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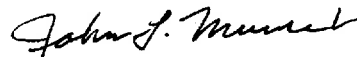
May 24, 2019

VIA ELECTRONIC FILINGRosemary 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 2021 Update
Docket No. M-2019-3006867**

Dear Secretary Chiavetta:

Attached please find the Comments of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power Company to the above-captioned Tentative Order concerning proposed updates to the Technical Reference Manual for Phase IV Energy Efficiency and Conservation Plans.

Very truly yours,


John L. Munsch
Attorney

JLM:dml

Enclosures

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**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

**Implementation of the Alternative Energy :
Portfolio Standards Act of 2004: :
Standards for the Participation of : Docket No. M-2019-3006867
Demand Side Management Resources – :
Technical Reference Manual 2021 Update :**

**COMMENTS OF METROPOLITAN EDISON COMPANY,
PENNSYLVANIA ELECTRIC COMPANY, PENNSYLVANIA POWER
COMPANY AND WEST PENN POWER COMPANY TO
THE TENTATIVE ORDER REGARDING THE
2021 TECHNICAL REFERENCE MANUAL**

I. INTRODUCTION

On April 27, 2019, the Pennsylvania Public Utility Commission (“Commission”) entered a Tentative Order in the above-referenced matter seeking comments to the proposed updates to the Technical Reference Manual (“TRM”) that will be applied to electric distribution companies’ (“EDCs”) Phase IV Energy Efficiency and Conservation (“EE&C”) Plans from June 1, 2021 through the duration of Phase IV. The Commission directed that comments be submitted within thirty days of the publication date of the Tentative Order in the Pennsylvania Bulletin and that reply comments be filed within fifty days of publication. Notice of the Tentative Order was published in the Pennsylvania Bulletin on April 27, 2019.¹

The Commission previously adopted *Energy-Efficiency and DSM Rules for Pennsylvania’s Alternative Energy Portfolio Standard, Technical Reference Manual*² to help implement the

¹ 49 Pa. B. 2074.

² *Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual Update* (Docket No. M-00051865; Order entered October 3, 2005).

Alternative Energy Portfolio Standards Act, 73 P.S. §§ 1647.1 – 1648.8. Subsequently, the protocols for measurement and verification of energy savings and load reduction impacts associated with EDC Energy Efficiency and Conservation Plans developed to meet the requirements of Act 129 were vetted through a collaborative process and specified in an updated TRM that was adopted in an Order in May 2009.³ The Commission recognized the need to review and update the TRM on a periodic basis and directed the Bureau of Technical Utility Services to oversee the implementation, maintenance and annual updating of the TRM for Phase I and Phase II. The Commission determined that the 2016 TRM would be applicable for the entirety of Phase III unless a mid-phase update was deemed necessary by the Commission.⁴ The Commission proposes in its Tentative Order that there be a process for optional limited updates to the TRM to keep it aligned with updates to codes and standards that occur during the phase.

Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power Company (collectively, “the Companies”) appreciate the efforts of the Commission, Staff and Statewide Evaluator in striving to balance the value of and issues with updating the TRM mid-phase by focusing on codes and standard changes for Phase IV. In general, the Companies believe the organization and documentation in the Tentative Order and Draft 2021 TRM are positive efforts and, to improve the TRM, the Companies submit Appendix 1, an 11-page document attached hereto, containing the Companies’ technical comments to the Commission’s Tentative Order. The Companies’ comments and suggested corrections, clarifications, or revisions to improve the TRM are identified in the Comments column of Appendix 1. Also included in Appendix 1 for ease of reference are volume, section, page and table numbers.

³ The TRM was adopted as a component of the EE&C Program in accordance with the Commission’s Energy Efficiency and Conservation Program Implementation Order entered January 16, 2009.

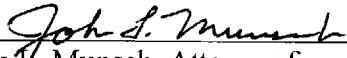
⁴ The TRM was adopted as a component of the EE&C Program in accordance with the Commission’s Energy Efficiency and Conservation Program Implementation Ordered entered June 19, 2015.

II. CONCLUSION

The Companies appreciate the opportunity to provide comments on the Commission's proposed revisions to the Technical Reference Manual and look forward to continuing to work with the Statewide Evaluator, program evaluation group and Commission Staff on this aspect of Act 129 compliance.

Date: May 24, 2019

Respectfully submitted,

By: 
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Appendix 1
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Volume	Section	Page	Topic / Item	Comment
1	Appendix D, 3.3.1	Lookups tab	load factor	Default load factor for pumps in calculator is 0.78 while the default load factor in the TRM is 0.79.
2	2.1.1	11	Baseline Wattage Values	For direct installation program where the removed bulb is known, the TRM mentions using the manufacturer rated comparable for the baseline if the measure lumens are outside of the bins provided, but no bins have been provided.
2	2.1.4	18	Introductory Table "Measure Unit"	The "Measure Unit" in the intro table reads "25-bulb strand" but the algorithm uses 50-bulb strand.
2	2.2.1	22	Table 2-7	The value for $EFLH_{heat}$ refers to Vol. 1, App. A (Table 1-8) which has entries for both "Primary HP" and "Secondary HP". "Secondary HP" is not clearly defined in this section.
2	2.2.1	23	Table 2-9	Need existing PTHP and PTAC values; Also, it's unclear if PTACs and PTHPs should use the CAC and HP rows as they are not "central".
2	2.2.2	27	Table 2-10	The default table for OF_{cool} and OF_{heat} should be numbered 2-13.
2	2.2.2	30	Table 2-18	Consider adding a statewide weighted average EFLH in the absence of zip code data for purchased products. Evaluation will plan to use the zip code where the unit was purchased as a proxy for the installation zip code, but this may not always be available.
2	2.2.3	33	Source 3	Page 4, not page 46.
2	2.2.5	36	Table 2-21	Source doc for UEF_{base} has 1.03 on page 102 compared to 1.02 in the TRM
2	2.2.6	40	Table 2-23	Consider removing "Room Air Conditioner" and "Electric Resistance" from this table as these types of heating systems are not eligible for tune-ups.
2	2.2.8	44	Table 2.25	CAPY default value is in units of BTU/hr (7,500) not kBtu/hr.
2	2.2.8	45	Table 2-26	The federal standard CEER value for units with louvered sides in the 25,000 to 27,999 BTU/h range does not agree with the CFR published value (CFR has 9.4, TRM has 9.0).
2	2.2.10	53	Table 2-33	Table 2-32 includes a default value for COP as included in Table 2-33, however COP is not included in that table rather there is a heading for $HSPF_{base}$.
2	2.2.10	53	Table 2-33	Should ductless minisplits be allowed in the duct sealing and insulation measure? Was ducted minisplit intended?
2	2.2.10	53	Table 2-34	Include default assumptions for "Leaky", "Average", and "Tight". Can an installation go up two levels i.e. from Leaky to Tight?

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2	2.2.12	62	Default Savings	Guidance will be needed on how to select EFLH for Upstream. Statewide default will need to be clearly identified in Vol. 1, Appendix A or a distribution by EDC provided.
2	2.2.13	65	Table 2-46	Title of Table 2-46 does not appear to match the contents.
2	2.3.1	66	Table 2-47	In table 2-47 the Unit for UEF_{ee} appear to be something other than gallons.
2	2.3.1	68	Table 2-49	Define what V_r is in the UEF_{base} table. It appears to be rates storage volume. Can V_r be different than 40,50,65,80,120? Should the bin definition be $tanksize, bin_i \leq V_r < tanksize, bin_i + 1$, i.e. for $i = bin\ 40\ gal$ ---- $40 \leq V_r < 50$
2	2.3.1	69	Default Savings	The default kWh savings equation appears to be incorrect ----- $45.5 * 365 * 8.3 * (119 - 52) / 3412 = 2706.75$ not 2841.27
2	2.3.5	82	Table 2-57	V_{HW} units should be gallons/cycle. The source for A_{tank} should be Table 2-56.
2	2.3.6	84	Description / Eligibility	Measure is currently limited to 3/4" insulation. 1/2" or 1" pipe insulation should also qualify.
2	2.3.7	86	Eligibility	Clarify that this measure can also be installed on new construction.
2	2.3.8	91	Eligibility	Clarify that this measure can also be installed on new construction.
2	2.3.8	92	Table 2-63	Provide a default value for GPM_{low} of 1.5 gpm.
2	2.3.9	96	Eligibility	Clarify that this measure can also be installed on new construction.
2	2.3.9	99	Source 10	CF for showerheads calculated the final value 0.00371 is incorrect, 0.00380 is the correct value as mentioned in front of the formula.
2	2.4	114		Section page numbering is not correct.
2	2.4.1	114	Table 2-69	Freezer volume multiplier in the adjusted volume calculator was not used.
2	2.4.1	114	Table 2-70	Refrigerator category 956 is unclear. Categories 3, 3-BI, 3I do not have E_{ann} equation.
2	2.4.1	114	Table 2-71	Freezer volume multiplier in the adjusted volume calculator was not used.
2	2.4.3	114	Unit Energy Consumption	The $UEC_{refrigerator}$ is missing a variable - PRE1990, Fraction of appliances manufactured before 1990 (Term is included in Table 2-5).
2	2.4.3	114	Table 2-75	$ETDF$ isn't consistent with $ETDF$ in measures 2.4.1 or 2.4.2. Different sources are used, however these measures should have the same $ETDF$.
2	2.5.2	150	Table 2-106	$Annual_Usage_{unspecified}$, determined Tier 1 APS to be used 60% of the time in home entertainment and 40% of the time in home office. Based on Source 1, (page 31) the correct values should be 69% and 31% respectively.
2	2.6.1	152	Eligibility	Is this measure also applicable for buildings with 2-4 dwelling units, and manufactured housing/trailers?

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2	2.6.1	154	Table 2-109	$Duct_{base}$ – Currently only have EDC Data Gathering. Is there a default assumption?
2	2.6.3	164	Table 2-120	Please provide a default COP_{gshp} .
2	2.6.4	170	Table 2-124	Provide a R_{value} for below grade depth with an average greater than 8'.
2	2.6.4	168	Algorithms	In the below grade portion of the equation, " $R_{exist} - R_{bg}$ " should be " $R_{exist} + R_{bg}$ "
2	2.6.5	172	Eligibility	Is the crawl space required to contain ductwork to qualify for this measure?
2	2.6.5	172	Table 2-126	Please provide a default COP_{gshp} .
2	2.6.6	176	Table 2-129	The value for η_{proto} should specify how early replacement or new construction portion of the Table 2-8 is used.
2	2.6.7	180	Table 2-312	Define "weatherstripped" and "non-weatherstripped". Clarify if hung window means single or double.
2	2.6.7	179	Algorithm	Algorithm is missing a term - window area, Table 2-312 units are cfm/ft ² , the CFM term in the savings equation is cfm not cfm/ft ² .
2	2.7.1	183	Algorithm	Given the relatively small impacts of lighting and appliances, the phrase "In instances where model parameters or inputs do not match TRM algorithm inputs, additional data collection is necessary to use the TRM algorithms" should be clarified. The goal should be to use reasonable and appropriate approximation methods to estimate and simulate savings from lights and appliances rather than to force an inventory in each rated home, followed by strict adherence to the TRM for these non-weather-sensitive measures. Indeed, the labor cost associated with the M&V burden just for lights and appliances would outweigh the monetized benefits for these measures.
2	2.7.1	184	Table 2-135	Frame Wall U-Factor for zone 6A should be 0.045.
2	2.7.1	184	Table 2-136	There are Pennsylvania-specific amendments to IECC. The value for Air Infiltration Rate should be 5.0 ACH ₅₀ for all zones. (https://www.energycodes.gov/adoption/states/pennsylvania)
2	2.7.3	191	Evaluation Protocols	Consider providing an allowance for sampling in cases where a low-rise multifamily building with many units is built with identical insulation, and other properties for each unit, or for groups of units. This would save implementation costs associated with HERS rating and simulating in REM/Rate each individual unit, where the entire complex could be more effectively verified with on-site sampling protocols and simulated in other SWE-approved software such as EnergyPlus.

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2	2.7.4	192	Algorithms	Add "Modeled energy and peak demand savings shall be produced by a RESNET accredited software program, <u>or by other models approved by the PA SWE.</u> " and allow for software to calculate impacts for both weather-sensitive and non-weather sensitive measures.
2	2.75	198	Avoided Decay	<p>Clarity on the assumption on which month the decay rate starts is needed. We calculated a monthly time series assuming linear decay to zero over 38.3 months. The monthly sum seems to do better than an annual sum, particularly in the first year. An alternative formulation may be:</p> $\text{Annual_kWh_Savings} = \text{Monthly_kWh_Savings} * (1 - \text{monthly_decay_rate} * \text{months_since_cessation}) * (1 - \text{monthly_churn} * \text{months_since_cessation})$ <p>Where Monthly_kWh_Savings is simply annual savings/12, monthly_decay_rate = 1/38.3 monthly_churn=0.5%, and months_since_cessation is 1:12 for the first year after treatment stops, 13:24 for the second year, and 24:36 for the third year, 37 and 38 for fourth year. The annual formula seems to overestimate the persisting savings in the first year (168.67 kWh, assuming a baseline 200 kWh annual impact and 0% churn, compared to 166.06 kWh by the monthly formula). This seems to be due to an embedded assumption that the decay rate in the first month after treatment is zero.</p>
3	3.1.1	18	Table 3-4	Daylighting controls (interior daylight dimmers) factors should be scalable to the operating hours of the facility. The longer the facility runs (especially outside of daylight hours) the lower this savings factor will be.
3	3.1.2	33	Excluded Fixture types	Emergency fixtures and exit signs should be included in the list of lighting that does not need to be included in a detailed inventory list for new construction projects.
3	3.1.7	49	Table 3-21	For omnidirectional lamps the first bin should be the same as the second bin. The first bin shows a $WATTS_{base}$ of 25 (same as incandescent equivalent) when the second bin has a $WATTS_{base}$ of 8 with the same incandescent equivalent of 25.
3	3.2.1	59	Table 3-27	Existing heating equation for new construction PTHP in the table is $3.7 - (0.052 \times \text{Cap} / 1,000)$ COP but the equation in IECC 2015 is $3.2 - (0.026 \times \text{Cap} / 1,000)$ COP

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3	3.2.4	82	Table 3-40	$HSPF_b$ for Standard DHP minimum efficiencies for split systems is described by EnergyStar in Source 2 at 8.5. Table 3-40 has a value of 8.2.
3	3.2.4	82	Table 3-40	Existing heating equation for new construction PTHP in the table is $3.7 - (0.052 \times \text{Cap} / 1,000)$ COP but the equation in IECC 2015 is $3.2 - (0.026 \times \text{Cap} / 1,000)$ COP
3	3.2.4	82	Table 3-40	The units of HSPF are the same as EER, however the PTHP replacement and new construction baseline units are in units of COP. The PTHP equations should be multiplied by 3.412 to convert them to the same units of EER and have consistent units with the savings equations. The new equations would be: PTHP (Replacements): $(2.9 - (0.026 \times \text{Cap} / 1,000)) \times 3.412$ HSPF and PTHP (New Construction): $(3.7 - (0.052 \times \text{Cap} / 1,000)) \times 3.412$ HSPF
3	3.2.7	94	Table 3-45	The value for the $CEER_{base}$ text should be updated to read: New Construction or Replace on Burnout: Default Federal Standard values from Table 3-46 to Table 3-48
3	3.2.9	100	Algorithm	The retrofit kWh algorithm should have the option to use the equation which uses "eff" (EER, SEER, or IEER) and not just be limited to the equation which only uses kW/ton.
3	3.2.11	108	Table 3-58	The documented Source 5 for $UDSF$ results in an additional 12.7% not 13.3% savings from installing the fans underfloor as opposed to installing them in the unit.
3	3.2.13	113	Description	IMP should be changed to measure in the sentence "This IMP is for use in Commercial and Industrial applications only."
3	3.3.4	135	Measure Vintage / Eligibility	The TRM algorithm section states "Savings values are applicable to new and retrofit units" however measure vintage only indicates retrofit.
3	3.3.4	135	Table 3-79	Two sources are listed for the savings per exhaust fan hp, however only the WPSDGENRCC0019 workpaper savings are represented (4,423 kWh/hp). The other workpaper's (PGECOFST116) savings are referenced but not used (4,197 kWh/hp).
3	3.3.5	138	Algorithm	The savings factor is being used to calculate the $Watts_{base}$ of the pump. However, the TRM determines $Watts_{base}$ by dividing the efficient wattage by the savings factor. This methodology makes the savings 82% not 18%. While the source for this savings factor could not be found, this is not a typical interpretation of the savings factor. Typically, a savings factor of 18% indicates the savings are 18%.

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				Thus, we recommend changing the baseline wattage equation to $Watts_{base} = Watts_{ee}/(1-SF)$, so $Watts_{savings} = 0.18 * Watts_{base}$
3	3.3.5	137	Description	The measure description does not mention baseline and efficient case controls. The savings increase dramatically if aquastat controls are also installed due to the reduction in operating hours.
3	3.3.6	142	Algorithm	PEI already accounts for efficiency and load factor; thus those values should not be included in the savings calculation.
3	3.4.1	146	Table 3-83	Please provide units for ETDF.
3	3.4.1	148	Table 3-86	Unclear on what Vr stands for.
3	3.4.2	151	Description	Measure life in source 1 is 5 years, not 8 years.
3	3.4.2	151	Eligibility	Eligibility should not include a "cleanability performance of 26 seconds per plate or less" in the eligibility section. Source 2 does not reference this standard and the savings equations do not reference this value.
3	3.4.2	152	Table 3-89	ETDF default table needs to be updated to reference Table 3-88, not Table 3-83
3	3.4.2	152	Table 3-91	Default kW savings for "Retrofit: Food Service" is found using Table 3-83 Restaurant ETDF: 0.0001525, not Table 3-88. Either Table 3-88 needs to include the ETDF for Restaurants from Table 3-83 or Table 3-89 needs to include a note that the default ETDF is taken from Table 3-83 or Table 3-88 depending on application.
3	3.5.1	160	Table 3-96:	The formulas for solid door freezers do not match the ENERGY STAR specifications and are a repeat of the refrigerator solid doors.
3	3.5.2	161	Algorithms	The algorithms assume a 100% load factor and the estimated kW _{base} and kW _{ee} values used do not match the values stated in Source 2 reference. A load factor should be added so the calculated motor power matches the measured motor power.
3	3.5.2	162	Table 3-97	The baseline motor efficiency for PSC does not match Source 2. The source states a PSC will operate between 35-50% efficiency but the table uses 60%.
3	3.5.2	162	Table 3-97	The WHF_e should not depend on the baseline existing fan motor. The WHF should depend on the refrigeration temperature and is independent of the equipment installed or removed.
3	3.5.3	164	Algorithms	The algorithms assume a 100% load factor and when used for SP and ECM do not match the values stated in Source 2. A load factor should be added so the calculated motor power matches the measured motor power.

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3	3.5.4	169	Table 3-100	<p>Values in the table were not able to be calculated for estimated savings based on weather. The note for Source 2 notes they are obtained by using the CDDs for each weather zone compared to the NW climate zone. Looking into Source 2, savings are obtained from eQUEST using 8 different locations in the NW region. A regression was attempted to find a correlation between the weather zones CDD and energy savings, but the data showed there was essentially no correlation between those two variables.</p> <p>If only the deemed values from the RTF were used, it is still unclear how the values in the table were populated, as they could not be recreated.</p> <p>Recommend keep the savings a deemed value regardless of outside air temperature since the values in the RTF for the 8 locations do not show a weather correlation.</p>
3	3.5.5	171	Eligibility	Final sentence should read "A default value to be used when the case service control strategies is unknown is also calculated. "
3	3.5.5	172	Table 3-102	Re-calculating the waste heat factors based on the footnote for Source 3 yields an average of 1.26 and 1.51 for Coolers and Freezers respectively.
3	3.5.6	175	Description	The measure uses an EUL of 10 but Source 1 states the only moving part is a relay with an EUL over 15 years.
3	3.5.6	174	Table 3-104	BF is 1.3 and 1.67 for coolers and freezer respectively, but these values differ from the values used in section 3.5.2 and 3.5.3 for the same term with similar measures.
3	3.5.7	177	Table 3-105, COP	Consider providing default COPs based on the compressor temperature range (or just freezer vs. cooler) similar to section 3.5.4.
3	3.5.9	181	Eligibility	The measure description paragraph is located under the Eligibility section
3	3.5.13	189	Description	Source 1 has EUL as 6.7 years.
3	3.5.14	191	Eligibility	Lighting retrofit should be removed from eligibility, as description states lighting should be considered as separate projects.
3	3.5.15	193	Eligibility	Lighting retrofit should be removed from eligibility, as description states lighting should be considered as separate projects.
3	3.5.16	195	Algorithm	Consider changing kW/ton values to kWh/ton divided by 8,760 hours a year to be consistent with methodology of previous sections 3.5.14 & 3.5.15
3	3.6.1	203-208	Eligibility	Top loading machines are included in the descriptions and calculations, but top loading units do not qualify for ENERGY STAR and therefore does not need to be

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				included. Related tables (Tables 3-128 and 3-130) should not be included and are incorrect because ENERGY STAR does not have a minimum requirement for top loading commercial units.
3	3.6.1	206	Table 3-126	ME_t value is not provided in Source 1.
3	3.6.1	206	Table 3-126	LAF is not a variable found in Source 1.
3	3.6.1	208	Table 3-129 and 3-131	The savings values for "electric hot water heater, gas dryer" and "gas hot water heater, electric dryer" are swapped.
3	3.6.1	208	Table 3-131	Default value for a front-loading machine in a laundromat is 0. Is it a correct assumption that there are no Electric WH or Electric Dryer as the default?
3	3.6.2	210	Table 3-132	Table and Source 2 is for residential fans.
3	3.6.2	210	Table 3-133	η_{base} and η_{ee} are from Source 4, but values from Source 2 which is for residential fans.
3	3.6.2	210	Table 3-133	Default efficacies are constant for all fans. Default efficacies should be included for each of the CFM ranges.
3	3.7.1	213	Description	EUL of 8 years comes from Source 1, the ENERGY STAR Calculator (tab 'Ice Machine Calcs' cell D38), which cites Food Service Technology Center research on models available in 2009. An alternate source is available: California Public Utilities Commission Database for Energy Efficient Resources (DEER) EUL Support Table for 2020 (10 years).
3	3.7.2	217	Description	EUL is not in Source 2 despite it being cited.
3	3.7.2	217	Algorithm	Algorithm assumes machine is operating at full capacity 100%. Only lighting energy is consumed at 100% whereas the compressor/refrigeration equipment would only operate when necessary. Source 2 data shows the average kW/peak kW is 14%.
3	3.7.2	218	Table 3-140	Separate ESFs could be used for a (1) load manager that only affects compressor/refrigeration usage, (2) load manager that reduces refrigeration AND light use, and (3) load managers that just reduce lighting (33%, 56%, and 29% reductions respectively) as included in Source 2.
3	3.7.4	222	Algorithm	The equation for daily kWh_{ee} should have an open parenthesis before the idle power and a close parenthesis after $EnergyToFood/Eff_{ee}$
3	3.7.4	223	Table 3-143	lbs_{Food} and $HOURS_{op}$ will not have a nameplate value since this value depends on the amount of food to be cook and facility operating hours, not the capacity of the unit.

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3	3.7.7	235	Table 3-155	ENERGY STAR calculator has baseline model for standard fryers at 1,050 Watts, not the 1,200 baseline <i>IDLE</i> energy rate included in the table.
3	3.7.9	239	Algorithm	Algorithms have incorrect conversion equation of 3,412 kWh/Btu. It should be 3,412 Btu/kWh.
3	3.7.9	241	Table 3-161	Our calculations do not match the values in table 3-161 exactly, but they are within 0.1%. This is likely due to the rounded value of 8.2 lb/gallon, we suspect that the values in Table 3-161 were calculated with a value that is closer to 8.21 lb/gallon.
3	3.7.9	239	Table 3-161	Default kW savings should be included.
3	3.7.10	244	Table 3-162 and Table 3-163	Values in Table 3-163 differ slightly from values calculated with defaults in Table 3-162 because the table rounds 35/6 and 40/6 (the production capacities of the baseline and energy star griddles respectively) to two decimal places. Consider adding a bar over the last decimal in 5.83 and 6.66 to produce exact match.
3	3.7.10	245	Table 3-163	Values in first three columns should be Wh/day savings.
3	3.8.1	248	Table 3-165	Add a minimum R_{base} value for existing scenarios to Table 3-165, similar to R_{base} in Table 2-122.
3	3.9.1	253	Table 3-168	Default savings need to be updated to reflect the most recent EnergyStar calculator
3	3.9.2	256	Table 3-170	Unable to match "Workstation – Laptop Computer with Monitor Savings". TRM list savings as 237 kWh, however using the calculator listed in the source the savings is 202 kWh (desktop monitor and notebook computer).
3	3.9.4	261	Description	In the measure description, it states "ENERGY STAR certified servers and mainframes can cut energy usage by 30% on average, and each watt saved at the server or mainframe level can translate to 1.9 watts saved when interactive effects are included." This when 30% is entered into the "savings factor" a factor of 0.43 is calculated. To calculate a factor of 1.9, the mainframes must cut energy usage by approximately 65%.
3	3.10.1	269	Description	EUL in source cited has 10 years as value, not 15. Consider using a consistent reference for compressed air like the IL TRM referenced in 3.10.5
3	3.10.1	269	Eligibility	Baseline should include the words "refrigerated thermal mass" air dryer. Efficient conditions should include the word "refrigerated".
3	3.10.1	269	Description	EUL in source cited has 10 years as value, not 15. Consider using a consistent reference for compressed air like the IL TRM referenced in 3.10.5

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3	3.10.2	272	Description	EUL in source cited has 10 years as value, not 15. Consider using a consistent reference for compressed air like the IL TRM referenced in 3.10.5
3	3.10.2	273	Table 3-183	CFM_{base} and CFM_{ee} term includes "Air Mass Flow" but CFM is volumetric flow.
3	3.10.3	276	Description	EUL in source is 5 years. Consider using a consistent reference for compressed air like the IL TRM referenced in 3.10.5.
3	3.10.4	281	Eligibility	Clarify if new tanks must be installed in place of existing or if the measure just covers any additional tanks that increase total capacity to the 4 gal/cfm requirement.
3	3.10.5	284	EUL	EUL in TRM is 10 years, but the source references another document that has 13 years.
3	3.10.6	287	Eligibility	Eligibility of measure should be clear if it is for systems with multiple air compressors or for a single VFD air compressor.
3	3.11.1	297	Eligibility	United States process loads voltages are 120/240 V, not 120 and 220.
3	3.11.1	298	Table 3-208	PF Source should be 4.
3	3.12.1	306	General	It is mentioned that baseline calculation should not include other event days such as Act 129 or PJM and weekends (Saturday and Sunday) but didn't mention that holidays and shut down days also should be excluded.
3	4.1.3	314	Description	EUL of 10 years is not found in source. The EUL for HVAC Fan Motors is 15 yrs.
3	Appendix C	12-47	Exterior Allowed Lighting Power Densities	The formula looking up the allowed LPDs for the exterior areas was based on looked for interior areas and not functioning properly. As it was the lookup was consistently showing zero.
3	Appendix C	28	Atrium (<40ft & >40ft) allowed LPD	The allowed LPD in the Appendix C calculator does not match what's stipulated in the TRM. The TRM states atriums <40ft in height have an allowed LPD of 0.03 W/sqft per foot in total height. For atriums >40ft the TRM states the allowed LPD is 0.40 W/sqft + 0.02 W/sqft per foot in total height. Appendix C is only considering 0.03 W/sqft and 0.40 W/sqft for <40ft and >40ft respectively.
3	Appendix C	Worksheet Lighting Inventory, range E12:E82, M12:M82	Data validation range	Data validation for lighting fixtures reference last row as 981, should extend to row 1045.

Appendix 1
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Volume	Section	Page	Topic / Item	Comment
3	Appendix C	Worksheet Fixture Identities	New technology LED	Add "Troffer LED Panel" to the LED Code Builder table on Lookups worksheet.
3	Appendix C	Worksheet Lookups	Exterior HOU	Exterior hours of 3,604 sourced from Mid Atlantic TRM with reference to Navigant Interior hours study, suggest using non daylight hours for Pittsburgh of 4,306.
3	Appendix C	Vol 3 pg. 22	Table 3-10	Where is this table being applied in Appendix C?