

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

Public Meeting held May 9, 2024

Commissioners Present:

Stephen M. DeFrank, Chairman  
Kimberly Barrow, Vice Chair  
Ralph V. Yanora  
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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 TENTATIVE ORDER**

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## 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>

Soon after the adoption of the Phase I Implementation Order, Commission staff initiated a collaborative process to review and update the TRM with the purpose of supporting both the AEPS Act and the Act 129 EE&C program that culminated in the

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<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.*



adoption of the 2009 TRM on May 28, 2009.<sup>6</sup> In adopting the 2009 TRM, the Commission determined that the TRM would be updated on an annual basis.<sup>7</sup>

With regard to Phase II of the Act 129 EE&C Program, the Commission again adopted the TRM as a component of the EE&C Program evaluation process.<sup>8</sup> The Commission determined that an annual updating process would be appropriate for Phase II, as in Phase I.<sup>9</sup>

Regarding Phase III of the EE&C Program, the Commission again adopted the TRM as a component of the EE&C Program evaluation process.<sup>10</sup> However, the Commission determined that the 2016 TRM would be applicable for the entirety of Phase III, unless a mid-phase update was deemed necessary by the Commission.<sup>11</sup>

Regarding Phase IV of the EE&C Program, the Commission again adopted the TRM as a component of the EE&C Program evaluation process.<sup>12</sup> In keeping with Phase III, the Commission determined that the 2021 TRM would be applicable for the entirety of Phase IV, unless a mid-phase update was deemed necessary by the Commission. In addition, the Commission adopted a new process for incorporating codes, standards, and ENERGY STAR specifications that change during Phase IV without undertaking a full TRM update.<sup>13</sup>

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<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 Update Order*, at Docket No. M-00051865, entered June 1, 2009 (2009 TRM).

<sup>7</sup> *Id.* at 17 and 18.

<sup>8</sup> See *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2012-2289411, entered August 3, 2012 (Phase II Implementation Order), at 71.

<sup>9</sup> *Id.* at 75.

<sup>10</sup> See *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2014-2424864, entered June 19, 2015 (Phase III Implementation Order), at 95.

<sup>11</sup> *Id.* at 97 and 98.

<sup>12</sup> See *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2020-3015228, entered June 19, 2020 (Phase IV Implementation Order), at 97.

<sup>13</sup> *Id.* at 98 and 99.

Regarding a potential Phase V of the EE&C Program, in keeping with guidance from previous Implementation Orders, we anticipate that the TRM will be adopted as a component of the EE&C Program evaluation process. If Phase V of the EE&C Program is adopted, the Commission proposes continuing with the process for incorporating codes, standards, and ENERGY STAR specifications that change during Phase V without undertaking a full TRM update.

In this Order, the Commission proposes several updates to climate-related assumptions in the TRM, an update to the building code, expanding the TRM to calculate winter peak demand savings, and other general changes described in greater detail in [Section B](#) below. The Commission proposes 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 proposed updates to residential and non-residential measures included from the Phase IV TRM. [Section G](#) and [Section H](#) of this Order list four residential and eight non-residential measures that the Commission proposes to remove from the 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 is to review the TRM and the Total Resource Cost (TRC) Test and provide suggestions for 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 proposes several changes and additions for consideration for inclusion in the 2026 TRM. With the adoption of this Tentative Order, the Commission seeks comments on the proposed 2026 TRM. The proposed 2026 TRM and its associated Appendices can be found on the Commission's website at <https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/>. A notice of the adoption of this Tentative Order and the proposed 2026 TRM will be published in the *Pennsylvania Bulletin*.

## **DISCUSSION**

The proposed 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, many of the issues raised during the 2021 TRM update process were referred to the SWE to do further research in order to provide recommendations during the 2026 TRM update. The proposed 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 proposed changes are intended to make the TRM a more effective and professional tool for validating energy savings and providing support for the Act 129 goals.

The major goals of the proposed 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 proposed 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 proposed changes and updates. Minor administrative changes will not be discussed.

#### **A. Application Of The TRM**

As discussed above, the Commission has previously updated the TRM on an annual basis in Phases I and II of the EE&C Program to capture changes in codes and regulations as they occur. In Phase III of the EE&C Program, the Commission adopted one TRM for the entire Phase with an option to propose modifications if necessary as well as a new annual process for incorporating codes, standards, and ENERGY STAR specifications that change during Phase III without undertaking a full TRM update. In Phase IV of the EE&C Program, the Commission adopted one TRM for the entire Phase with an option to propose modifications if necessary. While we have attempted to capture all known changes to codes and standards in this proposed TRM for Phase V, we recognize that the codes and standards are not static and may change during the course of Phase V. Accordingly, we have proposed a mechanism in [Section B.5](#) of this Order through which we will update the TRM for currently unknown changes to codes and standards that may occur from now through Phase V.

## **B. General Changes**

### **1. Code Changes**

Pennsylvania updated its building code from International Energy Conservation Code (IECC) 2015 to IECC 2018 in 2022. The Uniform Construction Code (UCC) Review and Advisory Council, established by the Pennsylvania Construction Code Act (PCCA), is charged with reviewing the 2021 IECC as part of the required triennial code revisions. The 2021 IECC is scheduled to have an effective date of July 13, 2025. Given the current estimated adoption timeline, the Commission proposes to utilize IECC 2021 minimum efficiency standards for TRM parameters which rely on building code for baseline values.

Additionally, several United States Department of Energy (US DOE) federal standards and ENERGY STAR specifications have been updated since the last TRM update. As with the updated building code, it is important for the TRM to reflect the most recent federal standards and ENERGY STAR specifications, so that annual energy savings and peak demand savings algorithms reflect the true savings.

### **2. 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 is considering bifurcating the peak demand definition to include both summer peak and winter peak. To support the associated planning considerations, we propose 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 EE 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 proposes 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 proposes 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.

### **3. 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. However, for most measures additional research is needed. For many measures, the Commission proposes 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 proposes 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 proposes to use the Pennsylvania state-specific load shapes. Additionally, the Commission proposes 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 proposes 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 coincidence factors to calculate summer peak demand savings. The Commission proposes that using summer ETDFs in lieu of summer coincidence factors 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 proposes 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>
<b>Mobile Home</b>	218,886 (3.92%)
<b>Multi-Family (2-4 Units)</b>	471,187 (8.44%)
<b>Multi-Family (5+Units)</b>	670,461 (12.01%)
<b>Single-Family Attached</b>	1,034,142 (18.52%)
<b>Single-Family Detached</b>	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.

#### **4. Incorporate Findings From The 2023 Residential And Non-Residential Baseline Studies**

In its planning for a potential Phase V of the Act 129 EE&C Program, the Commission directed the SWE to conduct electric energy efficiency baseline studies for the residential and non-residential markets to establish penetration and saturation rates of various EE&C measures and products within the service areas of the seven Pennsylvania EDCs that are subject to the energy efficiency requirements of Act 129. The fieldwork for the baseline studies was conducted in 2023 and both studies were publicly released on March 25, 2024. The Commission proposes to use the information provided in the Act 129 2023 Residential and Non-Residential Baseline Studies to align the 2026 TRM sources with current data for multiple measures.

#### **5. Process For Code Change Updates**

For Phase V, the Commission proposes 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 proposes the following schedule for this process:

<b>Estimated Date</b>	<b>Action</b>
March 15	SWE memo analyzing impact of code or standards changes will be delivered to TUS.
April 15	TUS will determine if an update is warranted.
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.

## **6. Updated Heating And Cooling Degree Days**

The Commission proposes 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 1-7 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 proposes adopting 15-year climate normals produced by the National Oceanic and Atmospheric Administration (NOAA).<sup>14</sup> The most recent 15-year climate normals were calculated using data

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<sup>14</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.

**Table 2: 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 proposes 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 3-27 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 2 ( $860 / 726 = 1.18$ ) to 594 returns a projected 701  $EFLH_{cool}$ . The ratio approach was not used to adjust operating assumptions for residential HVAC equipment. Adjustments for such residential HVAC equipment are discussed in Section B.7.

## **7. Updated Equivalent Full Load Hours And Coincidence Factors For Residential HVAC Equipment**

The Commission proposes to revise the EFLH and summer Coincidence Factor (CF) values for residential heating, ventilation, and air conditioning (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>15</sup> Since the Commission proposes using NOAA's 15-year climate normal as the normal weather definition (see Section B.6), 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 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 proposes the inclusion of a winter CF value for residential HVAC equipment. See Section B.2 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>16</sup> Typical heat pump runtime (compressor or auxiliary) during the winter peak demand

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<sup>15</sup> Available at <https://www.puc.pa.gov/pcdocs/1614698.docx>

<sup>16</sup> <https://www.ecobee.com/donateyourdata/>.

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 3.

**Table 3: 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

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

## **8. County To Climate Region Mapping**

The Commission proposes to update the climate region for two counties, Dauphin and Perry County, from climate region E to climate region F. This configuration matches current American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Climate Zones and 2021 IECC Climate Zones and therefore better aligns the TRM with the building code while allowing for the calculation of more localized results.

## 9. 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 proposes to follow the approach the New York State TRM uses for calculating both annual energy consumption and peak demand interactive effects.<sup>17</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.

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<sup>17</sup> <https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={B072068B-0000-CD13-BD60-CA459E7A687D}>

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.

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. 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>18</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. 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.

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<sup>18</sup> <https://www.puc.pa.gov/pcdocs/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)

The Commission proposes calculating different non-residential interactive energy and demand factors based on HVAC configuration (Table 4).

**Table 4: 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 propose 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 presence of electric cooling. Default values for applicability come from the Act 129 2023 Pennsylvania Residential Baseline Study.

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.

Default values for HVAC efficiency come from the Act 129 2023 Pennsylvania Residential Baseline Study. % Electric for residential interactive factors is calculated in the same manner as non-residential interactive factors. Table 5 shows the Commission's proposed residential interactive energy and demand factors by EDC.

**Table 5: 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

### **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 is proposing to include 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

#### **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 propose 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 3.5.19 – 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

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

The following sections describe clarifications and modifications to the residential measure protocols:

### **1. Section 2.1.1 – ENERGY STAR Lighting<sup>19</sup>**

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

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<sup>19</sup> See Section 2.1.1 – ENERGY STAR Lighting of the 2021 TRM, Volume 2, page 1.

In response to the US DOE's updated definition of general service lamps (GSLs) effective 7/8/22, the Commission proposes 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 proposes removing cross-sector sales from this measure as those are comprised of upstream GSLs which would no longer be eligible. The Commission proposes 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 proposes 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 proposes 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 proposes an in-service rate (ISR) of 100% for direct-install programs, and EDC data gathering for all other delivery channels.

## **2. Section 2.1.2 – Residential Occupancy Sensors<sup>20</sup>**

The Commission proposes updating the measure life from 10 to 8 years to reflect the most current California eTRM effective useful life (EUL). The Commission also proposes providing separate default wattages (Watts<sub>controlled</sub>) 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 recommends 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 proposes 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).

## **3. Section 2.1.3 – LED And Electroluminescent Nightlights<sup>21</sup>**

The Commission proposes updating the default ISR from the existing value of 0.2 to 0.14. The proposed value is based on PY13 and PY14 EDC data, which is more current than the existing value derived from PY9 EDC data.

## **4. Section 2.1.4 – Holiday Lights<sup>22</sup>**

The Commission proposes updating the default bulb wattages based on a sample of 180 holiday lights gathered from HomeDepot.com and Walmart.com in March of 2024. The Commission also proposes updating the annual hours of operation based on the Michigan Energy Measures Database.

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<sup>20</sup> See Section 2.1.2 – Residential Occupancy Sensors of the 2021 TRM, Volume 2, page 6.

<sup>21</sup> See Section 2.1.3 – LED and Electroluminescent Nightlights of the 2021 TRM, Volume 2, page 8.

<sup>22</sup> See Section 2.1.4 – Holiday Lights of the 2021 TRM, Volume 2, page 10.

**5. Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP<sup>23</sup>**

This measure in the 2021 TRM includes the consideration of midstream delivery. The Commission proposes to limit this measure to non-midstream delivery. Midstream delivery will be considered on its own as measure 2.2.2 – High Efficiency Equipment for Midstream Delivery: ASHP, CAC, GSHP, PTAC, PTHP.

The Commission proposes 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 air source heat pumps, a relationship must be established to air source equivalents to enable savings calculations; the Commission proposes updating these conversion factors.

**6. Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps With Midstream Delivery Option<sup>24</sup>**

The Commission proposes updating the minimum efficiency requirements to align with ENERGY STAR Version 6.1 Central Air Conditioner and Heat Pump Final Specification. The Commission also proposes 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

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<sup>23</sup> See Section 2.2.1 – High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP of the 2021 TRM, Volume 2, page 12.

<sup>24</sup> See Section 2.2.2 – High Efficiency Equipment: Ductless Heat Pumps with Midstream Delivery Option of the 2021 TRM, Volume 2, page 17.



construction installations based on applicable updates to federal standards. The Commission also proposes to update the midstream composites defaults for consistency with the changes described above.

**7. Section 2.2.3 – ECM Circulation Fans<sup>25</sup>**

The Commission proposes to reduce the measure life of electronically commutated motor (ECM) circulation fans to 5 years in line with the EUL in the California eTRM.

**8. Section 2.2.4 – GSHP Desuperheaters<sup>26</sup>**

The Commission proposes updating the default  $UEF_{base}$  values based on analysis of data from the Act 129 2023 Pennsylvania Residential Baseline Study.

**9. Section 2.2.5 – Air Conditioner & Heat Pump Maintenance<sup>27</sup>**

The Commission proposes 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 air source heat pumps, a relationship must be established to air source equivalents to enable savings calculations; the Commission proposes updating these conversion factors.

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<sup>25</sup> See Section 2.2.3 – ECM Circulation Fans of the 2021 TRM, Volume 2, page 25.

<sup>26</sup> See Section 2.2.4 – GSHP Desuperheaters of the 2021 TRM, Volume 2, page 27.

<sup>27</sup> See Section 2.2.5 – Air Conditioner & Heat Pump Maintenance of the 2021 TRM, Volume 2, page 29.

**10. Section 2.2.7 – ENERGY STAR Room Air Conditioners<sup>28</sup>**

With the latest federal standards updates, set to take effect on June 1, 2026, the federal standards will exceed the requirements of the current ENERGY STAR requirements for Room Air Conditioners (ACs); therefore, the Commission proposes the elimination of ENERGY STAR Version 5.0 as the default minimum efficiency requirements for efficient equipment. The Commission proposes updating the default equipment capacities for Room ACs for consistency with data from the Act 129 2023 Pennsylvania Residential Baseline Study. The Commission also suggests updating default baseline efficiency requirements for all vintages to be based on applicable federal standards.

**11. Section 2.2.8 – Room AC Retirement<sup>29</sup>**

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

**12. Section 2.2.10 – Air Handler Filter Whistles<sup>30</sup>**

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

**13. Section 2.2.11 – ENERGY STAR Certified Connected Thermostats<sup>31</sup>**

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

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<sup>28</sup> See Section 2.2.7 – ENERGY STAR Room Air Conditioners of the 2021 TRM, Volume 2, page 35.

<sup>29</sup> See Section 2.2.8 – Room AC (RAC) Retirement of the 2021 TRM, Volume 2, page 38.

<sup>30</sup> See Section 2.2.10 – Air Handler Filter Whistles of the 2021 TRM, Volume 2, page 46.

<sup>31</sup> See Section 2.2.11 – ENERGY STAR Certified Connected Thermostats of the 2021 TRM, Volume 2, page 48.

#### **14. Section 2.2.12 – Furnace Maintenance<sup>32</sup>**

The Commission proposes to increase the measure life of this measure to 3 years in line with all other tune-up measures. The Commission also suggests updating default baseline efficiency requirements for all vintages to be based on applicable updates made with the federal standards.

#### **15. Section 2.3.1 – Heat Pump Water Heaters<sup>33</sup>**

The Commission proposes 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>34</sup> The Commission also proposes updating the default cooling and heating system efficiencies (HSPF2 and SEER2) based on Act 129 2023 Pennsylvania Residential Baseline Study findings. Additionally, the Commission proposes 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.

#### **16. Section 2.3.2 – Solar Water Heaters<sup>35</sup>**

The Commission proposes updating the default baseline uniform energy factor ( $UEF_{base}$ ) from 0.90 to 0.92 based on Act 129 2023 Pennsylvania Residential Baseline Study findings.

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<sup>32</sup> See Section 2.2.10 – Furnace Maintenance of the 2021 TRM, Volume 2, page 56.

<sup>33</sup> See Section 2.3.1 – Heat Pump Water Heaters of the 2021 TRM, Volume 2, page 58.

<sup>34</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.

<sup>35</sup> See Section 2.3.2 – Solar Water Heaters of the 2021 TRM, Volume 2, page 64.

### **17. Section 2.3.5 –Water Heater Temperature Setback<sup>36</sup>**

The Commission proposes 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 proposes updating the volume of hot water used per clothes dryer cycle from 7 gallons to 25 gallons to align with US DOE and US EPA guidance. Furthermore, the Commission proposes 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 based on Act 129 2023 Pennsylvania Residential Baseline Study findings. Finally, the Commission proposes updating the default thermal efficiency of heat pump water heaters ( $\eta_{elec}$ ) from 2.10 to 3.11 based on a calculation in the Maryland EmPOWER TRM that links UEF to coefficient of performance (COP).

### **18. Section 2.3.6 –Water Heater Pipe Insulation<sup>37</sup>**

The Commission proposes 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 will improve the precision of the calculated savings values for water heater pipe insulation installation projects. The Commission also proposes updating the measure life from 13 years to 11 years to align with the California eTRM.

### **19. Section 2.3.7 – Low-flow Faucet Aerators<sup>38</sup>**

The Commission proposes updating the default number of persons per household ( $N_{persons}$ ) based on 2017-2021 American Community Survey 5-Year Estimates, and

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<sup>36</sup> See Section 2.3.5 – Water Heater Temperature Setback of the 2021 TRM, Volume 2, page 74.

<sup>37</sup> See Section 2.3.6 – Water Heater Pipe Insulation of the 2021 TRM, page 77.

<sup>38</sup> See Section 2.3.7 – Low-flow Faucet Aerators of the 2021 TRM, Volume 2, page 79.

default faucets per home ( $N_{\text{faucets-home}}$ ) and share of homes with electric water heaters (ELEC) based on Act 129 2023 Pennsylvania Residential Baseline Study findings.<sup>39</sup> Additionally, the Commission proposes updating the default kit delivery ISR from 28% to 26% based on surveys of FirstEnergy customers that received aerators in kits in PY13 and PY14. Furthermore, the Commission proposes updating the default heat pump water heater recover efficiency (RE) based on data from the Air-Conditioning, Heating, and Refrigeration Institute directory, and adding a default RE for unknown water heater type equal to the weighted average of REs by water heater type found in the Act 129 2023 Pennsylvania Residential Baseline Study.<sup>40</sup> The Commission proposes updating the default minutes of hot water usage per person per day ( $T_{\text{person-day}}$ ) for unknown rooms as the average of  $T_{\text{person-day}}$  for kitchens and bathrooms weighted by the average number of kitchens and bathrooms per home found in the Act 129 2023 Pennsylvania Residential Baseline Study. Finally, the Commission recommends removing the default efficient aerator flow rate ( $\text{GPM}_{\text{low}}$ ) and requiring EDC data gathering (as is the case for low-flow showerheads).

## **20. Section 2.3.8 – Low-flow Showerheads<sup>41</sup>**

The Commission proposes revising the measure life from 9 years to 10 years consistent with the California eTRM. Additionally, the Commission proposes updating default gallons per minute of the baseline showerhead ( $\text{GPM}_{\text{base}}$ ) and showerheads per home ( $N_{\text{showerheads-home}}$ ) based on Act 129 2023 Pennsylvania Residential Baseline Study findings.<sup>42</sup> Finally, the Commission proposes updating the default kit delivery ISR from

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<sup>39</sup> The updates to  $N_{\text{persons}}$  and ELEC impact two other measures that use this variable, including 2.3.8 Low-Flow Showerheads and 2.3.9 Thermostatic Shower Restriction Valves.

<sup>40</sup> The update to RE impacts several other measures that use this variable, including 2.3.8 Low-Flow Showerheads, 2.3.9 Thermostatic Shower Restriction Valves, and 2.3.10 Drain Water Heat Recovery Units.

<sup>41</sup> See Section 2.3.8 – Low-flow Showerheads of the 2021 TRM, Volume 2, page 84.

<sup>42</sup> These updates apply to 2.3.9 Thermostatic Shower Restriction Valves which also uses  $\text{GPM}_{\text{base}}$  and  $N_{\text{showerheads-home}}$ . See Section 2.3.9 – Thermostatic Shower Restriction Valve of the 2021 TRM, Volume 2, page 89.

35% to 21% based on surveys of FirstEnergy customers that received showerheads in kits in PY13 and PY14.

**21. Section 2.3.10 – Drain Water Heat Recovery Units<sup>43</sup>**

The existing algorithm focuses on shower drains only. However, this measure could conceivably serve all hot water end uses. The Commission therefore proposes revising the algorithm to accommodate separate default gallons of hot water used per household per day for whole house and showers only.

**22. Section 2.4.1 – ENERGY STAR Refrigerators<sup>44</sup> And Section 2.4.2 – ENERGY STAR Freezers<sup>45</sup>**

The Commission proposes 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 proposes 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.

**23. Section 2.4.3 – Refrigerator / Freezer Recycling with and without Replacement<sup>46</sup>**

The Commission proposes updating the default fraction of appliances located in unconditioned space (UNCONDITIONED) using Act 129 2023 Pennsylvania Residential Baseline Study findings. Additionally, the Commission proposes correcting the ENERGY STAR Refrigerators measure life (from 12 to 14 years) so that it matches the 14 years listed in Section 2.4.1 – ENERGY STAR Refrigerators. Finally, the

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<sup>43</sup> See Section 2.3.9 – Thermostatic Shower Restriction Valve of the 2021 TRM, Volume 2, page 89.

<sup>44</sup> See Section 2.4.1 – ENERGY STAR Refrigerators of the 2021 TRM, Volume 2, page 97.

<sup>45</sup> See Section 2.4.2 – ENERGY STAR Freezers of the 2021, Volume 2, TRM, page 105.

<sup>46</sup> See Section 2.4.3 – Refrigerator / Freezer Recycling with and without Replacement of the 2021 TRM, Volume 2, page 109.

Commission proposes correcting a typo where PY3 was written instead of PY8, the correct year.

#### **24. Section 2.4.4 – ENERGY STAR Clothes Washers<sup>47</sup>**

The Commission proposes updating default values for the number of clothes washer cycles per year (cycles) and the percentage of homes with a dryer that use the dryer every time clothes are washed (%dry/wash) with data from the 2020 US DOE Residential Energy Consumption Survey.<sup>48</sup> In addition, the Commission proposes 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 Act 129 2023 Pennsylvania Residential Baseline Study findings. Furthermore, the Commission proposes updating the measure life from 11 to 14 years based on a more recent and reliable source. The Commission also proposes 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 proposes adding the federal standards that become effective 3/1/28.

#### **25. Section 2.4.5 – ENERGY STAR Dryers<sup>49</sup>**

The Commission proposes increasing the measure life from 12 to 14 years to better align with updated values and sources used in other TRMs. In addition, the Commission proposes providing separate default ENERGY STAR combined energy factors (CEF<sub>ee</sub>) for dryers that use heat pump technology and those that do not, equal to the median CEF<sub>ee</sub> among all ENERGY STAR-certified dryers. Finally, the Commission proposes adding baseline combined energy factors (CEF<sub>base</sub>) for federal standards that go into effect 3/1/28.

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<sup>47</sup> See Section 2.4.4 – ENERGY STAR Clothes Washers of the 2021 TRM, Volume 2, page 115.

<sup>48</sup> These updates also apply to 2.4.5 ENERGY STAR Dryers.

<sup>49</sup> See Section 2.4.5 – ENERGY STAR Clothes Dryers of the 2021 TRM, Volume 2, page 119.

**26. Section 2.4.6 – Heat Pump Clothes Dryers<sup>50</sup>**

The Commission proposes combining this measure with ENERGY STAR clothes dryers because the same algorithms, federal standards, and ENERGY STAR standards apply to both measures.

**27. Section 2.4.8 – ENERGY STAR Dishwashers<sup>51</sup>**

The Commission proposes updating default efficient values to reflect updates to ENERGY STAR specifications and adding defaults for compact dishwashers.

**28. Section 2.4.9 – ENERGY STAR Dehumidifiers<sup>52</sup>**

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

**29. Section 2.4.11 – ENERGY STAR Ceiling Fans<sup>53</sup>**

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

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<sup>50</sup> See Section 2.4.6 – Heat Pump Clothes Dryers of the 2021 TRM, Volume 2, page 122.

<sup>51</sup> See Section 2.4.8 – ENERGY STAR Dishwashers of the 2021 TRM, Volume 2, page 127.

<sup>52</sup> See Section 2.4.9 – ENERGY STAR Dehumidifiers of the 2021 TRM, Volume 2, page 130.

<sup>53</sup> See Section 2.4.11 – ENERGY STAR Ceiling Fans of the 2021 TRM, Volume 2, page 136.



### **30. Section 2.4.12 – ENERGY STAR Air Purifiers<sup>54</sup>**

The Commission proposes 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 in effect after December 31<sup>st</sup>, 2023, until 2025 and a more efficient set of standards that will be in effect 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>55</sup>

### **31. Section 2.5.2 – Advanced Power Strips<sup>56</sup>**

The Commission proposes updating the ISR for this measure based on results from PY13/14.

### **32. Section 2.6.1 – Residential Air Sealing<sup>57</sup>**

Savings estimates under this section depend on an energy model of a representative prototype home. The Commission proposes replacing the current model with a new energy model created in BEopt v.2.8.0, a modelling tool developed by NREL.<sup>58</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 quadratic regression model and a table of regression coefficients. Savings are calculated by selecting the appropriate coefficients for the location and HVAC configuration and

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<sup>54</sup> See Section 2.4.12 – ENERGY STAR Air Purifiers of the 2021 TRM, Volume 2, page 139.

<sup>55</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>56</sup> See Section 2.5.2 – Advanced Power Strips of the 2021 TRM, page 145.

<sup>57</sup> See Section 2.6.1 – Residential Air Sealing of the 2021 TRM, page 148.

<sup>58</sup> See <https://www.nrel.gov/buildings/beopt.html>.

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. Finally, the Commission also proposes the introduction of advisories for implementers regarding indoor air quality and air safety in very tight homes.

### **33. Section 2.6.2 – Weather Stripping, Caulking, And Outlet Gaskets<sup>59</sup>**

The Commission proposes 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 proposes 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 proposes to add a variable reflecting the percent of homes with electric heating.

### **34. Section 2.6.3 – Ceiling/Attic, Wall, Floor, and Rim Joist Insulation<sup>60</sup>**

The Commission proposes 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.

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<sup>59</sup> See Section 2.6.2 – Weather Stripping, Caulking, and Outlet Gaskets of the 2021 TRM, Volume 2, page 153.

<sup>60</sup> See Section 2.6.3 – Ceiling/Attic, Wall, Floor, and Rim Joist Insulation of the 2021 TRM, Volume 2, page 159.

### **35. Section 2.6.4 – Basement Or Crawl Space Wall Insulation<sup>61</sup>**

The Commission proposes 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.

### **36. Section 2.6.5 – ENERGY STAR Windows<sup>62</sup>**

The Commission proposes 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.

### **37. Section 2.7.1 – Residential New Construction<sup>63</sup>**

The Commission proposes 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 proposes 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 proposes 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 proposes

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<sup>61</sup> See Section 2.6.4 – Basement or Crawl Space Wall Insulation of the 2021 TRM, Volume 2, page 164.

<sup>62</sup> See Section 2.6.5 – ENERGY STAR Windows of the 2021 TRM, Volume 2, page 169.

<sup>63</sup> See Section 2.7.1 – Residential New Construction of the 2021 TRM, Volume 2, page 172.

updating the parameters of the baseline code-compliant home according to the requirements of the 2021 IECC and updated federal standards. Multifamily buildings will follow the appropriate residential or commercial code in accordance with the 2021 IECC building definitions.

### **38. Section 2.7.2 – ENERGY STAR Manufactured Homes<sup>64</sup>**

The Commission proposes allowing the option of estimating whole-home energy and peak demand savings using energy modelling software when the software provides hourly consumption outputs. If the software does not provide hourly energy consumption outputs, the Commission proposes to estimate peak demand savings using deemed energy to demand factors. The Commission also proposes 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 proposes updating the parameters of the ENERGY STAR manufactured home in accordance with the v3 standards of the ENERGY STAR Manufactured Homes program.

### **39. Section 2.8.1 – Variable Speed Pool Pumps<sup>65</sup>**

The Commission proposes renaming this measure to Single-Speed Pool Pump Replacement to better reflect its standing after the introduction of federal minimum requirements for pool pump efficiency; a separate measure has been introduced for ENERGY STAR Pool Pumps. The proposed simplification of the algorithm in the 2026 TRM is algebraically equivalent to the equations in the 2021 TRM but simplifies savings calculations considerably. The Commission also proposes the provision of separate updated default volumes for above-ground and in-ground pools, rather than a single volume for all pools. Finally, the Commission proposes replacing the table of

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<sup>64</sup> See Section 2.7.2 – ENERGY STAR Manufactured Homes of the 2021 TRM, Volume 2, page 180.

<sup>65</sup> See Section 2.8.1 – Variable Speed Pool Pumps of the 2021 TRM, Volume 2, page 190.

default variable speed pool pump efficiencies with the federal minimum requirements which went into effect on July 19, 2021.

#### 40. Measure Number Changes

The changes proposed herein will result in new measure numbers for several residential measures. Table 6 below shows the current measure name and number and the new measure name and number (assuming all of the Commission’s proposed changes are made) for all affected measures. The table also shows measures that the Commission proposes removing – these measures are discussed in more detail later.

**Table 6: Proposed 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
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
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

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
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
2.3.10	Drain Water Heat Recovery Units	2.3.9	Drain Water Heat Recovery Units
2.4.4	ENERGY STAR Clothes Washers	2.4.8	ENERGY STAR Clothes Washers
2.4.5	ENERGY STAR Clothes Dryers	2.4.9	ENERGY STAR Clothes Dryers
2.4.6	Heat Pump Clothes Dryers	-	Deleted
2.4.7	Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer	-	Deleted
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
2.8.1	Variable Speed Pool Pumps	2.8.2	Single Speed Pool Pump Replacement

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

The following sections describe clarifications and modifications to the C&I EE&C measure protocols.

### **1. Section 3.1.1 – Lighting Improvements<sup>66</sup>**

The Commission proposes 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 DesignLights 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 proposes 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 proposes 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 2023 Act 129 Non-Residential Baseline Study found approximately 14% of all indoor linear general service lighting in Pennsylvania businesses was T-12 linear fluorescent.

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<sup>66</sup> See Section 3.1.1 – Lighting Improvements of the 2021 TRM, Volume 3, page 1.

To address this, the Commission proposes 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 proposes 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 with Electric Heat, Fossil Fuel Heat Only, Electric Heat Only, and Unknown (Market Average) will replace the two heating fuel configurations used in the 2021 TRM, which consisted of Non-Electric Heat and Electric Heat.

Finally, the Commission proposes 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.

## **2. Section 3.1.2 – New Construction Lighting<sup>67</sup>**

The Commission proposes 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.

## **3. Section 3.1.3 – Lighting Controls<sup>68</sup>**

The Commission proposes adding a winter coincidence factor and winter interactive energy and demand factors.

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<sup>67</sup> See Section 3.1.2 – New Construction Lighting of the 2021 TRM, Volume 3, page 15.

<sup>68</sup> See Section 3.1.3 – Lighting Controls of the 2021 TRM, Volume 3, page 25.



#### **4. Section 3.1.4 – LED Exit Signs<sup>69</sup>**

The Commission proposes adding a winter coincidence factor and winter interactive energy and demand factors. These minor updates lead to small changes in the default savings values.

#### **5. Section 3.1.6 – LED Refrigeration Display Case Lighting<sup>70</sup>**

The Commission proposes adding a winter coincidence factor to the measure equal to the winter CF for the ‘Grocery’ building type. The Commission also proposes to align the summer CF for this measure with the summer CF for the ‘Grocery’ building type.

#### **6. Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs<sup>71</sup>**

The Commission proposes 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 proposes to have the least efficient technology available for purchase set the baseline. The Commission proposes 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 propose to retain the Watts<sub>base</sub> tables by equipment type. For linear lamps, LED fixtures, and retrofit kits we propose 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

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<sup>69</sup> See Section 3.1.4 – LED Exit Signs of the 2021 TRM, Volume 3, page 28.

<sup>70</sup> See Section 3.1.6 – LED Refrigeration Display Case Lighting of the 2021 TRM, Volume 3, page 34.

<sup>71</sup> See Section 3.1.7 – Lighting Improvements for Midstream Delivery Programs of the 2021 TRM, Volume 3, page 36.

wattage based on the rated lumen output of the program-supported product and streamlines the measure characterization considerably.

### **7. Section 3.2.1 – HVAC Systems<sup>72</sup>**

The Commission suggests updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates made with the federal standards. The proposed introduction of ETDFs for peak demand calculations (described in Section B.6) eliminates the need for EER/EER2 metrics; the Commission suggests removing the usage of SEER to EER conversion factors from the measure.

### **8. Section 3.2.2 – Electric Chillers<sup>73</sup>**

The Commission also suggests 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 proposes to edit the savings algorithms to use the Integrated Part-Load Value metric alone.

### **9. Section 3.2.3 – Water Source And Geothermal Heat Pumps<sup>74</sup>**

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

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<sup>72</sup> See Section 3.2.1 – HVAC Systems of the 2021 TRM, Volume 3, page 44.

<sup>73</sup> See Section 3.2.2 – Electric Chillers of the 2021 TRM, Volume 3, page 53.

<sup>74</sup> See Section 3.2.3 – Water Source and Geothermal Heat Pumps of the 2021 TRM, Volume 3, page 58.

The Commission also suggests 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 air source heat pumps, a relationship must be established to air source equivalents to enable savings calculations; the Commission proposes updating these conversion factors.

**10. Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 tons<sup>75</sup>**

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

**11. Section 3.2.6 – Small C&I HVAC Refrigerant Charge Correction<sup>76</sup>**

The Commission proposes to reduce the measure life of this measure to 3 years in line with the values stated in the California eTRM. The Commission also suggests updating default baseline efficiency requirements for the new construction vintage to be based on applicable updates made with the federal standards.

**12. Section 3.2.7 – ENERGY STAR Room Air Conditioner<sup>77</sup>**

With the latest federal standards updates, set to take effect on June 1, 2026, the federal standards will exceed the requirements of the current ENERGY STAR

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<sup>75</sup> Section 3.2.4 – Ductless Mini-Split Heat Pumps – Commercial < 5.4 tons of the 2021 TRM, Volume 3, page 67.

<sup>76</sup> See Section 3.2.6 – Small C&I HVAC Refrigerant Charge Correction of the 2021 TRM, Volume 3, page 75.

<sup>77</sup> See Section 3.2.7 – ENERGY STAR Room Air Conditioner of the 2021 TRM, Volume 3, page 80.

requirements for Room ACs; therefore, the Commission proposes the elimination of ENERGY STAR Version 5.0 as the default minimum efficiency requirements for efficient equipment. The Commission proposes updating the default equipment capacities for Room ACs for consistency with data from the Act 129 2023 Pennsylvania Residential Baseline Study.

### **13. Section 3.2.8 – Controls: Guest Room Occupancy Sensor<sup>78</sup>**

The Commission proposes to reduce the measure life of this measure to 11 years in line with the values stated in the California eTRM.

In addition, the Commission proposes to update the structure of the current energy savings factor (ESF) values to better estimate summer and winter peak demand savings. The Commission also proposes to revise the savings algorithms to quantify cooling and heating savings separately to facilitate calculation of seasonal peak demand savings.

### **14. Section 3.2.9 – Controls: Economizer<sup>79</sup>**

The Commission proposes to reduce the measure life of this measure to 3 years in line with the values stated in the California eTRM.

Additionally, the Commission proposes to revise the current  $Eff_{ret}$  value with data from the Act 129 2023 Pennsylvania Non-Residential Baseline Study.

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<sup>78</sup> See Section 3.2.8 – Controls: Guest Room Occupancy Sensor of the 2021 TRM, Volume 3, page 84.

<sup>79</sup> See Section 3.2.9 – Controls: Economizer of the 2021 TRM, Volume 3, page 87.

**15. Section 3.2.11 – Computer Room Air Conditioner/Handler Electronically Commutated Plug Fans<sup>80</sup>**

The Commission proposes removing New Construction and Replace on Burnout vintages in line with current eligibility guidance laid out for the measure.

**16. Section 3.2.12 – Computer Room Air Conditioner/Handler VSD On AC Fan Motors<sup>81</sup>**

The Commission proposes removing New Construction and Replace on Burnout vintages in line with current eligibility guidance laid out for the measure.

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

The Commission proposes updating the eligibility criteria to require that efficient equipment exceed current federal standards for ceiling fan energy index (CFEI). The Commission also proposes 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 proposes to revise the savings algorithms to use the cubic feet per minute (CFM) / watt efficiency metric of a fan and its hours of operation.

**18. Section 3.3.1 – Premium Efficiency Motors<sup>82</sup>**

A new motor efficiency reference table is 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

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<sup>80</sup> See Section 3.2.10 – Computer Room Air Conditioner of the 2021 TRM, Volume 3, page 90.

<sup>81</sup> See Section 3.2.11 – Computer Room Air Conditioner/Handler Electronically Commutated Plug Fans of the 2021 TRM, Volume 3, page 94.

<sup>82</sup> See Section 3.3.1 – Premium Efficiency Motors of the 2021 TRM, page 104.

weather data provided by NOAA 15-year climate normals. Appendix D Motor and VFD Audit and Design Tool will be updated to reflect all changes.

**19. Section 3.3.2 – Variable Frequency Drive (VFD) Improvements<sup>83</sup>**

A new variable,  $PLR_{\text{winter peak}}$ , is introduced with a default flow-fraction of 70% to allow for the estimation of winter peak demand savings. Another proposed change is the introduction of a midstream delivery channel for VFDs with a maximum motor size based on end use. Additional proposed changes include 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.

**20. Section 3.3.3 – ECM Circulating Fan<sup>84</sup>**

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

**21. Section 3.4.1 – Heat Pump Water Heaters<sup>85</sup>**

The Commission proposes 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 2023 Act 129 Pennsylvania Non-Residential Baseline Study.

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<sup>83</sup> See Section 3.3.2 – Variable Frequency Drive (VFD) Improvements of the 2021 TRM, page 115.

<sup>84</sup> See Section 3.3.3 – ECM Circulating Fan of the 2021 TRM, page 119.

<sup>85</sup> See Section 3.4.1 – Heat Pump Water Heaters of the 2021 TRM, Volume 3, page 132.

In addition, the Commission proposes 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 proposes 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 proposes 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.

## **22. Section 3.4.2 – Low-Flow Pre-Rinse Sprayers For Retrofit Programs<sup>86</sup>**

To simplify the default savings calculations, the Commission proposes 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 proposes that the energy efficient flow rates used in default savings calculations also differ based on product class. We propose 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 proposes updating the uniform energy factor of the existing electric water heating system to match the Act 129 2023 Pennsylvania Residential Baseline Study results.

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<sup>86</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.

**23. Section 3.5.1 – High-Efficiency Refrigeration / Freezer Cases<sup>87</sup>**

The Commission proposes 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.

**24. Section 3.5.3 – Controls: Evaporator Fan Controllers<sup>88</sup>**

The Commission proposes updating the savings algorithm to include default values for the connected fan load required per motor horsepower, rather than requiring a separate equation to calculate connected load based on nameplate motor horsepower. Removing this equation also requires two fewer parameters compared to the 2021 TRM motor efficiency and load factor.

**25. Section 3.5.4 – Controls: Floating Head Pressure Controls<sup>89</sup>**

The Commission proposes updating the default values for the COP for refrigerator / freezer condensing units and remote condensers based on an updated version of the Regional Technical Forum (RTF) measure upon which these defaults are currently sourced (Grocery Floating Head Pressure Controls for Single Compressor Systems). The most recent version of the RTF measure was updated in 2022; the 2021 TRM draws from a 2016 version of the RTF measure. For condensing units, the proposed COP values are slightly higher. For remote condensers, the proposed COP values are slightly lower. The Commission also proposes updating the default savings values based on the 2022 version of the RTF measure, which involves using updated cooling degree day (CDD65) values from the RTF’s Climate Zone Calculation workbook

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<sup>87</sup> See Section 3.5.1 – High-efficiency Refrigeration / Freezer Cases of the 2021 TRM, Volume 3, page 146.

<sup>88</sup> See Section 3.5.3 – Controls: Evaporator Fan Controllers of the 2021 TRM, Volume 3, page 151.

<sup>89</sup> See Section 3.5.4 – Controls: Floating Head Pressure Controls of the 2021 TRM, Volume 3, page 154.



from 2022. These proposed updates will flow through to the default savings tables included in this protocol.

**26. Section 3.5.6 – Controls: Evaporator Coil Defrost Control<sup>90</sup>**

The Commission proposes adopting the annual savings calculation used by the 2024 Maryland EmPOWER TRM, which utilizes the COP of the refrigeration equipment rather than the savings factor for reduced cooling load from eliminating heat generated by the defrost element. By adopting this calculation methodology, the 2026 TRM adopts the default COP values used by the Maryland TRM. EmPOWER Maryland last updated the guidelines for this measure in 2023.

**27. Section 3.5.7 – Variable Speed Refrigeration Compressor<sup>91</sup>**

The Commission proposes 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.

**28. Section 3.5.8 – Strip Curtains For Walk-In Freezers And Coolers<sup>92</sup>**

The Commission proposes adding a default ISR of 75%, drawn from the same Strip Curtains measure maintained by the RTF.

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<sup>90</sup> See Section 3.5.6 – Controls: Evaporator Coil Defrost Control of the 2021 TRM, Volume 3, page 161.

<sup>91</sup> See Section 3.5.7 – Variable Speed Refrigeration Compressor of the 2021 TRM, Volume 3, page 163.

<sup>92</sup> See Section 3.5.8 – Strip Curtains for Walk-in Freezers and Coolers of the 2021 TRM, Volume 3, page 166.

## **29. Section 3.5.9 – Night Covers for Display Cases<sup>93</sup>**

The Commission proposes updating the savings algorithm for this measure to use the minimum total daily energy consumption values specified in federal regulations for refrigeration equipment (10 C.F.R. § 431.66), with separate values depending on the equipment manufacture date. The Commission also proposes updating the savings algorithm to explicitly use the energy savings factor developed by Southern California Edison’s Refrigeration Technology and Test Center—a critical reference supporting this measure in the 2021 TRM as well.

## **30. Section 3.5.10 – Auto Closers<sup>94</sup>**

The Commission proposes updating the default energy savings values associated with the measure and listing separate sets of default savings for each climate zone in Pennsylvania, as defined by the 2021 IECC. The default savings values in the 2021 TRM are drawn from a regression model based on CDD and HDD, with a single set of default savings for “All PA cities”. Due to differences in climate zone within Pennsylvania, the Commission proposes applying the regression model separately to each 2021 IECC climate zone in Pennsylvania, i.e. zones 4A and 5A.

## **31. Section 3.5.12 – Special Doors With Low Or No Anti-Sweat Heat For Low Reach-In Freezers And Coolers<sup>95</sup>**

The Commission proposes 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.

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<sup>93</sup> See Section 3.5.9 – Night Covers for Display Cases of the 2021 TRM, Volume 3, page 169.

<sup>94</sup> See Section 3.5.10 – Auto Closers of the 2021 TRM, Volume 3, page 171.

<sup>95</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.

**32. Section 3.5.13 – Suction Pipe Insulation For Walk-In Coolers And Freezers<sup>96</sup>**

The Commission proposes to expand on the existing CDD regression model based on work performed for Southern California Edison and provide calculated energy and demand savings for the nine Pennsylvania weather cities.

**33. Section 3.5.14 – Refrigerated Display Cases With Doors Replacing Open Cases<sup>97</sup>**

The Commission proposes updating the algorithm to reflect the interactive effects that this measure has on the building's comfort HVAC system. Specifically, this measure results in requiring 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).

**34. Section 3.5.15 – Adding Doors To Existing Refrigerated Display Cases<sup>98</sup>**

The Commission proposes updating the algorithm to reflect the interactive effects that this measure has on the building's comfort HVAC system. Specifically, this measure results in requiring additional cooling and less heating from the building's HVAC system. The revised algorithm computes interactive effects using a deemed cooling load

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<sup>96</sup> See Section 3.5.13 – Suction Pipe Insulation for Walk-in Coolers and Freezers of the 2021 TRM, Volume 3, page 177.

<sup>97</sup> See Section 3.5.14 – Refrigerated Display Cases with Doors Replacing Open Cases of the 2021 TRM, Volume 3, page 179.

<sup>98</sup> See Section 3.5.15 – Adding Doors to Existing Refrigerated Display Cases of the 2021 TRM, Volume 3, page 181.

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).

### **35. Section 3.5.17 – Refrigerated Case Light Occupancy Sensors<sup>99</sup>**

The Commission proposes removing demand savings associated with this measure under the assumption that savings occur during off-peak periods. The Commission also proposes 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 proposes 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.

### **36. Section 3.6.1 – ENERGY STAR Clothes Washer<sup>100</sup>**

The Commission proposes updating the default values associated with this measure to reflect updates to the fuel shares for water heaters and clothes dryers in the Act 129 2023 Pennsylvania Non-Residential Baseline Study. In addition, the capacities of baseline and energy efficient commercial washing machines are based off the ENERGY STAR qualified products list (QPL) for commercial clothes washers. Because this list is continuously updated, the Commission proposes updating the default capacities of commercial washers to reflect the average volume of washers in the QPL.

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<sup>99</sup> See Section 3.5.17 – Refrigerated Case Light Occupancy Sensors of the 2021 TRM, Volume 3, page 186.

<sup>100</sup> See Section 3.6.1 – ENERGY STAR Clothes Washer of the 2021 TRM, Volume 3, page 191.

**37. Section 3.6.2 – ENERGY STAR Bathroom Ventilation Fan in Commercial Applications<sup>101</sup>**

The Commission proposes updating the assumed fan capacity CFM based on the Home Ventilating Institute Certified Products Directory.

**38. Section 3.7.1 – High-Efficiency Ice Machines<sup>102</sup>**

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

**39. Section 3.7.2 – Controls: Beverage Machine Controls<sup>103</sup>**

The Commission proposes combining this measure with measure 3.7.3: Snack Machine Controls. The Commission also proposes updating the savings algorithms to include refrigeration savings (when applicable) and lighting savings. Furthermore, the Commission proposes updating default baseline values for LED lighting wattages based on the average tested wattage of 4-foot type A, B, A/B lamps on the DLC QPL, removing the fluorescent lighting option, and updating the Maximum Daily Energy Consumption values to align with the latest baseline findings and code.

**40. Section 3.7.3 – Controls: Snack Machine Controls<sup>104</sup>**

The Commission proposes combining this measure with measure 3.7.2 Beverage Machine Controls.

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<sup>101</sup> See Section 3.6.2 – ENERGY STAR Bathroom Ventilation Fan in Commercial Applications of the 2021 TRM, Volume 3, page 198.

<sup>102</sup> See Section 3.7.1 – High-efficiency Ice Machines of the 2021 TRM, Volume 3, page 201.

<sup>103</sup> See Section 3.7.2 – Controls: Beverage Machine Controls of the 2021 TRM, Volume 3, page 205.

<sup>104</sup> See Section 3.7.3 – Controls: Snack Machine Controls of the 2021 TRM, Volume 3, page 208.

**41. Section 3.7.4 – ENERGY STAR Electric Steam Cooker<sup>105</sup>**

The Commission proposes 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 proposes updating default values for pounds of food cooker 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.

**42. Section 3.7.5 – ENERGY STAR Combination Oven<sup>106</sup>**

The Commission proposes updating baseline and default efficient values to align with the 2021 IECC code requirements and Version 3.0 of the ENERGY STAR requirements for this measure.

**43. Section 3.7.6 – ENERGY STAR Commercial Convection Oven<sup>107</sup>**

The Commission proposes updating baseline values to align with the 2021 IECC code requirements and Version 3.0 of the ENERGY STAR requirements for this measure.

**44. Section 3.7.7 – ENERGY STAR Commercial Fryer<sup>108</sup>**

The Commission proposes updating baseline values to align with the 2021 IECC code requirements for this measure.

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<sup>105</sup> See Section 3.7.4 – ENERGY STAR Electric Steam Cooker of the 2021 TRM, Volume 3, page 210.

<sup>106</sup> See Section 3.7.5 – ENERGY STAR Combination Oven of the 2021 TRM, Volume 3, page 214.

<sup>107</sup> See Section 3.7.6 – ENERGY STAR Commercial Convection Oven of the 2021 TRM, Volume 3, page 218.

<sup>108</sup> See Section 3.7.7 – ENERGY STAR Commercial Fryer of the 2021 TRM, Volume 3, page 221.

**45. Section 3.7.8 – ENERGY STAR Commercial Hot Food Holding Cabinet<sup>109</sup>**

The Commission proposes updating baseline values and operating parameters to the latest values found in the ENERGY STAR Commercial Food Service calculator. Additionally, the Commission proposes updating the default savings for this measure to be dependent on the volume of the specific unit sold.

**46. Section 3.7.9 – ENERGY STAR Commercial Dishwasher<sup>110</sup>**

The Commission proposes updating the qualifying product criteria to Version 3.0 of the ENERGY STAR requirements for this measure. In addition, the Commission proposes updating the default efficient input values to Version 3.0 of the ENERGY STAR requirements.

**47. Section 3.7.10 – ENERGY STAR Commercial Griddles<sup>111</sup>**

The Commission proposes updating baseline values and operating parameters, including double sided griddles and preheat energy calculations, to the latest values found in the ENERGY STAR Commercial Food Service calculator.

**48. Section 3.8.1 – Wall And Ceiling Insulation<sup>112</sup>**

The Commission proposes 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.

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<sup>109</sup> See Section 3.7.8 – ENERGY STAR Commercial Hot Food Holding Cabinet of the 2021 TRM, Volume 3, page 224.

<sup>110</sup> See Section 3.7.9 – ENERGY STAR Commercial Dishwasher of the 2021 TRM, Volume 3, page 227.

<sup>111</sup> See Section 3.7.10 – ENERGY STAR Commercial Griddles of the 2021 TRM, Volume 3, page 227.

<sup>112</sup> See Section 3.8.1 – Wall and Ceiling Insulation of the 2021 TRM, Volume 3, page 234.

**49. Section 3.9.4 – ENERGY STAR Servers<sup>113</sup>**

The Commission proposes updating the energy savings (kWh) calculations to the Unit Energy Savings methodology as adopted by the ENERGY STAR Version 4.0 Computer Servers Final Specification.

**50. Section 3.9.5 – Server Virtualization<sup>114</sup>**

The Commission proposes updating the server idle power to full load power factors to the averages found on the ENERGY STAR qualified product list.

**51. Section 3.10.1 – Compressed Air Cycling Refrigerated Thermal Mass Dryer<sup>115</sup>**

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

**52. Section 3.10.2 – Compressed Air-Entraining Air Nozzle<sup>116</sup>**

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

**53. Section 3.10.3 – No-Loss Condensate Drains<sup>117</sup>**

The Commission proposes updating the compressor kW to CFM ratio based on the latest compressed air calculation workbooks and the measure life to 10 years as outlined

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<sup>113</sup> See Section 3.9.4 – ENERGY STAR Servers of the 2021 TRM, Volume 3, page 249.

<sup>114</sup> See Section 3.9.5 – Server Virtualization of the 2021 TRM, Volume 3, page 253.

<sup>115</sup> See Section 3.10.1 – Compressed Air Cycling Refrigerated Thermal Mass Dryer of the 2021 TRM, Volume 3, page 256.

<sup>116</sup> See Section 3.10.2 – Compressed Air-Entraining Air Nozzle of the 2021 TRM, Volume 3, page 259.

<sup>117</sup> See Section 3.10.3 – No-loss Condensate Drains of the 2021 TRM, Volume 3, page 263.



in the Illinois Statewide TRM. Additionally, the Commission proposes quantifying the hours of assumed downtime.

**54. Section 3.10.4 – Air-Tanks For Loads / No Load Compressors<sup>118</sup>**

The Commission proposes quantifying the hours of assumed downtime.

**55. Section 3.10.5 – Variable Speed Drive Air Compressors<sup>119</sup>**

The Commission proposes quantifying the hours of assumed downtime.

**56. Section 3.10.6 – Compressed Air Controller<sup>120</sup>**

The Commission proposes quantifying the hours of assumed downtime.

**57. Section 3.10.7 – Compressed Air Low Pressure Drop Filters<sup>121</sup>**

The Commission proposes quantifying the hours of assumed downtime.

**58. Section 3.10.8 – Compressed Air Mist Eliminators<sup>122</sup>**

The Commission proposes quantifying the hours of assumed downtime.

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<sup>118</sup> See Section 3.10.4 –Air-Tanks for Loads / No Load Compressors of the 2021 TRM, Volume 3, page 268.

<sup>119</sup> See Section 3.10.5 –Variable Speed Drive Air Compressors of the 2021 TRM, Volume 3, page 271.

<sup>120</sup> See Section 3.10.6 – Compressed Air Controller of the 2021 TRM, Volume 3, page 274.

<sup>121</sup> See Section 3.10.7 – Compressed Air Low Pressure Drop Filters of the 2021 TRM, Volume 3, page 277.

<sup>122</sup> See Section 3.10.8 – Compressed Air Mist Eliminators of the 2021 TRM, Volume 3, page 280.

**59. Section 3.11.3 – High Frequency Battery Chargers<sup>123</sup>**

The Commission proposes 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.

**60. Section 4.1.2 – Dairy Scroll Compressors<sup>124</sup>**

The Commission proposes 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.

**61. Section 4.1.3 – High-Efficiency Ventilation Fans With And Without Thermostats<sup>125</sup>**

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

**62. Section 4.1.4 – Heat Reclaimers<sup>126</sup>**

The Commission proposes adding a midstream delivery option to this measure. Additionally, the Commission proposes updating the electric water heater efficiency defaults ( $\eta_{water\ heater}$ ) to the average electric tank and heat pump water heater efficiencies observed in the Act 129 2023 Pennsylvania Residential Baseline Study.

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<sup>123</sup> See Section 3.11.3 – High Frequency Battery Chargers of the 2021 TRM, Volume 3, page 289.

<sup>124</sup> See Section 4.1.2 – Dairy Scroll Compressors of the 2021 TRM, Volume 3, page 298.

<sup>125</sup> See Section 4.1.3 – High-efficiency Ventilation Fans with and without Thermostats of the 2021 TRM, Volume 3, page 301.

<sup>126</sup> See Section 4.1.4 – Heat Reclaimers of the 2021 TRM, Volume 3, page 305.

**63. Section 4.1.5 – High Volume Low Speed Fans<sup>127</sup>**

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

**64. Section 4.1.6 – Livestock Waterer<sup>128</sup>**

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

**65. Section 4.1.7 – Variable Speed Drive (VSD) Controller on Dairy Vacuum Pumps<sup>129</sup>**

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

**66. Measure Number Changes**

The changes proposed herein will result in new measure numbers for several C&I measures. Table 7 below shows the current measure number and the new measure number (assuming all of the Commission’s proposed changes are made) for all affected measures. The table also shows measures that the Commission proposes removing – these measures are discussed in more detail later.

**Table 7: Proposed 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

<sup>127</sup> See Section 4.1.5 – High Volume Low Speed Fans of the 2021 TRM, Volume 3, page 308.

<sup>128</sup> See Section 4.1.6 – Livestock Waterer of the 2021 TRM, Volume 3, page 310.

<sup>129</sup> See Section 4.1.7 – Variable Speed Drive (VSD) Controller on Dairy Vacuum Pumps of the 2021 TRM, Volume 3, page 312.

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
3.1.7	Lighting Improvements for Midstream Delivery Programs	3.1.6	Midstream Lighting Incentives
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
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
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
3.4.3	Fuel Switching: Electric Resistance Water Heaters to Gas/Propane	-	Deleted
3.7.2	Controls: Beverage Machine Controls	3.7.2	Controls: Beverage and Snack Machine Controls
3.7.3	Controls: Snack Machine Controls	-	Deleted
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

<b>Current Measure Number</b>	<b>Current Measure Name</b>	<b>New Measure Number</b>	<b>New Measure Name</b>
3.9.4	ENERGY STAR Servers	3.9.2	ENERGY STAR Servers
3.9.5	Server Virtualization	3.9.3	Server Virtualization

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

Based on a review of the available research, the Commission proposes removing four residential EE&C measures and associated protocols. These measures are discussed below.

**1. Section 2.2.6 – Fuel Switching: Electric Heat to Gas/Propane/Oil Heat<sup>130</sup>**

The Commission proposes removing this measure from the TRM. At the time of this writing, the EPA is considering removing gas heaters from the ENERGY STAR specification for furnaces.<sup>131</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 dryers were removed from the specification.

**2. Section 2.3.3 – Fuel Switching: Electric Resistance To Fossil Fuel Water Heater<sup>132</sup>**

The 2021 TRM includes heating, water heating, and clothes dryer fuel switching measures. In other sections of this Tentative Order the Commission recommends

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<sup>130</sup> See Section 2.2.6 – Fuel Switching: Electric Heat to Gas/Propane/Oil Heat of the 2021 TRM, Volume 2, page 32.  
<sup>131</sup> US EPA. (2023, May 18). ENERGY STAR Furnaces and Central Air Conditioners: Sunset Proposal Memo. [Weblink](#)  
<sup>132</sup> See Section 2.3.3 – Programmable Thermostats of the 2021 TRM, Volume 2, page 68.

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 proposes removing Fuel Switching: Electric Resistance to Fossil Fuel Water Heater for consistency.

### **3. Section 2.4.7 – Fuel Switching: Electric Clothes Dryer To Gas Clothes Dryer<sup>133</sup>**

The Commission proposes removing this measure from the TRM. At the time of this writing, the EPA is considering removing gas dryers from the ENERGY STAR specification for clothes dryers.<sup>134</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.

### **4. Section 2.5.1 – ENERGY STAR Office Equipment<sup>135</sup>**

The Commission proposes removing this measure. There was zero participation in PY13 and PY14, the Commission believes that this market has largely transformed to efficient technologies.

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

Based on a review of the available research, the Commission proposes removing eight C&I EE&C measures and associated protocols. These measures are discussed below.

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<sup>133</sup> See Section 2.4.7 – Residential Whole House Fans of the 2021 TRM, Volume 2, page 127.

<sup>134</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)

<sup>135</sup> See Section 2.5.1 – ENERGY STAR Office Equipment of the 2021 TRM, page 141.

## **1. Section 3.1.5 – LED Channel Signage<sup>136</sup>**

According to the statewide tracking database maintained by the SWE, there have been zero installations of this measure statewide PY8-PY14. Initial cost research suggests that the incremental cost of this measure may actually be negative with the cost of LED kits being lower than maintenance of neon lamps and neon sign transformers before the difference in energy consumption is even considered. This suggests Act 129 incentives are not necessary to help accelerate the transition of signs away from neon to LED in Pennsylvania. The 2021 TRM measure characterization also contained some peculiar limitations on default savings assumptions to red signs. Rather than refine the measure characterization, the Commission proposes to remove this measure from the TRM.

## **2. Section 3.2.5 – Fuel Switching: Small Commercial Electric Heat To Natural Gas / Propane / Oil Heat<sup>137</sup>**

The Commission proposes removing this measure from the TRM. At the time of this writing, the US EPA is considering removing gas furnaces from the ENERGY STAR specification for heating equipment.<sup>138</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.

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<sup>136</sup> See Section 3.1.5 – LED Channel Signage of the 2021 TRM, Volume 3, page 31.

<sup>137</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>138</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)

**3. Section 3.4.3 – Fuel Switching: Electric Resistance Water Heaters To Gas/Propane<sup>139</sup>**

The 2021 TRM includes heating, water heating, and clothes dryer fuel switching measures. In other sections of this Tentative Order the Commission recommends 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 proposes removing Fuel Switching: Electric Resistance Water Heaters to Gas/Propane for consistency.

**4. Section 3.5.11 – Door Gaskets For Walk-In And Reach-In Coolers And Freezers<sup>140</sup>**

The Commission proposes removing this measure from the TRM. The 2021 TRM deemed savings values are based on an impact evaluation performed for the California PUC.<sup>141</sup> The impact evaluation report also provided survey results indicating that 12 of 71 respondents had maintenance contracts in place for their door gaskets. Of the remaining 59 respondents without maintenance contracts in place, 42 maintained their door gaskets either “often” or “sporadically”, 11 do not maintain their door gaskets, and six did not indicate a frequency of maintenance. This means that, of the 65 valid responses, 83% of respondents either have a maintenance contract in place or maintain their door gaskets at least sporadically. The high percentage of routine maintenance already performed on door gaskets leads the Commission to understand that door gasket maintenance is already a standard practice and therefore not suitable as a measure in the TRM.

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<sup>139</sup> See Section 3.4.3 – Fuel Switching: Electric Resistance Water Heaters to Gas/Propane of the 2021 TRM, page 142.

<sup>140</sup> See Section 3.5.11 – Door Gaskets for Walk-in and Reach-in Coolers and Freezers of the 2021 TRM, Volume 3, page 173.

<sup>141</sup> ADM Associates, Inc. (2010, February). “Commercial Facilities Contract Group 2006-2008 Direct Impact Evaluation”. Study ID: PUC0016.03 Volume 3 of 3 HIM Appendices. Pages J-3 and J-4. [https://www.calmac.org/publications/ComFac\\_Evaluation\\_V3\\_HIM\\_Appendices\\_02-18-2010.pdf](https://www.calmac.org/publications/ComFac_Evaluation_V3_HIM_Appendices_02-18-2010.pdf)



## **5. Section 3.5.16 – Air-Cooled Refrigeration Condenser<sup>142</sup>**

The Commission proposes removing this measure from the TRM. The 2021 IECC sets maximum approach temperatures, or design saturated condensing temperatures, for low-temperature and medium-temperature refrigeration systems at 10°F and 15°F, respectively. These approach temperatures are more stringent than the baseline assumptions in measure 3.5.16. of 15°F and 20°F for low-temperature and medium-temperature refrigeration systems, respectively. While the assumed efficient case of 8°F and 13°F approach temperatures for low-temperature and medium-temperature refrigeration systems, respectively, is still more efficient than the 2021 IECC, the method used to develop savings estimates for the measure does not allow for a simple approach temperature adjustment, as it is an extrapolation from the New York TRM’s DOE 2.2 modeling to Pennsylvania cities. Given the significant resources necessary to update the savings estimates and the measure’s historically low adoption, the Commission proposes to remove this measure from the TRM.

## **6. Section 3.5.18 – Refrigeration Economizers<sup>143</sup>**

The Commission proposes removing this measure from the TRM. The current TRM’s algorithm, input parameters, and reference sources are based upon the 2015 Efficiency Vermont TRM. The algorithm input parameters from the 2015 Efficiency Vermont TRM could not be corroborated with publicly available documents. Replacing existing assumptions with more-recent manufacturer data would be more defensible, however there is a lack of available data to do so since air-side economizers in commercial refrigeration applications are uncommon.

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<sup>142</sup> See Section 3.5.16 – Air-Cooled Refrigeration Condenser of the 2021 TRM, Volume 3, page 183.

<sup>143</sup> See Section 3.5.18 – Refrigeration Economizers of the 2021 TRM, Volume 3, page 187.

## **7. Section 3.9.1 – ENERGY STAR Office Equipment<sup>144</sup>**

The Commission proposes removing this measure. There was zero participation in PY13 and PY14 and increasing ENERGY STAR standards are decreasing the available savings for all types of office equipment. The Commission believes that this market has largely transformed to efficient technologies.

## **8. Section 3.9.2 – Office Equipment – Network Power Management Enabling<sup>145</sup>**

The Commission proposes removing this measure. Network power management has been built directly into recent operating systems, making this type of power management the baseline condition for existing and future equipment. Zero participation in PY13 and PY14 supports the argument that current and future opportunities for this measure are limited and shrinking.

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

The Commission proposes 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.

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<sup>144</sup> See Section 3.9.1 – ENERGY STAR Office Equipment of the 2021 TRM, Volume 3, page 237.

<sup>145</sup> See Section 3.9.2 – Office Equipment – Network Power Management Enabling of the 2021 TRM, Volume 3, page 243.

- Update LPD values in 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 Hours of Use (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 vs. 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 HOU 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.

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

The Commission proposes 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 include the following:

- Update annual run hours tables to reflect updated NOAA 15-year climate normal weather conditions.
- Introduce winter peak demand savings to the tool.

- Add ETDF tables to align the summer and winter peak demand estimates to support Phase V TRM methodology. Remove the use of coincidence factors to estimate demand savings.
- Add VFD Fan and VFD Pump flow fractions to the par load power ratio tables.
- Revise 0% flow fraction for "Fan: Air Foil / Backward Incline" from 0.56 to 0.53.
- Add new program year input and motor efficiency lookup table to accommodate July 2027 federal standard efficiency changes for 100 to 250 hp motors.
- Update HVAC Fan load profile flow fraction values to align TRM changes.

**K. Appendix E: Eligibility Requirements For Solid State Lighting Products In Commercial And Industrial Applications**

The Commission proposes 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 proposes that Appendix E also address eligibility guidelines when DLC technical requirements change and proposes 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.

**L. Appendix F: Building Operator Certification Audit And Design Tool**

The Commission proposes to include a Building Operator Certification Audit and Design Tool to assist with energy savings estimates for measure 3.11.5. This measure and the associated audit and design tool was developed and accepted as an Interim Measure Protocol (IMP) in Phase IV. Changes for the Phase V TRM include updates to the Commercial Buildings Energy Consumption Survey data table, the introduction of summer and winter ETDFs by facility type and end use to estimate peak demand savings, and the update of any Act 129 2018 Pennsylvania Non-Residential Baseline Study related data to align with 2023 baseline research.

**M. Appendix G: Adjustment Of Programmable Thermostats For Commercial And Industrial Buildings Calculator**

The Commission proposes to include an Adjustment of Programmable Thermostats for Commercial and Industrial Buildings Calculator to assist with energy savings estimates for measure 3.2.19. This measure and the associated calculator were developed and accepted as an IMP in Phase IV.

**CONCLUSION**

With this Tentative Order, the Commission seeks comments on the proposed additions and updates to the TRM. This Tentative Order represents the Commission's continuing efforts in establishing a comprehensive TRM with the purpose of supporting both the AEPS Act and the EE&C Program provisions of Act 129. We look forward to

receiving comments from interested stakeholders regarding the proposed changes to the TRM; **THEREFORE,**

**IT IS ORDERED:**

1. That the proposed 2026 Technical Reference Manual update be issued for comment.

2. That a copy of this Tentative 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 commented on the 2021 Technical Reference Manual update.

3. That the Law Bureau shall deposit a notice of this Tentative Order and proposed 2026 version of the Technical Reference Manual with the Legislative Reference Bureau for publication in the *Pennsylvania Bulletin*.

4. That interested parties shall have 30 days from the date the notice of this Tentative Order is published in the *Pennsylvania Bulletin* to file written comments referencing Docket Number M-2023-3044491 with the Pennsylvania Public Utility Commission, Attn: Secretary Rosemary Chiavetta, Commonwealth Keystone Building, Second Floor, 400 North Street, Harrisburg, Pennsylvania 17120. Comments may also be filed electronically through the Commission's e-file System.

5. That interested parties shall have 50 days from the date the notice of this Tentative Order is published in the *Pennsylvania Bulletin* to file written reply comments referencing Docket Number M-2023-3044491 with the Pennsylvania Public Utility Commission, Attn: Secretary Rosemary Chiavetta, Commonwealth Keystone Building,

Second Floor, 400 North Street, Harrisburg, Pennsylvania 17120. Comments may also be filed electronically through the Commission’s e-file System.

6. That a Word formatted copy of all comments and reply comments shall be electronically mailed to Regi Sam at [rsam@pa.gov](mailto:rsam@pa.gov), Tiffany Tran, [tiftran@pa.gov](mailto:tiftran@pa.gov), and Adam Young at [adyoung@pa.gov](mailto:adyoung@pa.gov). Attachments may not exceed three megabytes.

7. That this Tentative Order, the proposed 2026 version of the Technical Reference Manual, and all filed comments and reply comments related to this Tentative Order be published on the Commission’s website at <https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/>

8. That the contact person for technical issues related to this Tentative Order and the proposed 2026 version of the Technical Reference Manual is Regi Sam, Bureau of Technical Utility Services, 717-772-2151 or [rsam@pa.gov](mailto:rsam@pa.gov). The contact persons for legal and process issues related to this Tentative Order and the proposed 2026 version of the Technical Reference Manual are Tiffany Tran, 717-783-5413 or [tiftran@pa.gov](mailto:tiftran@pa.gov) and Adam Young, 717-783-3968 or [adyoung@pa.gov](mailto:adyoung@pa.gov) of the Law Bureau.

**BY THE COMMISSION**



Rosemary Chiavetta  
Secretary

(SEAL)

ORDER ADOPTED: May 9, 2024

ORDER ENTERED: May 9, 2024