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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Re: Standards for the Participation	:	Docket No. M-2012-2313373
of Demand Side Management	:	M-00051865
Resources – Technical Reference	:	
Manual (TRM) 2013 Update	:	

COMMENTS OF THE KEYSTONE ENERGY EFFICIENCY ALLIANCE TO
THE 2013 TRM ANNUAL UPDATE TENTATIVE ORDER

I. Introduction

On September 13, 2012, 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.

The Keystone Energy Efficiency Alliance ("KEEA"), a nonprofit trade association made up of sixty-one (61) energy efficiency and demand response companies and organizations, greatly appreciates the opportunity to submit comments to the PUC on these issues. The TRM directly affects the savings that utilities are able to claim towards their Act 129 Energy Efficiency and Conservation (EE&C) savings goals.

KEEA worked with Michael Blasnik and Associates and Bruce Harley, Senior Applied Building Science Manager at Conservation Services Group to compile these comments. Michael Blasnik and Bruce Harley are the primary authors of these comments. KEEA, Mr. Blasnik, and Mr. Harley have reviewed the 2013 TRM Update and submit the following comments for the Commission's consideration.

II. Comments

1. Impact of Weather – Draft 2013 TRM Section 1.16

In the proposed 2013 TRM, the Pennsylvania Public Utility Commission (Commission) maps Pennsylvania cities to California climate zones in Table 1-2 because California-based analyses were used in developing some savings estimates. This mapping is inappropriate, since the climates in California and Pennsylvania are very different. The table maps Philadelphia to the California Climate Zone 13, but Climate Zone 13 has only about half the heating degree days of Philadelphia and has about 50% more cooling degree days. The simple mapping in Table 1-2 should not be used, even for cooling calculations as stated in the paragraph above. Cooling degree days are generally a poor way to estimate cooling load in relatively mild cooling climates; matching cooling degree hours would be a better metric on which to base cooling season assignments.

2. Electric HVAC Algorithms – Draft 2013 TRM Section 2.1.1

The savings estimates for proper sizing (5%), maintenance of heating (10%) and cooling (10%) equipment, and duct sealing (18%) don't accurately reflect the variations in conditions across homes.

The heat pump and air conditioner maintenance savings of 10% are considerably higher than has been found in recent billing analysis of programs in California and Nevada. In addition, these fixed percent savings amounts do not appear to differentiate between state-of-the-art diagnostic approaches targeted to homes likely to have system problems vs. routine maintenance tasks done on typical homes, even though savings are likely to vary by an order of magnitude between such program designs. Table 2-1 cites source 15 for these savings estimates but that citation has nothing to do with system maintenance program savings. Perhaps source 16 is what was intended, but that source is vague at best.

The duct sealing savings of 18% might be a feasible result for leaky ducts located entirely in attics. But many homes in Pennsylvania have ducts in basements, where savings are likely to be closer to 2% or in crawl spaces where savings might be closer to 8%. Similar to the maintenance savings, the actual savings from duct sealing will vary dramatically depending on

the quality of the work, and the targeting of homes and using fixed savings estimates does not reward better designed programs. The source reference for the duct sealing savings simply cites "VEIC Estimate based on PEPCO assumptions" – which is not a vetted source.

Many savings results in this and other sections of the TRM are based on the estimated energy use for heating and cooling, which is expressed as Equivalent Full Load Hours multiplied by system input capacity. This approach, especially when EFLH is based on generic modeling runs multiplied by guessed-at oversizing factors, is inferior to the "optional" approach listed of using billing data analysis to establish heating and cooling loads. The billing data analysis approach should be listed as the preferred method. If a site-specific billing analysis-based estimate is not available, then utility-specific average heating and cooling loads should be used explicitly in favor of the modeling approach (capacity * EFLH) as shown.

Specifically for ground source heat pumps (GSHP), the AHRI rating is inadequate because (unlike the AHRI ratings for other HVAC systems, which are relatively self-contained), it does not account for the external fan or pumping energy that is required to actually run the system. RESNET has addressed this by requiring raters to note GSHP pump power ratings, and a further adjustment is made for fan static pressure; RESNET also has established default adjustments to the rated COP and EER when actual pump design is unknown. These or similar adjustments should be incorporated into the GSHP efficiency calculations. (See www.resnet.us/standards/Auxiliary_Electric_Energy_of_Ground_Source_Heat_Pumps_Amendment.pdf).

Further, the value for EDSH (assumed savings per desuperheater) is too high at 1842 kWh. Simple math suggests that as typically installed, a desuperheater would provide approximately far less of the hot water needs of a typical house; the value shown is more than 50% of a typical home's annual water heating load. This value seems to assume that the desuperheater water heating output (typically between 2500-4500 btuh) is available to heat water during all hours of GSHP heating and cooling operation. However, unless there is a separate pre-heat tank or other special setup, the desuperheater can only heat water when there is a coincident water heater load. Any time there is a hot water load at the tank, the (primary) 4500W electric resistance element will also normally be heating water at a rate of 3-6

times that of the desuperheater. This should be further refined with a bin analysis at least, or modeled explicitly for individual cases based on desuperheater rating, building loads, and hot water load profiles; a value of 1/4 or less the proposed value would be conservative, but much more realistic. (Note: an older study from 1998 of eight GSHPs by New England Electric System (now National Grid), found the desuperheater operation displaced between 4% and 32% of water heating energy at the four best sites; one of the eight had slight negative displacement.)

3. Furnace Whistle – Draft 2013 TRM Section 2.5

This section is not based on any measured results and doesn't adequately reflect how air handler systems work and how filters affect them. The savings are based on "reduced furnace blower fan motor power requirements" from changing filters more frequently. In reality, the fan motor power requirements for most systems with common permanent split capacitor (PSC) motors will actually increase when a clean filter is used, as increased air flow allows the fan to do more work which increases power draw by more than reduced static pressure would decrease power draw. For much less common ECM fans, power draw will be reduced by using a clean filter. But in neither case is the cited 30% savings (from a brochure with no sources) realistic. The main source of savings from more frequent filter replacement is expected to be in system heating and cooling efficiency rather than fan energy, but these potential savings are small or non-existent, depending upon prior filter replacement frequency, return duct leakage paths, and other factors.

4. Heat Pump Water Heater Energy Factor – Draft 2013 TRM Section 2.6.4

The adjustment for wet bulb temperature assumes that the heat pump water heaters are installed in garages or attics. This assumption is faulty – water heaters are nearly always located in basements or within the conditioned space in climates where sub-freezing temperatures occur. Water heaters may be frequently located in garages in hot climates, but not in Pennsylvania. This adjustment factor should be dropped. Instead, an adjustment should be included for potentially significant heating and cooling interactions. A heat pump water heater is like an air conditioner for the space that it is located – reducing cooling loads but

increasing heating loads, and these changes in loads should be included in the deemed savings calculations. In addition, section 2.6.7 indicates that deemed savings is the appropriate evaluation method. For a measure with such large impacts, little track record, and significant unknowns about actual performance and interactive effects in this climate, billing data analysis and perhaps some additional assessment of in-field performance would be warranted.

5. Home Audit Conservation Kits – Draft 2013 TRM Section 2.7

This measure includes a value for smart power strips that is likely too high (see comment on section 2.13 below). In addition, even though the measure correctly assigns an ISR factor to adjust savings for surveyed "actual" installation rates, the idea that the second smart power strip (when installed) would save as much as the first one is questionable. The first one installed would reasonably be assumed to be installed in the appliance/electronics "cluster" of highest potential savings, and so the savings would be expected to drop for any subsequent power strip. Note: this adjustment could be embedded in the ISR factor if it's accounted for in some way during the follow up surveys.

6. Programmable Thermostat – Draft 2013 TRM Section 2.11

This section includes an elaborate approach to estimating heating and cooling loads rather than simply using a billing analysis based approach (see comments on section 2.1.1). In addition, the cooling savings are set at 2% based on California analysis results for climate zone 16, which is officially described as "a high, mountainous and semiarid region above 5,000 feet in elevation." For heating, the equations used indicate that these savings are for heat pumps. The use of EFLH and a heating input rate of 36,000 Btu/hr makes it unclear how auxiliary heat is included. The oversizing factor of 40% for heating is unlikely to be accurate as heat pumps are typically sized for cooling loads and the remaining heating capacity is covered by auxiliary heat. The heating savings are listed as 3.6% and the reference is unclear as to how the number was derived and to what climate and heating type/housing stock it applies. There is very limited data on programmable thermostat savings in heat pump heated homes but the measure description should make clear that only programmable thermostats that are intended for use

with heat pumps (have special recovery algorithms) should be included since conventional programmable thermostats can increase auxiliary heating use in heat pump homes.

7. Room AC (RAC) Retirement Algorithms – Draft 2013 TRM Section 2.12.1

A direct (billing) analysis or estimated (typical kWh cooling usage for customer base) should be substituted for the EFLH approach. See discussion under comments on Section 2.1.1 (comment #2 above). Also, the mapping of CA climate zones should be revised (see comment on Section 1.16 – comment #1 above).

8. Smart Strip Plug Outlets – Draft 2013 TRM Section 2.13

The deemed value of 184 kWh is much larger than estimated 25 kWh savings from a detailed field data study of plug load savings opportunities (report ECW 257-1). The ECW study found lower standby power draws than assumed in the TRM. If applied selectively, the savings could average larger than the ECW value, but the TRM savings appear quite large. (Note this affects section 2.7 as well).

9. Electric Water Heater Pipe Insulation – Draft 2013 TRM Section 2.15

The deemed savings value of 3% is unsupported (the citation provides no analysis). However the deemed value of 96 kWh is not unreasonable for the two measures combined (a recent internal analysis by Conservation Services Group estimated 94 kWh for electric water heating savings in a similar climate).

10. Residential Whole House Fans – Draft 2013 TRM Section 2.16

The application of a REM/Rate modeled savings to all houses is likely to over-predict savings from this measure, possibly dramatically. REM/Rate assumes that when a house is air conditioned, the AC is left on at the selected thermostat setting throughout the cooling season. This is unlikely, given the relatively mild cooling climate of much of Pennsylvania. Also, customers who are likely to use a whole-house cooling fan correctly to introduce night cooling and offset mechanical AC loads are likely to try to offset cooling as much as possible even

without the fan. Further, some customers who install the fan won't use it effectively. Taking the REM/Rate results "as-is" is likely to overestimate both the baseline AC use and the savings.

11. Ductless Mini-Split Heat Pumps – Draft 2013 TRM Section 2.17.1

A direct (billing analysis) or estimated (typical kWh cooling usage for customer base) should be substituted for the EFLH approach. See discussion under comments on Section 2.1.1 (comment #2 above). Also, the load factor "LF" seems to be applied incorrectly here; this factor should likely be adjusted based on the degree to which the DHP(s) are sized to meet the entire heating load of the house rather than simply supplementing the existing heating system. Further, if a billing analysis is completed on the home, the application of the "LF" to adjust for – as stated – "and because the EFLH used are based on central ducted systems which may overestimate actual usage for baseboard systems" would be obviated. It is recommended that an explicit factor for the sizing of the heat pump relative to the building heating load be included, along with a separate estimate or model of electric resistance heating consumption (for which the use of EFLH would be completely inappropriate anyway).

12. Fuel Switching: Electric Heat to Gas Heat – Draft 2013 TRM Section 2.20

The calculations assume the new gas furnace will have an AFUE of 78%. But 78% AFUE units are no longer manufactured; there are few less than 80%. In any case, the measure should require at least a 90% AFUE furnaces be installed, now that they will be required by NAECA code in 2013 for all northern climates. Also, given the large cost and savings of this retrofit, savings should be based on a pre-retrofit billing data analysis instead of estimated EFLH and capacity in all cases with available data.

Note also that the EFLH (if used) would be inherently different for the installed furnace (the second term of the savings equation) than it is for the heat pump (first term), because typically a gas furnace would be sized differently than the pre-existing heat pump. Further, the EFLH shown is completely inappropriate for the case of electric resistance heat in the existing house; this would need to be replaced with billing analysis or modeled energy use for electric resistance.

13. Ceiling / Attic and Wall Insulation – Draft 2013 TRM Section 2.21

Cooling savings from ceiling insulation should be considerably larger than the estimates based on the CDD method here since attics are often significantly hotter than outdoor temperatures during the cooling season. The HDDs are apparently HDD65, which would lead to a systematic over-estimation of savings. A correction factor can be applied or HDD60 could be used to adjust savings. The assumption that an un-insulated wall behaves at R-3 will yield savings estimates that are too large. Evaluation studies have found savings more consistent with R-5 or R-6 for an existing un-insulated wall, and recent work by the National Renewable Energy Laboratory (NREL) confirms that higher R values for un-insulated walls are warranted. The combination of R-3 and the use of HDD65 will lead to savings estimates more than double the savings generally found. The R-9 default for the insulated wall is also low, as it is virtually unheard of to add R-6 insulation to a wall – the stud space is filled by high density blown insulation.

14. Refrigerator / Freezer Recycling with and without Replacement – Draft 2013 TRM Section 2.22

It would be more accurate to base the existing unit UEC on short term metered data if available or a label rated usage input rather than rely on regression models developed elsewhere.

15. Water Heater Tank Wrap – Draft 2013 TRM Section 2.40

Few electric water heaters are as poorly insulated as the base case in the TRM states. The requirement to collect make/model numbers should be the basis for checking this assumption, with an adjustment factor added to account for post-install analysis (similar to the ISR factors used elsewhere).

16. General Comments on Residential Measures

KEEA agrees with CLEAResult's comment on this docket that the Commission should consider the addition of one measure to strengthen Section 2 of the 2013 TRM: allowing for the conversion from electric resistance heat to heat pumps. KEEA would make two adjustments to CLEAResult's comments by adding the word "high efficiency" to the heat pump conversion and include solar thermal heating.

17. Commercial and Industrial Measures

Again, KEEA agrees with CLEAResult's comment on this docket that "the following measures could be added to the 2013 TRM Section 3 to reflect the current market of commercial and industrial energy efficiency measures:

a) ENERGY STAR Data Storage Servers;

b) ENERGY STAR Servers;

c) Server Virtualization;

d) Variable Frequency Drives on Fan Motors for CRAC units;

e) Variable Frequency Drives on Chilled Water Pumps serving;

f) Refrigeration Tune-Up;

g) Industrial Nozzles; and

h) Faucet Aerators (in commercial facilities)."

18. Other

The protocols for residential new construction (Draft 2013 TRM Section 2.23) lack specifics. KEEA would like to reserve the right to comment on this category as it evolves over time and through participation in the Technical Working Group (TWG). For example, it is implied, but not explicitly stated, that accredited modeling software other than REM/Rate may

be used for this purpose. KEEA would like clarification as to whether the TWG would be the proper place to raise other issues not fully vetted at this time.

III. Conclusion

KEEA appreciates the opportunity to comment on this docket and looks forward to working with future working group efforts, stakeholder meetings and commission proceedings to improve and refine the TRM and make Act 129 Phase II a success.

Respectfully submitted on behalf of KEEA,

President
Board of Directors