Citizens for Pennsylvania's Future
610 N. Third St.
Harrisburg, PA 17101-1113

May 11, 2015

Rosemary Chiavetta
Secretary of the Commission
Pennsylvania Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265

Re: PUC Docket No. M-2015-2469311

Dear Chairman Chiavetta:

After reviewing the Commission's recent Technical Reference Manual (TRM) 2016 Update Order, a coalition of interested stakeholders including Citizens for Pennsylvania's Future ("PennFuture"), the Clean Air Council, the Sierra Club, the Natural Resources Defense Council, the Environmental Defense Fund, and the Keystone Energy Efficiency Alliance ("KEEA") (hereinafter "Joint Commentators") have provided the attached detailed comments on the suggested updates to the TRM.

Sincerely,

Robert Altenburg
Director, Energy Center
Citizens for Pennsylvania's Future

Logan Welde
Staff Attorney
Clean Air Council

Tom Schuster
Sr. Campaign Representative for PA & NJ
Sierra Club

Dick Munson
Director, Midwest Clean Energy
Environmental Defense Fund

Jackson Morris
Director Eastern Energy
Natural Resources Defense Council

Maureen Mulligan
Policy Director
Keystone Energy Efficiency Alliance

Prepared for

PennFUTURE

by

Optimal ENERGY &

ENERGY FUTURES GROUP

encl: Joint Comments submitted to PUC

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 2016 Update	**)** **)** **)** **)** **)**	**Docket No. M-2015-2469311**

COMMENTS OF JOINT COMMENTATORS: PENNFUTURE, SIERRA CLUB, ENVIRONMENTAL DEFENSE FUND, CLEAN AIR COUNCIL, NATURAL RESOURCES DEFENSE COUNCIL, AND KEYSTONE ENERGY EFFICIENCY ALLIANCE

Section I – Introduction

Citizens for Pennsylvania's Future (PennFuture), Sierra Club, Environmental Defense Fund, Clean Air Council, Natural Resources Defense Council, and the Keystone Energy Efficiency Alliance (KEEA) (hereinafter "Joint Commentators") appreciate the opportunity to submit these comments in response to the Public Utility Commission's (Commission) Tentative Order on the 2016 Technical Reference Manual (TRM) dated March 26, 2015.

PennFuture is a membership based non-profit advocacy organization focused on energy and environmental issues that impact Pennsylvanians. We work to create a just future where nature, communities, and the economy thrive. We enforce environmental laws and advocate for the transformation of public policy, public opinion, and the marketplace to restore and protect the environment, safeguard public health, and reduce the consequences of climate change within Pennsylvania and beyond.

Sierra Club is a non-profit environmental organization whose mission is to explore, enjoy, and protect the wild places of the Earth and to practice and promote the responsible use of the Earth's resources and ecosystems. The Sierra Club currently has 24,049 members in

Pennsylvania, most of whom receive electricity service from one of the EDCs required to offer efficiency services under Act 129. These members have a strong interest in both the success of energy efficiency programs and in protecting wild places and their ambient environment from the effects of air, water, and other pollution from electrical generation.

Environmental Defense Fund's mission is to preserve the natural systems on which all life depends. Guided by science and economics, we find practical and lasting solutions to the most serious environmental problems. With more than 1,000,000 members, we work to solve the most critical environmental problems facing the planet. This has drawn us to areas that span the biosphere: climate & energy, oceans, ecosystems and health. Since these topics are intertwined, our solutions take a multidisciplinary approach.

Clean Air Council is a member-supported environmental organization serving the Mid-Atlantic Region. The Council is dedicated to protecting and defending everyone's right to breathe clean air. The Council works through a broad array of related sustainability and public health initiatives, using public education, community action, government oversight, and enforcement of environmental laws.

The Natural Resources Defense Council (NRDC) is a nonprofit environmental organization with more than 1.4 million members and online activists, including nearly 54,000 in Pennsylvania. Since our founding in 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, its public health, and the environment. NRDC's top institutional priority is curbing global warming emissions and building the clean energy future—a priority that can be advanced by ramping up investments in energy efficiency via strengthened programs such as those administered under Act 129.

The Keystone Energy Efficiency Alliance (KEEA) advocates on behalf of energy efficiency and renewable energy professionals on the local, state, and federal levels. By representing the interests of the clean energy industry in Pennsylvania, KEEA is growing the market for energy efficiency and helping the Keystone State secure a prosperous, sustainable tomorrow.

We appreciate that the Commission has been willing to work with stakeholders and take our comments into consideration throughout each phase of the program. We continue to support Act 129 and believe that a well implemented program will protect public health and the environment while promoting economic growth and ensuring affordable electricity is available to our citizens. With that in mind, we respectfully submit the following comments:

Section II – Overarching Comments

Update Process

While we agree with the proposal to only perform comprehensive updates on the TRM after every phase of Act 129, many significant changes are likely to occur between now and 2020. These changes may include the emergence of new technologies, significantly increased acceptance of existing technologies, and, most importantly, federal and state code updates. Under the current order it appears that if, for example, Pennsylvania updates its code from ASHRAE 90.1 – 2007 to ASHRAE 90.1 – 2010, the impacted measures will continue claiming savings based on the code that was in place at the start of phase III. If the code is updated in 2016, this could potentially mean four years of overstating savings from certain key measures. To avoid these and similar issues, we recommend that the final order clarify the process to perform targeted updates on specific measures that are impacted by code updates, baseline studies, or other specific research that emerges in the middle of phase III. These updates would be much

smaller and more focused than the general updates performed at the end of the phase, but are important to ensure that savings claims are accurate throughout the entirety of phase III. We suggest that the existing TRM Working Group (TWG) be used for this purpose. We would also appreciate the TWG keeping stakeholders informed during their update process to ensure appropriate updates are included.

Establishing Baselines

The TRM continues to place too much emphasis on building energy codes and federal appliance standards as the preferred or sole means to establish baselines. Rather, the TRM should rely on more accurate and timely assessments of "practices and market transformation" or "current market practices."[1] These would include PA-specific baseline studies, review of ENERGY STAR market share data, purchase of retailer or distributor sales data, etc. By definition, an appliance standard is the minimum efficiency that can be purchased in the market.[2] The distribution of non-program eligible products will always be above this minimum and the average efficiency of non-program complying units will similarly exceed the minimum standard. This average value should be used for the baseline for most consumer products. This becomes particularly important for federal standards that have not been updated recently and for which the saturation of efficient products has grown over time.

For building energy codes, enforcement and compliance considerations can further complicate determining baselines for new construction programs. Past experience in many other jurisdictions points to building elements that are either not complied with or, conversely, for which common practice exceeds the code minimums. On-site baseline studies should be used to

[1] P.A. PUC, Technical Reference Manual (TRM) State of Pennsylvania Act 129 Energy Efficiency and Conservation Program Act 213 Alternative Energy Portfolio Standards, 1.7 Baseline Estimates, Jun. 2016, 9.
[2] This is the case typically, though some standards entail manufacturing rather than retail prohibitions. In these cases, retail sell-through may need to be considered.

determine compliance and average efficiency levels for individual building elements and for overall, performance-based compliance.

Transmission and Distribution System Losses

There should be separate line loss factors for demand and energy. Energy line losses should be differentiated to match the current avoided cost period definitions. The current TRM text states that:

> *"The EDCs are allowed to use alternate loss factors calculated to reflect system losses at peaking conditions when available to gross up demand savings to the system level. The Commission encourages the use of the most recent and accurate values for line loss factors for energy and demand known to the EDCs, regardless of what was filed in the original Phase II EE&C Plans."*[3]

The text should be re-worded to require the use of loss factors to reflect system peak conditions.

Impact of Weather

Equivalent full load hours (ELFH) are *calculated based on a degree day scaling methodology*.[4] What heating and cooling degree day basis are they using to adjust EFLHs? For heating it appears that a base 65 may be used. This may be too high a heating degree day base to use given.

Section III Residential Comments

Lighting

We have several recommendations for residential lighting. First, the current lifetimes for CFLs and LEDs are based on an old Energy Star standard, which required that CFLS have a rated lifetime of 8,000 hours and that LEDs have a rated lifetime of 15,000. However, the current

[3] P.A. PUC, Technical Reference Manual (TRM) State of Pennsylvania Act 129 Energy Efficiency and Conservation Program Act 213 Alternative Energy Portfolio Standards, 1.14 Transmission and Distribution Line Losses, Jun. 2015, 13.
[4] 2015 TRM, at 14.

ENERGY STAR rated life requirement for CLFs is now 10,000 hours and 25,000 hours for non-decorative LEDs. We recommend updating the measure life assumptions to reflect the minimum expected lifetimes for the newest Energy Star standard. Further, for CFLS a 0.85 degradation factor is applied to the rated life of the bulb to arrive at a discounted measure life. This factor is from a 2008 ACEEE paper.[5] However, this adjustment is not typically made when calculating the lifetime of CFLs. We recommend a review of the cited ACEEE study to ensure that it is appropriate to apply the degradation factor from the study to the rated life of the CFL, and to determine if this study is used in other jurisdictions.

Secondly, the baseline equipment is defined to be "a standard or specialty incandescent bulb."[6] This implies that there are no CFLs assumed in the baseline for the LED measure. Given high rates of free ridership typically found in CFL programs in other jurisdictions, as well as research in other states, it is clear that CFLs would have a significant market share even in the absence of program activity. The baseline for the LED measure should therefore assume a weighted average of EISA compliant incandescents and CFLs, as opposed to 100% CFLs.

Further, in Table 2-2 the post-2020 baseline wattages may be too high. It appears that these baselines are based on the 45 lumen/watt backstop standard in the EISA legislation. However, the average efficiency of CFLs is already substantially above this standard requirement. For example, the average of all 60 watt equivalent standard ENERGY STAR CFLs as of 1/20/15 was 65.0 lumens/watt; substantially in excess of the backstop minimum. We recommend using efficiencies of the typical CFL for the post 2020 baseline, as opposed to the 45 lumen per watt backstop. However, we also note that the baseline will most likely not shifted

[5] *Id.* at 17, footnote 28.
[6] *Id.* at 17.

immediately in 2020, but that there will be a lag of several years while existing inventory is de-stocked.

Finally, we have a few other comments on specific factors in the lighting section:

- Table 2-1. We note that the summer coincidence factor of 0.091 is substantially below the summer coincidence factor derived from a recent NMR multi-state lighting study in Massachusetts, New York, Rhode Island and Connecticut. The value from that study that is most applicable to Pennsylvania is a 0.14 coincident factor.
- Table 2-4. We recommend that the date for which the applicable EISA standard applies be specified.
- LED Night light. 100,000 hour measure life seems very high. We recommend verifying that this claim is based on testing done to accepted industry practices, e.g., IES or ANSI test procedures.

HVAC

For the HVAC kW savings calculations, the EER unit is estimated by applying a factor to the SEER of the unit. While this approach can be useful when the exact specifications are unknown, it is not exact, and the ratio can change significantly from one air conditioner model to the next. Further, AC units are rated in both SEER and EER, and there is no reason that the actual EER of the unit can be used, as opposed to trying to estimate the value from the SEER. We recommend adding a field in the rebate form to collect the EER of the unit, and changing the value of EERe in Table 2-12 to reflect EDC data gathering.

Further, it is not entirely clear if the furnace fan measure is meant for retrofitting an existing furnace with a new fan, or if it is part of the furnace measure. It does seem that the characterization is meant more for retrofits. If this is the case, the source cited, "Electricity Use

by New Furnaces: A Wisconsin Field Study," may not be applicable, as it looked at furnace fans in new furnaces. In this case, a 2012 Impact evaluation looking at savings from furnace fans may be more applicable. We recommend reviewing this report to determine if it has more recent and appropriate savings estimates.[7]

This section contains many references to Energy Star specifications that are currently out of date. This impacts the eligibility requirements for ductless mini split heat pumps, as well as factors for Energy Star central air conditioners and heat pumps. The current Energy Star room ACs specification will be superseded by Version 4.0 on October 26, 2015. However, given the small (<12 kWh) savings for this measure with the current specification, we recommend requiring any currently rebated units meet the new specification.

Finally, the 2% cooling and 3.6% heating savings for programmable thermostats is low compared to many other jurisdictions. We recommend considering a separate characterization for wi-fi thermostats and/or learning thermostats such as Nests. These types of programmable thermostats should have higher savings than the percentages given in the current TRM.

Domestic Hot Water

In calculating interactive effects for heat pump water heaters, a central air conditioner with a default SEER of 12 is used. This is different than the efficiency used in the residential whole house fans characterization, which uses modeling of a home with a CAC of SEER 10. The SEER 12 is likely a more accurate baseline than the SEER 10. In addition, the HSPF default for heat pump water heaters of 7.4 is not consistent with default HSPF values in other sections of the TRM. We recommend that all default HVAC baseline values be reviewed for consistency. In the

[7] The Cadmus Group, *Brushless Fan Motors Impact Evaluation*, Jun. 2012, http://ma-eeac.org/wordpress/wp-content/uploads/Brushless-Fan-Motors-Impact-Evaluation_Part-of-the-Massachusetts-Residential-Retrofit-Low-Income-Program-Area-Evaluation.pdf.

case of the CAC baseline value, we recommend that SEER 12 be used instead of SEER 10, as this is most likely more reflective of the actual base case.

Further, fuel switching from a heat pump water heater to a fossil fuel water heater seems counterproductive given program support for heat pump water heaters. Conceivably, the same person could get a rebate for heat pump water heater and then, a couple years later, get another rebate to fuel switch to fossil fuel heating. Further, this measure is unlikely to pass the cost effectiveness test, particularly for a fuel switch to oil or propane.

Finally, for faucet aerators and low flow showerheads, the savings calculations assume that a home with electric water heat uses electric resistance heat. In reality, however, some homes have heat pump water heaters, and would achieve somewhat lower savings. We recommend including default savings calculated for faucet aerators and for low flow showerheads that allow for correct savings estimates in direct install applications in homes with HPWHs. Finally, in calculating savings for these two measures, the algorithms use recovery efficiency. We recommend changing this to Energy Factor, as this would give a more accurate estimate of savings for both electric resistance water heaters and heat pump water heaters.

Appliances

The TRM recognizes and provides savings estimates for ENERGY STAR's Most Efficient category. This is appropriate as the lower ENERGY STAR specification may yield insufficient savings and/or have too high a market share to justify continued support for specific products. As manufacturers often respond quickly to changes in ENERGY STAR specifications, it will be incumbent on the SWE and EDC's to closely monitor the appliance and consumer electronics markets to ensure that program eligibility criteria are set at the correct level and that support is withdrawn – or moved to a more efficient tier – for products with high market shares.

The ENERGY STAR specification ensures a minimum of a 9%, not 20% as stated, improvement in efficiency reflecting 2014 updates to both the Federal refrigerator and freezer efficiency standards and the corresponding ENERGY STAR specifications. The statement regarding Most Efficient being 30% better than the Federal standard is also incorrect. There are currently qualified units that use 15% less electricity than the Federal standard, but none use 30% less. We recommend revising these factors to reflect the actual improvements in efficiency for both Energy Star and Most Efficient units. Further, the Most Efficient default values should be expanded in anticipation of other configurations meeting the specification. In addition to the two configurations already listed there are qualified Most Efficient bottom-mount freezer units without automatic icemakers or through the door ice service. Finally, The Most Efficient default values may be too high. The current (as of 5/8/15) average savings for all qualified Most Efficient refrigerators over the Federal standard are:

- Bottom freezer/no ice service: 88 kWh/yr.
- Bottom freezer/automatic icemaker: 94 kWh/yr.
- Bottom freezer/through the door ice: 141 kWh/yr.

The default refrigerator savings are mostly between 30-60 kWh at the ENERGY STAR level. Given the low savings and likely high market share for these units in 2016 (the specification was updated in 2014), we recommend discontinuing support for this level of efficiency, and specifying higher eligibility requirements. Similarly, freezer default savings are between 20-60 kWh, with most in the 20-40 kWh range. We recommend discontinuing program support of this product category given the low per unit savings and moderate free-ridership.

The refrigerator/freezer recycling algorithms estimate savings based on data collected in Program Year Five. However, a key input onto the algorithm is the percentage of units manufactured before 1990. One would expect that this value would decline over time. Given the proposed multi-year nature of the 2016 TRM, there should be some attempt to estimate how this variable will change, i.e., decline, over time. Similarly, the regression equations are informed by data or protocols developed in 2013 for refrigerators (and most likely using 2011 and/or 2012 program data) and 2011-2012 for freezers. As the stock of older units continues to turn over, one might expect that the savings from recycled refrigerators would fall. We recommend looking at data from long-standing programs, i.e., those in California, that might inform how recycling savings trend over time.

Further, the current ENERGY STAR clothes dryer default savings of 25 kWh for a standard dryer are too low. ENERGY STAR states that savings are 20% and the TRM dryer fuel switch measure has base dryer consumption at 905 kWh/yr. Savings should therefore be around 150 -170 kWh/yr. Further, savings from an ENERGY STAR heat pump clothes dryer will likely be twice that of a standard ENERGY STAR dryer. We therefore recommend that this be characterized as a separate measure.

The fuel switch dryer measure calculates the increased gas use simply by taking the eliminated kWh usage and converting it to MMBtu. This is not necessarily accurate, as the gas dryer will have a different efficiency than the electric dryer. We recommend that the characterization specify that the gas dryer is ENERGY STAR, and manually calculate the increased gas use with the appropriate efficiency value.

The dishwasher characterization needs to be updated to reflect the new 1/29/16 ENERGY STAR V6.0 specification.

The market share for dehumidifiers meeting the current ENERGY STAR specification was 99% in 2013, and there is no revised specification under development. We therefore recommend removing this measure from the TRM and ending program support.

Consumer Electronics

Televisions have fairly low per unit savings – 3-85 kWh/yr. – as well as historically high ENERGY STAR market shares – 84% in 2013. We therefore recommend removing this measure from the TRM and ending program support. Alternatively, the Most Efficient TVs can be characterized as a potential EDC measure. Finally, the sources need to be updated to reflect the correct ENERGY STAR specifications.

For office equipment, sources state the ENERGY STAR Office Equipment Calculator was referenced in May 2013. However, the ENERGY STAR imaging equipment specification was updated January 1, 2014. We recommend reviewing to ensure that the values in the TRM reflect the current ENERGY STAR specifications.

Similarly, we recommend reviewing the power strip inputs and calculated savings to ensure that they reflect current efficiencies of office and audio visual equipment. The efficiencies for these equipment categories, particularly for TVs, continue to improve. As the controlled plug loads consume less power, the savings from both Tier 1 and Tier 2 power strips will likely decline.

Building Shell

We recommend that modeling be considered for insulation cooling savings. This would provide a less simplified savings estimate, and would likely eliminate the need for the adjustment factors applied to the cooling savings calculations: Discretionary Use Adjustment and the Attic

Heating Factor. There does not seem to be much base for these values, especially the Discretionary Use Adjustment.

HDD base 65 and CDD base 65 are being used to derive the savings. This base is probably not appropriate for current homes. Note that the use of the 0.75 Discretionary Use Adjustment for cooling acknowledges that a base 65 cooling degree day base should not be used without this adjustment. We recommend including a similar adjustment for heating, or preferably using different CDD and HDD bases.

Window savings are modeled with REM/Rate, which is not the best tool for this purpose. We recommend using RESFEN from LBNL which was developed specifically to model residential window energy use.

As discussed above, we recommend that Pennsylvania develop a new construction baseline based on onsite surveys, not minimum code requirements. The TRM should not be using code – regardless of how up to date – as a baseline. There are too many uncertainties regarding compliance and enforcement, as well as the tendency for certain key code requirements to often be exceeded, e.g., gas furnace efficiencies.

The new construction coincidence factor of 0.647 appears to be related to cooling. However, other end uses, most notably lighting, may contribute to energy savings and will have different coincident factors. We recommend updating the coincidence factor to reflect the mix of measures producing savings in a typical new construction project.

We recommend providing more information as to the assumptions of the building prototypes modeled to develop the air sealing UES and UDS factors. For example, the ratios of the ASHP vs. electric resistance UES values imply an ASHP system COP of between 1.7 to 1.9.

This result is lower than rated ASHP efficiencies. Is it the result of duct losses in the ASHP prototype(s)?

Finally, we have several comments on the User Defined Reference Home in the Home Performance with Energy Star characterization (Table 2-111):

- The GSHP efficiencies seem low.
- The boiler baseline is now higher given updated Federal standards.
- The modeling temperature set point is likely too high for heating (70°).
- Does IRC 2009 require 50% efficient lighting regardless of compliance path? Thought that this requirement only applied if the prescriptive compliance path were being pursued?
- What is timing of the next PA code revision? IECC 2012 has air leakage performance standards and mandatory efficient lighting requirements regardless of the compliance path used.

Section IV C&I Comments

Lighting

We have several recommendations relating to C&I lighting. First, commercial lighting measures have a measure life of 13 years for retrofit and 15 years for new construction. While this measure life is reasonable for fixtures, the TRM section is meant to apply to screw-in bulbs as well. It is typically assumed that the measure life of screw-in bulbs is only as long as the life of the bulb, as opposed to lighting fixtures, which are wired for specific bulb types and can thus be assured that the bulb will be replaced with a bulb of similar type. For this reason the measure life of screw-in bulbs is typically much shorter than for lighting fixtures. We recommend

revising the section to include a table showing different measure lives for different lighting technologies. This table could include lighting fixtures, screw-in CFLs, and screw-in LEDs.

Secondly, the TRM material on lighting does not allow for any Operation and Maintenance (O&M) benefits. Efficient lighting technology typically lasts longer than the baseline technology, and thus produces real and quantifiable benefits from less frequent replacement of the lamps and ballasts within the lighting fixture. In some cases, these benefits can be very significant. For example, metal halides are standard for parking lot pole lighting technology. However, these bulbs last about 10,000 hours, five times lower than a typical life for an equivalent LED of 50,000 hours. This means that a facility would have to pay the equipment and labor cost for the bulb replacement of the metal halide fixture five times in the time it would take for an LED to burn out. This can be a significant expense – especially if the pole is high enough to require a bucket truck rental. For lighting, these O&M expenditures are real and known, can be estimated in a TRM, and should therefore be including when evaluating a measure for cost-effectiveness. We recommend adding a table in the TRM that includes lifetimes and estimated replacement costs for common lighting measures.

Further, the TRM appropriately states that due to the Energy Independence and Security Act (EISA), standard T8s should be considered the baseline for any T12 retrofits. While we agree with this characterization, we worry that if the full cost of retrofitting the T12 fixtures to High Performance T8s is compared to the incremental savings of standard T8s to High Performance T8s, the measure may not look cost-effective. To avoid this situation, we recommend including clarifying language in the TRM to the effect that any lighting retrofits with a T12 baseline should be treated as lost opportunity measures with a standard T8 baseline, and

the cost used for screening should be the incremental cost of retrofitting the T12s to standard T8s versus retrofitting the T12s to the efficient technology.

Finally, the TRMs require metering for projects saving over 500,000 kWh. Since the wattage draw for lighting technologies is a well-known quantity and does not vary significantly with time, using light loggers to estimate hours of use is likely an easier and more effective way of verifying savings. We therefore recommend including language in the TRM explicitly allowing light loggers as a means of fulfilling the M&V requirements. Further, for projects that are measured with either electric meters or light loggers, we recommend that the project specific hours of use and coincidence factors be used, as opposed to the general hours in the tables. This comment applies to the new construction lighting section as well.

New Construction Lighting

The current TRM lists the baseline lighting power density (LPD) for new construction projects from ASHRAE 90.1 – 2007. This is appropriate for current new construction projects. However, if Pennsylvania adopts ASHRAE 90.1 – 2010 in the next five years, the baseline will become obsolete before the end of the current TRM cycle. We recommend either including language that if PA code is updated, current code should be used, or including the baseline values from ASHRAE 90.1 – 2010 as well, in the event that PA code is updated before the end of phase III in 2020.

LED Traffic Lights

LED traffic lights are already common practice throughout the country for new construction, and are incandescent traffic lights are rapidly being retrofit to LEDs. Thus this measure should be considered baseline for new construction, and the free-ridership level for

retrofits will be extremely high. The measure should thus be removed from the TRM and not supported by ratepayer money.

HVAC

The baselines of all HVAC measures should be reviewed. The current baselines are based on ASHRAE 90.1 - 2007. However, if Pennsylvania adopts ASHRAE 90.1 – 2010 in the next five years, the baseline will become obsolete before the end of the current TRM cycle. We recommend either including language that if PA code is updated, current code should be used, or including the baseline values from ASHRAE 90.1 – 2010 as well, in the event that PA code is updated before the end of phase III in 2020.

In addition, it is specified that the baseline for early retirement HVAC measures be the nameplate data of the existing equipment. While this is appropriate for the first few years after installation, it should be assume that, in the base case, the existing equipment would have failed at some point in the future and thus would have needed replacement with a code compliant unit. At this point, the baseline shifts to the code compliant unit, and savings are reduced for the remainder of the measure life. This is typically assumed to occur after one third of the measure life has expired. In other words, if an HVAC unit has an expected life of 15 years, the baseline shift would occur after five years of savings. We recommend adding a description of this baseline shift to the HVAC measures. Alternatively, this issue can be equivalently handled via a reduced measure life.

Water Heating

It is unclear whether one is required to use the default square footage listed in Table 3-69, or whether one can use the actual square footage of the facility. We recommend clarifying that

the listed square feet numbers are default, and, if known, the actual square footage of the building can be used.

Further, fuel switching from a heat pump water heater to a fossil fuel water heater seems counterproductive given program support for heat pump water heaters. Conceivably, the same person could get a rebate for heat pump water heater and then, a couple years later, get another rebate to fuel switch to fossil fuel heating. Further, this measure is unlikely to pass the cost effectiveness test, particularly for a fuel switch to oil or propane.

Other Comments

Refrigerated Cases – The only difference between "adding doors to existing refrigerated door cases" and "refrigerated cases with doors replacing open cases" appears to be that the latter requires that the doors be no sweat but the former does not. Otherwise, the savings are very similar. It is unclear why this is only a requirement for a full replacement, and not just adding doors. We recommend considering combining the two measures, and standardizing the requirement of no sweat.

Office Equipment – The savings estimates for office equipment are based on an Energy Star calculator from 2013, which no longer appears to be on the website. Further, there is a new Energy Star specification that came into effect on January 1, 2014 that is unlikely to be reflected in the current savings numbers from 2013. Finally, Energy Star office equipment has high baseline penetration – in 2013, imaging equipment achieved an 81% market share, and computers achieved a 55% market share.[8] We recommend revising the savings numbers to reflect the new Energy Star specification for the efficient equipment and the higher than code baseline penetration for the standard equipment.

[8] U.S. EPA, *ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2013 Summary*, https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2013_USD_Summary_Report.pdf?f438-67be.