

**PENNSYLVANIA  
PUBLIC UTILITY COMMISSION  
Harrisburg, PA 17120**

Public Meeting held September 12, 2024

Commissioners Present:

Stephen M. DeFrank, Chairman  
Kimberly Barrow, Vice Chair  
Ralph V. Yanora  
Kathryn L. Zerfuss  
John F. Coleman, Jr.

Implementation of the Alternative Energy Portfolio  
Standards Act of 2004: Standards for the Participation  
of Demand Side Management Resources –  
Technical Reference Manual 2026 Update

Docket No. M-2023-3044491

**2026 TRM UPDATE FINAL ORDER**

## TABLE OF CONTENTS

BACKGROUND .....	3
DISCUSSION.....	4
A. Uncontested TRM Changes.....	6
B. General Changes.....	7
1. Expansion of the TRM to Calculate Winter Peak Demand Savings.....	7
2. Use of NREL End Use Load Shapes to Estimate Peak Demand Savings.....	8
3. Process for Code Change Updates .....	12
4. Updated Heating and Cooling Degree Days .....	14
5. Updated Equivalent Full Load Hours and Coincidence Factors for Residential HVAC Equipment .....	16
6. Lighting Interactive Effects Calculator .....	18
7. Transmission and Distribution Losses .....	24
8. Definitions of Measure Vintage .....	25
9. In-Service Date for Upstream and Midstream Measures .....	27
10. Resource Savings in Current and Future Program Years and Adjustments to Energy and Resource Savings .....	27
11. Measure Applicability Based on Sector .....	28
12. Typographical and Formatting Errors .....	28
13. Calculation Examples for TRM Algorithms .....	30
C. Additional Residential EE&C Measure Protocols .....	30
1. Section 2.2.2 – High Efficiency Equipment for Midstream Delivery: ASHP, CAC, PTAC, PTHP.....	31
2. Section 2.2.9 – Window Heat Pump .....	32
3. Section 2.3.10 – Smart Water Heater Controller .....	33
4. Section 2.2.14 – ENERGY STAR Bathroom Exhaust Fan.....	33
5. Section 2.4.5 – ENERGY STAR Coolers .....	34
6. Section 2.4.6 – Cooler Recycling with and Without Replacement.....	34
7. Section 2.8.3 – Photovoltaic (PV) Solar Generation.....	34
8. Additional Residential Measures Recommended by Commentators .....	35
D. Additional C&I EE&C Measure Protocols .....	36

1. Section 3.1.7 – Indoor Horticultural Lighting.....	37
2. Section 3.2.2 – HVAC Systems for Midstream Delivery .....	39
3. Section 3.2.6 – Ductless Mini-Split Heat Pumps – Commercial <5.4 Tons for Midstream Delivery .....	40
4. Section 3.2.8 – HVAC Tune-up .....	40
5. Section 3.2.18 – C&I ENERGY STAR Certified Connected Thermostats .....	41
6. Section 3.2.19 – Adjustment of Programmable Thermostats.....	41
7. Section 3.2.20 – Duct Sealing and Insulation .....	42
8. Section 3.2.21 – Chilled Water Pipe Insulation .....	42
9. Section 3.7.10 – Commercial Induction Cooktops .....	42
10. Section 3.11.6 – Photovoltaic (PV) Solar Generation.....	43
11. Additional C&I Measures Recommended by Commentators.....	44
E. Existing Residential EE&C Measure Protocols and Processes .....	44
12. Section 2.1.1 – ENERGY STAR Lighting.....	46
13. Section 2.1.2 – Residential Occupancy Sensors .....	<b>Error! Bookmark not defined.</b>
14. Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP .....	48
15. Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option.....	51
16. Section 2.2.5 – Air Conditioner & Heat Pump Maintenance.....	53
17. Section 2.2.8 – Room AC Retirement.....	54
18. Section 2.2.9 – Duct Sealing & Duct Insulation .....	55
19. Section 2.2.10 – Air Handler Filter Whistles .....	55
20. Section 2.2.11 – ENERGY STAR Certified Connected Thermostats .....	56
21. Section 2.2.12 – Furnace Maintenance .....	58
22. Section 2.3.1 – Heat Pump Water Heaters .....	59
23. Section 2.3.5 –Water Heater Temperature Setback .....	60
24. Section 2.3.6 –Water Heater Pipe Insulation .....	61
25. Section 2.4.1 – ENERGY STAR Refrigerators and Section 2.4.2 – ENERGY STAR Freezers .....	62
26. Section 2.4.4 – ENERGY STAR Clothes Washers .....	63
27. Section 2.4.9 – ENERGY STAR Dehumidifiers .....	64

28. Section 2.4.10 – Dehumidifier Retirement.....	64
29. Section 2.4.11 – ENERGY STAR Ceiling Fans .....	65
30. Section 2.4.12 – ENERGY STAR Air Purifiers .....	65
31. Section 2.6.1 – Residential Air Sealing.....	66
32. Section 2.6.2 – Weather Stripping, Caulking, and Outlet Gaskets .....	67
33. Section 2.6.3 – Ceiling/Attic, Wall, Floor, and Rim Joist Insulation.....	69
34. Section 2.6.4 – Basement or Crawl Space Wall Insulation.....	70
35. Section 2.6.5 – ENERGY STAR Windows .....	71
36. Section 2.7.1 – Residential New Construction.....	71
37. Section 2.7.2 – ENERGY STAR Manufactured Homes.....	74
38. Section 2.7.3 – Home Energy Reports .....	75
39. Measure Number Changes .....	76
F. Existing C&I EE&C Measure Protocols .....	79
1. Section 3.1.1 – Lighting Improvements .....	81
2. Section 3.1.2 – New Construction Lighting.....	86
3. Section 3.1.6 – LED Refrigeration Display Case Lighting.....	86
4. Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs.....	87
5. Section 3.2.1 – HVAC Systems .....	89
6. Section 3.2.2 – Electric Chillers.....	90
7. Section 3.2.3 – Water Source and Geothermal Heat Pumps.....	91
8. Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 tons .....	92
9. Section 3.2.8 – Controls: Guest Room Occupancy Sensor .....	93
10. Section 3.2.13 – Circulation Fan: High-Volume Low-Speed .....	93
11. Section 3.3.1 – Premium Efficiency Motors .....	94
12. Section 3.3.2 – Variable Frequency Drive (VFD) Improvements .....	95
13. Section 3.3.3 – ECM Circulating Fan .....	95
14. Section 3.4.1 – Heat Pump Water Heaters .....	96
15. Section 3.4.2 – Low-Flow Pre-Rinse Sprayers for Retrofit Programs.....	98
16. Section 3.5.1 – High-Efficiency Refrigeration / Freezer Cases .....	99
17. Section 3.5.7 – Variable Speed Refrigeration Compressor.....	99
18. Section 3.5.8 – Strip Curtains for Walk-In Freezers and Coolers.....	100

19. Section 3.5.12 – Special Doors with Low or No Anti-Sweat Heat for Low Reach-In Freezers and Coolers .....	100
20. Section 3.5.14 – Refrigerated Display Cases with Doors Replacing Open Cases .....	101
21. Section 3.5.15 – Adding Doors to Existing Refrigerated Display Cases .....	102
22. Section 3.5.17 – Refrigerated Case Light Occupancy Sensors .....	103
23. Section 3.7.1 – High-Efficiency Ice Machines .....	103
24. Section 3.7.4 – ENERGY STAR Electric Steam Cooker .....	104
25. Section 3.8.1 – Wall and Ceiling Insulation.....	105
26. Section 3.10.1 – Compressed Air Cycling Refrigerated Thermal Mass Dryer.....	105
27. Section 3.10.2 – Compressed Air-Entraining Air Nozzle.....	106
28. Section 3.10.3 – No-Loss Condensate Drains.....	106
29. Section 3.10.5 – Variable Speed Drive Air Compressors .....	107
30. Section 3.11.3 – High Frequency Battery Chargers.....	108
31. Section 4.1 – Agricultural .....	108
32. Section 4.1.2 – Dairy Scroll Compressors .....	109
33. Section 4.1.3 – High-Efficiency Ventilation Fans with and Without Thermostats.....	109
34. Section 4.1.5 – High Volume Low Speed Fans .....	110
35. Section 4.1.6 – Livestock Waterer .....	111
36. Section 4.1.8 – Low Pressure Irrigation System .....	111
37. Measure Number Changes .....	112
G. Removed Residential EE&C Protocols .....	114
1. Section 2.2.6 – Fuel Switching: Electric Heat to Gas/Propane/Oil Heat .....	115
2. Section 2.3.3 – Fuel Switching: Electric Resistance to Fossil Fuel Water Heater.....	117
3. Section 2.4.7 – Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer.....	118
H. Removed C&I EE&C Measure Protocols .....	119
1. Section 3.2.5 – Fuel Switching: Small Commercial Electric Heat to Natural Gas / Propane / Oil Heat.....	120
2. Section 3.4.3 – Fuel Switching: Electric Resistance Water Heaters to Gas/Propane .	122
I. Appendix C: Lighting Audit and Design Tool .....	123
J. Appendix D: Motors and VFD Audit and Design Tool .....	125

K. Appendix E: Eligibility Requirements for Solid State Lighting Products in Commercial and Industrial Applications .....	126
CONCLUSION.....	128

**BY THE COMMISSION:**

As explained in our Order, entered June 1, 2009, at Docket No. M-00051865, in implementing the Alternative Energy Portfolio Standards Act (AEPS Act), 73 P.S. §§ 1648.1-1648.8 and 66 Pa.C.S. § 2814, this Commission had adopted an *Energy Efficiency and DSM Rules for Pennsylvania’s Alternative Energy Portfolio Standard, Technical Reference Manual (TRM)*.<sup>1</sup> In adopting the original version of the TRM, this Commission directed its Bureau of Conservation, Economics and Energy Planning (CEEP)<sup>2</sup> to oversee the implementation, maintenance, and periodic updating of the TRM.<sup>3</sup> Additionally, in the *Energy Efficiency and Conservation Program Implementation Order for Phase I of Act 129’s Energy Efficiency and Conservation (EE&C) Program*,<sup>4</sup> this Commission adopted the TRM as a component of the EE&C Program evaluation process. In that Phase I Implementation Order, this Commission also noted that “as the TRM was initially created to fulfill requirements of the AEPS Act, it will need to be updated and expanded to fulfill the requirements of the EE&C provisions of Act 129.”<sup>5</sup>

On May 9, 2024, the Commission issued for Comment the proposed 2026 Technical Reference Manual that would be used for a potential Phase V of the EE&C Program.<sup>6</sup> With this Order, and in keeping with guidance from previous Implementation Orders, the Commission adopts the TRM as a component of the EE&C Program evaluation process. If the Commission adopts a Phase V of the EE&C Program, the

---

<sup>1</sup> Order entered on October 3, 2005, at Docket No. M-00051865 (October 3, 2005 Order).

<sup>2</sup> As of August 11, 2011, the Bureau of CEEP was eliminated and its functions and staff transferred to the newly created Bureau of Technical Utility Services (TUS). See Implementation of Act 129 of 2008; Organization of Bureaus and Offices, Final Procedural Order, entered August 11, 2011, at Docket No. M-2008-2071852, at 4.

<sup>3</sup> See October 3, 2005 Order at 13.

<sup>4</sup> See Energy Efficiency and Conservation Program Implementation Order, at Docket No. M-2008-2069887, entered January 16, 2009 (Phase I Implementation Order), at 13.

<sup>5</sup> *Id.*

<sup>6</sup> See Implementation of the Alternative Energy Portfolio Standards Act of 2004: Standards for the Participation of Demand Side Management Resources – Technical Reference Manual 2026 Update, Tentative Order at Docket No. M-2023-3044491, entered May 9, 2024.

Commission will allow for optional updates to keep the TRM aligned with updates to codes and standards that occur during the phase.

With this Order the Commission adopts winter peak demand savings, the use of load shape data produced by the National Renewable Energy Laboratory (NREL) to estimate peak demand savings, updates to climate related assumptions in the TRM such as updates to heating degree day (HDD) and cooling degree day (CDD) values, a revised taxonomy of commercial and industrial (C&I) building types, and other general changes described in greater detail in [Section B](#) below. The Commission adopts nine new residential and 16 new non-residential measures to include in the 2026 TRM. *See* [Section C](#) and [Section D](#) of this Order for a listing of these measures. [Section E](#) and [Section F](#) of this Order describe the Commission's adopted updates to residential and non-residential measures included from the Phase IV TRM. [Section G](#) and [Section H](#) of this Order lists four residential and eight non-residential measures that the Commission has removed from the TRM. [Section I](#), [Section J](#), and [Section K](#) provide updates to Appendices to the 2026 TRM.

## **BACKGROUND**

Act 129 of 2008, P.L. 1592, specifically directed this Commission to establish an evaluation process that monitors and verifies data collection, quality assurance, and the results of each electric distribution company's (EDC) EE&C plan and the EE&C program as a whole. *See* 66 Pa.C.S. § 2806.1(a)(2). To assist in meeting this obligation, the Commission contracted with the NMR Group, Inc., in April 2021 to perform these duties as the Act 129 Statewide Evaluator (SWE). As part of its duties, the SWE reviews the TRM and the Total Resource Cost (TRC) Test and suggests possible revisions and additions to these guidance documents.

The SWE, in collaboration with staff from the Commission's Bureau of Technical Utility Services (TUS), reviewed the 2021 TRM and proposed several changes and additions for consideration for inclusion in the 2026 TRM. The Commission released these proposed changes for comment when we adopted the 2026 TRM Update Tentative Order at our May 9, 2024, Public Meeting. A notice of the Tentative Order and proposed 2026 TRM update was published in the *Pennsylvania Bulletin* on May 25, 2024. Comments were due on June 24, 2024, and Reply Comments were due on July 14, 2024.

The following parties filed comments in response to the Tentative Order: Duquesne Light Company (Duquesne Light); FirstEnergy Pennsylvania Electric Company (FirstEnergy); Keystone Energy Efficiency Alliance (KEEA); MaGrann, EAM, and ReVireo; Performance Systems Development; PECO Energy Company (PECO); PPL Electric Utilities Corporation (PPL); UGI Utilities, Inc. (UGI). UGI was the only party to file reply comments.

## **DISCUSSION**

The changes and improvements to the TRM are based on more recent research, a review of TRMs from other states, and the needs and experiences of the EDCs. The EDCs provided, through the SWE evaluation, measurement, and verification (EM&V) process, much of the data that forms the basis of these recommended improvements. Specifically, the current proposed improvements were the result of SWE site inspections and comments from conservation service providers (CSPs) and EDC independent evaluators. Additionally, some issues raised during the 2021 TRM update process were referred to the SWE to conduct further research to provide recommendations during the 2026 TRM update.

The adopted updates focus on improving assumptions for key parameters, algorithms, and deemed savings values, as well as accounting for new codes and standards for residential and commercial & industrial (C&I) EE&C measures. These

changes are intended to make the TRM a more effective and professional tool for validating energy savings and supporting the Act 129 goals.

The major goals of the adopted modifications are as follows:

1. To add protocols for EE&C measures being implemented by the EDCs and to broaden the scope of the TRM;
2. To update the TRM baseline assumptions to reflect changes to building codes in the Commonwealth;
3. To retain the three separate volumes of the TRM – a general volume that describes the purpose of the TRM and how it should be used, a volume for residential measures, and a volume for non-residential (C&I and agricultural) measures;
4. To update TRM assumptions based on findings from the SWE’s residential and non-residential baseline studies;
5. To appropriately balance the integrity and accuracy of claimed energy savings estimates with costs incurred to measure and verify the claimed energy savings;
6. To clarify existing calculation methods;
7. To allow more flexibility for the EDCs to use territory-specific or gathered data when calculating savings; and
8. To provide additional reasonable methods for measurement and verification of energy savings associated with EE&C measures without unduly burdening EE&C program and evaluation staff.

Below is a summary list of the changes adopted in this 2026 TRM update.

1. General improvements to the TRM.
2. Inclusion of 9 new residential EE&C measure protocols.
3. Clarification of the existing residential EE&C measure protocols.

4. Inclusion of 16 new C&I EE&C measure protocols.
5. Clarification of the existing C&I EE&C measure protocols.
6. Expanding the TRM to provide the algorithms and assumptions needed to estimate winter peak demand impacts.
7. Updates to Appendix C – Lighting Audit and Design Tool.
8. Updates to Appendix D – Motor and VFD Audit and Design Tool.
9. Adding Appendix F – Building Operator Certification Audit and Design Tool.
10. Adding Appendix G – Adjustment of Programmable Thermostats Calculator.

Below, we will discuss in more detail the more significant changes and updates that are being adopted. Minor administrative changes will not be discussed.

#### **A. Uncontested TRM Changes**

The following TRM changes proposed in the Tentative TRM Update Order elicited no comments in opposition. Accordingly, the Commission adopts them as proposed.

1. Changes related to International Energy Conservation Code (IECC) 2021 building code updates.
2. Changes related to incorporating the findings from the 2023 Residential and Non-Residential Baseline Studies.
3. Changes related to updating the county to climate region mapping.
4. Including a Building Operator Certification Audit and Design Tool (Appendix F) to assist with energy savings estimates.
5. Including an Adjustment of Programmable Thermostats for Commercial and Industrial Buildings Calculator (Appendix G) to assist with energy savings estimates.

## **B. General Changes**

### **1. Expansion of the TRM to Calculate Winter Peak Demand Savings**

The 2021 TRM only provides the algorithms and assumptions needed to calculate summer peak demand savings. The 2021 TRM focus on summer peak reflects the historic Act 129 definition of capacity savings as a summer-only construct. Peak reduction goals in Phases I, III, and IV focused exclusively on summer peak demand reductions and the calculation of avoided capacity costs in the TRC Test relied on summer peak demand reductions as inputs. In preparation for a potential Phase V of Act 129, the Commission considered bifurcating the peak demand definition to include both summer peak and winter peak. To support the associated planning considerations, we proposed expanding the TRM to provide the algorithms and assumptions needed to estimate winter peak demand impacts as well as summer peak demand impacts.

Recent market trends highlight the need for winter peak savings to be included in the 2026 TRM. Neighboring states have adopted aggressive policies to promote building electrification, including installing electric heat pumps in lieu of fossil fuel furnaces and boilers. Electrification of the space heating end use may start to bring winter peak loads closer to summer peak loads. New England states have historically always calculated and reported both winter peak and summer peak demand savings. Maryland's latest TRM update also included the addition of winter peak savings. In its Phase IV Implementation Order, the Commission required EDCs to nominate a portion of the peak demand reductions they acquire through Act 129 programs into the PJM Forward Capacity Market (FCM). The energy efficiency resources nominated to PJM must file both winter and summer peak demand values so inclusion of winter peak demand savings assumptions in the TRM will help support FCM participation. The Commission therefore proposed that winter peak demand savings be added to the 2026 TRM. Winter peak is defined by PJM as non-holiday weekdays hours ending 8, 9, 19, and 20 during the months of January and February. The Commission proposed that the 2026 TRM mirror this PJM winter peak definition in the same way the Act 129 summer peak definition

aligns with the PJM definition of summer peak. The addition of a winter peak demand definition affects virtually every measure in the TRM.

**a. Comments**

PECO asks the Commission to consider continuing with a summer-only savings target in a potential Phase V of Act 129 if energy efficiency is no longer eligible for participation in the PJM Base Residual Auction. PECO suggests that if Phase V targets are summer-only, the Commission should not require characterization of winter peak to simplify program implementation, verification, and reporting. PECO Comments at 3.

**b. Disposition**

The Commission recognizes the uncertainty surrounding the recognition of demand reductions from energy efficiency at PJM. This is one of many factors that must be weighed carefully in the Tentative Implementation Order for Phase V of Act 129. We reiterate our position from the Tentative Order that inclusion of winter peak demand savings algorithms and assumptions enhances the TRM and provides flexibility for Phase V planning. The measure characterizations in the Final 2026 TRM provide the information needed to estimate winter demand savings. This does not mean that the Commission will propose winter peak demand savings targets for a potential Phase V of Act 129.

**2. Use of NREL End Use Load Shapes to Estimate Peak Demand Savings**

Expansion of the TRM to include winter peak demand savings requires assumptions about the operating characteristics of efficient equipment during winter mornings and evenings. For some measures, such as commercial lighting, the existing research includes 8760 load shapes which can be used to develop winter coincidence factors (CF). However, for most measures additional research is needed. For many measures, the Commission proposed using load shape data produced by the National Renewable Energy Laboratory (NREL) to estimate peak demand savings, as NREL

provides load profiles for a wide variety of residential and commercial end uses as well as for various building types. The load profile data can be used to calculate energy to demand factors (ETDFs), which convert annual energy savings to seasonal demand impacts. This methodology allows for a streamlined and standardized way of calculating peak demand savings for both winter and summer. This method is only appropriate for measures where the savings are “load following” meaning that the distribution of savings across the year generally aligns with when the energy is used.

An ETDF is defined as the average energy consumption during seasonal peak hours divided by the total annual energy consumption. A winter peak ETDF would be the average energy consumption for hours-ending 8, 9, 19, and 20 on non-holiday weekdays during January and February divided by the total annual energy consumption. A summer peak ETDF would be the average energy consumption for hours ending 15-18 on non-holiday weekdays during June, July, and August. ETDFs are end use and building type-specific, and the Commission proposed the following methodology to derive ETDFs from the load shape data:

- (1) Aggregating the 15-minute NREL load shape data to an hourly level;
- (2) Calculating the average consumption during summer and winter peak hours;
- (3) Summing the total energy consumption for the year of data provided; and
- (4) Dividing the average summer and winter peak consumption by the total annual consumption.

NREL provides load profiles for different geographic regions and weather types and has multiple releases of load shape data spanning 2021-2024. The Commission proposed to use the Pennsylvania state-specific load shapes. Additionally, the Commission proposed to use load shape datasets based on typical meteorological year (TMY) data for the residential load shapes, and load shape data based on actual meteorological year (AMY) data from 2018 for commercial load shapes. The Commission proposed using AMY-based load shape data for the commercial sector as TMY-based commercial load shapes are not available for the most recent year of release (2023).

The 2021 TRM utilized CFs to calculate summer peak demand savings. The Commission proposed that using summer ETDFs in lieu of summer CFs should be determined on a case-by-case basis for each measure. NREL provides load shape data for the five different residential building types shown in Table 1. Since most residential measures in the TRM do not differentiate savings assumptions by building type, the Commission proposed to create composite residential load shapes via a weighted average of the five NREL building types. The weighting parameter underpinning the composite residential load shapes and ETDFs is the “Units Represented” column shown in Table 1. These values represent NREL’s estimates of the number of each household type in Pennsylvania.

**Table 1: Residential Housing Type Weighting**

<b>Building Type</b>	<b>Units Represented</b>
Mobile Home	218,886 (3.92%)
Multi-Family (2-4 Units)	471,187 (8.44%)
Multi-Family (5+Units)	670,461 (12.01%)
Single-Family Attached	1,034,142 (18.52%)
Single-Family Detached	3,186,929 (57.10%)

For C&I peak demand savings, a combination of NREL commercial building types should be averaged (weighted by floor area) to create a composite ETDF on a case-by-case basis.

**a. Comments**

KEEA recommends that the Commission document the mapping of commercial building types used in the TRM to the commercial building types provided in the NREL load profile database. KEEA Comments at 2.

**b. Disposition**

The Commission agrees that a clear mapping between TRM building types and NREL building types should be provided. However, because different sets of building types are relevant to each measure, a single mapping cannot be applied to all measures. For example, measure 3.4.2 (Low-Flow Pre-Rinse Sprayers) is applicable only to quick—service restaurants, full-service restaurants, groceries, and a composite building type. The mapping of NREL building types to commercial building types is therefore done on a case-by-case basis.

While the Commission will not provide a mapping for each measure in the TRM, the Commission can provide a general mapping between TRM commercial building types and NREL building types. The mapping scheme shown in Table 2 was used in producing the six-period load shapes for calculating avoided energy benefits and was the starting point for most measure mapping in Volume 3 of the TRM.

**Table 2: TRM to NREL Commercial Building Type Mapping**

<b>TRM Building Type</b>	<b>NREL Building Type</b>
Education	Primary School
	Secondary School
Health	Hospital

TRM Building Type	NREL Building Type
	Outpatient
Grocery	Retail Stand Alone
Lodging	Large Hotel
	Small Hotel
Office	Small Office
	Medium Office
	Large Office
Restaurant	Full Service Restaurant
	Quick Service Restaurant
Retail	Retail Strip Mall
Warehouse	Warehouse

**3. Process for Code Change Updates**

For Phase V, the Commission proposed continuing with a process that began in Phase IV for incorporating codes, standards, and ENERGY STAR specifications that change during the phase without undertaking a full TRM update. Each year of the phase, the SWE will track code updates to federal standards, ENERGY STAR specifications, and state-adopted building energy codes. Based on the extent of code updates that occur, the SWE will recommend whether to open the TRM for a code refresh for the following program year. Code updates that are not finalized and in effect before July 1 of a program year will not be considered for inclusion in the TRM in that update cycle. Changes to the TRM proposed by the SWE through this process will be limited to updating values directly related to codes, standards, and ENERGY STAR specifications.

The Commission proposed the following schedule for this process:

Estimated Date	Action
March 15	SWE memo analyzing the impact of codes or standards changes will be delivered to TUS.
April 15	TUS will determine if an update is warranted.

<b>Estimated Date</b>	<b>Action</b>
July 1	Codes and standards must be in effect by this date.
July	Tentative TRM Order and Manual on Public Meeting Agenda.
August - September	Comment and review process.
November	Final TRM Order and Manual on Public Meeting Agenda.

**a. Comments**

Duquesne Light recommends that the calendar for the code update process be updated to clarify that the effective date of any changes would be the start of the following program year, June 1st. Duquesne Light Comments at 2.

**b. Disposition**

The Commission agrees with Duquesne Light and has updated the calendar for the code update process to clarify that the effective date of any changes would be the start of the following program year, June 1<sup>st</sup>. Each year of the phase, the SWE will track code updates to federal standards, ENERGY STAR specifications, and state-adopted building energy codes. Based on the extent of code updates that occur, the SWE will recommend whether to open the TRM for a code refresh for the following program year. Code updates that are not finalized and have an effective date before July 1 of a program year will not be considered for inclusion in the TRM in that update cycle. In cases where a new code or standard has a compliance date in a given year, the new code or standard will go into effect for the 2026 TRM at the start of the next consecutive program year.

The Commission adopts the following schedule for this process, using calendar year 2027 as an example of the process:

<b>Estimated Date</b>	<b>Action</b>
March 15, 2027	SWE memo analyzing the impact of codes or standards changes will be delivered to TUS.

<b>Estimated Date</b>	<b>Action</b>
April 15, 2027	TUS will determine if an update is warranted.
July 1, 2027	Codes and standards must be in effect by this date.
July 2027	Tentative TRM Order and Manual on Public Meeting Agenda.
August - September 2027	Comment and review process.
November 2027	Final TRM Order and Manual on Public Meeting Agenda.
June 1, 2028 (PY20)	Codes and standards changes incorporated into the TRM.

The Commission has also clarified Section 1.8 of Volume 1 of the TRM for a known federal standard with a compliance date in a future given year. The new federal standard will be considered the baseline at the start of the next consecutive program year.

#### **4. Updated Heating and Cooling Degree Days**

The Commission proposed to update the heating degree day (HDD) and cooling degree day (CDD) values used in Appendix A (Climate Dependent Values) of Volume 1 of the TRM. CDD and HDD values in Table 1-8 (formerly Table 1-7) of Volume 1 were based on NREL’s TMY3 weather data. The TMY3 values were last updated nearly twenty years ago. For the last two decades, actual weather conditions in Pennsylvania have shown fewer annual HDDs and more annual CDDs than the TMY3 projections. The Commission believes that long-term climate projections based on more recent weather trends will better reflect weather conditions for the life of EE&C measures installed during a potential Phase V of Act 129.

In place of TMY3 weather data, the Commission proposed adopting 15-year climate normals produced by the National Oceanic and Atmospheric Administration (NOAA).<sup>7</sup> The most recent 15-year climate normals were calculated using data

---

<sup>7</sup> National Oceanic and Atmospheric Administration. U.S. Climate Normals. Available at <https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals>

from 2006 to 2020. As such, they incorporate recent climate conditions. A comparison of CDD and HDD values (base 65) from TMY3 and NOAA 15-year climate normals is shown below in Table 3.

**Table 3: Comparison of Current and Proposed CDD65 and HDD65 by Reference City**

Reference City	TMY3		NOAA 15-Year Normals	
	CDD65	HDD65	CDD65	HDD65
Allentown	773	5,666	1,049	5,130
Binghamton, NY	405	7,037	401	7,009
Bradford	204	8,230	284	7,177
Erie	579	6,476	803	5,770
Harrisburg	1,121	6,126	1,242	4,886
Philadelphia	1,184	4,824	1,450	4,347
Pittsburgh	726	5,946	860	5,437
Scranton	608	6,235	847	5,573
Williamsport	759	5,782	867	5,578

This proposed update affects most weather-dependent measures in the TRM. Some weather-dependent measures use CDD and HDD directly as parameters in the savings algorithms, while other measures rely on estimated operating hours based on assumed weather conditions. Unless otherwise noted, the Commission proposed to use a ratio approach to adjust operating assumptions derived using TMY3 climate assumptions to reflect the proposed NOAA 15-year normal climate values. Consider the  $EFLH_{cool}$  values from Table 3-25 in Section 3.2.1 of the 2021 TRM. The equivalent full load hours (EFLHs) for cooling for the “Education – College/University” building type in Pittsburgh is 594. Applying the ratio of new to old CDD65 from Table 3 ( $860 / 726 = 1.18$ ) to 594 returns a projected 701  $EFLH_{cool}$ . The ratio approach was not used to adjust operating assumptions for residential heating, ventilation, and air conditioning (HVAC) equipment. Adjustments for such residential HVAC equipment are discussed in Section B.5.

**a. Comments**

KEEA recommends that special consideration be given to multifamily buildings when calculating heating and cooling degree days. KEEA Comments at 2.

**b. Disposition**

The Commission appreciates KEEA’s suggestion and agrees that special consideration should be given to multifamily units. However, all building types, including multifamily homes, experience the same weather conditions, and therefore heating and cooling degree days will be uniform across all building types and the Commission declines to make any changes based on KEEA’s comments.

**5. Updated Equivalent Full Load Hours and Coincidence Factors for Residential HVAC Equipment**

The Commission proposed to revise the EFLH and summer CF values for residential HVAC equipment in Appendix A of Volume 1 of the TRM to align the EFLH and summer CF values with updated normal weather assumptions. The EFLH and summer CF values in the 2021 TRM were weather-normalized using TMY3 weather data as the normal weather definition. More details about how these values were derived can be found in Section B.5 of the 2021 TRM Update Tentative Order.<sup>8</sup> Since the Commission proposed using NOAA’s 15-year climate normal as the normal weather definition (see Section B.4), it follows that the EFLH and summer CF values for residential HVAC equipment should be updated as well.

The proposed EFLH values were weather-normalized using NOAA’s 15-year climate normals rather than TMY3 weather data. Other than changing the normal weather definition, no new analysis was done. Proposed EFLH<sub>cool</sub> values are higher than the values in the 2021 TRM. Proposed EFLH<sub>heat</sub> values are lower than the values in the

---

<sup>8</sup> Available at <https://www.puc.pa.gov/pdocs/1614698.docx>

2021 TRM. These changes reflect directional changes in the proposed update to the normal weather assumptions.

In addition to updating the EFLH and summer CF values, the Commission also proposed the inclusion of a winter CF value for residential HVAC equipment. See Section B.1 for a longer discussion on the expansion of the TRM to include winter peak demand savings. The Commission’s proposed values for the winter CFs were calculated using thermostat runtime data collected through Ecobee’s Donate Your Data platform.<sup>9</sup> Typical heat pump runtime (compressor or auxiliary) during the winter peak demand window was modeled using a fractional regression model with outdoor air temperature as the explanatory variable. These runtime models, in conjunction with NOAA’s 15-year hourly climate normals, are used to predict weather-normalized runtime on non-holiday weekdays in January and February during hours-ending 8, 9, 19, and 20. The CF is the average predicted runtime proportion for each weather station. By weather station, the Commission’s proposed winter CF values for residential HVAC equipment are shown in Table 4.

**Table 4: Proposed Winter Coincidence Factors for Electric Residential HVAC**

<b>Reference City</b>	<b>Winter CF</b>
Allentown	0.366
Binghamton, NY	0.464
Bradford	0.478
Erie	0.402
Harrisburg	0.351
Philadelphia	0.302
Pittsburgh	0.379
Scranton	0.398
Williamsport	0.392

---

<sup>9</sup> <https://www.ecobee.com/donateyourdata/>.

This proposed update affects measures in Section 2.2 (HVAC), Section 2.3 (Domestic Hot Water), and Section 2.6 (Building Shell).

**a. Comments**

PECO suggests that the  $EFLH_{heat}$  calculations for primary and secondary heat pumps assume that the entire heating load is met by efficient air source heat pump (ASHP) equipment with no electric resistance backup. PECO expects a meaningful number of ASHP installations to include electric resistance backup. As such, PECO suggests differentiating savings for cold climate models (without a need for electric resistance backup) from standard ASHPs. PECO Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees that a meaningful number of ASHP installations will include electric resistance backup. However, the Commission notes that the  $EFLH_{heat}$  values already account for electric resistance backup heating. The SWE team modeled the compressor and auxiliary heat components of ASHPs separately and then calculated  $EFLH_{heat}$  assumptions for the full system by examining the frequency that the two components run independently and together. The Commission agrees with PECO regarding the importance of the TRM differentiating heating savings for cold climate heat pumps, but notes that this signal already exists in the updated 2026 TRM. The key efficiency parameter in the heat pump savings algorithm is HSPF2 (heating efficiency) and cold climate heat pumps have higher HSPF2 values than standard heat pumps.

**6. Lighting Interactive Effects Calculator**

Light Emitting Diode (LED) lighting technology emits less waste heat as a byproduct compared to legacy lighting technologies. In the summer this reduces the work required by home or business cooling systems, while in the winter the heating system must make up for the reduced waste heat. The proposed addition of winter peak demand savings to the TRM requires assumptions about these interactive effects during

the winter peak. Since the SWE needed to model this additional component, the whole regime was reconsidered and updated.

The Commission proposed to follow the approach the New York State TRM uses for calculating both annual energy consumption and peak demand interactive effects.<sup>10</sup> Interactive energy ( $IF_e$ ) and demand ( $IF_d$ ) factors are calculated using the following formulas:

$$IF_e = \frac{IGC \times \%A \times C_e}{Eff_{HVAC}} \times \%Electric$$
$$IF_d = \frac{IGC \times \%A \times C_d}{Eff_{HVAC}} \times \%Electric$$

The parameters of the equations are defined as follows:

- (1) IGC (%): Internal Gain Contribution.
- (2) %A (%): Applicability.
- (3)  $C_e$  (%): Concurrency for lighting and HVAC system use.
- (4)  $C_d$  (%): Concurrency for summer or winter peak demand and lighting.
- (5)  $Eff_{HVAC}$  (%): HVAC Efficiency.
- (6) % Electric: Percent electric.

The sources and default values for these parameters differ between residential interactive factors and non-residential interactive factors. We first discuss the parameters for non-residential interactive factors and then the residential interactive factors.

Internal gain contribution (IGC) is the percentage of heat that remains inside the building, contributing to the increased or decreased need for heating or cooling from the HVAC system. The default value for IGC is 55% for commercial buildings, which comes from the New York State TRM.

---

<sup>10</sup> <https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={B072068B-0000-CD13-BD60-CA459E7A687D}>

Applicability is the percentage of lighting that is installed in spaces that are heated or cooled by the HVAC system. Applicability for a default or unknown HVAC system is based on the market average HVAC split found by the Act 129 2023 Pennsylvania Non-Residential Baseline Study.<sup>11</sup> Ninety-two percent of interior floor space is heated, and of that, 7% is heated with electricity and 93% is heated with fossil fuels. Therefore, about 6% of interior floor space has electric heating, and 86% of interior floor space has fossil fuel heating. The default applicability for heating is the sum of these two components, or 92%. The Act 129 2023 Pennsylvania Non-Residential Baseline Study found that 59% of interior floor space is air conditioned, so the applicability for cooling is 59%.

Energy use concurrency ( $C_e$ ) is the percent of time that both lighting and HVAC systems are operating simultaneously. Concurrency is estimated from a combination of lighting and weather profiles. Lighting profiles are the 8760 profiles detailing the percentage of time lighting that is used during each hour in a year and differ between commercial building types. The lighting profile for a default or unknown commercial building type is estimated by averaging the lighting profiles of all other commercial building types. These lighting profiles come from the Act 129 2014 Pennsylvania Statewide Commercial and Residential Light Metering Study.<sup>12</sup> Weather profiles contain temperature data at various weather stations in Pennsylvania for each hour in a year. The SWE used NOAA 15-year climate normals (2006-2020) to develop the calculator. Default weather profiles were obtained by averaging the temperatures across all weather stations. The temperature data was then used to determine whether heating, cooling, or no HVAC was used during each hour. The heating threshold is 50°F and the cooling threshold is 60°F. These two components help estimate heating and cooling concurrency.

---

<sup>11</sup> See Pennsylvania Act 129 2023 Non-Residential Baseline Study, submitted by Demand Side Analytics et al., February 2024. [https://www.puc.pa.gov/media/2884/2023\\_pa\\_non-residential\\_baseline\\_study.pdf](https://www.puc.pa.gov/media/2884/2023_pa_non-residential_baseline_study.pdf)

<sup>12</sup> See <https://www.puc.pa.gov/pdocs/1340978.pdf> January 13, 2015, Docket No. M-2014-2424864. Commercial lighting load shapes available at [https://www.puc.pa.gov/Electric/xls/Act129/SWE-Light\\_Metering\\_Study-AppendixB-Commercial\\_Load\\_Shapes.xlsx](https://www.puc.pa.gov/Electric/xls/Act129/SWE-Light_Metering_Study-AppendixB-Commercial_Load_Shapes.xlsx)

Heating concurrency is the ratio between the amount of time both lighting and heating are used and the amount of time only lighting is used. Cooling concurrency is the ratio between the amount of time both lighting and cooling are used and the amount of time only lighting is used.

Concurrency for peak demand ( $C_d$ ) was calculated in a similar fashion. However, instead of considering whether lighting is used concurrently with heating, cooling, or HVAC, the Commission considers whether lighting is used during summer or winter peak demand hours to estimate concurrency for interactive summer and winter demand factors.

HVAC efficiency is the efficiency of the HVAC system and comes from the Act 129 2023 Pennsylvania Non-Residential Baseline Study.

% Electric is the percentage of HVAC that is fueled by electricity. For heating, the % Electric is the ratio between the amount of heat fueled by electricity and the amount of heat fueled by electricity or fossil fuels. For cooling, the Commission assumes that 100% of cooling is fueled by electricity. Default values for % Electric come from the Act 129 2023 Pennsylvania Non-Residential Baseline Study.

The Commission proposed calculating different non-residential interactive energy and demand factors based on HVAC configuration, shown in Table 5 below.

**Table 5: Proposed Interactive Energy and Demand Factors for Non-residential Buildings**

<b>HVAC Scenario</b>	<b>IF<sub>electric</sub></b>	<b>IF<sub>demand_s</sub></b>	<b>IF<sub>demand_w</sub></b>
AC with Fossil Fuel Heat	0.0573	0.1379	0.0000
AC with Electric Heat	-0.0700	0.1379	-0.2880
Fossil Fuel Heat Only	0.0000	0.0000	0.0000
Electric Heat Only	-0.1273	0.0000	-0.2880
Unknown – use market average	0.0256	0.0813	-0.0185

While the methodology for calculating residential interactive factors is very similar to the method outlined above for calculating non-residential interactive factors, there are several key differences. We proposed to use base residential interactive factors on EDC service territory rather than project-specific HVAC configuration. This in turn affects some of the parameters used in the interactive factor equations.

The default value for residential IGC is 60%, which comes from the New York State TRM. Applicability is based on the EDC-specific HVAC splits between electric heating, fossil fuel heating, and the presence of electric cooling. Default values for applicability come from the Act 129 2023 Pennsylvania Residential Baseline Study.<sup>13</sup>

Concurrency also differs based on EDC. EDC service territories are inherently geographic and map to different weather stations. Weather profiles are therefore EDC-specific. In addition, the threshold for heating is 60°F and the threshold for cooling is 70°F. There is only one default lighting profile (“all bulbs”) for all EDCs, which is derived from the Act 129 2014 Pennsylvania Statewide Commercial and Residential Light Metering Study. Concurrency for energy use ( $C_e$ ) and peak demand ( $C_d$ ) are then calculated using the method described above with the residential assumptions.

---

<sup>13</sup> See Pennsylvania Act 129 2023 Residential Baseline Study, submitted by NMR Group, Inc., March 21, 2024. [https://www.puc.pa.gov/media/2883/2023\\_pa\\_residential\\_baseline\\_study.pdf](https://www.puc.pa.gov/media/2883/2023_pa_residential_baseline_study.pdf)

Default values for HVAC efficiency come from the Act 129 2023 Pennsylvania Residential Baseline Study. Percentage electric for residential interactive factors is calculated in the same manner as non-residential interactive factors. Table 6 shows the Commission's proposed residential interactive energy and demand factors by EDC.

**Table 6: Proposed Interactive Energy and Demand Factors for Residential Buildings**

<b>EDC</b>	<b>IF<sub>electric</sub></b>	<b>IF<sub>demand_s</sub></b>	<b>IF<sub>demand_w</sub></b>
PECO	-0.0006	0.1077	-0.0525
PPL	-0.0615	0.0944	-0.1337
Duquesne Light	0.0005	0.0864	-0.0263
Met-Ed	-0.0404	0.1077	-0.1122
Penelec	-0.0399	0.0665	-0.0788
Penn Power	-0.0092	0.1184	-0.0501
West Penn	-0.0485	0.0904	-0.1050

**a. Comments**

Duquesne Light indicates an inconsistency in the Tentative Order with respect to the subscript of the interactive effect term that deals with kWh impacts. Duquesne Light Comments at 2.

**b. Disposition**

For Phase V of Act 129, the default lighting interactive effects assumptions for lighting upgrades in non-residential buildings will follow the values shown in Table 7. These values match the proposed values, with the header IF<sub>electric</sub> changed to IF<sub>energy</sub> to match the algorithms in Volume 3 of the TRM.

**Table 7: Final Interactive Energy and Demand Factors for Non-residential Buildings**

<b>HVAC Scenario</b>	<b>IF<sub>energy</sub></b>	<b>IF<sub>demand_s</sub></b>	<b>IF<sub>demand_w</sub></b>
AC with Fossil Fuel Heat	0.0573	0.1379	0.0000
AC with Electric Heat	-0.0700	0.1379	-0.2880
Fossil Fuel Heat Only	0.0000	0.0000	0.0000
Electric Heat Only	-0.1273	0.0000	-0.2880
Unknown – use market average	0.0256	0.0813	-0.0185

Table 8 shows the default lighting interactive effects assumptions for residential lighting upgrades. The values are identical to the proposed values in Table 6, but the headers are updated to align with the parameter names in Volume 2 of the TRM. In Volume 2 of the TRM, the lighting interactive effect terms use an “IE” naming convention instead of the “IF” convention used in Volume 3.

**Table 8: Final Interactive Energy and Demand Factors for Residential Buildings**

<b>EDC</b>	<b>IE<sub>kWh</sub></b>	<b>IE<sub>kW_s</sub></b>	<b>IE<sub>kW_w</sub></b>
PECO	-0.0006	0.1077	-0.0525
PPL	-0.0615	0.0944	-0.1337
Duquesne Light	0.0005	0.0864	-0.0263
Met-Ed	-0.0404	0.1077	-0.1122
Penelec	-0.0399	0.0665	-0.0788
Penn Power	-0.0092	0.1184	-0.0501
West Penn	-0.0485	0.0904	-0.1050

## 7. Transmission and Distribution Losses

The Tentative Order did not address the TRM assumptions regarding line losses during transmission and distribution that appear in Volume 1 as the Commission proposed no changes to these assumptions relative to the 2021 TRM. However, two parties commented on the proposed values.

**a. Comments**

PECO suggests that the Commission update the line losses assumptions in Section 1.15 of the TRM based on the SWE’s Avoided Cost of Transmission and Distribution Capacity Study. PECO Comments at Appendix A, 1. Duquesne Light requests that the line loss factors in Volume 1 of the 2026 TRM be updated to align with the Company’s Commission-approved tariffs and provide the suggested table values. Duquesne Light Comments at 6-7.

**b. Disposition**

The Commission agrees with Duquesne Light that Act 129 assumptions about parameters such as transmission and distribution losses should align with other publicly available filings where possible. The values in Table 1-5 (formerly Table 1-4) of the Final 2026 TRM, Volume 1 reflect the line loss factors specified by Duquesne Light in its comments. Specifically, a residential line loss factor (LLF) of 1.0741, a small C&I LLF of 1.065, and a large C&I LLF of 1.0308. The scope of the SWE’s Avoided Cost of Transmission and Distribution Capacity Study referenced in PECO’s comments on this issue did not include an analysis of losses so the study results cannot be used to update this area of the TRM.

**8. Definitions of Measure Vintage**

The Tentative Order did not address the definitions of key terms that appear in Section 1.4 of Volume 1 as the Commission proposed no changes to the list of terms or their definitions. However, stakeholder comments were submitted on the definitions.

**a. Comments**

Duquesne Light suggests the term “Replace on Burnout” (ROB) be changed to “Normal Replacement” but proposed no modification to the definition itself. Duquesne Light also suggests the Commission adjust the portion of the “Early Replacement Measure” (EREP) definition pertaining to incremental cost. Duquesne Light Comments

at 5-6. PECO questions the definition of the “Time of Sale” measure vintage and requests that the Commission clarify how a Time of Sale measure characterization differs from the Replace on Burnout and New Construction vintages that appear throughout Volume 2 and Volume 3 of the TRM. PECO Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with Duquesne Light that the definition of incremental cost for Early Replacement measures in Volume 1 of the proposed 2026 TRM is incomplete because it does not describe the treatment of cost when a dual baseline procedure is used. Other Act 129 documents such as TRC Test Orders and the Pennsylvania Evaluation Framework provide more detailed guidance on calculation of incremental costs when a dual baseline is used to estimate lifetime energy savings. For completeness, the Commission has added clarifying text to the definition of Early Replacement Measure to address the correct characterization of incremental costs when a dual baseline calculation is used. The Commission rejects Duquesne Light’s suggestion to rename the Replace on Burnout measure vintage “Normal Replacement.” Different jurisdictions have various terms for end-of-life replacement. The Illinois TRM uses “Time of Sale” and the New England program administrators use “Lost Opportunity.” The Commission finds the term “Replace on Burnout” more descriptive and intuitive than “Normal Replacement” and disagrees with Duquesne Lights’s suggestion that a terminology change would limit confusion.

The Commissions appreciates PECO raising this issue as clear definitions and consistent terminology are key elements of the TRM. The Time of Sale measure definition in section 1.4 of the TRM has been expanded to clarify that Time of Sale measures are a subset of the Replace on Burnout measure vintage. The definition has also been expanded to clarify that Time of Sale measures are typically what is offered through an “upstream” or “midstream” program delivery model.

## **9. In-Service Date for Upstream and Midstream Measures**

The Commission did not propose any changes to the guidance regarding in-service date in Section 1.3 of the TRM and the Tentative Order did not address the topic. However, stakeholder comments were submitted requesting an update to the guidance.

### **a. Comments**

PECO notes that the in-service date guidance in Volume 1 does not specifically address upstream or midstream programs. Since the in-service date determines which TRM version applies, this results in a lack of clarity regarding TRM applicability for upstream and midstream programs. PECO states that the sales date and installation date can sometimes result in a divergence where the applicable TRM assumptions vary for upstream and midstream programs. PECO suggests aligning the TRM version to the sales date for such measures and noting it in this section. PECO Comments at Appendix A, 1.

### **b. Disposition**

The Commission agrees with PECO that specific guidance regarding the appropriate in-service date for upstream and midstream programs is important. Section 1.3 of Volume 1 has been expanded to direct EDCs and their CSPs to use the sales date as the in-service date for upstream and midstream programs.

## **10. Resource Savings in Current and Future Program Years and Adjustments to Energy and Resource Savings**

The Commission did not propose any changes to the guidance on the number of years resource savings can be claimed under Act 129 in Sections 1.9 and 1.13 of the TRM and the Tentative Order did not address the topic. However, stakeholder comments were submitted for several measures, requesting the Commission reconsider the 15-year cap on claiming savings.

**a. Comments**

PPL requests that the Commission, General Assembly, and interested stakeholders consider potential changes to Act 129 to address the 15-year cap on measure life. PPL Comments at 2. PECO notes that the 2026 TRM maintains a 15-year cap on measure life, and that this cap prevents the recognition of all lifetime benefits associated with the solar photovoltaic (PV) measure and urges the Commission to consider whether the 15—year cap could be applied on a weighted average measure basis for an EDC’s Plan in its entirety. PECO Comments at Appendix A, 4 and A, 6. PPL also notes that the maximum 15-year measure life is noted for several other measures, including High Efficiency Equipment, and comments that this reduces EDCs’ ability to provide customers with comprehensive measures. PPL Comments at 5.

**b. Disposition**

The Commission understands the interest in removing the 15-year cap on measure life; however, it is not possible to do so without legislative changes to Act 129.

**11. Measure Applicability Based on Sector**

The Commission did not propose any changes to the guidance on measure applicability based on sector in Section 1.19 of the TRM and the Tentative Order did not address the topic. However, stakeholder comments were submitted requesting clarification to the guidance.

**a. Comments**

PPL notes that section 1.19 provides general guidelines for EE&C measures in multifamily buildings, and that in general, in-unit measures should rely on residential sector protocols and common-area measures should rely on commercial sector protocols. PPL requests clarification for instances when commercial-style lighting is installed in residential units and residential measures are used in common areas. PPL Comments at

2. PPL also requests clarification on guidance for air sealing projects in multifamily buildings with block and or masonry construction. PPL Comments at 2.

**b. Disposition**

The Commission reiterates the general guidance that in-unit measures should rely on residential sector protocols and common-area measures should rely on commercial sector protocols when they are available. Using PPL’s examples, commercial-style lighting installed in residential units should follow the residential LED lighting protocol (Section 2.1.1) and advanced power strips should follow section 3.9.1. In the case of residential refrigerators or other residential measures for which there is no C&I protocol, the Commission recommends following the appropriate residential protocol as general guidance.

Regarding air sealing, the Commission recommends following the general guidance in section 1.19, with residential areas considered areas in residential buildings three stories or less in height and C&I protocols for measures typically found in C&I areas, including multifamily buildings that are four stories or more in height. The Commission agrees with PPL’s comment and has simplified section 1.19 and removed the guidance on air sealing, duct sealing, and insulation by type of construction.

**12. Typographical and Formatting Errors**

**a. Comments**

PPL observes that there are several sections of Volumes 2 and 3 with formatting issues, such as table references, and typographical errors. PPL Comments at 3. FirstEnergy notes that in Volume 1, the Table 1-2 footnotes need a comma in the superscript between footnotes 6 and 7. FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with PPL and FirstEnergy and has attempted to correct all formatting and typographical errors in Volumes 1, 2, and 3.

**13. Calculation Examples for TRM Algorithms**

**a. Comments**

KEEA comments that the Commission should include calculation examples wherever algorithms are used, whether for solar photovoltaic or other measures within the TRM, to prevent and eliminate confusion. KEEA Comments at 2.

**b. Disposition**

The Commission disagrees with KEEA and declines to add calculation examples to the TRM algorithms.

**C. Additional Residential EE&C Measure Protocols**

The Commission recognizes that the expansion of the residential section of the TRM is essential for the accurate and timely measurement and verification (M&V) of the EDCs' Act 129 EE&C programs and proposed including nine new residential EE&C measure protocols. The EDCs' independent evaluators, in collaboration with the SWE, produced, reviewed, and edited these residential EE&C measure protocols.

The nine new residential EE&C measure protocols are as follows:

- Section 2.2.9 – Window Heat Pump
- Section 2.3.10 – Smart Water Heater Controller
- Section 2.2.14 – ENERGY STAR Bathroom Exhaust Fan
- Section 2.4.4 – Low-Capacity Refrigerator / Freezer Recycling Without Replacement
- Section 2.4.5 – ENERGY STAR Coolers

- Section 2.4.6 – Cooler Recycling With and Without Replacement
- Section 2.4.7 – Residential Induction Cooktops
- Section 2.8.1 – ENERGY STAR Pool Pump
- Section 2.8.3 – Photovoltaic (PV) Solar Generation

No comments were received on Section 2.4.4 – Low-Capacity Refrigerator / Freezer Recycling Without Replacement, Section 2.4.7 – Residential Induction Cooktops, or Section 2.8.1 – ENERGY STAR Pool Pump. These proposed changes are hereby adopted by the Commission for use in Phase V.

Comments received on the remaining new residential EE&C measure protocols are addressed below.

**1. Section 2.2.2 – High Efficiency Equipment for Midstream Delivery: ASHP, CAC, PTAC, PTHP**

**a. Comments**

PECO and PPL request clarification on the method used to weight midstream composite values of Winter CF by EDC and point out errors likely caused by incorrect rounding of decimals. PECO Comments at Appendix A, 2. PPL Comments at 4. In addition, PPL highlights inconsistencies in the algorithms for calculating winter peak demand savings. PPL Comments at 4.

**b. Disposition**

The Commission acknowledges the issues with the Winter CF values identified by PECO and PPL and has made appropriate corrections; the composites are derived using Table 1-7 (formerly Table 1-6, showing EDC climate region weights) from Volume 1 Appendix A. The Commission has now edited the algorithms to use the correct  $OF_{\text{heat}}$  factor.

## **2. Section 2.2.9 – Window Heat Pump**

### **a. Comments**

PECO, PPL, and FirstEnergy comment that this measure produces winter peak demand savings, and a winter peak demand algorithm should be provided. PECO suggests combining the window heat pump measure with the room air conditioner measures as a single ENERGY STAR specification that covers both product types exists. PPL recommends the inclusion of natural gas heating system as a potential baseline heating system. FirstEnergy suggests correcting the inconsistencies in the headers of the oversize factor section of the measure. PECO Comments at Appendix A, 2. PPL Comments at 4. FirstEnergy Comments at Appendix A, 1.

### **b. Disposition**

The Commission agrees with PECO, PPL and FirstEnergy and has added an algorithm to capture winter peak demand savings but disagrees with PECO's suggestion to combine the room air conditioner and window heat pump measures. The Commission considered combining the room air conditioner and window heat pump measures; however, the current ENERGY STAR specification for window unit air conditioners does not meet the requirements of the 2026 federal standards update and thus cannot be used as the basis of the measure. Furthermore, maintaining window heat pumps and room air conditioners as separate measures is consistent with other sections of the TRM and allows for more granular tracking of technology types. Additionally, the Commission disagrees with PPL's suggestion to include natural gas heating systems as potential baseline heating systems as it constitutes electrification and is thus ineligible under the stipulations of Act 129. The Commission agrees with FirstEnergy and has added "electric furnace" in the header of the oversize factor section of the measure.

### **3. Section 2.3.10 – Smart Water Heater Controller**

#### **a. Comments**

FirstEnergy recommends that the  $V_{HW}$  variable be adjusted to match the value used in 2.3.5 Water Heater Temperature Setback, that the  $Cycles_{wash}$  term be altered, that the default savings in Table 2-81 (formerly Table 2-79) be updated accordingly, and that the page number on Source 8 be corrected. FirstEnergy Comments at Appendix A, 2.

#### **b. Disposition**

The Commission agrees with FirstEnergy that the  $V_{HW}$  default value should be consistent across measures and has set them both equal to 20 gallons per cycle. The default savings in Table 2-81 (formerly Table 2-79) have been updated to reflect the change in default  $V_{HW}$ . In addition, the page number on Source 8 has been corrected. However, the Commission has determined not to change the  $Cycles_{wash}$  term as it was derived from the Residential Energy Consumption Survey using final weights in accordance with the user guide.

### **4. Section 2.2.14 – ENERGY STAR Bathroom Exhaust Fan**

#### **a. Comments**

FirstEnergy notes that the CFM ranges in the tables do not capture ENERGY STAR models with CFMs higher than 200 and recommends adjusting the default table values and savings to include a CFM range higher than 200. FirstEnergy Comments at Appendix A, 2. PECO highlights several incorrect table cross-references. PECO Comments at Appendix A, 3.

#### **b. Disposition**

The Commission agrees with FirstEnergy and has updated the tables in this measure to include a CFM range of 201-500 to capture models with CFM ranges higher than 200. The savings have been updated to reflect this new range. In addition, the Commission agrees with PECO and has corrected the table cross-references.

## **5. Section 2.4.5 – ENERGY STAR Coolers**

### **a. Comments**

PECO notes that several table headings and cross references were not formatted consistently with the other table headings and cross references in this section of Volume 2 of the TRM. PECO Comments at Appendix A, 3.

### **b. Disposition**

The Commission agrees with PECO and has edited the table headings and cross references to make them consistent with the other table headings and cross references in the Volume 2 of the TRM.

## **6. Section 2.4.6 – Cooler Recycling with and Without Replacement**

### **a. Comments**

PPL notes that a table incorrectly referenced “Refrigerators and Freezers” in the heading and “refrigerators” in the terms. PPL Comments at 6.

### **b. Disposition**

The Commission agrees with PPL and has corrected the table by replacing “Refrigerators and Freezers” with “Coolers” in the heading and deleting “refrigerators” from the terms.

## **7. Section 2.8.3 – Photovoltaic (PV) Solar Generation**

### **a. Comments**

PECO, PPL and FirstEnergy recommend several revisions including the option to use 8,760 outputs from PVWatts to estimate summer and winter peak demand savings, request clarifications on how existing facility usage should be characterized for new construction buildings, the introduction of EDC data gathering for model inputs, and details on how the in-situ loss factors were determined. Additional recommendations include a review of ETDF factors that are generating high demand estimates, and updated

labels adding cardinal and ordinal directions to azimuth tables, and a request to reconsider the 15-year measure life that reduces system benefits in the total resource cost tests. PECO Comments at Appendix A, 4, PPL Comments at 7, and FirstEnergy Comments at Appendix A, 3.

### **b. Disposition**

The Commission agrees with PECO's, PPL's, and FirstEnergy's comments regarding the limitations imposed by the ETDF approach to estimate summer and winter demand savings and has included the option to calculate demand estimates from 8,760 generation models aligned with the TRM summer and winter peak demand periods. Furthermore, additional details on how to characterize consumption for new construction buildings have been included, and the use of EDC data gathering has been expanded to cover most of the PVWatts model input assumptions. Finally, ETDF lookup tables have been revised to accurately align with demand savings expectations from PV systems, and cardinal and ordinal direction labels have been added. In addition, the Commission notes that it has increased the maximum system size for residential PV systems to 50 kW<sub>AC</sub> to be consistent with the Alternative Energy Portfolio Standards Act and has added example calculations.

As discussed in General Changes, Section B.10, the Commission understands the interest in removing the 15-year cap on measure life. However, it is not possible to do so without legislative changes to Act 129.

## **8. Additional Residential Measures Recommended by Commentators**

### **a. Comments**

PECO recommends that the Commission consider incorporating several additional measures in the 2026 TRM including Residential Insulated Cellular Shades, Residential Kitchen Exhaust Fan, Residential ENERGY STAR Next Generation New Construction Baseline, Residential ENERGY STAR Level 2 ("L2") Chargers, and Residential Energy

Recovery Ventilators. PECO Comments at 3. KEEA recommends allowing flexibility in adopting new measures, refining existing ones, or phasing out those that have become standard practice. KEEA Comments at 4.

#### **b. Disposition**

The Commission acknowledges the energy savings potential of the identified measures, but, without proposed measure protocols, the proposed measures cannot be vetted by the Commission or reviewed and commented on by other stakeholders. Therefore, the Commission declines to add the recommended measures to the 2026 TRM. In addition, the Commission notes that there is flexibility to adopt new measures through interim measure protocols and that measures can be refined through the code change update process (see section B.3).

#### **D. Additional C&I EE&C Measure Protocols**

As with residential measures, expansion of the C&I section of the TRM is also essential for the accurate and timely M&V of these EE&C programs. Based on collaborative discussions between the SWE and the EDCs, as well as a review of the available research, we proposed the inclusion of the following 16 new C&I EE&C measures and associated protocols:

- Section 3.1.7 – Indoor Horticultural Lighting
- Section 3.2.2 – HVAC Systems for Midstream Delivery
- Section 3.2.6 – Ductless Mini-Split Heat Pumps – Commercial <5.4 Tons for Midstream Delivery
- Section 3.2.8 – HVAC Tune-up
- Section 3.2.16 – Demand Control Ventilation
- Section 3.2.17 – Advanced Rooftop Controls
- Section 3.2.18 – C&I ENERGY STAR Certified Connected Thermostats

- Section 3.2.19 – Adjustment of Programmable Thermostats and associated Appendix G: Adjustment of Programmable Thermostats Calculator
- Section 3.2.20 – Duct Sealing and Insulation
- Section 3.2.21 – Chilled Water Pipe Insulation
- Section 3.4.3 – Domestic Hot Water Pipe Insulation
- Section 3.5.16 – Food Service Equipment Novelty Cooler Shutoff
- Section 3.7.10 – Commercial Induction Cooktops
- Section 3.11.4 – ENERGY STAR Uninterruptible Power Supplies
- Section 3.11.5 – Building Operator Certification Training and associated Appendix F: Building Operator Certification Audit and Design Tool
- Section 3.11.6 – Photovoltaic (PV) Solar Generation

No comments were received on Section 3.2.16 – Demand Control Ventilation, Section 3.2.17 – Advanced Rooftop Controls, Section 3.4.3 – Domestic Hot Water Pipe Insulation, Section 3.5.16 – Food Service Equipment Novelty Cooler Shutoff, Section 3.11.4 – ENERGY STAR Uninterruptible Power Supplies, and Section 3.11.5 – Building Operator Certification Training. Therefore, these proposed changes are hereby adopted by the Commission for use in Phase V.

Comments received on the remaining new residential EE&C measure protocols are addressed below.

## **1. Section 3.1.7 – Indoor Horticultural Lighting**

### **a. Comments**

FirstEnergy notes that the proposed savings algorithms for projects with and without dimming are effectively the same and suggests they be consolidated into a single set of algorithms. FirstEnergy Comments at Appendix A, 3. FirstEnergy also

recommends simplification of the peak demand savings algorithms, noting that the peak demand calculations have a base CF, an efficient CF, and a dimming factor. FirstEnergy suggests the TRM mirror the energy savings calculation for peak demand by including  $CF_{s\_ee}$  and  $CF_{w\_ee}$  terms that can be adjusted by a dimming factor when a dimming strategy is used. FirstEnergy Comments at Appendix A, 4.

PPL maintains that the interactive energy factors found in Table 3-22 are lower than what is found in other TRMs that offer horticultural lighting measures. Fully indoor cannabis facilities do not economize and utilize mechanical cooling/dehumidification year-round. A winter interactive factor of zero is not realistic and recommends that this variable be reevaluated. PPL Comments at 8.

#### **b. Disposition**

The Commission agrees with FirstEnergy that two sets of algorithms are not needed for this measure characterization and has consolidated the kWh and peak kW savings equations into a single set of algorithms. An additional paragraph has been added to clarify that  $HOU_{adj}$  is the same as  $HOU_{ee}$  for projects without dimming since the two dimming parameters are zero. The Commission also agrees with FirstEnergy that the structure of the energy savings algorithms can be applied to the peak demand savings algorithms. The final TRM summer peak demand characterization includes  $CF_{s\_ee}$  and  $CF_{s\_adj}$  terms to capture the summer CF of the efficient configuration with and without adjustment for dimming. The winter peak demand characterization includes  $CF_{w\_ee}$  and  $CF_{w\_adj}$  terms to capture the winter CF of the efficient configuration with and without adjustment for dimming.

The Commission disagrees with PPL's suggestion to reevaluate the interactive effect assumptions for this measure. A general statement about the values in other states' TRMs does not indicate a technical issue with the proposed parameter values. The Commission reminds PPL that this measure pertains to other crops besides cannabis and

covers greenhouses as well as fully indoor facilities. Given the expected variation in cooling and ventilation requirements across different horticulture operations, an EDC data gathering option has been added to each of the interactive effect parameters in this measure characterization. PPL and its CSPs are encouraged to collect data on HVAC operation in program-supported horticulture operations and develop site-specific interactive effect assumptions.

## **2. Section 3.2.2 – HVAC Systems for Midstream Delivery**

### **a. Comments**

PECO requests clarification on the apparent contradiction between the statement that there is no minimum efficiency level threshold for HVAC systems larger than 5.4 tons and minimum efficiencies listed in Table 3-29 (formerly Table 3-30). PECO Comments at Appendix A, 5. PPL requests adding “cool” and “heat” subscripts to the “kWh” term in the peak demand reduction algorithms. PPL Comments at 8. FirstEnergy suggests referencing Table 3-24 in lieu of Table 3-29 and calls for the deletion of Table 3-29. In addition, FirstEnergy identifies errors in Table 3-29 for efficiency values of IEER equipment >760 kBTUh and baseline requirements of packaged terminal equipment, and incorrect tabular column and row formatting. FirstEnergy Comments at Appendix A, 5.

### **b. Disposition**

The Commission has reviewed Table 3-29 (formerly Table 3-30) and the language highlighted in PECO’s comments. While Table 3-29 defines the minimum baseline efficiencies for the ROB/NC vintage, the language in paragraph three under “Eligibility” highlighted by PECO refers to minimum efficiencies of the installed efficient equipment. Furthermore, the section defines that systems larger than 5.4 tons have no thresholds for the efficiency of the efficient equipment. In addition, the Commission reviewed and added the appropriate subscripts to the algorithms, as suggested by PPL. Finally, inconsistencies highlighted by FirstEnergy in Table 3-29 have been corrected. However,

the Commission disagrees with FirstEnergy and declines to reference Table 3-29 in lieu of Table 3-24, despite the similarity between the tables. Future expansions or changes in the protocols of midstream measures in terms of observing baseline efficiencies can be incorporated locally in Table 3-29.

**3. Section 3.2.6 – Ductless Mini-Split Heat Pumps – Commercial <5.4 Tons for Midstream Delivery**

**a. Comments**

PPL identifies a statement below Table 3-44 (formerly Table 3-45) and requests clarification on its applicability to technology types. PPL Comments at 9.

**b. Disposition**

The Commission agrees with PPL and has clarified the statement and its applicability to be solely for cold climate ductless mini-split heat pumps.

**4. Section 3.2.8 – HVAC Tune-up**

**a. Comments**

FirstEnergy suggests removing the mandate of using EER/EER2 for peak demand savings, post implementation of ETDFs. In addition, FirstEnergy also highlights a typographical error in Table 3-48 (formerly Table 3-49). FirstEnergy Comments at Appendix A, 5.

**b. Disposition**

The Commission agrees with FirstEnergy and has corrected the typographical error in Table 3-48 (formerly Table 3-49). The value now reads IEER instead of EER. In addition, the mandate of using EER/EER2 in peak demand calculations has been removed.

## **5. Section 3.2.18 – C&I ENERGY STAR Certified Connected Thermostats**

### **a. Comments**

PPL highlights two typographical errors in Table 3-74 and requests clarification on the recent updates to eligibility of baseboard heating as primary heating systems under ENERGY STAR Connected Thermostat Version 2.0. PPL Comments at 9.

### **b. Disposition**

The Commission agrees with PPL and has corrected the errors. The second instance of ETDF now reads “Winter,” and the EER “Water to air, ground water heat pump” is now 18.0. PPL raises an important update to the ENERGY STAR Connected Thermostat Version 2.0 specification concerning the eligibility of baseboard heating systems as a primary heating type. However, given that this version of the specification is still in the development phase, the Commission disagrees with PPL and declines to incorporate the technology eligibility into the TRM at this time.

## **6. Section 3.2.19 – Adjustment of Programmable Thermostats**

### **a. Comments**

PPL highlights two typographical errors in Table 3-76 and points out the same error in Table 3-74. PPL Comments at 10.

### **b. Disposition**

The Commission agrees with PPL and has corrected the errors: the second instance of “Rated capacities...” now references heating (instead of cooling), and “Percent of cooling savings” and “Percent of heating savings” units were changed from kWh to %. However, the Commission could not locate the error in Table 3-74 and assumes that it was noted incorrectly by PPL.

## **7. Section 3.2.20 – Duct Sealing and Insulation**

### **a. Comments**

PPL highlights a typographical error in Table 3-77. PPL Comments at 9.

### **b. Disposition**

The Commission agrees with PPL and has corrected the error in Table 3-77; the second instance of ETDF now reads “Winter.” While making this correction, the Commission discovered another error and has restructured the algorithm formulae to increase legibility, and to incorporate a term for thermal regain factor in Method 2. This addition improves alignment with Method 1 and the new C&I Duct Sealing and Insulation measure.

## **8. Section 3.2.21 – Chilled Water Pipe Insulation**

### **a. Comments**

FirstEnergy requests clarification on the algorithms for h-conv and h-rad. FirstEnergy Comments at Appendix A, 5.

### **b. Disposition**

Regarding FirstEnergy’s request for clarification, the variables h-conv and h-rad are supposed to be EDC data gathered and the guidance has been changed in Table 3-81. EDCs should refer to the default savings in Table 3-82 if the variables cannot be gathered from labels.

## **9. Section 3.7.10 – Commercial Induction Cooktops**

### **a. Comments**

FirstEnergy suggests adding a source for the EnergyToFood variable in the definition of terms and revising the value to 0.038. FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with FirstEnergy’s suggestion. The EnergyToFood variable reference has been added and the value has been updated. Default savings for the measure have also been updated to align with this change.

**10. Section 3.11.6 – Photovoltaic (PV) Solar Generation**

**a. Comments**

PECO, PPL, and FirstEnergy recommend several revisions including the option to use 8,760 outputs from PVWatts to estimate summer and winter peak demand savings, clarifications on how existing facility usage should be characterized for new construction buildings, the introduction of EDC data gathering for model inputs, and details on how the in-situ loss factors were determined. Additional recommendations include a review of ETDF factors that are generating high demand estimates, and updated labels adding cardinal and ordinal directions to azimuth tables, the removal of PV generating limits above annual site load, and a request to reconsider the 15-year measure life that reduces system benefits in the total resource cost tests. PECO Comments at Appendix A, 6, PPL Comments at 11 and 12, and FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with stakeholder comments regarding the limitations imposed by the ETDF approach to estimate summer and winter demand savings and has included the option to calculate demand estimates from 8,760 generation models aligned with the TRM summer and winter peak demand periods. Furthermore, additional details on how to characterize consumption for new construction buildings have been included and the use of EDC data gathering has been expanded to cover most of the PVWatts model input assumptions. Finally, ETDF lookup tables have been revised to accurately align with demand savings expectations from PV systems, cardinal and ordinal direction labels and example calculations have been added, and the quantified generation cap based

on site load has been removed. In addition, the Commission added example calculations on how to apply the algorithms to estimate demand savings.

As discussed in General Changes, Section B.10 the Commission understands the interest in removing the 15-year cap on measure life. However, it is not possible to do so without legislative changes to Act 129.

## **11. Additional C&I Measures Recommended by Commentators**

### **a. Comments**

PECO recommends that the Commission consider incorporating several additional measures in the 2026 TRM including Commercial and Industrial (“C&I”) Energy Recovery Ventilation, Residential Cool Roofs, and L2 Electric Vehicle Chargers. PECO Comments at 3. KEEA recommends allowing for flexibility in adopting new measures, refining existing ones, or phasing out those that have become standard practice. KEEA Comments at 4.

### **b. Disposition**

The Commission acknowledges the energy savings potential of the identified measures, but, without proposed measure protocols, the proposed measures cannot be vetted by the Commission or reviewed and commented on by other stakeholders. Therefore, the Commission declines to add the recommended measures to the 2026 TRM. In addition, the Commission notes that there is flexibility to adopt new measures through interim measure protocols and that measures can be refined through the code change update process (see Section B.3).

## **E. Existing Residential EE&C Measure Protocols and Processes**

The following sections describe clarifications and modifications to the residential measure protocols. Some of the proposed changes received no stakeholder comments.

Those proposed changes, which are not reproduced in the sections to follow, are hereby adopted by the Commission for use in Phase V. Affected measures include:

- 2.1.3 - LED and Electroluminescent Nightlights
- 2.1.4 - Holiday Lights
- 2.2.3 - ECM Circulation Fans
- 2.2.4 - GSHP Desuperheaters
- 2.2.7 - ENERGY STAR Room Air Conditioners
- 2.3.2 - Solar Water Heaters
- 2.3.4 - Water Heater Tank Wrap
- 2.3.5 - Water Heater Temperature Setback
- 2.3.7 - Low Flow Faucet Aerators
- 2.3.8 - Low Flow Showerheads
- 2.3.9 - Thermostatic Shower Restriction Valves
- 2.4.2 - ENERGY STAR Freezers
- 2.4.3 - Refrigerator / Freezer Recycling with and without Replacement
- 2.4.5 - ENERGY STAR Clothes Dryers
- 2.4.6 - Heat Pump Clothes Dryers
- 2.4.8 - ENERGY STAR Dishwashers
- 2.5.1 - ENERGY STAR Office Equipment
- 2.5.2 - Advanced Power Strips
- 2.8.1 - Variable Speed Pool Pumps
- 2.9.1 - Direct Load Control and Behavior-Based Demand Response Programs

The changes proposed by the Commission in our Tentative Order that received stakeholder comments are addressed below.

## 1. Section 2.1.1 – ENERGY STAR Lighting<sup>14</sup>

The Commission proposed to rename this measure Residential LED Lighting because the United States Environmental Protection Agency (U.S. EPA) is sunsetting the ENERGY STAR specifications for lamps and luminaires effective 12/31/24.

In response to the U.S. Department of Energy's (U.S. DOE's) updated definition of general service lamps (GSLs) effective 7/8/22, the Commission proposed limiting eligibility of GSLs with 310 to 3,300 lumens to early replacement (i.e., direct install) programs and limiting eligibility of fixtures to linear fixtures. The Commission proposed removing cross-sector sales from this measure as those are comprised of upstream GSLs which would no longer be eligible. The Commission proposed a measure life of two years for early replacement LEDs, estimated as one-half (the assumed proportion of remaining life) the product of (1) the distribution of incandescent, halogen, and Compact Fluorescent Light (CFL) bulbs from the Act 129 2023 Pennsylvania Residential Baseline Study and (2) the service lifetimes for incandescent, halogen, and CFL bulbs assumed in US DOE appliance and equipment standards rulemakings.

The Commission proposed updating baseline wattages ( $Watts_{base}$ ) as follows. For direct install GSLs, EDCs would need to record wattages of existing lamps being removed. For GSLs outside of the Energy Independence and Security Act (EISA) lumen range and exempt bulb types, baseline wattage would be the manufacturer rated comparable wattage. For linear fixtures, baseline wattage would be lumens divided by a default efficacy ( $Efficacy_{base}$ ).

The Commission proposed including a factor ( $L$ ) to adjust interactive effect factors to account for the proportion of LEDs installed in interior locations when the installation location is unknown. In addition, the Commission proposed an in-service rate

---

<sup>14</sup> See Section 2.1.1 – ENERGY STAR Lighting of the 2021 TRM, Volume 2, page 1.

(ISR) of 100% for direct-install programs, and EDC data gathering for all other delivery channels.

**a. Comments**

PECO and Duquesne Light comment that the default ISR for residential lighting other than direct install has been removed but that there is potential for exempted products (e.g., linear lighting). Both commenters suggest retaining the deemed 0.92 ISR for such products. In addition, Duquesne Light requests clarification on the expectation for EDC data gathering to inform the ISR for non-direct install programs. PECO Comments at Appendix A, 1 and Duquesne Light Comments at 2.

PPL comments that differentiation for replacement type and lower measure life for direct install (Early Replacement) will reduce cost-effectiveness, thereby creating a negative impact on cost effectiveness for in-person programs, especially for income—eligible customers where direct install applications are most likely. Income-eligible customers may continue to store and have access to inefficient lighting, which would indicate that a higher measure life is required. PPL Comments at 3.

PECO requests a source be included for the updated interactive effect values presented in Table 2-5. PECO Comments at Appendix A, 1.

FirstEnergy requests that formulas be provided for the calculation of interactive effects with EDC-gathered data. FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with PECO and Duquesne Light and has added a deemed ISR of 0.92 for linear LED lighting. The Commission rejects PPL’s suggestion that a higher measure life is needed for direct install applications. PPL provides no evidence that income-eligible customers, or other residential customers, continue to store and have

access to inefficient lighting. The updated HVAC interactive effect values in Table 2-5 come from source 6, SWE Interactive Effect Calculator. If PECO would like to review the residential, or non-residential, interactive effects calculator developed by the SWE the Commission will direct the Phase IV SWE to upload the Microsoft Excel tool to its SharePoint site. Furthermore, this tool also contains the formulas for calculating interactive effects requested by FirstEnergy.

## **2. Section 2.1.2 – Residential Occupancy Sensors<sup>15</sup>**

The Commission proposed updating the measure life from 10 to 8 years to reflect the most current California eTRM effective useful life (EUL). The Commission also proposed providing separate default wattages ( $\text{Watts}_{\text{controlled}}$ ) for hard-wired and plug-in occupancy sensors, including 108w for hard-wired occupancy sensors (based on data gathered for the Act 129 2023 Pennsylvania Residential Baseline Study), and 9w for plug-in occupancy sensors (based on the typical wattage of a 60w equivalent LED). Additionally, the Commission recommended incorporating an interactive factor in the savings algorithm to account for the reduction in waste heat when lights are switched off while spaces are unoccupied. Finally, the Commission proposed upstream default ISRs of 95% for hard-wired occupancy sensors (from the Maryland EmPOWER TRM) and 16% for plug-in occupancy sensors (based on a weighted average of evaluated PY13 and PY14 outlet gasket ISRs from FirstEnergy kits).

### **a. Comments**

PECO suggests including exterior occupancy sensors in this measure entry and comments that the Commission should consider applying the kit ISR value of 0.16 for plug-in occupancy models, as is specified for most other occupancy sensor types. PECO Comments at Appendix A, 1 and 2. PPL and Duquesne Light question using a kit-distributed outlet gasket ISR for lighting occupancy sensors distributed through kits.

---

<sup>15</sup> See Section 2.1.2 – Residential Occupancy Sensors of the 2021 TRM, Volume 2, page 6.

Both, PPL and Duquesne Light, suggest developing a measure-specific ISR. PPL Comments at 3 and Duquesne Light Comments at 3.

**b. Disposition**

The Commission acknowledges the energy savings potential of exterior residential occupancy sensors but is not aware of any measure protocols for exterior residential occupancy sensors. Therefore, the Commission declines to expand the measure eligibility to exterior residential occupancy sensors but is open to developing a protocol via the interim measure protocol process. The Commission agrees with PPL and Duquesne Light that applying an ISR from kit-distributed outlet gaskets to kit-distributed lighting occupancy sensors may not be appropriate and therefore has updated the default ISRs for all kit-delivered occupancy sensors to EDC data gathering.

**3. Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP16**

This measure in the 2021 TRM includes the consideration of midstream delivery. The Commission proposed limiting this measure to non-midstream delivery. Midstream delivery would become its own measure: 2.2.2 – High Efficiency Equipment for Midstream Delivery: ASHP, CAC, GSHP, PTAC, PTHP.

The Commission proposed updating the default efficiencies for early replacement equipment using data from the Act 129 2023 Pennsylvania Residential Baseline Study and updating default efficiencies for replace on burnout or new construction installations based on applicable updates to federal standards.

Because the calculation of ground source heat pump efficiency metrics differs from that of ASHPs, a relationship must be established to air source equivalents to enable

---

<sup>16</sup> See Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP of the 2021 TRM, Volume 2, page 12.

savings calculations; therefore, the Commission proposed updating these conversion factors.

**a. Comments**

PPL indicates that Table 2-10 contains multiple errors, including unsourced values and discrepancies when using the formula in footnote b to calculate EER2 and utilizing the formula in footnote c to calculate HSPF. PPL Comments at 4.

PECO requests clarification on the application of measures 2.2.1 and 2.2.3, if ASHP equipment in 2.2.1 is required to be ducted and suggests consolidating the ASHP and ductless heat pump technologies into a single measure entry. Additionally, PECO notes that while the algorithms for estimating savings from proper sizing account for both heating and cooling, only cooling savings are mentioned in the introduction. Lastly, PECO recommends updating the oversize factor to values gathered from the recently conducted baseline studies (as opposed to the 2012 PA Potential Study). PECO Comments at Appendix A, 2.

FirstEnergy highlights several inconsistencies with the labeling of table numbers and descriptions of GSER factors. FirstEnergy comments that baseline assumptions for packaged terminal equipment are the same for early replacement and new construction/replace on burnout vintages and asks for the baseline measure of a GSHP in the replace on burnout/new construction vintage to be reverted to an ASHP as it was through the duration of Phase IV. FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with PPL's comments and has confirmed the validity of the values presented in Table 2-10. For additional clarity, the Commission has updated footnotes b and c to show all formulas used to derive the EER2 and COP values, including the formulas referenced from Volume 1 Appendix A.

The Commission acknowledges the fact that ASHPs are required to be ducted but declines PECO’s recommendation to combine the two measure types because the disaggregation of technology types allows for more granular tracking of measure installations. However, the Commission agrees with PECO that both heating and cooling savings result from proper sizing and has therefore deleted the word “cooling” from the introduction. The Commission has reviewed multiple Pennsylvania residential baseline studies; however, due to the lack of data availability, the Commission declines PECO’s recommendation to update the oversize factor to values gathered from the recently conducted baseline studies and maintains the current source as the Act 129 2012 Pennsylvania Residential Baseline Study (referred to as “2012 PA Potential study” in PECO’s comment).

The Commission agrees with FirstEnergy and has corrected the incorrect table and footnotes and has edited the GSER factor description to refer to “SEER” instead of “HSPF.” The Commission confirms the equivalent baselines for packaged terminal equipment between early replacement and new construction/replace on burnout vintages and has changed the baseline measure for GSHP technology to be an ASHP for the replace on burnout/new construction vintage.

#### **4. Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option<sup>17</sup>**

The Commission proposed updating the minimum efficiency requirements to align with ENERGY STAR Version 6.1 Central Air Conditioner and Heat Pump Final Specification. The Commission also proposed updating (1) the default efficiencies for early replacement equipment using data from the Act 129 2023 Pennsylvania Residential Baseline Study, and (2) the default efficiencies for replace on burnout or new construction installations based on applicable updates to federal standards. Finally, the

---

<sup>17</sup> See Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option of the 2021 TRM, Volume 2, page 17.

Commission proposed updating the midstream composites defaults for consistency with the changes described above.

**a. Comments**

PECO suggests consolidating the ASHP and ductless heat pump technologies into a single measure entry. Additionally, PECO notes that while the algorithms for estimating savings from proper sizing account for both heating and cooling, only cooling savings are mentioned in the introduction. Lastly, PECO suggests updating the oversize factor to values gathered from the recently conducted baseline studies (as opposed to the 2012 PA Potential Study). PECO Comments at Appendix A, 2.

FirstEnergy suggests removing the word “central” in the description of  $C_{\text{opy}}_{\text{cool}}$  in Table 2-16 and correcting the reference to Table 2-8 to properly reference Table 2-10. FirstEnergy Comments at Appendix A, 1.

PPL notes inconsistent usage of HVAC efficiency metrics throughout Volumes 2 and 3 of the TRM, citing the usage of SEER instead of SEER2 for measure 2.2.2 as an example. PPL Comments at 3.

**b. Disposition**

The Commission acknowledges the fact that ASHPs are required to be ducted but declines PECO’s recommendation to combine the two measure types because the disaggregation of technology types allows for more granular tracking of measure installations. However, the Commission agrees with PECO that both heating and cooling savings result from proper sizing and has therefore deleted the word “cooling” from the introduction. The Commission has reviewed multiple Pennsylvania residential baseline studies; however, due to the lack of data availability, the Commission declines PECO’s recommendation to update the oversize factor to values gathered from the recently conducted baseline studies and maintains the current oversize factor source as the Act

129 2012 Pennsylvania Residential Baseline Study (referred to as “2012 PA Potential study” in PECO’s comment).

The Commission agrees with, and has implemented, FirstEnergy’s suggestions regarding the word “central” in the description of Capy<sub>cool</sub> and the Table 2-10 reference.

Regarding PPL’s comments, the Commission has reviewed HVAC measures in Volumes 2 and 3 (including measure 2.2.2) and finds no errors with the usage of efficiency metrics and thus disagrees with PPL’s comments. A few technology types, including ASHPs and central air conditioners (CACs), have updated to the new efficiency metrics (SEER2, EER2, HSPF2), while others, such as PTAC/PTHPs and GSHPs, are still using the old efficiency metrics (SEER, EER, HSPF).

#### **5. Section 2.2.5 – Air Conditioner & Heat Pump Maintenance<sup>18</sup>**

The Commission proposed updating the default efficiencies for early replacement equipment using data from the Act 129 2023 Pennsylvania Residential Baseline Study. The Commission also proposed updating default efficiencies for replace on burnout or new construction installations based on applicable updates to federal standards. Because the calculation of ground source heat pump efficiency metrics differs from that of ASHPs, a relationship must be established to air source equivalents to enable savings calculations. Therefore, the Commission proposed updating these conversion factors.

##### **a. Comments**

Duquesne Light points out that this is a retrofit measure, and as such, any references to replace on burnout, new construction, and federal standards are erroneous. Duquesne Light Comments at 3.

---

<sup>18</sup> See Section 2.2.5 – Air Conditioner & Heat Pump Maintenance of the 2021 TRM, Volume 2, page 29.

**b. Disposition**

This measure does not include federal standards as baseline minimum defaults. The Commission agrees with Duquesne Light that it was an error to recommend updating default efficiencies for replace on burnout or new construction installations in the Tentative Order. The Commission notes that default values should reference the Act 129 2023 Pennsylvania Residential Baseline Study and points out that the default values do reference Table 2-10’s early replacement vintage, which are sourced from the Act 129 2023 Pennsylvania Residential Baseline Study.

**6. Section 2.2.8 – Room AC Retirement<sup>19</sup>**

The Commission proposed updating default baseline efficiency requirements for all vintages to be based on applicable federal standards.

**a. Comments**

Duquesne Light comments that a federal standard baseline does not apply to all vintages, but only to the second portion (EUL-RUL) of early replacements and suggests updating the default baseline efficiency for retired room air conditioners based on the 2023 baseline findings. Duquesne Light Comments at 3. FirstEnergy requests clarification regarding the usage of EER versus CEER when the ENERGY STAR database and manufacturers’ specification sheet do not have an EER rating ( $EER_{ee}$ ). FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with Duquesne Light that a federal standard baseline does not apply to all vintages and that it was an error to have stated so in the Tentative Order. Therefore, the Commission has updated the early retirement default baseline efficiency ( $EER_{RetRAC}$ ) to a value sourced from the Act 129 2018 Pennsylvania Residential Baseline

---

<sup>19</sup> See Section 2.2.8 – Room AC (RAC) Retirement of the 2021 TRM, Volume 2, page 38.

Study, the last study with field research values having RAC ratings in EER. In addition, the Commission agrees with FirstEnergy and has added an algorithm to convert CEER to EER for cases in which CEER is available, but EER is not.

## **7. Section 2.2.9 – Duct Sealing & Duct Insulation<sup>20</sup>**

Although the Commission did not propose any changes in the Tentative Order, the Commission received stakeholder comments on this measure.

### **a. Comments**

FirstEnergy highlighted errors in the Distribution Efficiency Adders in Table 2-42 (formerly Table 2-41). FirstEnergy Comments at Appendix A, 1.

### **b. Disposition**

The Commission agrees with FirstEnergy and has corrected the language in the Order. While making this correction, the Commission discovered another error and has restructured the algorithm formulae to increase legibility, and to incorporate a term for thermal regain factor in Method 2. This addition improves alignment with Method 1 and the new C&I Duct Sealing and Insulation measure. The Commission also provided a source for the equipment capacity to the air handler flow conversion factor (TCFM) and included the smaller conversion factor applicable to non-furnace systems. Finally, the Commission modified the measure wording to clarify that Method 2 relies upon leakage to outside test results.

## **8. Section 2.2.10 – Air Handler Filter Whistles<sup>21</sup>**

The Commission proposed that new ISR values be adopted based on an analysis of PY13 and PY14 participation data gathered by the EDCs.

---

<sup>20</sup> See Section 2.2.9 – Duct Sealing & Duct Insulation of the 2021 TRM, Volume 2, page 42.

<sup>21</sup> See Section 2.2.10 – Air Handler Filter Whistles of the 2021 TRM, Volume 2, page 46.

**a. Comments**

FirstEnergy highlights errors in the formatting of Table 2-44 (formerly Table 2-43) and requests clarification on the applicability of winter peak demand savings for ASHP and furnace technology types. FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with FirstEnergy and has reformatted Table 2-44 (formerly Table 2-43) to consolidate ASHP kWh, furnace kWh, and winter peak demand savings under the “Heating” heading. Since peak demand savings are independent of EFLH of the technology type, the default savings need not be broken down by using weighted averages and values used as shown in Table 2-44 for ASHP or electric furnaces.

**9. Section 2.2.11 – ENERGY STAR Certified Connected Thermostats<sup>22</sup>**

The Commission proposed to reduce the measure life of this measure to 9 years in line with the EUL in the California eTRM.

**a. Comments**

PECO notes the general variability in savings estimates for connected thermostats among TRMs in Pennsylvania and other jurisdictions and specifically highlights the significantly lower savings yielded by a similar measure in the Maryland TRM v11. PECO requests reconsideration of the inputs and assumptions used in the calculations of the measure and alternatively suggests a detailed billing analysis be conducted to quantify the benefits of smart thermostats. PECO highlights discrepancies between Table 2-53 (formerly Table 2-52) depicting between 0-10% of CAC w/ Electric furnaces and Table 2-136 (formerly Table 2-134) presenting a statewide average of 35% electric primary heating fuel. PECO Comments at Appendix A, 3.

---

<sup>22</sup> See Section 2.2.11 – ENERGY STAR Certified Connected Thermostats of the 2021 TRM, Volume 2, page 48.

PPL requests a rollback on the reduced EUL in the proposed Phase V measure, citing higher EULs in the Illinois TRM and the practice of customers replacing their thermostats during the replacement of primary HVAC systems. In addition, PPL requests clarification on the recent updates to the eligibility of baseboard heating as the primary heating system under ENERGY STAR Connected Thermostat Version 2.0. PPL Comments at 5.

**b. Disposition**

The Commission reviewed deemed savings in the Maryland TRM and finds that the energy savings factors used in the supporting analysis workbook are comparable with the factors used in the 2026 TRM and does not recommend further revisions at this time. While the Commission acknowledges the significant variations between savings values in the Maryland TRM and the 2026 TRM for electric furnaces, the savings are closer for thermostats installed on ASHP systems. These minor variations in savings could be due to increased baseline electricity consumption associated with higher full load hour operation of systems in Pennsylvania climatic conditions and default capacities of the HVAC equipment assumed between the TRMs. The Commission appreciates PECO's suggestion to carry out a detailed billing analysis but finds it not to be feasible at this point in the TRM update cycle. The Commission directs the SWE to carry out a detailed billing analysis for this measure during Phase V. The Commission reviewed Tables 2-52 and Table 2-136 (formerly Table 2-134), and the apparent discrepancy stems from Table 2-136 referencing heating fuel source only, which is agnostic to system type (e.g. ASHP, electric furnace, baseboard, etc.), while the 0-10% values cited by PECO in Table 2-53 (formerly Table 2-52) pertain only to CAC with electric furnace systems. However, the Commission did notice errors in the values of Table 2-53, unrelated to stakeholder comments, which have now been corrected.

The document referenced by PPL presents a range in the EULs for thermostats between 9.2 and 13.8 years depending on various factors. The Commission maintains the

change in EUL noting that the California eTRM value is based on extensive supporting research and analysis. PPL raises an important update to the ENRGY STAR Connected Thermostat Version 2.0 specification concerning the eligibility of baseboard heating systems as a primary heating type. However, given that this version of the specification is still in the development phase, the Commission declines to incorporate the technology eligibility into the TRM at this time.

#### **10. Section 2.2.12 – Furnace Maintenance<sup>23</sup>**

The Commission proposed to increase the measure life of this measure to 3 years in line with all other tune-up measures.

##### **a. Comments**

PECO highlights a possible error in the header of the default savings Table 2-55 (formerly Table 2-54) and requests clarification as to whether the default savings need to be scaled by the furnace capacity. PECO Comments at Appendix A, 3. FirstEnergy requests for the inclusion of peak demand savings for the measure. FirstEnergy Comments at Appendix A, 2. Duquesne Light suggests removing language from the Tentative Order calling for updates to baseline equipment efficiencies consistent with federal standards since this measure only applies to the maintenance of existing equipment. Duquesne Light Comments at 4.

##### **b. Disposition**

The Commission agrees with PECO and has corrected the error in Table 2-55 (formerly Table 2-54); the default values are unit savings for furnaces in each of the depicted cities and need not be scaled by the capacity of the furnace. The Commission disagrees with FirstEnergy and contends that peak demand savings for this measure are low and difficult to estimate reliably, and therefore declines to include peak demand

---

<sup>23</sup> See Section 2.2.12 – Furnace Maintenance of the 2021 TRM, Volume 2, page 56.

savings for this measure. Algorithms denoting a 0 value for peak demand savings have now been added to the measure. The Commission however agrees with Duquesne Light and has now removed the language calling for updates to baseline equipment efficiencies consistent with federal standards.

### **11. Section 2.3.1 – Heat Pump Water Heaters<sup>24</sup>**

The Commission proposed updating the temperature of the cold-water supply ( $T_{in}$ ) from 52 degrees (based on temperature data from 1999 to 2018) to 53 degrees (based on temperature data from 2003 to 2023).<sup>25</sup> The Commission also proposed updating the default cooling and heating system efficiencies (HSPF2 and SEER2) based on Act 129 2023 Pennsylvania Residential Baseline Study findings. Additionally, the Commission proposed aligning the baseline uniform energy factor ( $UEF_{base}$ ) table with federal minimum standards by removing the pre-2017 formulas and correcting the formulas for >55 gal and  $\leq 120$  gallons.

Since the Tentative Order and proposed TRM were made public for comment, the U.S. DOE has updated 10 CFR Parts 429 and 430 (effective date July 5, 2024), which affects Table 2-62 (formerly Table 2-61). The UEF values in this table have been updated to include current federal standards.

#### **a. Comments**

PECO identifies an incorrect table cross-reference within Table 2-60 (formerly Table 2-59). PECO Comments at Appendix A, 3.

---

<sup>24</sup> See Section 2.3.1 – Heat Pump Water Heaters of the 2021 TRM, Volume 2, page 58.

<sup>25</sup> This update impacts a number of other measures that use  $T_{in}$ , including 2.3.2 Solar Water Heaters, 2.3.7 Low-Flow Faucet Aerators, 2.3.8 Low-Flow Showerheads, 2.3.9 Thermostatic Shower Restriction Valves, and 2.3.10 Drain Water Heat Recovery Units.

PPL requests that the Eligibility section be updated to reference ENERGY STAR Version 5.0. PPL Comments at 5.

**b. Disposition**

The Commission agrees with PECO’s recommendation and has corrected the table cross-references within Table 2-60 (formerly Table 2-59). Furthermore, the Commission agrees with PPL and has corrected the reference in the Eligibility section. It now correctly references ENERGY STAR 5.0.

**12. Section 2.3.5 –Water Heater Temperature Setback<sup>26</sup>**

The Commission proposed updating the number of clothes washer cycles per year from 251 to 178 based on data from the U.S. Energy Information Administration’s 2020 Residential Energy Consumption Survey. The Commission also proposed updating the volume of hot water used per clothes dryer cycle from 7 gallons to 25 gallons to align with U.S. DOE and U.S. EPA guidance. Furthermore, the Commission proposed updating the default uniform energy factor ( $UEF_{WH}$ ) for electric storage water heaters from 0.90 to 0.92 and from 2.0 to 3.2 for heat pump water heaters (HPWHs) based on Act 129 2023 Pennsylvania Residential Baseline Study findings. Finally, the Commission proposed updating the default thermal efficiency of HPWHs ( $\eta_{elec}$ ) from 2.10 to 3.11 based on a calculation in the Maryland EmPOWER TRM that links UEF to coefficient of performance (COP).

**a. Comments**

The Commission did not receive any stakeholder comments for this measure.

---

<sup>26</sup> See Section 2.3.5 – Water Heater Temperature Setback of the 2021 TRM, Volume 2, page 74.

## **b. Disposition**

Although no stakeholders submitted comments, the Commission noted that the average UEF for HPWHs used to calculate the COP was incorrect. Table 2-69 (formerly Table 2-67) included a default COP value of 3.11 for HPWHs, which was incorrectly calculated using average UEF values from the ENERGY STAR guidelines for water heaters. The Commission has instead calculated the default COP for HPWHs using the average UEF of HPWHs found in the Act 129 2023 Pennsylvania Residential Baseline Study; this yields a new default COP of 3.56 for HPWHs. The error has been corrected in the final TRM.

## **13. Section 2.3.6 –Water Heater Pipe Insulation<sup>27</sup>**

The Commission proposed adopting the algorithms used in the 2023 Illinois Statewide TRM and the 2022 Arkansas TRM, which incorporate the surface area of the hot water heater pipes and the R-value of the new pipe insulation. This would improve the precision of the calculated savings values for water heater pipe insulation installation projects. The Commission also proposed updating the measure life from 13 years to 11 years to align with the California eTRM.

### **a. Comments**

PECO recommends including an option for HPWH in addition to electric resistance water heater type in the first paragraph of 2.3.6 Water Heater Pipe Insulation. PECO Comments at Appendix A, 3. FirstEnergy comments that the description of  $L_{vertical}$  should be the length of the pipe from the water heating source which runs vertically. Furthermore, FirstEnergy comments that this is a low-impact measure, so perhaps it would be acceptable to assume a certain horizontal / vertical length ratio rather than requiring two distinct length measurements. FirstEnergy Comments at 2.

---

<sup>27</sup> See Section 2.3.6 – Water Heater Pipe Insulation of the 2021 TRM, page 77.

## **b. Disposition**

The Commission agrees with PECO's recommendation to include an option for HPWH in addition to electric resistance water heaters. The Commission has amended the first paragraph to specify that HPWHs are eligible and has added a default efficiency value for HPWHs to Table 2-71 (formerly Table 2-69).

Additionally, the Commission agrees with FirstEnergy's comment regarding the description of L\_vertical and has fixed the typographical error. However, the Commission declines to adopt a certain horizontal / vertical length ratio rather than requiring two distinct length measurements because such a ratio would vary greatly depending on the geometry of each home. Instead, the Commission has amended Table 2-71 (formerly Table 2-69) to include a default value of 3 vertical feet if the vertical length of hot water pipe is unknown, following the guidance of the 2023 Illinois Statewide TRM.

## **14. Section 2.4.1 – ENERGY STAR Refrigerators<sup>28</sup> and Section 2.4.2 – ENERGY STAR Freezers<sup>29</sup>**

The Commission proposed updating the ENERGY STAR Most Efficient standards to the current (2024) specifications and adding the federal standards that go into effect in 2029 and 2030. The Commission also proposed removing the 36-inch height restriction for compact refrigerators and freezers as this is no longer a part of federal standards or ENERGY STAR criteria.

## **a. Comments**

PPL notes that application of new variables in the federal energy consumption algorithms ("I" and door coefficients) had not been defined clearly. PPL Comments at 6.

---

<sup>28</sup> See Section 2.4.1 – ENERGY STAR Refrigerators of the 2021 TRM, Volume 2, page 97.

<sup>29</sup> See Section 2.4.2 – ENERGY STAR Freezers of the 2021, Volume 2, TRM, page 105.

**b. Disposition**

The Commission agrees with PPL and has clarified when and how to apply the variable “I” and door coefficients in the federal energy consumption algorithms.

**15. Section 2.4.4 – ENERGY STAR Clothes Washers<sup>30</sup>**

The Commission proposed updating default values for the number of clothes washer cycles per year (cycles) and the percentage of homes with dryers that use the dryer every time clothes are washed (%dry/wash) with data from the 2020 U.S. DOE Residential Energy Consumption Survey.<sup>31</sup> In addition, the Commission proposed updating the percentage of water heaters that are electric (%Elec<sub>DHW</sub>) and the percentage of dryers that are electric (%Elec<sub>Dryer</sub>) based on Act 129 2023 Pennsylvania Residential Baseline Study findings. Furthermore, the Commission proposed updating the measure life from 11 to 14 years based on a more recent and reliable source. The Commission also proposed combining the capacity of baseline clothes washer (CAPY<sub>base</sub>) and the capacity of the ENERGY STAR clothes washer (CAPY<sub>EE</sub>) into a single variable (CAPY) consistent with other TRMs as the default values are the same. Finally, the Commission proposed adding the federal standards that become effective 3/1/28.

**a. Comments**

PECO highlights an incorrect table cross-reference. PECO Comments at Appendix A,4.

**b. Disposition**

The Commission agrees with PECO and has corrected the table cross-reference.

---

<sup>30</sup> See Section 2.4.4 – ENERGY STAR Clothes Washers of the 2021 TRM, Volume 2, page 115.

<sup>31</sup> These updates also apply to 2.4.5 ENERGY STAR Dryers.

## **16. Section 2.4.9 – ENERGY STAR Dehumidifiers<sup>32</sup>**

The Commission proposed updating default efficient values to reflect updates to ENERGY STAR specifications. The Commission also proposed updating the annual hours of use from 1,632 to 2,160 based on a more recent, dehumidifier metering study.

### **a. Comments**

PPL notes that the summer and winter peak demand savings in the default energy savings table were incorrect. PPL Comments at 6. PECO identifies an incorrect table cross-reference. PECO Comments at Appendix A, 3.

### **b. Disposition**

The Commission agrees with PPL and has corrected the summer peak demand savings and removed winter peak demand savings from the default energy table (there are no winter peak demand savings for this measure). Furthermore, the Commission agrees with PECO and has corrected the table cross-reference.

## **17. Section 2.4.10 –Dehumidifier Retirement**

The Commission did not propose any changes to the dehumidifier retirement measure, but stakeholder comments were submitted requesting an update to the measure.

### **a. Comments**

PPL suggests that the weather data be updated using NOAA's 15-year annual climate normals (2006-2020) to create consistency across weather impacted measures. PPL Comments at 6.

---

<sup>32</sup> See Section 2.4.9 – ENERGY STAR Dehumidifiers of the 2021 TRM, Volume 2, page 130.

**b. Disposition**

The Commission agrees with PPL and has utilized NOAA’s 15-year annual climate normals to update dry bulb temperature and the hourly dewpoint data was used to update relative humidity and temperature humidity index values. Annual kWh savings were recalculated to reflect the changes in weather data.

**18. Section 2.4.11 – ENERGY STAR Ceiling Fans<sup>33</sup>**

The Commission proposed updating the measure life from 15 to 10 years to better align with updated values and sources found in other TRMs. Additionally, the Commission proposed removing the lighting savings from the measure due to the 12/31/24 sunset of ENERGY STAR specifications for lamps and luminaires.

**a. Comments**

PECO highlights an incorrect table cross-reference. PECO Comments at Appendix A, 4. PPL suggests defining the term SF displayed in the defaults table as “SF Only.” PPL Comments at 6.

**b. Disposition**

The Commission agrees with PECO and PPL and has therefore corrected the table cross-reference and defined the term SF as single-family in the defaults table for clarity.

**19. Section 2.4.12 – ENERGY STAR Air Purifiers<sup>34</sup>**

The Commission proposed removing the default savings for this measure and using EDC data for savings calculations. A new federal standard for air purifiers has been introduced and prior to this no federal standard existed. The federal standard will be rolled out in two phases with a set of efficiency standards set to go into effect after December 31<sup>st</sup>, 2023, until 2025 and a more efficient set of standards that will be in effect

---

<sup>33</sup> See Section 2.4.11 – ENERGY STAR Ceiling Fans of the 2021 TRM, Volume 2, page 136.

<sup>34</sup> See Section 2.4.12 – ENERGY STAR Air Purifiers of the 2021 TRM, Volume 2, page 139.

after 2025. The set of standards set to go in effect after 2025 will be equivalent to current ENERGY STAR standards and currently ENERGY STAR is not in the process of releasing new specifications for this product.<sup>35</sup>

**a. Comments**

Duquesne Light notes that the current default of 1.0 watt for partial-on wattage ( $POW_{base}$ ) parameter is in line with the ENERGY STAR specification for non-connected units but connected units allow for a  $POW_{base}$  of 2.0 watts and recommends changing the default  $POW_{base}$  to 1.0 watt for non-connected units and 2.0 watts for connected units. Duquesne Light Comments at 4. PECO highlights an incorrect table cross-reference. PECO Comments at Appendix A,4.

**b. Disposition**

The Commission agrees with Duquesne Light and has changed the defaults for  $POW_{base}$  to reflect the differences between non-connected and connected units. In addition, the Commission agrees with PECO’s comments and has corrected the table cross-reference.

**20. Section 2.6.1 – Residential Air Sealing<sup>36</sup>**

Savings estimates under this section depend on an energy model of a representative prototype home. The Commission proposed replacing the current model with a new energy model created in BEopt v.2.8.0, a modelling tool developed by NREL.<sup>37</sup> The characteristics of the prototype model are based on data from the Act 129 2023 Pennsylvania Residential Baseline Study. Results from running the model under varying climate reference locations and HVAC configurations were used to generate a

---

<sup>35</sup> See <https://www.ecfr.gov/compare/2023-08-09/to/2023-08-08/title-10/chapter-II/subchapter-D/part-430/subpart-C/section-430.32>.

<sup>36</sup> See Section 2.6.1 – Residential Air Sealing of the 2021 TRM, page 148.

<sup>37</sup> See <https://www.nrel.gov/buildings/beopt.html>.

quadratic regression model and a table of regression coefficients. Savings are calculated by selecting the appropriate coefficients for the location and HVAC configuration and applying them in the algorithm along with factors defining the ratio of duct efficiency and HVAC equipment efficiency in the air-sealed home versus the prototype model and the pre- and post-air sealing air infiltration measurements in the home. These savings are capped at 40% of the HVAC system's expected consumption and include a correction to the application of equipment efficiency in this calculation. Finally, the Commission also proposed the introduction of advisories for implementers regarding indoor air quality and air safety in very tight homes.

**a. Comments**

FirstEnergy requests that the phrase “a blower-door test” be replaced with “blower door tests” in the second sentence, and that the words “in addition” be removed before the impact formulas on page 171. FirstEnergy Comments at Appendix A, 2.

**b. Disposition**

The Commission agrees with FirstEnergy's recommendations and has made the changes accordingly.

**21. Section 2.6.2 – Weather Stripping, Caulking, and Outlet Gaskets<sup>38</sup>**

The Commission proposed to add variables to the cooling and heating energy algorithms applicable to enable savings to be more easily calculated for measures installed via direct install programs. Specifically, in the cooling energy savings algorithm, the Commission proposed to add one variable to reflect the portion of sealed area served by room air conditions, and another variable to reflect the portion of homes which have comfort cooling. In the heating energy savings algorithm, the Commission proposed to add a variable reflecting the percent of homes with electric heating.

---

<sup>38</sup> See Section 2.6.2 – Weather Stripping, Caulking, and Outlet Gaskets of the 2021 TRM, Volume 2, page 153.

**a. Comments**

PPL points out that the formula for  $kW_{cool}$  incorrectly utilizes the term  $\%_{elec}$ , which should be  $\%_{cool}$ . PPL Comments at 6.

PECO notes that the default  $\%_{cool}$  value (corrected from  $\%_{elec}$ ) in the  $kWh_{cool}$  algorithm is 67%, which reflects only permanent cooling systems and does not include room air conditioners. However, the  $kWh_{cool}$  algorithm includes a  $F_{RAC}$  term to derate the savings based on areas actually cooled by room air conditioning when these systems are present. PECO Comments at Appendix A, 4.

FirstEnergy requests to add “exterior” to eligibility bullets to ensure measures are installed on the homes’ exteriors. FirstEnergy also suggests adding restrictions to limit the use of spray foam cans to reflect the recent SWE guidance memo regarding verifying savings from spray foam used under this measure. FirstEnergy Comments at Appendix A, 2.

**b. Disposition**

The Commission agrees with PPL’s comment and has replaced  $\%_{elec}$  with  $\%_{cool}$  in the  $kWh_{cool}$  algorithm. The Commission agrees with PECO’s recommendation to update the  $\%_{cool}$  value to reflect both permanent and removable cooling systems. The default  $\%_{cool}$  value has been updated to allow users to select a default value to reflect either a permanent, removable, or total comfort cooling system penetration according to Table 92 of the Act 129 2023 Pennsylvania Residential Baseline Study. The Commission also updated Table 2-143 and Table 2-144 (formerly Table 2-141 and Table 2-142) to reflect the new 76% default total cooling system penetration for  $\%_{cool}$ .

The Commission agrees with FirstEnergy’s suggestion to add “exterior” to the eligibility criteria and has updated the Eligibility section’s language for clarity. Additionally, the Commission agrees with FirstEnergy’s recommendation to incorporate

the recent SWE guidance memo into the TRM. The guidance memo’s intent was not to limit the usage of spray foam cans under this measure; rather, the memo was intended to clarify how savings should be verified. Language reflecting the guidance memo was therefore added to the Evaluation Protocols section of this measure in the TRM.

## **22. Section 2.6.3 – Ceiling/Attic, Wall, Floor, and Rim Joist Insulation<sup>39</sup>**

The Commission proposed to remove the “AHF” term from the cooling energy savings algorithm. The AHF is a factor used to account for inaccuracies in engineering algorithms; however, the value’s reference source indicates that the AHF value represents an adjustment factor for a combined air sealing and attic insulation measure and does not provide an insulation-specific adjustment factor. Therefore, this adjustment factor is considered not appropriate for this insulation-only measure and should be removed from the algorithm.

### **a. Comments**

FirstEnergy requests clarification if multifamily buildings qualify for this measure. FirstEnergy also points out that the reference for  $R_{\text{base}}$  should be Table 2-147 (formerly Table 2-145) instead of Table 12. Lastly, FirstEnergy indicates that meeting high ENERGY STAR requirements is limiting and especially high for ceilings and attics. FirstEnergy argues that for homes with low  $R_{\text{base}}$  values, most of the savings from R-60 insulation in ceilings/attics can be obtained by reaching R-40 or R-50. Thus, FirstEnergy recommends that the ENERGY STAR requirements be removed or relaxed. FirstEnergy Comments at Appendix A, 2.

### **b. Disposition**

The Commission understands the ambiguity raised by FirstEnergy around the application of the measure in multifamily spaces and has therefore added clarification in

---

<sup>39</sup> See Section 2.6.3 – Ceiling/Attic, Wall, Floor, and Rim Joist Insulation of the 2021 TRM, Volume 2, page 159.

the Eligibility section. The Commission agrees with FirstEnergy’s recommendation and has corrected the reference for  $R_{\text{base}}$  from Table 12 to Table 2-147. The Commission also agrees with FirstEnergy’s recommendation that ENERGY STAR requirements be removed and has updated the measure to remove reference to a minimum added R-value requirement in retrofit cases.

### **23. Section 2.6.4 – Basement or Crawl Space Wall Insulation<sup>40</sup>**

The Commission proposed to remove the “AF” term from the heating energy savings algorithm. The AF term is an adjustment factor accounting for prescriptive engineering algorithms overestimating savings based on a 2012 study. This value could not be replicated from the previously referenced study and a similar adjustment factor from comparable studies could not be found.

#### **a. Comments**

PPL requests that the measure protocol specify that only residential buildings with a primary electric heating and/or cooling source are eligible. PPL Comments at 7. FirstEnergy recommends wording changes for clarity, specifically: refining the language in the first paragraph, replacing the word “sealing” with “encapsulation,” and correcting the typographical errors in the Framing Factor options. FirstEnergy Comments at Appendix A, 3.

#### **b. Disposition**

The Commission agrees with PPL’s recommendation and has added language to clarify that only residential buildings with a primary electric heating and/or cooling source are eligible in the Eligibility section. Furthermore, the Commission agrees with all of FirstEnergy’s word changes and has updated the measure protocol accordingly.

---

<sup>40</sup> See Section 2.6.4 – Basement or Crawl Space Wall Insulation of the 2021 TRM, Volume 2, page 164.

#### **24. Section 2.6.5 – ENERGY STAR Windows<sup>41</sup>**

The Commission proposed revisions to this algorithm to better represent the savings of homes with ductless mini-splits serving only a portion of the home and introduce support for savings from room air conditioners.

##### **a. Comments**

PPL notes that the sourced measure life and Act 129 limited measure life had been transposed. PPL Comments at 7.

##### **b. Disposition**

The Commission concurs with PPL and has corrected the measure life accordingly.

#### **25. Section 2.7.1 – Residential New Construction<sup>42</sup>**

The Commission proposed to incorporate the guidance provided in the June 1, 2021, Multifamily New Construction Interim Measure Protocol into the existing Residential New Construction measure. All multifamily buildings will be eligible for this measure, provided they meet 2023 ENERGY STAR Multifamily New Construction program requirements. The Commission additionally proposed to continue to reference energy modeling software approved by RESNET (for single dwellings) and the ENERGY STAR Multifamily New Construction program (for multifamily). The Commission also proposed that there be two options for calculating peak demand savings: first, directly from the energy modeling software when hourly outputs are available from the software, or second, using TRM default energy to demand factors when hourly outputs are not available from the software. Furthermore, the Commission proposed updating the parameters of the baseline code-compliant home according to the requirements of the 2021 IECC and updated federal standards. Multifamily buildings

---

<sup>41</sup> See Section 2.6.5 – ENERGY STAR Windows of the 2021 TRM, Volume 2, page 169.

<sup>42</sup> See Section 2.7.1 – Residential New Construction of the 2021 TRM, Volume 2, page 172.

will follow the appropriate residential or commercial code in accordance with the 2021 IECC building definitions.

**a. Comments**

MaGrann, EAM and ReVireo and Performance Systems Development recommend the Commission and SWE perform an ongoing review of ENERGY STAR’s Single Family New Homes and Multifamily New Construction programs to ensure the TRM measure protocol accurately reflects up-to-date ENERGY STAR guidance. MaGrann, EAM and ReVireo Comments at 1 and Performance Systems Development Comments at 2.

MaGrann, EAM and ReVireo, Performance Systems Development, and UGI recommend adopting a market practice baseline instead of a code minimum baseline. MaGrann, EAM and ReVireo Comments at 1, Performance Systems Development Comments at 3, 4, and 6, and UGI Reply Comments at 4.

Performance Systems Development recommends adding an alternative pathway for approving simulation software in addition to the current RESNET accredited software list, in accordance with ENERGY STAR’s Certification System guidelines.<sup>43</sup> Performance Systems Development Comments at 2. Performance Systems Development proposes to include the impacts of non—participant spillover in addition to gross savings for new construction programs. Performance Systems Development Comments at 4 and 7.

---

<sup>43</sup> See <https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Certification%20System%202022-05-09.pdf>

FirstEnergy requests clarification of the definition of “Multifamily” and if DOE-2.2 was intended as the approved software instead of DOE-2.1. FirstEnergy Comments at Appendix A, 3.

**b. Disposition**

The Commission agrees with the recommendations of MaGrann, EAM and ReVireo and Performance Systems Development to perform ongoing reviews of ENERGY STAR guidelines. Accordingly, the Commission has directed the SWE to conduct an annual codes and standards review, which includes ENERGY STAR guidelines, as part of the TRM updating process (see Section B.3).

The Commission rejects the recommendation of MaGrann, EAM and ReVireo, Performance Systems Development, and UGI to adopt a market practice baseline on the grounds that the 2026 TRM utilizes a codes and standards baseline as described in Volume 1 of the 2026 TRM, Sections 1.4 and 1.8, specifically: “the baseline used for calculating energy savings is the construction of a new building or installation of new equipment that complies with applicable code, standard or industry standard practice in the absence of applicable code or standards in place at the time of construction/installation/substantial renovation.”

The Commission agrees with Performance Systems Development’s recommendation to add alternative pathways to approve simulation software and has incorporated the ENERGY STAR Certification System’s broader simulation software approval pathway into the TRM using language suggested by Performance Systems Development and contained in the ENERGY STAR guidelines. The Commission agrees with Performance Systems Development and has accepted Performance Systems Development’s proposal regarding the use of non—participant spillover, but only to improve program design and implementation by applying net savings in the TRC Test.

However, the Commission rejects Performance Systems Development’s proposal regarding the use of non-participant spillover, or more broadly net savings, in determining Act 129 compliance and targets, citing the Phase IV Implementation Order, Section E.2, which states that compliance is based on gross savings and the cost—effectiveness of the portfolio offered by EDCs will continue to be based on the gross TRC ratio.

Regarding FirstEnergy’s request for clarification, the Commission has added clarification to the measure protocol’s Eligibility section to define single-family and multifamily buildings, which aligns with the ENERGY STAR Multifamily New Construction program guidelines. Additionally, the Commission agrees with FirstEnergy’s comment about referencing DOE2-2 rather than DOE2-1 and has corrected the reference from DOE-2.1 with the current DOE-2 version, DOE-2.2.

#### **26. Section 2.7.2 – ENERGY STAR Manufactured Homes<sup>44</sup>**

The Commission proposed allowing the option of estimating whole-home energy and peak demand savings using energy modeling software when the software provides hourly consumption outputs. If the software does not provide hourly energy consumption outputs, the Commission proposed to estimate peak demand savings using deemed energy to demand factors. The Commission also proposed updating the parameters of the baseline manufactured home according to the requirements of updated federal standards that will be effective July 1, 2025. The Commission further proposed updating the parameters of the ENERGY STAR manufactured home in accordance with the v3 standards of the ENERGY STAR Manufactured Homes program.

---

<sup>44</sup> See Section 2.7.2 – ENERGY STAR Manufactured Homes of the 2021 TRM, Volume 2, page 180.

**a. Comments**

PPL recommends the removal of text referring to calculating additional demand savings from other measures in the TRM since the savings for this measure are calculated via a building simulation model which should incorporate savings from all measures implemented at the home. PPL Comments at 7.

**b. Disposition**

The Commission agrees with PPL’s comment and has removed the measure protocol text referring to additional demand savings being derived from other TRM measures.

**27. Section 2.7.3 – Home Energy Reports<sup>45</sup>**

The Commission did not propose any changes to this measure other than expansion to include winter peak demand savings algorithms. However, one stakeholder provided comments on the measure characterization.

**a. Comments**

FirstEnergy requests that the Commission clarify its disposition on resurrecting cohorts that have ceased treatment for a total of three Act 129 program years and whether this counts as “resetting the clock” to Year 1 for said cohorts. Additionally, FirstEnergy suggests that the two-year period without persistence adjustments should be counted from the date that a cohort launches. FirstEnergy Comments at Appendix A, 3.

**b. Disposition**

Regarding FirstEnergy’s request for clarification, the Commission notes that the Final 2026 TRM includes a fifth item in the enumerated list of Home Energy Report (HER) policy and technical considerations. The additional guidance explicitly states the

---

<sup>45</sup> See Section 2.7.3 – Home Energy Reports of the 2021 TRM, Volume 2, page 185.

implied suggestion whereby an HER cohort with no treatment for three Act 129 program years should be modeled like a new cohort. In this scenario, the first program year after the three (or more) year break is considered Year 1 of Exposure in the savings algorithms. The Commission declines FirstEnergy’s suggestion to modify the mapping of Act 129 program year to the “Year of HER Exposure” term in the savings algorithms. The existing guidance ensures that all months within a program year have the same persistence assumption applied.

**28. Measure Number Changes**

The changes proposed herein will result in new measure numbers for several residential measures. Table 9 below shows the current measure name and number and the new measure name and number for all affected measures. The table also shows measures that the Commission proposed removing – these measures are discussed in more detail later.

**a. Comments**

Duquesne Light requests that Table 9 include newly added sections in addition to renumbered and deleted sections. Duquesne Light Comments at 4.

**b. Disposition**

The Commission agrees with Duquesne Light and has made changes to Table 9 and also Table 10.

**Table 9: Measure Number Changes for Residential Measures**

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
2.1.1	ENERGY STAR Lighting	2.1.1	Residential LED Lighting
2.2.2	High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option	2.2.3	High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
2.2.3	ECM Circulation Fans	2.2.4	ECM Circulation Fans
2.2.4	GSHP Desuperheaters	2.2.5	GSHP Desuperheaters
2.2.5	Air Conditioner & Heat Pump Maintenance	2.2.6	Air Conditioner & Heat Pump Maintenance
2.2.6	Fuel Switching: Electric Heat to Gas/Propane/Oil Heat	-	Deleted
2.2.7	ENERGY STAR Room Air Conditioners	2.2.7	Room Air Conditioners
-	Non-existent	2.2.9	Window Heat Pump
2.2.9	Duct Sealing & Duct Insulation	2.2.10	Duct Sealing & Duct Insulation
2.2.10	Air Handler Filter Whistles	2.2.11	Air Handler Filter Whistles
2.2.11	ENERGY STAR Certified Connected Thermostats	2.2.12	ENERGY STAR Certified Connected Thermostats
2.2.12	Furnace Maintenance	2.2.13	Furnace Maintenance
-	Non-existent	2.2.14	ENERGY STAR Bathroom Exhaust Fan
2.3.3	Fuel Switching: Electric Resistance to Fossil Fuel Water Heater	-	Deleted
2.3.4	Water Heater Tank Wrap	2.3.3	Water Heater Tank Wrap
2.3.5	Water Heater Temperature Setback	2.3.4	Water Heater Temperature Setback
2.3.6	Water Heater Pipe Insulation	2.3.5	Water Heater Pipe Insulation
2.3.7	Low Flow Faucet Aerators	2.3.6	Low Flow Faucet Aerators
2.3.8	Low Flow Showerheads	2.3.7	Low Flow Showerheads
2.3.9	Thermostatic Shower Restriction Valves	2.3.8	Thermostatic Shower Restriction Valves
-	Non-existent	2.3.10	Smart Water Heater Controller
2.3.10	Drain Water Heat Recovery Units	2.3.9	Drain Water Heat Recovery Units
-	Non-existent	2.4.4	Low-Capacity Refrigerator / Freezer Recycling Without Replacement

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
2.4.4	ENERGY STAR Clothes Washers	2.4.8	ENERGY STAR Clothes Washers
-	Non-existent	2.4.5	ENERGY STAR Coolers
2.4.5	ENERGY STAR Clothes Dryers	2.4.9	ENERGY STAR Clothes Dryers
2.4.6	Heat Pump Clothes Dryers	-	Deleted
-	Non-existent	2.4.6	Cooler Recycling With and Without Replacement
2.4.7	Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer	-	Deleted
-	Non-existent	2.4.7	Residential Induction Cooktops
2.4.8	ENERGY STAR Dishwashers	2.4.10	ENERGY STAR Dishwashers
2.4.9	ENERGY STAR Dehumidifiers	2.4.11	ENERGY STAR Dehumidifiers
2.4.10	Dehumidifier Retirement	2.4.12	Dehumidifier Retirement
2.4.11	ENERGY STAR Ceiling Fans	2.4.13	ENERGY STAR Ceiling Fans
2.4.12	ENERGY STAR Air Purifiers	2.4.14	ENERGY STAR Air Purifiers
2.5.1	ENERGY STAR Office Equipment	-	Deleted
2.5.2	Advanced Power Strips	2.5.1	Advanced Power Strips
-	Non-existent	2.8.1	ENERGY STAR Pool Pump
2.8.1	Variable Speed Pool Pumps	2.8.2	Single Speed Pool Pump Replacement
-	Non-existent	2.8.3	Photovoltaic (PV) Solar Generation

## **F. Existing C&I EE&C Measure Protocols**

The following sections describe clarifications and modifications to the C&I measure protocols. Some of the proposed changes in our Tentative Order received no stakeholder comments. Those proposed changes, which are not reproduced in the sections to follow, are hereby adopted by the Commission for use in Phase IV. Affected measures include:

3.1.3 - Lighting Controls

3.1.4 - LED Exit Signs

3.1.5 - LED Channel Signage

3.2.6 - Small C&I HVAC Refrigerant Charge Correction

3.2.7 - ENERGY STAR Room Air Conditioner

3.2.9 - Controls: Economizer

3.2.10 - Computer Room Air Conditioner

3.2.11 - Computer Room Air Conditioner/Handler Electronically Commutated

### **Plug Fans**

3.2.12 - Computer Room Air Conditioner/Handler VSD on AC Fan Motors

3.3.4 - VSD on Kitchen Exhaust Fan

3.3.5 - ECM Circulator Pump

3.3.6 - High Efficiency Pumps

3.5.2 - High-Efficiency Evaporator Fan Motors for Walk-In or Reach-In

### **Refrigerated Cases**

3.5.3 - Controls: Evaporator Fan Controllers

3.5.4 - Controls: Floating Head Pressure Controls

3.5.5 - Controls: Anti-Sweat Heater Controls

3.5.6 - Controls: Evaporator Coil Defrost Control

3.5.9 - Night Covers for Display Cases

3.5.10 - Auto Closers

3.5.13 - Suction Pipe Insulation for Walk-In Coolers and Freezers

3.5.16 - Air-Cooled Refrigeration Condenser

- 3.5.18 - Refrigeration Economizers
- 3.6.1 - ENERGY STAR Clothes Washer
- 3.6.2 - ENERGY STAR Bathroom Ventilation Fan in Commercial Applications
- 3.7.2 - Controls: Beverage Machine Controls
- 3.7.3 - Controls: Snack Machine Controls
- 3.7.5 - ENERGY STAR Combination Oven
- 3.7.6 - ENERGY STAR Commercial Convection Oven
- 3.7.7 - ENERGY STAR Commercial Fryer
- 3.7.8 - ENERGY STAR Commercial Hot Food Holding Cabinet
- 3.7.9 - ENERGY STAR Commercial Dishwasher
- 3.7.10 - ENERGY STAR Commercial Griddle
- 3.9.1 - ENERGY STAR Office Equipment
- 3.9.2 - Office Equipment – Network Power Management Enabling
- 3.9.3 - Advanced Power Strips
- 3.9.4 - ENERGY STAR Servers
- 3.9.5 - Server Virtualization
- 3.10.4 - Air Tanks for Load/No Load Compressors
- 3.10.6 - Compressed Air Controller
- 3.10.7 - Compressed Air Low Pressure Drop Filters
- 3.10.8 - Compressed Air Mist Eliminators
- 3.11.1 - High Efficiency Transformer
- 3.11.2 - Engine Block Heat Timer
- 3.12.1 - Load Curtailment for Commercial and Industrial Programs
- 4.1.4 – Heat Reclaimers
- 4.1.7 - Variable Speed Drive (VSD) Controller on Dairy Vacuum Pumps

The changes proposed by the Commission in our Tentative Order that received stakeholder comments are addressed below.

### **1. Section 3.1.1 – Lighting Improvements<sup>46</sup>**

The Commission proposed to rename this measure “Lighting Retrofits” to align with clarified vintage and baseline assumptions. This measure only applies to cases where program participants replace working lighting equipment with Design Lights Consortium (DLC) certified LED equipment or permanently remove working lamps or fixtures. We believe the revised measure name will help to distinguish this measure from the Midstream Lighting Incentives measure which follows a replace on burnout vintage.

The Commission proposed assuming a single measure life of 15 years for all LED Lighting Equipment and a measure life of 11 years for Permanent Lamp/Fixture Removal. In addition, because the EISA “backstop” provision, which came into effect in August 2023, introduced minimum efficacy standards for GSLs, screw-based integrated LED lamps are no longer eligible for lighting retrofit incentives. The Commission therefore proposed to remove screw-based lighting from this measure.

The Energy Policy Act of 2005 (EPACT 2005) and EISA of 2007 introduced new efficacy standards for linear fluorescent bulbs and ballasts, effectively phasing out most T-12 bulbs. As a result, standard T-8s became the baseline for Act 129 T-12 linear fluorescent retrofits beginning with the 2016 TRM. Despite the standard change, the Act 129 2023 Non-Residential Baseline Study found approximately 14% of all indoor linear general service lighting in Pennsylvania businesses was T-12 linear fluorescent. To address this, the Commission proposed allowing existing T-12 fixtures to be used as a baseline provided the existing fixture is in working condition at the time of the retrofit.

The Commission also proposed adding interactive energy and demand impacts for winter, as well as adding new HVAC configurations for determining the interactive energy and demand factors. Five HVAC configurations, AC with Fossil Fuel Heat, AC

---

<sup>46</sup> See Section 3.1.1 – Lighting Improvements of the 2021 TRM, Volume 3, page 1.

with Electric Heat, Fossil Fuel Heat Only, Electric Heat Only, and Unknown (Market Average) replaced the two heating fuel configurations used in the 2021 TRM, which consisted of Non-Electric Heat and Electric Heat.

Finally, the Commission proposed an additional savings control factor strategy, Networked Lighting Control. A networked lighting control system consists of an intelligent network of individually addressable luminaires and control devices, allowing for the application of multiple control strategies and programmability.

**a. Comments**

PPL requests the Commission clarify the definition of the Network Lighting Control strategy that was added to the Savings Control Factor Assumptions table. PPL notes that the 49% savings factor from source 16 was based on sites with and without Luminaire Level Lighting Control (LLLC). Based on this, PPL recommends specific language be added to the definition stating that the Network Lighting Control strategy may still apply when LLLC is not present. PPL Comments at 8.

PECO questions whether source 6 should be Version 10 of the Mid Atlantic TRM rather than the 2017 lighting metering study by Navigant Consulting referenced in the proposed TRM. PECO Comments at Appendix A, 5.

Duquesne Light asserts that the Commission's proposed limitation of measure 3.1.1 to the Early Replacement is inconsistent with industry standard practice and suggests that Replace on Burnout should be the default for downstream C&I lighting. Duquesne Light's comments include excerpts from other state guidance documents which support this position. Duquesne Light also cites increased complexity due to the need for dual baseline or adjusted EUL calculations when early replacement is used and notes that each of its four prior EE&C plans assumed a Replace on Burnout vintage when estimating TRC costs. Duquesne Light Comments on Pages 7-9.

FirstEnergy notes that the proposed summer and winter CFs for 1-shift, 2-shift, and 3-shift Industrial building type are identical despite having very different hours of use (HOU). FirstEnergy then states that 1-shift and 2-shift manufacturing facilities generally have much lower CFs. In Phase IV this led to evaluated CFs based on verbal verification or on-site monitoring that were much lower than the TRM CFs used by the implementation CSPs in good faith. FirstEnergy suggests CFs closer to 0.4 or 0.5 since operation generally starts in the morning and ends by 4pm at the latest. FirstEnergy Comments at Appendix A, Page 7.

#### **b. Disposition**

The Commission agrees with PPL that Network Lighting Controls do not require LLLC, and the 49% savings factor may apply to controls projects which meet the other definitions of Network Lighting Control, but do not have LLLC. The definition of the Network Lighting Control strategy has been modified to clarify that LLLC is not a required element. A similar change has been made to the “Lookups” tab of the Appendix C Lighting Audit and Design Tool.

The Commission disagrees with PECO and maintains that source 6 was correctly referenced in the proposed TRM. Version 10 of the Mid Atlantic TRM used the Navigant study as the basis for its commercial lighting HOU and CF assumptions. As a rule, the Commission prefers to directly reference studies or research efforts rather than pointing to TRMs from other states which reference those studies. This allows stakeholders to directly review the underlying research without searching other state TRMs to locate the underlying study.

The Commission appreciates Duquesne Light’s concerns about the measure vintage issue but rejects Duquesne Light’s suggestion to add the Replace on Burnout vintage to measure 3.1.1 of the 2026 TRM. The proposed change was a deliberate update to impose consistency across EDCs on this issue and ensure alignment between savings

claims and incremental cost assumptions. The baseline wattage values for measure 3.1.1 and the associated Appendix C Lighting Audit and Design Tool are determined by the specifications of the replaced equipment. A Replace on Burnout vintage requires assumptions about the least efficient new equipment the participant could purchase which are not part of the measure characterization.

The excerpts Duquesne Light presents to support its position are undercut by the Commission and SWE's understanding of the issue in New York. Duquesne Light cites Appendix M of the New York TRM (Guidelines for Early Replacement Condition) but doesn't also cite Appendix O (Commercial and Industrial Lighting Policy) which addresses the C&I lighting explicitly. The guidance in Appendix O directly contradicts Duquesne Light's presentation of measure vintage in New York state energy efficiency programs. Specifically, Appendix O states:<sup>47</sup>

Regarding commercial and industrial lighting issues, the technical manual, effective 1/1/11 [as modified September 2012], states: **“The baseline condition is assumed to be the existing [and operational] lighting fixture in [all applications other than new construction or extensive renovations which trigger the building code].” This makes the savings baseline and costs for TRC analysis independent of the age of the operational fixture.** This approach reflects the frequent impracticality of determining the age of lighting fixtures.

Absent this provision, replacement of fixtures in place which are either (1) irreparable (unusable and not economic to repair) or, (2) operating and not demonstrably younger than their EUL (in short, broken or past EUL) would be treated as normal/end of life replacement: modeled with incremental costs and with incremental savings for the full EUL of the new measure, including for first year scorecard reporting. Fixtures in place in working order and demonstrably aged below their EUL would get early replacement treatment which, for most non-lighting measures, would mean dual baseline treatment per Appendix M. **Appendix M, however, excludes lighting**

---

<sup>47</sup> See New York Technical Reference Manual. (2024, version 11). Filed October 6, 2023. Pages 1385-1386. <https://dps.ny.gov/technical-resource-manual-version-11-filed-october-6-2023-effective-january-1-2024>

**from such treatment. Therefore, the conventional early replacement modeling of full costs and full savings would still apply, with the full savings against the old fixture in place modeled for the full EUL of the new equipment and reported as first year scorecard savings.**

If a lighting fixture of any age is operational, replacement is early replacement. The full savings against the fixture in place will be reported as first year savings and modeled for the full EUL of the replacement measure in TRC screening. Costs will be full costs, the total costs of the replacement, as is usual for early replacement analysis outside Appendix M.

Based on our review of the New York TRM, EM&V reports, and utility filings we find that the proposed handling of downstream lighting in the Pennsylvania TRM is aligned with New York rather than at odds with it. This casts doubt on Duquesne Light's characterization of its recommendation as "industry standard practice" on the topic. The Commission maintains that the proposed separation of TRM measures by vintage sets clear guidance on this issue for the EDCs and their CSPs. Measure 3.1.1 characterizes the Early Replacement vintage, measure 3.1.2 characterizes New Construction, and measure 3.1.6 characterizes the Replace on Burnout vintage.

The Commission agrees with FirstEnergy and adopts FirstEnergy's suggestion to differentiate the summer and winter CFs between 1-shift, 2-shift, and 3-shift Industrial/Manufacturing facilities. The updated values were computed by applying the ratio of annual HOU between 1-shift or 2-shift and 3-shift to the 3-shift CFs. The resulting summer CFs are 0.41 and 0.68 for 1-shift and 2-shift facilities respectively. The updated winter CFs are 0.35 and 0.58 for 1-shift and 2-shift facilities respectively. As suggested by FirstEnergy, this change should help limit variation between reported gross and verified gross summer and winter peak demand savings.

## **2. Section 3.1.2 – New Construction Lighting<sup>48</sup>**

The Commission proposed updating the interior and exterior lighting power density (LPD) values used to calculate baseline wattage values to align with the allowances in IECC 2021. The LPD values in IECC 2021 are generally lower than the allowances in the 2021 TRM, which were based on IECC 2015.

### **a. Comments**

PECO suggests removing the reference to “tradable” versus “non-tradable” exterior spaces from Table 3-11 as this methodology is used by ASHRAE for lighting takeoffs and is not relevant for calculating savings estimates. PECO Comments at Appendix A, 5.

### **b. Disposition**

The Commission agrees with and has adopted PECO’s recommendation. The Commission has removed references to “tradable” versus “non-tradable” exterior spaces in Table 3-11. These terms still appear in the Eligibility Requirements section of the measure characterization which explains that the TRM does not distinguish between tradable and non-tradable exterior spaces.

## **3. Section 3.1.6 – LED Refrigeration Display Case Lighting<sup>49</sup>**

The Commission proposed adding a winter CF to the measure equal to the winter CF for the “Grocery” building type. The Commission also proposed to align the summer CF for this measure with the summer CF for the “Grocery” building type.

### **a. Comments**

FirstEnergy notes that refrigeration display case lighting can be controlled by occupancy sensors and suggests the algorithms be expanded to multiply the HOURS term

---

<sup>48</sup> See Section 3.1.2 – New Construction Lighting of the 2021 TRM, Volume 3, page 15.

<sup>49</sup> See Section 3.1.6 – LED Refrigeration Display Case Lighting of the 2021 TRM, Volume 3, page 34.

by  $(1 - \text{SVG}_{\text{base}})$  like other commercial lighting measures. FirstEnergy Comments at Appendix A, 3.

#### **b. Disposition**

The Commission agrees with FirstEnergy’s suggestion and has expanded the algorithms that allow EDCs to explicitly account for reduced operating hours and CFs when controls are present. Projects involving installation of lighting controls in refrigerated cases should still follow the algorithms and assumptions in Section 3.1.3 – Lighting Controls.

#### **4. Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs<sup>50</sup>**

The Commission proposed to rename this measure “Midstream Lighting Incentives” and make it exclusive to the replace on burnout vintage. Given the replace—on—burnout vintage, the Commission proposed to have the least efficient technology available for purchase set the baseline. The Commission proposed removal of most screw-based lamps from this measure due to EISA standards. The remaining lamps are exempt under the US DOE definition of GSLs. For these exempt products we proposed to retain the  $\text{Watts}_{\text{base}}$  tables by equipment type. For linear lamps, LED fixtures, and retrofit kits we proposed to simplify the baseline wattage calculations by specifying a default efficacy value. Efficacy is the lumen output per input Watt. Instead of tables with rows for various lumen ranges, the SWE calculated baseline efficacy values using the methodology from the 2021 TRM. This allows users to quickly compute baseline wattage based on the rated lumen output of the program-supported product and streamlines the measure characterization considerably.

---

<sup>50</sup> See Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs of the 2021 TRM, Volume 3, page 36.

**a. Comments**

PPL notes that the energy and demand savings algorithms of the proposed 2026 TRM show  $(1 - SVG_{\text{base}})$  and  $(1 - SVG_{\text{ee}})$  where the 2021 TRM showed  $(1 + SVG_{\text{base}})$  and  $(1 + SVG_{\text{ee}})$  and requests the Commission clarify if the change was an error or an actual change. PPL Comments at 8. FirstEnergy states that EDC data gathering should be an option for the  $kW_{\text{base}}$  term. FirstEnergy also suggests that the proposed TRM is unclear whether baseline control savings factors should be applied if the evaluator finds existing baseline controls. FirstEnergy Comments at Appendix A, 3.

**b. Disposition**

The Commission agrees with PPL's comment and notes that the energy and demand savings algorithms in the 2021 TRM were incorrect. Lighting controls lower the HOU and CFs of lighting equipment. This error was identified early in Phase IV by multiple CSPs and recorded in a workbook of TRM issues and clarifications shared by the SWE, the EDCs, and their EM&V contractors. The error was more formally addressed in August 2022 when the SWE issued a set of measure revisions as part of the Codes and Standards process described in Section B.3.

The Commission rejects FirstEnergy's suggestion to allow EDC data gathering for the baseline wattage. Since this measure is limited to the Replace on Burnout vintage, the appropriate baseline is not the replaced lighting system. Rather, the baseline is the least efficient lighting product the participant could choose to purchase with comparable characteristics and performance. The Commission recommends FirstEnergy have its EM&V contractor work directly with the SWE regarding the handling of the  $SVG_{\text{base}}$  parameter when primary data collection on the evaluation sample returns site-specific evidence of baseline controls. This type of issue is best addressed in the Pennsylvania Evaluation Framework and EDC EM&V plans.

## **5. Section 3.2.1 – HVAC Systems<sup>51</sup>**

The Commission proposed updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates to federal standards. The proposed introduction of ETDFs for peak demand calculations (described in Section B.2) eliminates the need for EER/EER2 metrics; the Commission suggested removing the usage of SEER to EER conversion factors from the measure.

### **a. Comments**

PPL notes the inclusion of Table 3-26, CF values for HVAC Systems, under the primary HVAC Systems measure and requests that the table be moved to measure 3.2.9, which is the only current measure using the data table. PPL Comments at 8. PPL and FirstEnergy request adding the “cool” and “heat” subscripts to the “kWh” term in the peak demand calculation algorithms. PPL Comments at 8. FirstEnergy Comments at Appendix A, 4.

FirstEnergy requests clarification on the appropriate efficiency metrics to use for the calculation of peak demand savings and recommends that the terminology of standard versus non-standard packaged terminal equipment be clarified by adding the definitions from eCFR 431.92. In addition, FirstEnergy requests highlighting a footnote below table 3-24 to draw the readers’ attention to it. FirstEnergy Comments at Appendix A, 4.

### **b. Disposition**

The Commission agrees with PPL’s recommendation to move Table 3-26 to measure 3.2.9; its new table number is Table 3-54. Additionally, the Commission agrees with PPL and FirstEnergy regarding the need for distinct identification of heating and cooling-specific values of kWh savings in the peak demand savings calculations. The measure has been updated to reflect this change.

---

<sup>51</sup> See Section 3.2.1 – HVAC Systems of the 2021 TRM, Volume 3, page 44.

The Commission agrees with FirstEnergy’s comments requesting clarification in usage of efficiency metrics for savings and peak demand calculations and has made several clarifications such as adding subscripts "cool" and "heat" respectively in the delta kWh terms in the peak kW formulas. The Commission agrees with FirstEnergy’s comment to clarify the definition of non-standard packaged terminal equipment and has now added the federal standards definitions under Table 3-24 and a note number superscript identifying the “subtraction of 0.2 from the baseline efficiency values.”

## **6. Section 3.2.2 – Electric Chillers<sup>52</sup>**

The Commission proposed updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates made with the federal standards. Post adoption of ETDFs for peak demand calculations, the Commission proposed to edit the savings algorithms to use the Integrated Part-Load Value metric alone.

### **a. Comments**

PECO suggests changing the notes under Table 3-33 (formerly Table 3-34) for efficiency values to default to full load values for systems under Path A, and part load (IPLV) values for systems under Path B. PECO Comments at Appendix A, 5. FirstEnergy highlights an incomplete sentence under the notes of Table 3-29 (formerly Table 3-30). FirstEnergy Comments at Appendix A, 5.

### **b. Disposition**

The Commission disagrees with PECO’s comments and finds no inconsistencies in the notes under Table 3-33 (formerly Table 3-34). Systems optimized to full load (Path A) but performing at part load conditions will have an IPLV chosen. Conversely, systems optimized to part load conditions (Path B) but performing at full load will have a

---

<sup>52</sup> See Section 3.2.2 – Electric Chillers of the 2021 TRM, Volume 3, page 53.

full load value chosen. The Commission agrees with PECO that the highlighted sentence was incomplete and was erroneously copied from the Phase IV TRM that is no longer applicable to Phase V as ETDFs will be used to calculate peak demand savings. The Commission has removed the incomplete sentence and incorrect guidance.

### **7. Section 3.2.3 – Water Source and Geothermal Heat Pumps<sup>53</sup>**

In line with the existing guidance on eligibility of not allowing equipment types to be coupled with chillers, the Commission suggested removing Water Source Heat Pumps as eligible technology type from the measure. The Commission proposed to rename this measure as Groundwater Source and Ground Source Heat Pumps.

The Commission also proposed updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates made with the federal standards.

Because the calculation of ground source heat pump efficiency metrics differs from that of ASHPs, a relationship must be established to air source equivalents to enable savings calculations; the Commission proposed updating these conversion factors.

#### **a. Comments**

FirstEnergy comments about missing cross-references in Table 3-37 (formerly Table 3-38). FirstEnergy Comments at Appendix A, 5.

#### **b. Disposition**

The Commission agrees with FirstEnergy and has made the appropriate corrections to Table 3-37 (formerly Table 3-38).

---

<sup>53</sup> See Section 3.2.3 – Water Source and Geothermal Heat Pumps of the 2021 TRM, Volume 3, page 58.

## **8. Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 tons<sup>54</sup>**

The Commission proposed updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates made with the federal standards.

### **a. Comments**

FirstEnergy and PECO comment on the incorrect conversion factors laid out between HSPF2 and COP under Table 3-43 (formerly Table 3-44) and issues with the phrasing of HSPF/COP for packaged terminal equipment. FirstEnergy Comments at Appendix A, 5. PECO Comments at Appendix A, 5. PPL identifies a statement below Table 3-42 (formerly Table 3-43) and requests clarification on its applicability to technology types. PPL Comments at 9. FirstEnergy notes a few errors in Table 3-43 identifying baseline efficiencies, including elaborations on baseline heat pumps to be split between single package and split systems, identifying PTAC/PTHP systems by their size, and correcting their federal standards values. FirstEnergy Comments at Appendix A, 5.

### **b. Disposition**

The Commission agrees with FirstEnergy and PECO about incorrect conversion factors and has updated the measure to present the correct HSPF to COP conversion. However, the Commission disagrees with FirstEnergy's comment about the phrasing of HSPF/COP for packaged terminal equipment. As PTHP systems are still rated using the HSPF efficiency metric and federal standards do not call for an update to HSPF2, readers are asked to convert between COP and HSPF, and further conversions to HSPF2 will follow guidance issued in Volume 1 Appendix A. The Commission agrees with PPL's comment about the statement below Table 3-42 (formerly Table 3-43) and has clarified its applicability to be solely for cold climate ductless mini-split heat pumps.

---

<sup>54</sup> Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 tons of the 2021 TRM, Volume 3, page 67.

Additionally, the Commission agrees with FirstEnergy regarding a few errors in Table 3-43 and has made appropriate updates to address these issues.

### **9. Section 3.2.8 – Controls: Guest Room Occupancy Sensor<sup>55</sup>**

The Commission proposed reducing the measure life of this measure to 11 years in line with the values stated in the California eTRM. In addition, the Commission proposed updating the structure of the current energy savings factor (ESF) values to better estimate summer and winter peak demand savings. The Commission also proposed revising the savings algorithms to quantify cooling and heating savings separately to facilitate calculation of seasonal peak demand savings.

#### **a. Comments**

PPL highlights a typographical error in Table 3-55. PPL Comments at 9.

#### **b. Disposition**

The Commission agrees with PPL’s comment and has corrected the error; the second instance of ETDF now reads as “Winter.”

### **10. Section 3.2.13 – Circulation Fan: High-Volume Low-Speed**

The Commission proposed updating the eligibility criteria to require that efficient equipment exceed current federal standards for ceiling fan energy index (CFEI). The Commission also proposed changing the default baseline efficiency value of a conventional fan, and the default values set for efficient high-volume low-speed fans. Finally, the Commission proposed revising the savings algorithms to use the cubic feet per minute (CFM) / watt efficiency metric of a fan and its hours of operation.

---

<sup>55</sup> See Section 3.2.8 – Controls: Guest Room Occupancy Sensor of the 2021 TRM, Volume 3, page 84.

**a. Comments**

PPL identifies a typographical error in the algorithms of the measure. PPL Comments at 9.

**b. Disposition**

The Commission agrees with PPL that there is a typographical error in the algorithms and has therefore made the correction. The algorithm now reads “(1/Effbase-1/Effee).”

**11. Section 3.3.1 – Premium Efficiency Motors**

A new motor efficiency reference table was proposed to accommodate changing federal standards for National Electrical Manufacturers Association (NEMA) (Design A and B) and International Electrotechnical Commission (IEC) (Design N, NE, NEY, or NY) motors that are scheduled to take effect on July 1, 2027. The motor default run hours reference table has a proposed update that aligns motor use with updated Phase V weather data provided by NOAA 15-year climate normals. Appendix D Motor and VFD Audit and Design Tool were updated to reflect all changes.

**a. Comments**

FirstEnergy and PPL identify several inconsistencies between table labels in the TRM section and associated lookup tables within Appendix D calculator.

**b. Disposition**

The Commission agrees with FirstEnergy and PPL that there are inconsistencies between table labels in the TRM section and associated lookup tables within Appendix D calculator and has therefore corrected the Appendix D calculator lookup table labels accordingly.

## **12. Section 3.3.2 – Variable Frequency Drive (VFD) Improvements<sup>56</sup>**

A new variable,  $PLR_{\text{winter peak}}$ , was introduced with a default flow-fraction of 70% to allow for the estimation of winter peak demand savings. Another proposed change was the introduction of a midstream delivery channel for variable frequency drives (VFDs) with a maximum motor size based on end use. Additional proposed changes included modifications in the default load profile for HVAC fans, and a minor reduction in flow-fraction at zero percent for “Air Foil/Backward Incline” baseline controls.

### **a. Comments**

PPL noted that the units for kilowatt per horsepower conversion factor in the Definition of Terms Table 3-93 are incorrectly listed as kWh per HP. PPL Comments at 10.

### **b. Disposition**

The Commission agrees with PPL that the correct units for the conversion factor are kW per HP and has revised Table 3-93 to reflect this change.

## **13. Section 3.3.3 – ECM Circulating Fan<sup>57</sup>**

The Commission proposed updating the measure life for electronically commutated motor (ECM) circulating fans based on the latest EUL from the California eTRM.

### **a. Comments**

PPL noted that the units for kilowatt per horsepower conversion factor in the Definition of Terms Table 3-98 are incorrectly listed as kWh per HP. PPL Comments at 10.

---

<sup>56</sup> See Section 3.3.2 – Variable Frequency Drive (VFD) Improvements of the 2021 TRM, page 115.

<sup>57</sup> See Section 3.3.3 – ECM Circulating Fan of the 2021 TRM, page 119.

**b. Disposition**

The Commission agrees with PPL that the correct units for the conversion factor are kW per HP and has revised Table 3-98 to reflect this change.

**14. Section 3.4.1 – Heat Pump Water Heaters<sup>58</sup>**

The Commission proposed an update to the default COP adjustment factor for midstream delivery based on a weighted average of conditioned and unconditioned water heater location data from the Act 129 2023 Pennsylvania Non-Residential Baseline Study. In addition, the Commission proposed using a weighted average of the square footage of various commercial building types to determine the gallons of water used per year for an unknown/default commercial building. The weighted average is calculated from square footage estimates provided by the Act 129 2023 Pennsylvania Non—Residential Baseline Study.

The Commission also proposed updating the UEF for efficient electric water heaters to match the requirements set forth in version 5.0 of ENERGY STAR’s residential water heater product specification. The Commission proposed that the baseline UEF coefficients be updated as well to match updated federal standards. The 2026 TRM will include baseline UEFs that correspond to different draw patterns (very small, low, medium, and high), rather than assuming a medium draw pattern.

**a. Comments**

PECO noted that the default square footage assumption was greatly increased from the 2021 TRM. PECO also recommended that the savings algorithm include the number of water heaters present at facilities surveyed in the baseline study. PECO Comments at Appendix A, 5. In addition, PECO identified C&I HPWHs as one of several measures

---

<sup>58</sup> See Section 3.4.1 – Heat Pump Water Heaters of the 2021 TRM, Volume 3, page 132.

having estimates that generally exceed values present in other TRMs, specifically Maryland TRM v11. PECO Comments at 2.

**b. Disposition**

The Commission appreciates PECO's suggestion of incorporating the number of water heaters present at a commercial facility and agrees that the number of water heaters should be included in the savings calculations. The Commission therefore has changed the square footage parameters in the savings algorithm to a square footage per water heater parameter. The average number of water heaters in commercial facilities is 1.752, according to the Act 129 2023 Pennsylvania Non-Residential Baseline Study. Thus, the default square footage per water heater parameter would become 10,360. This is calculated by dividing the default square footage of a commercial building (18,152 square feet) by the average number of water heaters per building (1.752).

The Commission disagrees with PECO's comment that the energy savings exceed those found in other TRMs. After reviewing the default savings estimates provided in the PA and MD TRMs, the Commission has determined that the PA estimates are for water heaters installed in an unknown location, whereas the MD estimates are for water heaters installed either in (1) an office or (2) a school. The PA estimate for a 40-gallon water heater installed in an unknown location (2,707 kWh) falls in between the MD estimates for a water heater installed in an office (1,076 kWh) and a school (3,941 kWh). The Commission finds the default savings estimates comparable and declines to make further revisions.

Although no stakeholders commented on the matter, since the release of the Tentative 2026 TRM Order, the U.S. DOE has finalized new energy conservation standards for water heaters. The Commission therefore has included the new and amended baseline UEFs (effective July 5, 2024) into Table 3-110.

### **15. Section 3.4.2 – Low-Flow Pre-Rinse Sprayers for Retrofit Programs<sup>59</sup>**

To simplify the default savings calculations, the Commission proposed using one value for daily water usage, 64 min per day. This value comes from the EPA’s WaterSense Specification for Commercial Pre-Rinse Spray Valves Supporting Statement. In addition, because federal baseline standards for flow rates have been updated to distinguish between three product classes based on spray force, the Commission proposed that the energy efficient flow rates used in default savings calculations also differ based on product class. We proposed to align baseline flow rates for the retrofit vintage to the federal standard of 1.6 gallons per minute that was in effect until January 2019. The Commission proposed updating the uniform energy factor of the existing electric water heating system to match the Act 129 2023 Pennsylvania Residential Baseline Study results.

#### **a. Comments**

PPL noted that while  $U_{base}$  and  $U_{ee}$  are used in the savings algorithm, only  $U$  is defined in the terms and definitions table (Table 3-113). FirstEnergy recommended that the default summer and winter ETDFs listed in the terms and definitions table (Table 3-113) point to the table of ETDFs instead (Table 3-112). PPL Comments at 10 and FirstEnergy Comments at Appendix A, 6.

#### **b. Disposition**

The Commission agrees with the comments provided by PPL and FirstEnergy and has therefore modified the savings algorithm to only include the term  $U$ , as  $U_{base}$  and  $U_{ee}$  are the same. Additionally, the Commission changed the definition of summer and winter ETDFs in the table of terms and definitions to refer to the table of ETDFs.

---

<sup>59</sup> See Section 3.4.2 – Low-flow Pre-Rinse Sprayers for Retrofit Programs and Time of Sale Programs of the 2021 TRM, Volume 3, page 138.

### **16. Section 3.5.1 – High-Efficiency Refrigeration / Freezer Cases<sup>60</sup>**

The Commission proposed updating the ENERGY STAR Requirements and default efficient kWh values based on the ENERGY STAR Product Criteria for Commercial Refrigerators and Freezers Version 5.0.

#### **a. Comments**

FirstEnergy notes that the equations for solid door freezers do not match the ENERGY STAR specifications. PPL notes the omission of savings for horizontal doors. FirstEnergy Comments at Appendix A, 3 and PPL Comments at 11.

#### **b. Disposition**

The Commission agrees with the comments provided by FirstEnergy and PPL and has changed the relevant algorithm to match the ENERGY STAR specification.

### **17. Section 3.5.7 – Variable Speed Refrigeration Compressor<sup>61</sup>**

The Commission proposed revising the annual energy savings and peak demand savings algorithms for this measure such that the algorithms use deemed and default input parameters which rely on currently available reference sources. Under this proposed change, nameplate compressor horsepower would still need to be collected by the EDCs, load factor and duty cycle could be collected by the EDCs or use default values, and all other algorithm parameters would be deemed from secondary reference sources and/or the SWE's analyses.

#### **a. Comments**

FirstEnergy recommends that the efficiency term should be in the denominator of the kWh savings algorithm. FirstEnergy Comments at Appendix A, 6.

---

<sup>60</sup> See Section 3.5.1 – High-efficiency Refrigeration / Freezer Cases of the 2021 TRM, Volume 3, page 146.

<sup>61</sup> See Section 3.5.7 – Variable Speed Refrigeration Compressor of the 2021 TRM, Volume 3, page 163.

**b. Disposition**

The Commission agrees with FirstEnergy’s comment and has updated the kWh savings algorithm accordingly.

**18. Section 3.5.8 – Strip Curtains for Walk-In Freezers and Coolers<sup>62</sup>**

The Commission proposed adding a default ISR of 75%, drawn from the same Strip Curtains measure maintained by the Regional Technical Forum (RTF). The Commission proposed updating the effective full-load hours (EFLH) assumptions used in the RTF measure algorithm to reflect the more-recent 2019 NEEA Commercial Building Stock Assessment.

**a. Comments**

FirstEnergy comments that the energy savings per square foot values do not match the source values from the RTF.

**b. Disposition**

The Commission agrees with FirstEnergy and has confirmed that the savings values do not match the RTF source, due to updated EFLH hours as described above. Therefore, the Commission has updated the sources cited for energy savings per square foot values to indicate they are not the exact values from the RTF source.

**19. Section 3.5.12 – Special Doors with Low or No Anti-Sweat Heat for Low Reach-In Freezers and Coolers<sup>63</sup>**

The Commission proposed adding default base case and efficient case door heater wattages, delineated by cooler and freezer applications, based on equipment specification sheets from three commercial refrigeration manufacturers.

---

<sup>62</sup> See Section 3.5.8 – Strip Curtains for Walk-in Freezers and Coolers of the 2021 TRM, Volume 3, page 166.

<sup>63</sup> See Section 3.5.12 – Special Doors with Low or No Anti-sweat Heat for Reach-In Freezers and Coolers of the 2021 TRM, Volume 3, page 175.

**a. Comments**

PPL and FirstEnergy request clarification regarding the difference in default values presented in Table 3-142 (formerly Table 3-144) and savings calculated using default  $Watts_{base}$  and  $Watts_{ee}$  values from Table 3-141 (formerly Table 3-143). PPL Comments at 11. FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with PPL and FirstEnergy that clarification is needed for the  $Watts_{base}$  and  $Watts_{ee}$  values presented in Table 3-141 (formerly Table 3-143). The values were rounded and therefore do not exactly calculate to the default savings values presented in Table 3-142 (formerly Table 3-144). To avoid future confusion, the Commission has added an additional decimal place to the  $Watts_{base}$  and  $Watts_{ee}$  values in Table 3-141 and has recalculated default savings values in Table 3-142 based on the rounded  $Watts_{base}$  and  $Watts_{ee}$  values in Table 3-141.

**20. Section 3.5.14 – Refrigerated Display Cases with Doors Replacing Open Cases<sup>64</sup>**

The Commission proposed updating the algorithm to reflect this measure's interactive effects on the building's comfort HVAC system. Specifically, this measure requires additional cooling and less heating from the building's HVAC system. The revised algorithm computes interactive effects using a deemed cooling load reduction in the display case, which was taken from a study published in *ASHRAE Transactions*. Other input parameters for calculating interactive effects include heating and cooling EFLH (which are deemed) and building HVAC system efficiencies (which can be gathered by EDCs or use the TRM default value).

---

<sup>64</sup> See Section 3.5.14 – Refrigerated Display Cases with Doors Replacing Open Cases of the 2021 TRM, Volume 3, page 179.

**a. Comments**

FirstEnergy notes that the word “coefficient” is misspelled in Table 3-145 (formerly Table 3-147). FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with FirstEnergy’s comment and has corrected the spelling error in Table 3-145 (formerly Table 3-147).

**21. Section 3.5.15 – Adding Doors to Existing Refrigerated Display Cases<sup>65</sup>**

The Commission proposed updating the algorithm to reflect this measure's interactive effects on the building’s comfort HVAC system. Specifically, this measure requires additional cooling and less heating from the building’s HVAC system. The revised algorithm computes interactive effects using a deemed cooling load reduction in the display case, which was taken from a study published in *ASHRAE Transactions*. Other input parameters for calculating interactive effects include heating and cooling EFLH (which are deemed) and building HVAC system efficiencies (which can be gathered by EDCs or use the TRM default value).

**a. Comments**

FirstEnergy notes that the word “coefficient” is misspelled in Table 3-146 (formerly Table 3-148). FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with FirstEnergy’s comment and has corrected the spelling error in Table 3-146 (formerly Table 3-148).

---

<sup>65</sup> See Section 3.5.15 – Adding Doors to Existing Refrigerated Display Cases of the 2021 TRM, Volume 3, page 181.

## **22. Section 3.5.17 – Refrigerated Case Light Occupancy Sensors<sup>66</sup>**

The Commission added algorithms showing that peak demand savings equal zero based on the assumption that savings occur during off-peak periods. The Commission also proposed updating default savings per controlled watt of refrigerated case lights to include a separate set of default savings for high-temperature applications (40 °F – 60 °F), and separate annual operating hours assumptions for 24-hr/day and 18-hr/day facilities. The Commission also proposed an additional factor to account for the minimum dimming level present (default value is 50%) in case lighting applications with non-zero load, when dimmed.

### **a. Comments**

Duquesne Light disagrees with the assumption that savings attributable to this measure occur during off-peak periods. Further, they comment that the TRM should allow for EDCs to provide data validating demand reductions for implementation of this measure.

### **b. Disposition**

The Commission agrees with Duquesne Light that peak demand savings could result from the implementation of this measure and has updated the relevant algorithms to align default demand savings (per watt of controlled lighting) with the RTF source.

## **23. Section 3.7.1 – High-Efficiency Ice Machines<sup>67</sup>**

New proposed values for baseline efficiencies, ice harvest rates, duty cycle, and measure life were recommended for batch- and continuous-type ice machines, reflecting the most recent proposed values in the Federal Register Proposed Rules.

---

<sup>66</sup> See Section 3.5.17 – Refrigerated Case Light Occupancy Sensors of the 2021 TRM, Volume 3, page 186.

<sup>67</sup> See Section 3.7.1 – High-efficiency Ice Machines of the 2021 TRM, Volume 3, page 201.

**a. Comments**

Duquesne Light suggests that only published federal standards be used to establish baseline efficiencies. Duquesne Light Comment at page 5.

**b. Disposition**

The Commission agrees with Duquesne Light that the proposed new federal standard for Commercial Ice Machines does not have a compliance date at this time. Therefore, the Commission has revised the baseline values in the TRM to align with the existing federal standards and the measure EUL has been updated.

**24. Section 3.7.4 – ENERGY STAR Electric Steam Cooker<sup>68</sup>**

The Commission proposed updating baseline values to align with the 2021 IECC code requirements for this measure which consequently eliminated the opportunity for default savings. The Commission also proposed updating default values for pounds of food cooked per day, hours of operation per day, and days of operation per year to reflect the latest values from the ENERGY STAR Commercial Food Service calculator.

**a. Comments**

PPL suggests correcting the value of variable  $CAPY_{base}$  in the definition of terms to align with the source baseline of 23.3. PPL Comment at page 11.

**b. Disposition**

The Commission agrees with PPL that there was a discrepancy between the source and TRM and has updated the value of  $CAPY_{base}$  from 16.7 to 23.3.

---

<sup>68</sup> See Section 3.7.4 – ENERGY STAR Electric Steam Cooker of the 2021 TRM, Volume 3, page 210.

## **25. Section 3.8.1 – Wall and Ceiling Insulation<sup>69</sup>**

The Commission proposed updating the default initial R-values for ceilings and walls in new construction settings from IECC 2015 to IECC 2021, and including IECC climate zones 4, 5, and 6.

### **a. Comments**

FirstEnergy suggests broadening the eligibility of the building shell measure to include buildings with ground source heat pumps, ductless air conditioners, and chillers. FirstEnergy Comments at Appendix A, 6.

### **b. Disposition**

The Commission agrees with FirstEnergy's suggestion and has therefore expanded the eligibility of the building shell measure to include all air-conditioned buildings.

## **26. Section 3.10.1 – Compressed Air Cycling Refrigerated Thermal Mass Dryer<sup>70</sup>**

The Commission proposed updating the compressor kW to CFM ratio based on the latest compressed air calculation workbooks.

### **a. Comments**

FirstEnergy suggests separating summer and winter coincident factors to account for the larger overlap of single-shift compressor operation with the winter peak period. FirstEnergy Comments at Appendix A, 6.

---

<sup>69</sup> See Section 3.8.1 – Wall and Ceiling Insulation of the 2021 TRM, Volume 3, page 234.

<sup>70</sup> See Section 3.10.1 – Compressed Air Cycling Refrigerated Thermal Mass Dryer of the 2021 TRM, Volume 3, page 256.

**b. Disposition**

The Commission agrees with FirstEnergy’s suggestion and has therefore separated summer and winter CF and added winter CF to the measure lookup tables and default savings.

**27. Section 3.10.2 – Compressed Air-Entraining Air Nozzle<sup>71</sup>**

The Commission proposed updating the dryer kW to compressor CFM ratio based on the latest compressed air calculation workbooks. Additionally, the Commission proposed quantifying the hours of assumed downtime.

**a. Comments**

FirstEnergy suggests separating summer and winter coincident factors to account for the larger overlap of single-shift compressor operation with the winter peak period. FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with FirstEnergy’s suggestion and has therefore separated summer and winter CF and added winter CF to the measure lookup tables.

**28. Section 3.10.3 – No-Loss Condensate Drains<sup>72</sup>**

The Commission proposed updating the compressor kW to CFM ratio based on the latest compressed air calculation workbooks and the measure life to 10 years as outlined in the Illinois Statewide TRM. Additionally, the Commission proposed quantifying the hours of assumed downtime.

---

<sup>71</sup> See Section 3.10.2 – Compressed Air-Entraining Air Nozzle of the 2021 TRM, Volume 3, page 259.

<sup>72</sup> See Section 3.10.3 – No-loss Condensate Drains of the 2021 TRM, Volume 3, page 263.

**a. Comments**

FirstEnergy suggests separating summer and winter coincident factors to account for the larger overlap of single-shift compressor operation with the winter peak period. FirstEnergy Comments at Appendix A, 6.

**b. Disposition**

The Commission agrees with FirstEnergy’s suggestion and has therefore separated summer and winter CF and added winter CF to the measure lookup tables.

**29. Section 3.10.5 – Variable Speed Drive Air Compressors<sup>73</sup>**

The Commission proposed quantifying the hours of assumed downtime.

**a. Comments**

FirstEnergy recommends aligning the compressor motor efficiency variable in the measure algorithms and definition of terms. They also suggest increasing the maximum eligible compressor above the current 40hp level. FirstEnergy Comments at Appendix A, 5 and comment page 11.

**b. Disposition**

The Commission agrees with FirstEnergy’s suggestion to align the compressor motor variable ( $\eta$ ). The 40hp TRM cutoff will remain in place as larger systems can still be claimed as custom projects that can more accurately represent end-use variability from larger consumption projects.

---

<sup>73</sup> See Section 3.10.5 –Variable Speed Drive Air Compressors of the 2021 TRM, Volume 3, page 271.

### **30. Section 3.11.3 – High Frequency Battery Chargers<sup>74</sup>**

The Commission proposed updating the default CF for single-shift or two-shift applications from 0.25 to 0 based on the most up-to-date information from the 2023 Illinois Statewide TRM.

#### **a. Comments**

FirstEnergy suggests correcting the definition of the variable  $CR_{EE}$  from “efficient power conversion efficiency” to “efficient charge return factor” to accurately represent its use. FirstEnergy Comments at Appendix A, 6.

#### **b. Disposition**

The Commission agrees with FirstEnergy’s suggestion. The definition of the variable  $CR_{EE}$  has been modified to efficient charge return factor.

### **31. Section 4.1 – Agricultural**

#### **a. Comments**

PPL recommends that Animal Agricultural hours of operation be added, based on ASABE Standard 344.4 Animal Lighting. PPL Comments at 12.

#### **b. Disposition**

The Commission disagrees with PPL’s recommendation to add Animal Agricultural hours of operation. Among the measures in Section 4.1 that refer to hours of operation, they refer to hours of operation of ventilation fans which are calculated based on temperature data, therefore no changes have been made.

---

<sup>74</sup> See Section 3.11.3 – High Frequency Battery Chargers of the 2021 TRM, Volume 3, page 289.

### **32. Section 4.1.2 – Dairy Scroll Compressors<sup>75</sup>**

The Commission proposed updating the default  $EER_{base}$  from 5.85 to 0.85 \*  $EER_{ee}$ . This approach is consistent with several other TRMs and is based on data indicating scroll compressors are approximately 15% more efficient than reciprocating compressors.

#### **a. Comments**

PPL recommends that “New Construction” be added to Measure Vintage as an option. PPL Comments at 12. FirstEnergy recommends that the Dairy Scroll Compressors kWh formula be rewritten so that the CBTU variable only appears once in the equation. FirstEnergy Comments at Appendix A, 7.

#### **b. Disposition**

The Commission disagrees with PPL’s recommendation and declines to make the change. Scroll compressors are a baseline expectation in new equipment, so the measure should only apply to retrofit situations. See New York State TRM, page 424. The Commission agrees with FirstEnergy’s recommendation and has updated the Dairy Scroll Compressors kWh equation accordingly.

### **33. Section 4.1.3 – High-Efficiency Ventilation Fans with and Without Thermostats<sup>76</sup>**

The Commission proposed adding a midstream delivery option to this measure. In addition, the Commission proposed updating the measure life from 15 to 13 years to align with the California eTRM.

---

<sup>75</sup> See Section 4.1.2 – Dairy Scroll Compressors of the 2021 TRM, Volume 3, page 298.

<sup>76</sup> See Section 4.1.3 – High-efficiency Ventilation Fans with and without Thermostats of the 2021 TRM, Volume 3, page 301.

**a. Comments**

FirstEnergy recommends that the equations be prefaced with descriptions or titles to make it easier to read. FirstEnergy Comments at Appendix A, 7. PPL recommends that this measure include circulation fans. PPL also recommends that poultry hours of operation be added to Table 4-5. PPL Comments at 12.

**b. Disposition**

The Commission declines FirstEnergy’s recommendation. Each equation is prefaced with a short paragraph, explaining the context of that particular equation. This is consistent with other measures throughout the TRM. The Commission declines PPL’s first recommendation as this measure explicitly does not apply to circulation fans. Additionally, measure 4.1.5 High Volume Low Speed Fans calls for using HVLS fans to replace circulation fans. Furthermore, the Commission declines PPL’s second recommendation. The referenced standard does not provide guidance on annual run hours for ventilation fans, and the Commission does not find any reason to change Table 4-5 at this time.

**34. Section 4.1.5 – High Volume Low Speed Fans<sup>77</sup>**

The Commission proposed adding a midstream delivery option to this measure.

**a. Comments**

PPL recommends that the algorithm for kWh be corrected by switching the  $Eff_{HVLS}$  and  $Eff_{baseline}$  terms. PPL Comments at 12. FirstEnergy recommends that a reference to 3.2.14 be corrected to 3.2.15, edit the phrase “With qualifying fans meeting Federal...” to “Qualifying fans meeting Federal...”, and correct Table 4-9 to list W/CFM as units. FirstEnergy Comments at Appendix A, 7.

---

<sup>77</sup> See Section 4.1.5 – High Volume Low Speed Fans of the 2021 TRM, Volume 3, page 308.

**b. Disposition**

The Commission agrees with PPL and FirstEnergy and has made the corrections to the algorithms and references accordingly.

**35. Section 4.1.6 – Livestock Waterer<sup>78</sup>**

The Commission proposed adding a midstream delivery option to this measure.

**a. Comments**

FirstEnergy recommends that the text in the eligibility section be modified for clarity. FirstEnergy Comments at Appendix A, 7.

**b. Disposition**

The Commission agrees with FirstEnergy’s recommendation and has updated the text in the eligibility section.

**36. Section 4.1.8 – Low Pressure Irrigation System**

Although the Commission did not propose any changes in the Tentative Order, the Commission received comments on this measure.

**a. Comments**

FirstEnergy recommends that the title of this section be changed to “Irrigation System Pressure Reduction” because the protocol applies to early replacements and retrofits. FirstEnergy Comments at Appendix A, 7.

---

<sup>78</sup> See Section 4.1.6 – Livestock Waterer of the 2021 TRM, Volume 3, page 310.

**b. Disposition**

The Commission disagrees with FirstEnergy and declines to change the name of the section to maintain consistency with previous versions of the TRM. However, the Commission has changed the measure vintage to “Early Replacement or Retrofit.”

**37. Measure Number Changes**

The changes proposed herein will result in new measure numbers for several C&I measures. Table 10 below shows the current measure number and the new measure number for all affected measures. The table also shows measures that the Commission proposed removing – these measures are discussed in more detail later.

**Table 10: Measure Number Changes for Non-Residential Measures**

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
3.1.1	Lighting Improvements	3.1.1	Lighting Retrofits
3.1.5	LED Channel Signage	-	Deleted
3.1.6	LED Refrigeration Display Case Lighting	3.1.5	LED Refrigeration Display Case Lighting
-	Non-existent	3.1.7	Indoor Horticultural Lighting
3.1.7	Lighting Improvements for Midstream Delivery Programs	3.1.6	Midstream Lighting Incentives
-	Non-existent	3.2.2	HVAC Systems for Midstream Delivery
3.2.2	Electric Chillers	3.2.3	Electric Chillers
3.2.3	Water Source and Geothermal Heat Pumps	3.2.4	Groundwater Source and Ground Source Heat Pumps
3.2.4	Ductless Mini-Split Heat Pumps – Commercial < 5.4 Tons	3.2.5	Ductless Mini-Split Heat Pumps – Commercial < 5.4 Tons
3.2.5	Fuel Switching: Small Commercial Electric Heat to Natural Gas / Propane / Oil Heat	-	Deleted
-	Non-existent	3.2.6	Ductless Mini-Split Heat Pumps – Commercial <5.4 Tons for Midstream Delivery

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
3.2.6	Small C&I HVAC Refrigerant Charge Correction	3.2.7	Small C&I HVAC Refrigerant Charge Correction
3.2.7	ENERGY STAR Room Air Conditioner	3.2.9	Room Air Conditioner
-	Non-existent	3.2.8	HVAC Tune-up
3.2.8	Controls: Guest Room Occupancy Sensor	3.2.10	Controls: Guest Room Occupancy Sensor
3.2.9	Controls: Economizer	3.2.11	Controls: Economizer
3.2.10	Computer Room Air Conditioner	3.2.12	Computer Room Air Conditioner
3.2.11	Computer Room Air Conditioner/Handler Electronically Commutated Plug Fans	3.2.13	Computer Room Air Conditioner/Handler Electronically Commutated Plug Fans
3.2.12	Computer Room Air Conditioner/Handler VSD on AC Fan Motors	3.2.14	Computer Room Air Conditioner/Handler VSD on AC Fan Motors
3.2.13	Circulation Fan: High-Volume Low-Speed	3.2.15	Circulation Fan: High-Volume Low-Speed
-	Non-existent	3.2.16	Demand Control Ventilation
-	Non-existent	3.2.17	Advanced Rooftop Controls
-	Non-existent	3.2.18	C&I ENERGY STAR Certified Connected Thermostats
-	Non-existent	3.2.19	Adjustment of Programmable Thermostats
-	Non-existent	3.2.20	Duct Sealing and Insulation
-	Non-existent	3.2.21	Chilled Water Pipe Insulation
3.4.3	Fuel Switching: Electric Resistance Water Heaters to Gas/Propane	-	Deleted
-	Non-existent	3.4.3	Domestic Hot Water Pipe Insulation
3.5.11	Door Gaskets for Walk-in and Reach-in Coolers and Freezers	-	Deleted
3.5.12	Special Doors with Low or No Anti-Sweat Heat for Reach-In Freezers and Coolers	3.5.11	Special Doors with Low or No Anti-Sweat Heat for Reach-In Freezers and Coolers

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
3.5.13	Suction Pipe Insulation for Walk-In Coolers and Freezers	3.5.12	Suction Pipe Insulation for Walk-In Coolers and Freezers
3.5.14	Refrigerated Display Cases with Doors Replacing Open Cases	3.5.13	Refrigerated Display Cases with Doors Replacing Open Cases
3.5.15	Adding Doors to Existing Refrigerated Display Cases	3.5.14	Adding Doors to Existing Refrigerated Display Cases
3.5.16	Air-Cooled Refrigeration Condenser	-	Deleted
3.5.17	Refrigerated Case Light Occupancy Sensors	3.5.15	Refrigerated Case Light Occupancy Sensors
3.5.18	Refrigeration Economizers	-	Deleted
3.5.19	Food Service Equipment Novelty Cooler Shutoff	3.5.16	Food Service Equipment Novelty Cooler Shutoff
3.7.2	Controls: Beverage Machine Controls	3.7.2	Controls: Beverage and Snack Machine Controls
3.7.3	Controls: Snack Machine Controls	-	Deleted
-	Non-existent	3.7.10	Commercial Induction Cooktops
3.9.1	ENERGY STAR Office Equipment	-	Deleted
3.9.2	Office Equipment – Network Power Management Enabling	-	Deleted
3.9.3	Advanced Power Strips	3.9.1	Advanced Power Strips
3.9.4	ENERGY STAR Servers	3.9.2	ENERGY STAR Servers
3.9.5	Server Virtualization	3.9.3	Server Virtualization
-	Non-existent	3.11.4	ENERGY STAR Uninterruptible Power Supplies
-	Non-existent	3.11.5	Building Operator Certification (BOC)
-	Non-existent	3.11.6	Photovoltaic (PV) Solar Generation

## **G. Removed Residential EE&C Protocols**

Based on a review of the available research, the Commission proposed removing four residential EE&C measures and associated protocols. No stakeholder comments

were received in response to removing one measure, Section 2.5.1 – ENERGY STAR Office Equipment and it has been excluded from the Final 2026 TRM.

The changes proposed by the Commission in our Tentative Order that received stakeholder comments are addressed below.

### **1. Section 2.2.6 – Fuel Switching: Electric Heat to Gas/Propane/Oil Heat<sup>79</sup>**

The Commission proposed removing this measure from the TRM. At the time of writing the Tentative Order, the EPA was considering removing gas heaters from the ENERGY STAR specification for furnaces.<sup>80</sup> Since Fuel Switching: Electric Heat to Gas/Propane/Oil Heat eligibility depends on ENERGY STAR certification, this measure would no longer be eligible if gas heaters were removed from the specification.

#### **a. Comments**

UGI comments that it supports the continued inclusion of all fuel-switching measures in the 2026 TRM, arguing that the measures further energy conservation and savings. UGI notes that the EPA issued a notice on April 16, 2024, clarifying that the ENERGY STAR furnace specification will include updated specifications for gas furnaces rather than removing them. UGI adds that comprehensive EE&C programs include a full range of available measures and that natural gas measures should not be excluded from EE&C plans. UGI Comments at 3-6. KEEA comments that it supports the Commission’s proposed removal of fuel-switching measures and argues that fuel switching shifts the burden from one fuel source to another without reducing consumption. KEEA at 2. In their reply comments, UGI comments that, in Pennsylvania, the average price for natural gas for residential customers is lower than the

---

<sup>79</sup> See Section 2.2.6 – Fuel Switching: Electric Heat to Gas/Propane/Oil Heat of the 2021 TRM, Volume 2, page 32.

<sup>80</sup> See US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [Weblink](#)

national average, and the average price of electricity is higher than the national average. UGI Reply Comments at 2-4.

**b. Disposition**

The Commission disagrees with UGI’s recommendation to continue including fuel-switching measures in the 2026 TRM and acknowledges KEEA’s comments supporting the removal of fuel-switching measures. The TRM is designed to support Act 129 EE&C programs and, to a lesser extent, the Alternative Energy Portfolio Standards Act. Act 129 programs are funded by electric ratepayers with established electric consumption and peak electric demand reduction targets for the large EDCs. EE&C programs under Act 129 do not require including electric to fossil fuel switching measures to be comprehensive. While UGI is correct that ENERGY STAR furnace specification is proposed to include updated specifications for gas furnaces rather than removing them, the ENERGY STAR status is still in a state of uncertainty as the proposed new specifications are still in development.<sup>81</sup>

While the fuel-switching measures will be removed from the 2026 TRM, if an EDC wishes to incentivize a fuel-switching measure in Phase V, the Commission proposes that the EE&C plan should state a proposed minimum standard and provide justification for the threshold. For example, if an EE&C plan includes fuel switching from Electric Heat to Gas/Propane/Oil Heat, the EE&C plan should specify the minimum qualifying AFUE or thermal efficiency of the efficient heating system.

---

<sup>81</sup> US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [Weblink](#) US EPA (2024, April 16). [ENERGY STAR Version 5.0 Furnaces Draft 1 Cover Letter](#). [Weblink](#)

## **2. Section 2.3.3 – Fuel Switching: Electric Resistance to Fossil Fuel Water Heater<sup>82</sup>**

The 2021 TRM includes heating, water heating, and clothes dryer fuel switching measures. In other sections of this Tentative Order the Commission recommended removing the heating and clothes dryer fuel switching measures due to changes in ENERGY STAR standards, leaving water heating as the only remaining fuel switching measure in the TRM. The Commission proposed removing Fuel Switching: Electric Resistance to Fossil Fuel Water Heater for consistency.

### **a. Comments**

UGI comments that it supports the continued inclusion of all fuel-switching measures in the 2026 TRM, arguing that the measures further energy conservation and savings. UGI adds that comprehensive EE&C programs include a full range of available measures and that natural gas measures should not be excluded from EE&C plans. UGI Comments at 3-6. KEEA comments that it supports the Commission’s proposed removal of fuel-switching measures and argues that fuel switching shifts the burden from one fuel source to another without reducing consumption. KEEA at 2. In their reply comments, UGI comments that in Pennsylvania the average price for natural gas for residential customers is lower than the national average and the average price of electricity is higher than the national average. UGI Reply Comments at 2-4.

### **b. Disposition**

The Commission disagrees with UGI’s recommendation to continue including fuel-switching measures in the 2026 TRM and acknowledges KEEA’s comments supporting the removal of fuel-switching measures. The TRM is designed to support Act 129 EE&C programs and, to a lesser extent, the Alternative Energy Portfolio Standards Act. Act 129 programs are funded by electric ratepayers with established electric

---

<sup>82</sup> See Section 2.3.3 – Programmable Thermostats of the 2021 TRM, Volume 2, page 68.

consumption and peak electric demand reduction targets for the large EDCs. EE&C programs under Act 129 do not require including electric to fossil fuel switching measures to be comprehensive.

While the fuel-switching measures will be removed from the 2026 TRM, if an EDC wishes to incentivize a fuel-switching measure in Phase V, the Commission proposes that the EE&C plan should state a proposed minimum standard and provide justification for the threshold.

### **3. Section 2.4.7 – Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer<sup>83</sup>**

The Commission proposed removing this measure from the TRM. At the time of this writing, the EPA was considering removing gas dryers from the ENERGY STAR specification for clothes dryers.<sup>84</sup> Since Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer eligibility depends on ENERGY STAR certification, this measure would no longer be eligible if gas dryers were removed from the specification.

#### **a. Comments**

UGI comments that it supports the continued inclusion of all fuel-switching measures in the 2026 TRM, arguing that the measures further energy conservation and savings. UGI adds that comprehensive EE&C programs include a full range of available measures and that natural gas measures should not be excluded from EE&C plans. UGI Comments at 3-6. KEEA comments that it supports the Commission’s proposed removal of fuel-switching measures and argues that fuel switching shifts the burden from one fuel source to another without reducing consumption. KEEA at 2. In their reply comments, UGI comments that in Pennsylvania the average price for natural gas for residential

---

<sup>83</sup> See Section 2.4.7 – Residential Whole House Fans of the 2021 TRM, Volume 2, page 127.

<sup>84</sup> US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [https://www.energystar.gov/sites/default/files/asset/document/Furnace\\_CAC\\_Proposal.pdf](https://www.energystar.gov/sites/default/files/asset/document/Furnace_CAC_Proposal.pdf)

customers is lower than the national average and the average price of electricity is higher than the national average. UGI Reply Comments at 2-4.

**b. Disposition**

The Commission disagrees with UGI’s recommendation to continue including fuel-switching measures in the 2026 TRM and acknowledges KEEA’s comments supporting the removal of fuel-switching measures. The TRM is designed to support Act 129 EE&C programs and, to a lesser extent, the Alternative Energy Portfolio Standards Act. Act 129 programs are funded by electric ratepayers with established electric consumption and peak electric demand reduction targets for the large EDCs. EE&C programs under Act 129 do not require including electric to fossil fuel switching measures to be comprehensive.

While the fuel-switching measures will be removed from the 2026 TRM, if an EDC wishes to incentivize a fuel-switching measure in Phase V, the Commission proposes that the EE&C plan should state a proposed minimum standard and provide justification for the threshold.

**H. Removed C&I EE&C Measure Protocols**

Based on a review of the available research, the Commission proposed removing eight C&I EE&C measures and associated protocols. No stakeholder comments were received in response to removing the following measures, which have been excluded from the Final 2026 TRM.

Section 3.1.5 – LED Channel Signage

Section 3.5.11 – Door Gaskets for Walk-In And Reach-In Coolers And Freezers

Section 3.5.16 – Air-Cooled Refrigeration Condenser

Section 3.5.18 – Refrigeration Economizers

Section 3.9.1 – ENERGY STAR<sup>®</sup> Office Equipment

Section 3.9.2 – Office Equipment – Network Power Management Enabling

The changes proposed by the Commission in our Tentative Order that received stakeholder comments are addressed below.

**1. Section 3.2.5 – Fuel Switching: Small Commercial Electric Heat to Natural Gas / Propane / Oil Heat<sup>85</sup>**

The Commission proposed removing this measure from the TRM. At the time of this writing, the US EPA was considering removing gas furnaces from the ENERGY STAR specification for heating equipment.<sup>86</sup> Since Fuel Switching: Small Commercial Electric Heat to Natural gas/Propane/Oil Heat eligibility depends on ENERGY STAR certification, this measure would no longer be eligible if gas furnaces were removed from the specification.

**a. Comments**

UGI comments that it supports the continued inclusion of all fuel switching measures in the 2026 TRM, arguing that the measures further energy conservation and savings. UGI notes that the EPA issued a notice on April 16, 2024, clarifying that the ENERGY STAR furnace specification will include updated specifications for gas furnaces rather than removing them. UGI adds that comprehensive EE&C programs include a full range of available measures and that natural gas measures should not be excluded from EE&C plans. UGI Comments at 3-6. KEEA comments that it supports the Commission’s proposed removal of fuel switching measures and argues that fuel switching shifts the burden from one fuel source to another without reducing consumption. KEEA at 2. In their reply comments, UGI comments that in Pennsylvania the average price for natural gas for residential customers is lower than the national

---

<sup>85</sup> See Section 3.2.5 – Fuel Switching: Small Commercial Electric Heat to Natural gas / Propane / Oil Heat of the 2021 TRM, Volume 3, page 71.

<sup>86</sup> US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [https://www.energystar.gov/sites/default/files/asset/document/Furnace\\_CAC\\_Proposal.pdf](https://www.energystar.gov/sites/default/files/asset/document/Furnace_CAC_Proposal.pdf)

average and the average price of electricity is higher than the national average. UGI Reply Comments at 2-4.

**b. Disposition**

The Commission disagrees with UGI’s recommendation to continue including fuel-switching measures in the 2026 TRM and acknowledges KEEA’s comments supporting the removal of fuel-switching measures. The TRM is designed to support Act 129 EE&C programs and, to a lesser extent, the Alternative Energy Portfolio Standards Act. Act 129 programs are funded by electric ratepayers with established electric consumption and peak electric demand reduction targets for the large EDCs. EE&C programs under Act 129 do not require including electric to fossil fuel switching measures to be comprehensive. While UGI is correct that ENERGY STAR furnace specification is proposed to include updated specifications for gas furnaces rather than removing them, the ENERGY STAR status is still in a state of uncertainty as the proposed new specifications are still in development.<sup>87</sup>

While the fuel-switching measures will be removed from the 2026 TRM, if an EDC wishes to incentivize a fuel switching measure in Phase V, the Commission proposes that the EE&C plan should state a proposed minimum standard and provide justification for the threshold. For example, if an EE&C plan includes fuel switching Electric Heat to Gas/Propane/Oil Heat, the EE&C plan should specify the minimum qualifying AFUE or thermal efficiency of the efficient heating system.

---

<sup>87</sup> US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [Weblink](#) US EPA (2024, April 16). [ENERGY STAR Version 5.0 Furnaces Draft 1 Cover Letter](#). [Weblink](#)

## **2. Section 3.4.3 – Fuel Switching: Electric Resistance Water Heaters to Gas/Propane<sup>88</sup>**

The 2021 TRM includes heating, water heating, and clothes dryer fuel switching measures. In other sections of this Tentative Order the Commission recommended removing the heating and clothes dryer fuel switching measures due to changes in ENERGY STAR standards, leaving water heating as the only remaining fuel switching measure in the TRM. The Commission proposed removing Fuel Switching: Electric Resistance Water Heaters to Gas/Propane for consistency.

### **a. Comments**

UGI comments that it supports the continued inclusion of all fuel-switching measures in the 2026 TRM, arguing that the measures further energy conservation and savings. UGI adds that comprehensive EE&C programs include a full range of available measures and that natural gas measures should not be excluded from EE&C plans. UGI Comments at 3-6. KEEA comments that it supports the Commission’s proposed removal of fuel-switching measures and argues that fuel-switching shifts the burden from one fuel source to another without reducing consumption. KEEA at 2. In their reply comments, UGI comments that in Pennsylvania the average price for natural gas for residential customers is lower than the national average and the average price of electricity is higher than the national average. UGI Reply Comments at 2-4.

### **b. Disposition**

The Commission disagrees with UGI’s recommendation to continue including fuel-switching measures in the 2026 TRM and acknowledges KEEA’s comments supporting the removal of fuel-switching measures. The TRM is designed to support Act 129 EE&C programs and, to a lesser extent, the Alternative Energy Portfolio Standards Act. Act 129 programs are funded by electric ratepayers with established electric

---

<sup>88</sup> See Section 3.4.3 – Fuel Switching: Electric Resistance Water Heaters to Gas/Propane of the 2021 TRM, page 142.

consumption and peak electric demand reduction targets for the large EDCs. EE&C programs under Act 129 do not require including electric to fossil fuel switching measures to be comprehensive.

While the fuel-switching measures will be removed from the 2026 TRM, if an EDC wishes to incentivize a fuel-switching measure in Phase V, the Commission proposes that the EE&C plan should state a proposed minimum standard and provide justification for the threshold.

### **I. Appendix C: Lighting Audit and Design Tool**

The Commission proposed several revisions to the 2021 TRM Appendix C to increase customer usability while allowing for increased customization. Additionally, all proposed changes to Section 3.1.1 of the TRM have been incorporated into the tool. These proposed changes include the following:

- Expand a lookup table to generate the appropriate exterior lighting allowances when the building area method is selected for interior lighting.
- Correct some minor formula errors in the “Fixture Identities” tab.
- Update LPD values in the Lookups sheet in Building Area Method and Space-by-Space LPD Option Configurator lookup tables to reflect IECC 2021 allowances.
- Remove "Is this a Small Business Direct Install Project?" dropdown from I27 on General Information sheet and dependent formulas on Lighting Inventory sheet (column J).
- Remove functionality to override T12 baseline fixtures with T8 wattages.
- Add a row for Network Lighting Controls in SVG lookup table on Lookups sheet.
- Remove screw-based HOU and CF from Lookups sheet.

- Add CF\_w to General Service Lighting section of HOU and CF table on Lookups sheet.
- Ensure General Service Lighting HOU and CFs reflect TRM values.
- Add winter peak calculation formulas to Lighting Inventory sheet where applicable.
- Delete "HOU Type" column, which was used to designate General versus Screw-in, in Post-Installation Details section of Lighting Inventory sheet.
- Adjust HOU and CF formulas by removing references to HOU Type column, only looking up the General Service Lighting HOUs and CFs.
- Delete "HOU Type" column from Fixture Identities sheet.
- Add IFdemand\_w column on Lighting Inventory sheet and integrate into winter peak formulas.
- Adapt IF by Space Cooling Type and IF for Comfort Cooled Spaces by HVAC Configuration (new term) to include updated values and new variables.
- Adapt HOU, CF, and IF by Facility Type table in Lookups sheet to include new variables for HVAC Configuration selection on General Information sheet.
- Reconfigure interactive effects calculations to use HVAC Configuration selection on General Information sheet.
- Add additional Intermediate CF Calculations table on General Information sheet to account for winter CF.
- Add new row in Custom Lighting Operation Schedules table in General Information sheet to include winter CF.

**a. Comments**

FirstEnergy suggests that the conditional formatting to shade columns AB through AK of the Lighting Inventory tab for new construction projects be removed. FirstEnergy correctly notes that these columns are used whether the project is retrofit or new

construction. FirstEnergy Comments at Appendix A, 8. FirstEnergy also flags a one-hour discrepancy (4,306 versus 4,305) between the Appendix C calculator and Volume 3 of the TRM regarding annual HOU for the Exterior, Photocell-Controlled building type. FirstEnergy Comments at Appendix A, 8.

**b. Disposition**

The purpose of shading columns AB through AK of the Lighting Inventory tab is to hide interim calculations that are not meaningful at the line-item level. This is the case when the Building Area Method is used for new construction lighting projects. With the Building Area Method, all the rows in the inventory must be summed up and compared to the allowance for the building to estimate savings. The conditional cell shading has been preserved when users select Building Area Method in cell D39 of the General Information tab for a new construction project. The Commission agrees with FirstEnergy’s suggestion when the Space-by-Space method is used for new construction because each line-item returns meaningful outputs that could have value to users. The conditional formatting logic in columns AB through AK of the Lighting Inventory tab has been updated to only apply shading when the Building Area Method is used.

The Commission agrees with FirstEnergy’s identified discrepancy between Volume 3 and Appendix C for the Exterior, Photocell-Controlled building type. The Lookups tab of Appendix C has been updated to reflect the same 4,305 annual HOU value presented in Table 3-3.

**J. Appendix D: Motors and VFD Audit and Design Tool**

The Commission proposed several updates to the 2021 TRM Appendix D calculator to increase usability and to align with the proposed algorithm revisions for VFD improvement measures. These proposed changes included the following:

- Updated annual run hours tables to reflect updated NOAA 15-year climate normal weather conditions.
- Introduced winter peak demand savings to the tool.
- Added ETDF tables to align the summer and winter peak demand estimates to support Phase V TRM methodology. Removed the use of coincidence factors to estimate demand savings.
- Added VFD Fan and VFD Pump flow fractions to the par load power ratio tables.
- Revised 0% flow fraction for “Fan: Air Foil / Backward Incline” from 0.56 to 0.53.
- Added new program year input and motor efficiency lookup table to accommodate July 2027 federal standard efficiency changes for 100 to 250 hp motors.
- Updated HVAC Fan load profile flow fraction values to align TRM changes.

**a. Comments**

FirstEnergy and PPL identified several inconsistencies between table labels in TRM sections 3.3.1 and 3.3.2 and associated lookup tables within Appendix D calculator.

**b. Disposition**

The Commission agrees with FirstEnergy and PPL that there are inconsistencies between table labels in the TRM section and associated lookup tables within Appendix D calculator. Therefore, the Appendix D calculator lookup table labels have been updated.

**K. Appendix E: Eligibility Requirements for Solid State Lighting Products in Commercial and Industrial Applications**

The Commission proposed to simplify Appendix E of the TRM considerably by aligning Act 129 eligibility with the DLC technical requirements and QPLs. The DLC

maintains comprehensive lists of solid-state lighting, horticultural lighting, and network lighting controls. On March 13, 2023, the US EPA announced plans to sunset its ENERGY STAR specifications for lamps and luminaires, effective December 31, 2024. While the US EPA will maintain a new specification for recessed downlights, these measures will be largely ineligible during Phase V of Act 129. The Commission proposed that Appendix E also address eligibility guidelines when DLC technical requirements change and proposed a grace period where EDCs and their CSPs can claim savings for products certified under the prior technical requirements through the end of the program year during which the DLC technical requirements change becomes effective.

**a. Comments**

FirstEnergy notes that there have been very few historical requests for exceptions to the DLC requirement and suggests the DLC exception process be relaxed to allow EDCs to make case-by-case judgments in consultation with their EM&V vendors. FirstEnergy Comments at Appendix A, 1.

**b. Disposition**

The Commission agrees with FirstEnergy that such exceptions may be justified on a case-by-case basis for unique lighting applications. Appendix E of the TRM has been modified to include language describing a process whereby EDCs may waive the DLC requirement with the written approval of their EM&V contractor.

## CONCLUSION

This Order represents the Commission's continuing efforts in establishing a comprehensive TRM with a purpose of supporting both the AEPS Act and the EE&C Program provisions of Act 129. We extend our thanks to all who provided comments; **THEREFORE,**

### IT IS ORDERED:

1. That the 2026 Technical Reference Manual update, as modified by this Order, is adopted and replaces all prior versions of the Technical Reference Manual as of June 1, 2026.
2. That a copy of this Order shall be served upon all electric distribution companies, the Office of Consumer Advocate, the Office of Small Business Advocate, the Commission's Bureau of Investigation and Enforcement, the Pennsylvania Department of Environmental Protection, and all parties who filed comments.
3. That the Secretary shall deposit a notice of this Order and the 2026 version of the Technical Reference Manual with the Legislative Reference Bureau for publication in the *Pennsylvania Bulletin*.

4. That this Order and the 2026 Technical Reference Manual update, as well as its appendices, be published on the Commission's website at <https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/>

**BY THE COMMISSION**



Rosemary Chiavetta  
Secretary

(SEAL)

ORDER ADOPTED: September 12, 2024

ORDER ENTERED: September 12, 2024