and may be misinterpreted.

## Conclusion

In conclusion, PennFuture and KEEA appreciate the opportunity to comment on this docket and look forward to participating in future working group efforts, stakeholder meetings and commission proceedings to improve and refine the TRM and make Act 129 Phase II a success.

Sincerely,



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