TECHNICAL REFERENCE MANUAL

Volume 1: General Information

State of Pennsylvania

Act 129 Energy Efficiency and Conservation Program

&

Act 213 Alternative Energy Portfolio Standards

Issued May 2024

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1 GENERAL INFORMATION

1.1 INTRODUCTION

The Technical Reference Manual (TRM) was developed to measure the resource savings from standard energy efficiency measures. The savings' algorithms use measured and customer data as input values in industry-accepted algorithms. The data and input values for the algorithms come from Alternative Energy Portfolio Standards (AEPS) application forms,[1] EDC program application forms, industry accepted standard values (e.g., ENERGY STAR standards), or data gathered by Electric Distribution Companies (EDCs). The standard input values are based on the best available measured or industry data.

Some electric input values were derived from a review of literature from various industry organizations, equipment manufacturers, and suppliers. These input values are updated to reflect changes in code, federal standards, and recent program evaluations.

1.2 PURPOSE

The TRM was developed to estimate annual electric energy savings and coincident peak demand savings for a selection of energy efficient technologies and measures. The TRM provides guidance to the Administrator responsible for awarding Alternative Energy Credits (AECs). The revised TRM serves a dual purpose: to determine compliance with the AEPS Act, 73 P.S. §§ 1648.1-1648.8, and to determine compliance with the energy efficiency and conservation requirements of Act 129 of 2008, 66 Pa.C.S. § 2806.1. The TRM will continue to be updated as needed to reflect new and updated technologies, measures, and federal and state standards and codes.

Resource savings to be measured include electric energy (kWh) and electric capacity (kW) savings. The algorithms in this document focus on the determination of the per unit annualized energy savings and peak demand savings for the energy efficiency measures. Estimates of annualized kWh savings per year are presented as ΔkWh in TRM algorithms. Estimates of summer electric capacity savings are presented as $\Delta kW_{summer\ peak,}$ and estimates of winter electric capacity savings are presented as $\Delta kW_{winter\ peak}$. The algorithms and methodologies set forth in this document must be used to determine EDC reported gross savings. Depending on the approved evaluation measurement and verification (EM&V) plan, TRM algorithms may also be used to determine EDC verified gross savings.

For an Act 129 program, EDCs may, as an alternative to using the energy and demand savings values for standard measures contained in the TRM, use alternative methods to calculate *ex ante* (reported gross) savings and/or ask their evaluation contractor to use a custom method to verify *ex post* (verified gross) savings. However, the EDCs must track savings estimated from the TRM protocols and alternative methods and report both sets of values in the semi-annual and/or annual EDC reports. The EDCs must justify the deviation from the TRM *ex ante* and *ex post* protocols in the semi-annual and/or annual reports in which they report the deviations. EDCs should be aware that use of a custom method as an alternative to the approved TRM protocol increases the risk that the Commission may challenge their claimed savings towards compliance targets. The alternative measurement methods are subject to review and approval by the Commission to ensure their accuracy after the reports are filed to the Commission.

1.3 USING THE TRM

This section provides a consistent framework for EDC Implementation Conservation Service Providers (ICSPs) to estimate *ex ante* savings and for EDC evaluation contractors to estimate *ex post* savings for Act 129 Energy Efficiency & Conservation (EE&C) programs.

[1] Note: Information in the TRM specifically relating to the AEPS Act is shaded in gray.

MEASURE CATEGORIES

The TRM categorizes all non-custom measures into two categories: deemed measures and partially deemed measures. Methods used to estimate *ex ante* and/or *ex post* savings differ for deemed measures and partially deemed measures.

- ***Deemed measure protocols*** have specified "deemed energy and demand savings values." No additional measurement or calculation is required to determine deemed savings. These protocols also may contain an algorithm with "stipulated variables" to provide transparency into deemed savings values and to facilitate the updating of deemed savings values in future TRMs. A stipulated value for a variable refers to a single input value to an algorithm, while a deemed savings estimate is the result of calculating the end result of all of the stipulated values in the savings algorithm. Stipulated variables should not be adjusted using customer-specific or program-specific information for calculating *ex ante* and/or *ex post* savings.
- ***Partially deemed measure protocols*** have algorithms with stipulated and "open variables" that require customer-specific input of certain parameters to calculate the energy and demand savings. Customer-specific or program-specific information is used for each open variable, resulting in a range of savings values for the same measure. Open variables are sometimes listed with a "default value" and an option for "EDC Data Gathering" in the TRM. When a measure indicates that an input to a prescriptive saving algorithm may take on a range of values, an average value is also provided in many cases. This value is considered the default input to the algorithm, and should be used when customer-specific information is not available. Only variables specifically identified as open variables may be adjusted using customer-specific or program-specific information. When no default value is given for an open variable, customer-specific data collection is required. Partially deemed measure protocols may include "default savings" tables that list the energy and demand savings values calculated using defaults for all open variables. Unlike deemed savings, the use of default savings values is optional. EDCs may elect to have ICSPs use default savings for *ex ante* savings and have evaluation contractors collect customer-specific information for the calculation of *ex post* savings.

Note: Custom measures are considered too complex or unique to be included in the list of standard measures provided in the TRM, so they are outside the scope of this TRM. Custom measures are determined through a custom-measure-specific process, which is described in Section 1.17 in this TRM. Savings calculations for custom measures generally require site-specific equipment specifications, operating schedules, baseline and installed efficiencies, and calculation methodologies to estimate energy and demand savings.

CUSTOMER AND PROGRAM SPECIFIC DATA

The EDCs and their contractors are encouraged to collect and apply customer-specific or program-specific data in the *ex ante* and/or *ex post* savings calculations for as many open variables as possible to reflect the most accurate savings values. The EDC Data Gathering option should be used for measures with important variations in one or more input values (e.g., delta watts, efficiency level, equipment capacity, operating hours). Customer-specific data comes directly from the measure application form or application process and/or EDC data gathering, such as facility staff interviews, posted schedules, building monitoring systems (BMS), panel data, or metered data. In addition, standard input values for stipulated variables and default values for some open variables provided in this TRM are to be based on evaluations completed in Pennsylvania or best available measured or industry data, available from other jurisdictions or industry associations. The EDCs may use default values for open variables in the TRM if customer-specific or program-specific information is unreliable or the EDCs cannot obtain the information.

Values for exact variables that should be determined using customer-specific information are clearly described in the measure protocols in this TRM. This methodology will provide the EDCs

with more flexibility to use customer-specific data, when available, obtained from their application process and evaluations to improve the accuracy and reliability of savings.

END-USE CATEGORIES & THRESHOLDS FOR USING DEFAULT VALUES

The determination of when to use default values for open variables provided in the TRM in the *ex ante* and/or *ex post* savings calculations is a function of the savings impact and uncertainty associated with the measure. While the EDCs are required to collect and apply customer specific or program specific data for projects with savings at or above the established kWh thresholds in the TRM, they are allowed to use either default values or customer specific or program specific data for projects with savings below the thresholds. The default values are appropriate for low-impact and low-uncertainty measures, such as lighting retrofits in a small business facility. In contrast, customer-specific values are appropriate for high-impact and high-uncertainty measures, such as HVAC or lighting retrofits in universities or hospitals that have diverse facilities, and where those types of projects represent a significant share of program savings for a year.

The TRM organizes all measures into various end-use categories. An end-use is defined as the grouping of related technology types all associated with a similar application or primary function. This TRM establishes kWh savings thresholds at the end-use category level and the thresholds should be used to determine whether customer-specific information is required for estimating *ex ante* and/or *ex post* savings. If a project involves multiple measures/technology[2] types that fall under the same end-use category, the savings for all those measures/technology types should be grouped together to determine if the project falls below or above a particular threshold.[3] Table 1-1 lists all the end-use categories and the sections for measures within a particular end-use category.

Table 1-1: End-Use Categories and Measures in the TRM

End-Use Categories	List of Measures (Sections)
Residential Market Sector	
Lighting - 2.1	2.1.1 – 2.1.4
HVAC - 2.2	2.2.1 – 2.2.14
Domestic Hot Water - 2.3	2.3.1 – 2.3.10
Appliances – 2.4	2.4.1 – 2.4.14
Consumer Electronics – 2.5	2.5.1
Building Shell – 2.6	2.6.1 – 2.6.5
Whole Home – 2.7	2.7.1 – 2.7.3
Miscellaneous – 2.8	2.8.1 – 2.8.3
Demand Response – 2.9	2.9.1
Commercial & Industrial Market Sector	
Lighting – 3.1	3.1.1 – 3.1.7
HVAC – 3.2	3.2.1 – 3.2.21
Motors and VFDs – 3.3	3.3.1 – 3.3.6
Domestic Hot Water – 3.4	3.4.1 – 3.4.3
Refrigeration – 3.5	3.5.1 – 3.5.19
Appliances – 3.6	3.6.1 – 3.6.2
Food Service Equipment – 3.7	3.7.1 – 3.7.10

[2] A technology is defined as the grouping of related measures in order to differentiate one type of measure from another. Each technology type may consist of multiple measures (e.g., LEDs, and VFDs are all different technology types. An 8W LED and a 12W LED are different measures within the LED technology type).
[3] For example, LED lighting and lighting controls are individual measures within the Lighting end-use category.

End-Use Categories	List of Measures (Sections)
Building Shell – 3.8	3.8.1
Consumer Electronics – 3.9	3.9.1 – 3.9.3
Compressed Air – 3.10	3.10.1 – 3.10.8
Miscellaneous – 3.11	3.11.1 – 3.11.6
Demand Response – 3.12	3.12.1
Agricultural Sector	
Agricultural Equipment	4.1.1 – 4.1.8

Table 1-2 shows the kWh thresholds for various end-use categories. For projects with savings of established kWh thresholds or higher, the EDCs are required to collect site-specific information for open variables used in the calculation of energy and demand savings. If savings for individual end-use categories within projects fall below the threshold, the EDCs may gather customer-specific data or use the default stipulated value for each open variable. The thresholds below are subject to review and adjustment by the EDC evaluation contractors in coordination with SWE to minimize the uncertainty of estimates. End-use metering is the preferred method of data collection for projects above the threshold, but trend data from BMS or panel data and billing analysis[4] are acceptable substitutes. The EDCs are encouraged to meter projects with savings below the thresholds that have high uncertainty but are not required where data is unknown, variable, or difficult to verify. Exact conditions of "high uncertainty" are to be determined by the EDCs to appropriately manage variance. Metering completed by the ICSP may be leveraged by the evaluation contractor, subject to a reasonableness review.[5] This approach is intended to determine values for key variables and verify savings at a high level of rigor for projects that account for the majority of the program's expected savings.

Table 1-2: kWh Savings Thresholds

End-use Category	Expected kWh/yr Savings Threshold[6][7]
C&I Solar PV	≥ 2,000,000
C&I Lighting	≥ 750,000
C&I HVAC	≥ 250,000
C&I Motors & VFDs	≥ 250,000
C&I Building Shell	≥ 250,000
Agricultural Equipment	≥ 250,000

APPLICABILITY OF THE TRM FOR ESTIMATING *EX ANTE* (CLAIMED) SAVINGS

For replacements, retrofits, and new construction appliances,[8] the applicable date for determining which TRM version to use to estimate EDC claimed savings is the "in-service date" (ISD) – the date

[4] A billing analysis should be conducted using at least 12 months of billing data (pre- and post-retrofit).
[5] EDC evaluation contractors must verify the project-specific M&V data (including pre- and post-metering results) obtained by the ICSPs, as practicable, for projects in the evaluation sample. If the evaluation contractor determines that data collected by the ICSP is not reasonably valid, then the evaluator must perform measurements consistent with IPMVP options to collect post-retrofit information for projects that have estimated end-use savings above a threshold kWh/year level. The SWE reserves the right to audit and review claimed and verified impacts of any project selected in the evaluation sample.
[6] In situations where an ICSP meters a project because the expected kWh savings are above the established threshold and then realizes that the actual savings are below the threshold, metered results should be used for reporting claimed and verified savings.
[7] The Commission allows the EDCs to use alternative methods for obtaining customer-specific data where customer processes do not support metering. The EDCs are required to provide supporting documentation to the SWE for review if there are any such exceptions.
[8] Appliances include dishwashers, clothes washers, dryers, ovens/ranges, refrigerators, and freezers.

at which the measure is "installed and commercially operable,"[9] and when savings actually start to occur. This is analogous to when a customer's meter "sees" the savings under expected and designed-for operation. For most projects, this is obvious. For projects with commissioning, the ISD occurs after the commissioning is completed. For incented measures that have been installed, but are not being used because there is no occupant or will not be used until another, unrelated installation/project is completed, the ISD will be considered the date at which the equipment is energized. For new construction, the appropriate TRM must be based on the date when the building/construction permit was issued (or the date construction starts if no permit is required) because that aligns with codes and standards that define the baseline. Savings begin to accrue at the project's ISD.

1.4 DEFINITIONS

The TRM is designed for use with both the AEPS Act and Act 129; however, it contains words and terms that apply only to the AEPS or only to Act 129. The following definitions are provided to identify words and terms that are specific for implementation of the AEPS:

- **Administrator/Program Administrator (PA)** – The Credit Administrator of the AEPS program that receives, processes, and approves AEPS Credit applications.
- **AEPS application forms** – Application forms submitted to qualify and register alternative energy facilities for AECs.
- **Application worksheets** – Part of the AEPS application forms.
- **Alternative Energy Credits (AECs)** – A tradable instrument used to establish, verify, and measure compliance with the AEPS. One credit is earned for each 1,000 kWh of electricity generated (or saved from energy efficiency or conservation measures) at a qualified alternative energy facility.
- **Coincidence Factor (CF)** – The ratio of the (1) sum of every unit's average kW load during the PJM summer or winter peak load period (see Table 1-4) to the (2) sum of the non-coincident maximum kW connected load for every unit. This value is expressed in decimal format throughout the TRM unless designated otherwise.
- **Direct Install (DI) Measure** – A prescriptive measure implemented on site during an energy audit or other initial visit without the requirement of a diagnostic testing component. Examples of these DI measures that can be installed directly include the changing of an incandescent bulb to an LED or the installation of faucet aerators.
- **Early Retirement (ERET) Measure** – The removal of equipment from service that is not scheduled to be replaced by either a more efficient option or a less efficient option and is deemed to be eligible for savings due to the nature of reduction in energy use by taking the equipment out of service.
- **EDC Reported Gross Savings** – Also known as "EDC Claimed Savings" or "*Ex Ante* Savings." EDC estimated savings for projects and programs of projects that are completed and/or M&Ved. The estimates follow a TRM method or Site Specific M&V Plan (SSMVP). The savings calculations/estimates follow algorithms prescribed by the TRM or SSMVP and are based non-verified, estimated, stipulated, EDC gathered or measured values of key variables.
- **Efficiency Kits**– A collection of energy efficient upgrade measure materials that can be delivered to and installed by the end-user. Examples of these items are low-flow showerheads and faucet aerators.
- **Replace on Burnout (ROB) Measure** – The replacement of equipment that has failed or is at the end of its service life with a model that is more efficient than required by the codes and

[9] Pennsylvania Public Utility Commission Act 129 Phase II Order, Docket Number: M-2012-2289411 and M-2008-2069887, Adopted August 2, 2012, language in Section K.1.b.

standards in effect at the time of replacement, or is more efficient than standard practice if there are no applicable codes or standards. The baseline used for calculating energy savings for replace on burnout measures is the applicable code, standard, or industry standard practice in the absence of applicable code or standards. The incremental cost for replacement on burnout measures is the difference between the cost of baseline and more efficient equipment. Examples of projects that fit in this category include replacement due to existing equipment failure, or imminent failure, as judged by a competent service specialist, as well as replacement of equipment that may still be in functional condition, but is operationally obsolete due to industry advances and is no longer cost effective to keep.

- **New Construction Measure (Substantial Renovation Measure)** – The substitution of efficient equipment for standard baseline equipment that the customer does not yet own or during the course of a major renovation project that removes existing, but operationally functional equipment. The baseline used for calculating energy savings is the construction of a new building or installation of new equipment that complies with applicable code, standard or industry standard practice in the absence of applicable code or standards in place at the time of construction/installation/substantial renovation. The incremental cost for a new construction or substantial renovation measure is the difference between the cost of the baseline and more efficient equipment. Examples of projects that fit in this category include installation of a new production line, construction of a new building, an addition to an existing facility, renovation of a plant that replaces an existing production line with a production line for a different product, substantial renovation of an existing building interior, and replacement of an existing standard HVAC system with a ground source heat pump system.
- **Realization Rate** – The ratio of “Verified Gross Savings” to “EDC Reported Gross Savings.”
- **Retrofit Measure (RET)** – Measures that modify or add on to existing equipment with technology to make the system more energy efficient. Retrofit measures may have a dual baseline. For the estimated remaining useful life of the existing equipment the baseline is the existing equipment; afterwards, the baseline is the applicable code, standard, or industry standard practice expected to be in place at the time the unit would have been naturally replaced or retrofitted. If there are no known or expected changes to the baseline standards, the standard in effect at the time of the retrofit is to be used. Incremental cost is the full cost of equipment retrofit. In practice, in order to avoid the uncertainty surrounding the determination of "remaining useful life," retrofit measure savings and costs sometimes follow ROB baseline and incremental cost definitions. Examples of projects that fit this category include installation of a VFD on an existing HVAC system or installation of wall and ceiling insulation.
- **Early Replacement Measure (EREP)** – The replacement of existing equipment, which is functioning as intended and is not operationally obsolete, with a more efficient model primarily for purposes of increased efficiency. Early replacement measures may have a dual baseline. For the estimated remaining useful life of the existing equipment the baseline is the existing equipment; afterwards, the baseline is the applicable code, standard, or industry standard practice expected to be in place at the time the unit would have been naturally replaced. If there are no known or expected changes to the baseline standards, the standard in effect at the time of the early replacement is to be used. Incremental cost is the full cost of equipment replacement. In practice, in order to avoid the uncertainty surrounding the determination of "remaining useful life," early replacement measure savings and costs sometimes follow ROB baseline and incremental cost definitions. Examples of projects that fit this category include upgrading an existing production line to gain efficiency; upgrading an existing, but functional, lighting or HVAC system that is not part of a renovation/remodeling project; and replacing an operational chiller with a more efficient unit.
- **Time of Sale (TOS) Measure** – A measure implemented, usually incentivized at the retail level, that provides a financial incentive to the buyer or end user in order to promote the higher efficiency of the measure product over a standard efficiency product. Examples include the low-flow pre-rinse sprayers available to commercial kitchens and their applicable incentives to be purchased over standard flow sprayers.

- **Verified Gross Savings** – Evaluator estimated savings for projects and programs of projects that are completed and for which the impact evaluation and EM&V activities are completed. The estimates follow a TRM method or SSMVP. The savings calculations/estimates follow algorithms prescribed by the TRM or SSMVP and are based on verified values of stipulated variables, EDC or evaluator-gathered data, or measured key variables.
- **Measure Life** – The number of years that the new high-efficiency equipment is expected to function and generate energy and demand savings. These are generally based on engineering lives, but sometimes adjusted based upcoming changes to codes and standards. Two important distinctions fall under this definition: Effective Useful Life and Remaining Useful Life.
- **Effective Useful Life (EUL)** – EUL is based on the manufacturers' rating of the effective useful life (how long the equipment will last). For example, an LED with a rated life of 15,000 hours that operates 2,500 hours per year will typically have an EUL of six years. Operating characteristics vary across homes and businesses, so the EUL assumptions in the TRM are an estimate of the median number of years that the measures installed under a program are still in place and operable.
- **Remaining Useful Life (RUL)** – RUL applies to retrofit or early replacement measures. For example, if an existing working refrigerator is replaced with a high-efficiency unit, the RUL is an assumption of how many more years the existing unit would have lasted.

1.5 General Framework

In general, energy and demand savings will be estimated using TRM stipulated values, measured values, customer data and information from the AEPS application forms, worksheets, and field tools.

Three systems will work together to ensure accurate data on a given measure:

1) The application form that the customer or customer's agent submits with basic information.
2) Application worksheets and field tools with more detailed, site-specific data, input values, and calculations.
3) Algorithms that rely on standard or site-specific input values based on measured data. Parts or all of the algorithms may ultimately be implemented within the tracking system, application forms, worksheets, and field tools.

1.6 Algorithms

The algorithms that have been developed to calculate the energy and/or demand savings are typically driven by a change in efficiency level between the energy efficient measure and the baseline level of efficiency. The following are the basic algorithms:

$\Delta kW = kW_{base} - kW_{ee}$

$\Delta kWh = \Delta kW \times EFLH$

$\Delta kW_{summer\ peak} = \Delta kW \times CF_s$ *or* $\Delta kWh \times ETDF_s$

$\Delta kW_{winter\ peak} = \Delta kW \times CF_w$ *or* $\Delta kWh \times ETDF_w$

Where:

ΔkW = *Change in connected load*

$\Delta kW_{summer\ peak}$ = *Summer Coincident Peak Demand Savings*

$\Delta kW_{winter\ peak}$ = *Winter Coincident Peak Demand Savings*

ΔkWh = *Annual Energy Savings*

kW_{base} = *Connected load kW of baseline case.*

kW_{ee} = *Connected load kW of energy efficient case.*

EFLH = *Equivalent Full Load Hours of operation for the installed measure.*

CF_s = *The fraction of connected load expected to be operating and therefore conserving during the summer peak demand period as defined in Section 1.11.*

CF_w = *The fraction of connected load expected to be operating and therefore conserving during the winter peak demand period as defined in Section 1.11.*

$ETDF_s$ = *A mathematical conversion factor from annual energy savings to summer peak demand savings based on the load shape of the affected end-use. Equal to the average load during the summer peak definition divided by annual load.*

$ETDF_w$ = *A mathematical conversion factor from annual energy savings to winter peak demand savings based on the load shape of the affected end-use. Equal to the average load during the winter peak definition divided by annual load.*

Other resource savings calculation methods are used in the TRM as appropriate. Specific algorithms for each of the measures may incorporate additional factors to reflect specific conditions associated with a measure. This may include factors to account for coincidence of multiple installations or interaction between different measures.

1.7 Data and Input Values

The input values and algorithms in this TRM are based on the best available and applicable data. The input values for the algorithms come from the AEPS application forms, EDC data gathering, or from standard values based on measured or industry data.

Many input values, including site-specific data, come directly from the AEPS application forms, EDC data gathering, worksheets, and field tools. Site-specific data on the AEPS application forms and EDC data gathering are used for measures with important variations in one or more input values (e.g., delta watts, efficiency level, capacity, etc.).

Standard input values are based on the best available measured or industry data, including metered data, measured data from other state evaluations (applied prospectively), field data, and standards from industry associations. The standard values for most commercial and industrial measures are supported by end-use metering for key parameters for a sample of facilities and circuits.

For the standard input assumptions for which metered or measured data were not available, the input values (e.g., delta watts, delta efficiency, equipment capacity, operating hours, coincidence factors) were assumed based on best available industry data or standards. These input values were based on a review of literature from various industry organizations, equipment manufacturers, and suppliers.

1.8 Baseline Estimates

The savings methods and assumptions can differ substantially based on the program delivery mechanism for each measure type. Within each of the measure protocols in the TRM, there is a definition for the measure's baseline efficiency, a critical input into the savings calculations. Most measures will fall into one of two categories, each with a baseline that is most commonly used:

- One for market-driven choices – often called "lost opportunity" and either replacing equipment that has failed (replace on burnout) or new installations (new construction)
- One for discretionary installations – either early replacement or retrofit

For all new construction (NC) and ROB scenarios, the baseline is typically a jurisdictional code or a national standard; however, there may be cases where a market baseline is appropriate. In these scenarios, the Commission has a preference for codes and standards as it is too expensive and time consuming to conduct market baseline and characterization research. Additionally, the TRM provides estimates for *gross* energy savings only, whereas *net* savings "…include the effects of free-ridership, spillover, and *induced market effects.*"[10] Calculating savings against a market baseline produces an estimate of the net savings rather than gross savings. Since Act 129 compliance goals are established on a gross basis, the TRM facilitates calculation of progress towards those goals. The $\Delta kW_{summer\ peak}$, $\Delta kW_{winter\ peak}$, and ΔkWh savings calculations are based on standard efficiency equipment versus new high-efficiency equipment.

For discretionary installation scenarios, the baseline is typically the existing equipment efficiency, but in the case of early replacement (EREP), at some point the $\Delta kW_{summer\ peak}$, $\Delta kW_{winter\ peak}$, and ΔkWh savings calculations must incorporate changes to the baseline for new installations (e.g., code or market changes). This approach encourages residential and business consumers to replace working inefficient equipment and appliances with new high-efficiency products rather than taking no action to upgrade or only replacing them with new standard-efficiency products.

All baselines are designed to reflect current market practices that are updated periodically to reflect upgrades in federal equipment standards, building code, or information from evaluation results. Specifically for commercial and industrial measures, Pennsylvania is in the process of reviewing and adopting the 2021 International Energy Conservation Code (IECC). 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. 2021 IECC is scheduled to have an effective date of July 13, 2025. Per Section 401.2 of IECC 2021, commercial buildings must comply with either "[t]he requirements of ANSI/ASHRAE/IESNA Standard 90.1[-2019]" or comply with the requirements outlined in IECC 2021 Chapter 4.

In accordance with IECC 2021, commercial protocols relying on code standards as the baseline condition may refer to either IECC 2021 or ASHRAE 90.1-2019 per the program design.

The baseline estimates used in the TRM are based on applicable federal standards, or are documented in baseline studies or other market information. This TRM reflects the most up-to-date codes, practices, and market transformation effects. The measures herein include, where appropriate, schedules for the implementation of federal standards to coincide with the beginning of a program year. These implementation schedules apply to measures where the federal standard is considered the baseline, as described herein or otherwise required by law. In cases where the ENERGY STAR criterion is considered the eligibility requirement and the existing ENERGY STAR Product Specification Version expires in a given year, the new ENERGY STAR Product Specification Version will become the eligibility requirement at the start of the next consecutive program year.

1.9 Resource Savings in Current and Future Program Years

AECs, energy efficiency, and demand response reduction savings will apply in equal annual amounts corresponding to either PJM planning years or calendar years, beginning with the year deemed appropriate by the Administrator and lasting for the approved life of the measure for AEPS Credits. Energy efficiency and demand response savings associated with Act 129 can claim savings for up to fifteen years.

[10] "Estimating Net Savings: Common Practices." The Uniform Methods Project. December 2014, pg. 3.

1.10 Prospective Application of the TRM

The TRM will be applied prospectively. The input values are from the AEPS application forms, EDC program application forms, EDC data gathering, and standard input values (based on measured data including metered data and evaluation results). The TRM will be updated on an as-needed basis, as determined by the Commission, based on new information and available data and then applied prospectively for future program years. Updates will not alter the number of AEPS Credits, once awarded, by the Administrator, nor will they alter any energy savings or demand reductions already in service and within measure life. If any errors are discovered in the TRM or clarifications are required, those corrections or clarifications should be applied to the associated measure calculations for the current program year, if applicable.

1.11 Electric Resource Savings

Algorithms have been developed to determine the annual electric energy and electric coincident peak demand savings from energy efficiency. Annual electric energy savings are calculated and then allocated separately by season (summer, shoulder, and winter) and time of day (on-peak and off-peak). Summer and winter coincident peak demand savings from energy efficiency are calculated using a demand savings algorithm for each measure that includes coincidence factors or energy-to-demand factors.

Table 1-3: Periods for Energy Savings

Period	Definition
Summer	May through September
Shoulder	March, April, October, November
Winter	December through February
Peak	7am to 11:00pm Mon.-Fri.
Off-Peak	11pm to 7am Mon.-Fri., Weekends and Holidays

Table 1-4: Periods for Coincident Peak Demand Savings

Period	Summer	Winter
Months	June, July, and August	January and February
Day Types	Non-Holiday Weekdays	
Hours (Eastern Prevailing Time)	2pm to 6pm (Hours Ending 15, 16, 17, & 18)	7am to 9am and 6pm to 8pm (Hours Ending 8, 9, 19 & 20)

The time periods for energy savings and coincident peak demand savings were chosen to best fit the Act 129 requirement, which reflects the seasonal avoided cost patterns for electric energy and capacity that are used for the energy efficiency program cost effectiveness purposes. For energy, the summer period of May through September was selected based on the pattern of avoided costs for energy at the PJM level. Similarly, the winter period of December through February was chosen to reflect the higher wholesale energy prices during the coldest months of the year. The shoulder period is split between spring and fall months that correspond to the mildest weather conditions

and lowest historic energy costs. For capacity, the definition of summer and winter peak is adopted from PJM Manual 18B.

1.12 Post-implementation Review

The Administrator will review AEPS application forms and tracking systems for all measures and conduct field inspections on a sample of installations. For some programs and projects (e.g., custom, large process, large and complex comprehensive design), post-installation review and on-site verification of a sample of AEPS application forms and installations will be used to ensure the reliability of site-specific savings' estimates.

1.13 Adjustments to Energy and Resource Savings

Coincidence with Electric System Peak

Summer and winter coincidence factors are used to reflect the portion of the connected load savings or generation that is coincident with the system peak periods.

Measure Retention and Persistence of Savings

The combined effect of measure retention and persistence is the ability of installed measures to maintain the initial level of energy savings or generation over the measure life. If the measure is subject to a reduction in savings or generation over time, the reduction in retention or persistence is accounted for using factors in the calculation of resource savings.

It is also important to note that the 2008 Pennsylvania Act 129 legislation states that the Total Resource Cost (TRC) test shall be used to determine program cost effectiveness, and defines the TRC test as:

> A STANDARD TEST THAT IS MET IF, OVER THE EFFECTIVE LIFE OF EACH PLAN NOT TO EXCEED 15 YEARS, THE NET PRESENT VALUE OF THE AVOIDED MONETARY COST OF SUPPLYING ELECTRICITY IS GREATER THAN THE NET PRESENT VALUE OF THE MONETARY COST OF ENERGY EFFICIENCY CONSERVATION MEASURES.
>
> 66 Pa.C.S. § 2806.1(m).

Thus, when TRC ratios are calculated for Act 129 programs, the life for any measure cannot be longer than 15 years.

Interactive Measure Energy Savings

Throughout the TRM, the interactive effect of thermostatically sensitive building components is accounted for in specific measure protocols, as appropriate. In instances where there is a measurable amount of interaction between two energy consuming sources, the energy or peak demand savings are accounted for in either the algorithms or in the modeling software used to determine energy savings.

For example, in a residential protocol where the lighting load has a direct effect on the energy used to condition the space, the TRM provides an interactive effect value to be used in the savings algorithm for certain measures. Other measures rely on the characteristics of the modeling software that account for the effect within a building, such as a new construction protocol software that will apply the effects for a measurable difference in the baseline and efficient buildings.

Likewise, in Commercial and Industrial (C&I) applications, the TRM accounts for the internal gains affected by implementing certain measures, as well as by using stipulated values within the measure algorithms or by site-specific analysis where warranted, such as in the case of custom

C&I measures. For example, the use of electronically commutated motors and the reduced heat output that affects the space cooling energy shall be specified by the measure protocol and where no interaction is present then the interactive energy savings is zero.

VERIFIED GROSS ADJUSTMENTS

Evaluation activities at a basic level consist of verification of the installation and operation of measures. In many cases, the number of widgets found on-site may differ from the number stated on the application, which represents the number of widgets paid for by the program. When the number of widgets found on-site is less than what is stated on the application, the savings will be adjusted by a realization rate. For example, if an application states 100 widgets but an on-site inspection only finds 85, the realization rate applied is 85% (assuming no other discrepancies). On-site widget counts within 5% of the application numbers can be considered to be within reasonable error without requiring realization rate adjustment.

On the other hand, if the number of widgets found on-site is more than what is stated on the application, the savings will be capped at the application findings. For example, if an application states 100 widgets but an on-site inspection finds 120, the realization rate applied is 100% (assuming no other discrepancies).

1.14 CALCULATION OF THE VALUE OF RESOURCE SAVINGS

The calculation of the value of the resources saved is not part of the TRM. The TRM is limited to the determination of the resource savings in physical terms at the customer meter.

In order to calculate the value of the energy and demand savings for reporting cost-benefit analyses and other purposes, the energy savings are determined at the customer level and then increased by the amount of the transmission and distribution losses (or line losses) to reflect the energy savings at the system level. The energy savings at the system level are then multiplied by the appropriate avoided costs to calculate the value of the benefits.

System Savings	*= (Savings at Customer) X (T&D Loss Factor)*
Value of Resource Savings	*= (System Savings) X (System Avoided Costs) + (Value of Other Resource Savings)*

Please refer to the 2026 TRC Test Order[11] for a more detailed discussion of other resource savings.

1.15 TRANSMISSION AND DISTRIBUTION SYSTEM LOSSES

The TRM calculates the electric energy and peak demand savings at the customer meter level. The electric energy consumption reduction compliance targets for Phase IV of Act 129 are established at the retail level. The energy savings must be reported to the Commission at the customer meter level without application of any line loss factor. These savings are used to determine if EDCs have met their statutory electric energy targets for Phase IV.

These savings need to be increased by the amount of transmission and distribution system losses in order to determine the energy savings at the system level. The electric line loss factors multiplied by the savings calculated from the algorithms will result in savings at the system level.

Demand savings goals or compliance towards demand response targets are to be calculated at the system level. The EDC shall apply the proper line loss factor to the peak load reductions to assess progress towards Phase IV demand reduction goals.

[11] https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/total-resource-cost-test/

When performing benefit-cost savings calculations, it is important to value the savings at the system level and apply the line loss factors to both energy consumption and demand savings at that level when running the TRC test.

The EDCs should use the same line loss factors (LLFs) used by the SWE for the Energy Efficiency and Demand Response Potential Studies. These LLFs shown below in Table 1-4.

Table 1-5: Line Loss Factors Used in the EE and DR Potential Studies

EDC	Residential LLF	Small C&I LLF	Large C&I LLF
Duquesne	1.0741	1.0741	1.0081
Met-Ed	1.0945	1.0720	1.0720
PECO	1.0799	1.0799	1.0799
Penelec	1.0945	1.0720	1.0720
Penn Power	1.0949	1.0545	1.0545
PPL	1.0875	1.0875	1.0420
West Penn Power	1.0943	1.0790	1.0790

1.16 Measure Lives

Measure lives are provided at the beginning of each measure protocol for informational purposes and for use in other applications, such as reporting lifetime savings or in benefit-cost analysis. For the purpose of calculating the TRC test, measures cannot claim savings for more than 15 years.

In general, avoided cost savings for programs where measures replace units before the end of their useful life are measured from the efficient unit versus the replaced unit for the remaining useful life of the existing unit, then from the efficient unit versus a new standard unit for the balance of the efficient measure's life. Specific guidance can be found in the Commission's TRC Orders.

1.17 Custom Measures

Custom measures are considered too complex or unique to be included in the list of standard measures provided in the TRM. Also included are measures that may involve metered data but require additional assumptions to arrive at a "typical" level of savings as opposed to an exact measurement.

While TRM measures are reviewed and approved by the Commission through the TRM update process, custom measures do not undergo the same approval process. The EDCs are not required to submit savings protocols for C&I custom measures to the Commission or the SWE for each measure/technology type prior to implementing the custom measure; however, the Commission recommends that site-specific custom measure protocols be established in general conformity to the International Performance Measurement and Verification Protocol (IPMVP)[12] or Federal Energy Management Program[13] M&V Guidelines. All evaluation sampled custom projects require a Site-Specific Measurement and Verification Plan (SSMVP) developed or approved for use by the EDC evaluator, which must be available for SWE review. The qualification for and availability of AEPS Credits and energy efficiency and demand response savings are determined on a case-by-case basis.

[12] https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp
[13] https://www.energy.gov/femp/articles/mv-guidelines-measurement-and-verification-performance-based-contracts-version-40

An AEPS application must be submitted containing adequate documentation fully describing the energy efficiency measures installed or proposed and an explanation of how the installed facilities qualify for AECs. The AEPS application must include a proposed evaluation plan by which the Administrator may evaluate the effectiveness of the energy efficiency measures provided by the installed facilities. All assumptions should be identified, explained, and supported by documentation, where possible. The applicant may propose incorporating tracking and evaluation measures using existing data streams currently in use provided that they permit the Administrator to evaluate the program using the reported data.

To the extent possible, the energy efficiency measures identified in the AEPS application should be verified by the meter readings submitted to the Administrator.

1.18 Impact of Weather

To account for weather differences within Pennsylvania, the ELFH and CF values are provided for most HVAC measures in Appendix A . Non-residential HVAC EFLH assumptions were derived from eQUEST modeling performed by the Phase II SWE team. Residential HVAC EFLH assumptions were developed by the Phase III SWE team using connected thermostat runtime data from the Mid-Atlantic region. EFLH values are provided for nine reference cities: Allentown; Bradford; Binghamton, NY; Erie; Harrisburg; Philadelphia; Pittsburgh; Scranton; and Williamsport. These reference cities provide a representative sample of the various climate and utility regions in Pennsylvania.

Climate assumptions in this TRM are based on 15-year climate normals (2006) from the National Centers for Environmental Division of the National Oceanic and Atmospheric Administration.[14] Appendix A contains all climate-dependent assumptions, including EFLH, heating degree days, and cooling degree days by reference city.

The adoption of new long-run climate assumptions in the 2026 TRM necessitated updates to many weather-dependent parameters from previous TRM. A linear scaling approach was used in cases where the underlying modeling files or analysis data sets were unavailable. In addition, a few protocols in this TRM rely on work and analysis completed in other states, where savings values are adjusted for climate. Where possible, regression modeling was used to extrapolate Pennsylvania savings values based on the savings values from other states. Where a regression was not possible, linear scaling was used in combination with the HDD and CDD values across the nine Pennsylvania reference cities to calibrate the savings estimates from other jurisdictions to Pennsylvania's climate.

1.19 Measure Applicability Based on Sector

Protocols for the residential sector quantify savings for measures typically found in residential areas under residential meters. Residential areas are considered areas in residential buildings three stories or less in height. Likewise, protocols for the C&I or Agriculture sectors quantify savings for measures typically found in C&I areas under C&I meters. C&I or Agriculture areas are any buildings not defined as "residential buildings," including multifamily buildings that are four stories or more in height.

Protocols in the residential and C&I sections describe measure savings based on the *application* or *usage characteristics* of the measure rather than how the measure is *metered*. EDCs, their ICSPs, and evaluation contractors are expected to use professional judgment with regard to the appropriate usage characteristics of a participating building.

- Measures in residential environments that are commercially metered should use residential sector protocols.

[14] https://www.ncei.noaa.gov/products/land-based-station/us-climate-normals

- Measures in commercial environments that are residentially metered should use the commercial or agricultural sector protocols.

Sector assignment questions are common for Multifamily buildings because of the variety of metering configurations employed by the EDCs. Some general guidelines for EE&C measures in multifamily buildings include:

- In-unit measures should rely on residential sector protocols.
- Common-area measures should rely on commercial sector protocols.
- Air sealing, duct sealing, and ceiling/attic and wall insulation protocols and standards for residential measures should be used when a building has a wood frame.
- Air sealing, duct sealing, and ceiling/attic and wall insulation protocols and standards for C&I measures should be used when a building has a metal or steel frame.

Depending on the scale, an agricultural facility could be metered under a range of meters, but the agricultural measure protocol will supersede the meter type in the same fashion as listed for the other sectors.

1.20 Algorithms for Energy Efficient Measures

The 2026 TRM is divided into three volumes. This document is Volume 1 and includes a cross-cutting overview of the guiding principles used to develop the TRM. Volume 1 also includes all TRM appendices. Volume 2 of the TRM addresses residential sector measures. Volume 3 of the TRM addresses the non-residential sector and includes two sections. Section 3 addresses commercial and industrial sector measures. Section 4 addresses agricultural measures for residential, commercial, and industrial market sectors.

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APPENDIX A: CLIMATE DEPENDENT VALUES

Climate-dependent values have been updated for the current version of the TRM. Relevant changes include the transition of climate assumptions from TMY3 to 15-year weather normals (2006-2020), updating the climate region for two counties, and adjustments to reference city catchment areas. The new climate regions in Figure 1-1 are a blend of NOAA Climate Divisions and IECC Climate Zones. They better align the TRM with the building code while allowing for the calculation of more localized results.

Figure 1-1: Climate Regions

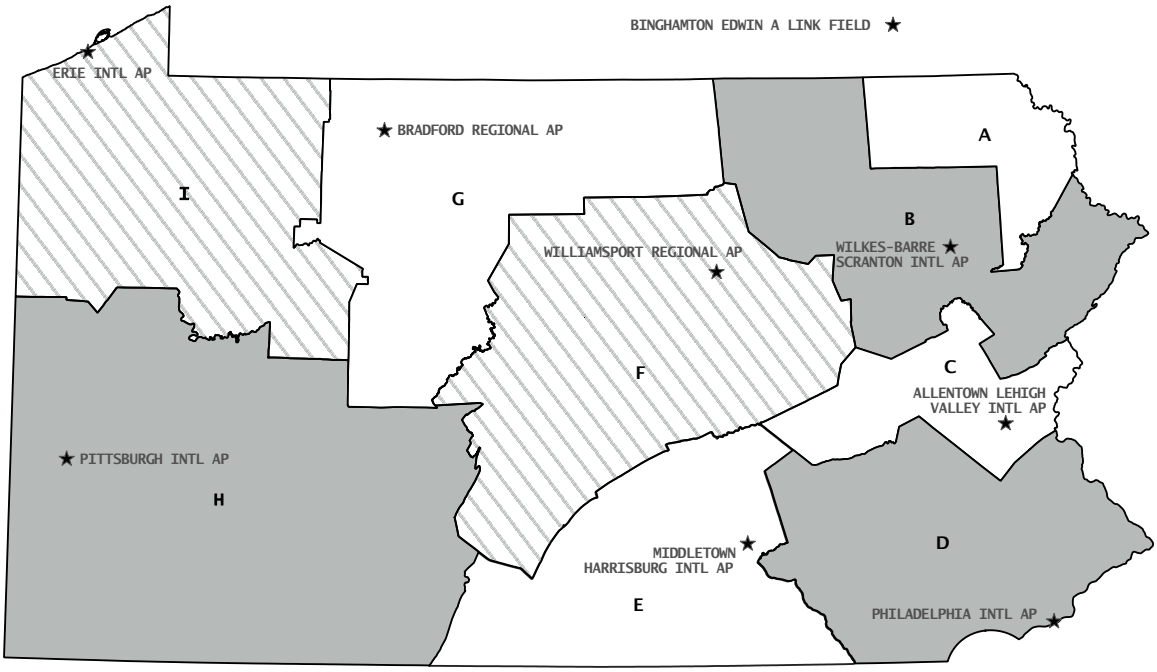

Table 1-6: Reference City and Weather Station by Climate Region

Climate Region	Reference City	MASLIB ID	Station Name
C	Allentown	725170	Allentown-Lehigh Valley International Airport
A	Binghamton, NY	725150	Greater Binghamton Airport / Edwin A Link Field
G	Bradford	725266	Bradford Regional Airport
I	Erie	725260	Erie International Airport
E	Harrisburg	725115	Middletown-Harrisburg International Airport
D	Philadelphia	724080	Philadelphia International Airport
H	Pittsburgh	725200	Pittsburgh International Airport
B	Scranton	725130	Wilkes-Barre Scranton International Airport
F	Williamsport	725140	Williamsport Regional Airport

Use of the county-Climate Region mappings in Table 1-5 is recommended where possible for climate-dependent value lookups since some ZIP Codes straddle Climate Region borders. However, a table mapping ZIP Codes to Climate Regions is available at

http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information/technical_reference_manual.aspx. In general, ZIP Codes are mapped to the Climate Region containing the largest fraction of the ZIP Code's population. A small number of exceptions to this rule exist, such as where topography indicates that the neighboring region is more suitable. Alternatively, EDC-specific climate region weightings have been computed in Table 1-6. These weights are based on the relative mix of 2020 U.S. Census Bureau block group populations served by each EDC and may be used to develop EDC-specific average savings values instead of determining location-specific savings for individual projects. The values in Table 1-6 should be used for deemed and partially deemed measure protocols. Weather-dependent custom C&I projects should rely on location-specific weather assumptions.

Table 1-7: EDC Climate Region Weights (by Population)

Climate Region	EDC						
	Duquesne	First Energy				PECO	PPL
		Met-Ed	Penelec	Penn Power	West Penn Power		
A	–	–	2.6%	–	–	–	1.6%
B	–	7.5%	6.1%	–	–	–	21.2%
C	–	13.1%	–	–	–	–	22.5%
D	–	38.0%	–	–	–	99.8%	24.7%
E	–	41.3%	3.3%	–	10.7%	0.2%	16.8%
F	–	–	7.5%	–	10.8%	–	13.1%
G	–	–	10.6%	–	3.6%	–	–
H	100%	–	34.4%	71.9%	73.4%	–	–
I	–	–	35.6%	28.1%	1.5%	–	–

Table 1-8: Heating & Cooling Degree Days by Climate Region

Climate Region	Reference City	Conditioned Space		Unconditioned Space	
		CDD65	HDD65	CDD75	HDD50
C	Allentown	1,049	5,130	165	2,159
A	Binghamton, NY	401	7,009	4	3,477
G	Bradford	284	7,177	0	3,521
I	Erie	803	5,770	91	2,617
E	Harrisburg	1,242	4,886	246	2,007
D	Philadelphia	1,450	4,347	341	1,643
H	Pittsburgh	860	5,437	78	2,431
B	Scranton	847	5,573	96	2,488
F	Williamsport	867	5,578	98	2,481

Table 1-9: Residential HVAC Equivalent Full Load Hour and Coincidence Factor Assumptions

Climate Region	Reference City	Summer CF	Winter CF	$EFLH_{cool}$		$EFLH_{heat}$		
				CAC & HP	Room AC	Non-HP	Primary HP	Secondary HP[15]
C	Allentown	0.419	0.366	759	235	825	1,200	817
A	Binghamton	0.246	0.464	386	120	1,170	1,516	1,093
G	Bradford	0.236	0.478	306	95	1,191	1,545	1,105
I	Erie	0.296	0.402	627	194	945	1,331	931
E	Harrisburg	0.438	0.351	858	266	782	1,145	773
D	Philadelphia	0.477	0.302	972	301	682	1,027	672
H	Pittsburgh	0.367	0.379	670	208	886	1,262	876
B	Scranton	0.358	0.398	651	202	908	1,285	892
F	Williamsport	0.405	0.392	662	205	909	1,278	888

New federal standards and ENERGY STAR (Version 6.1)[16] specifications for air conditioners and heat pumps are effective January 1, 2023. These revisions increase the overall efficiency requirements for equipment, and change the units used to measure equipment efficiency; from SEER and EER to SEER2 and EER2 for cooling, and from heating season performance factor (HSPF) to HSPF2 for heating.

In line with the updated ENRGY STAR and Federal Standards, defaults of SEER, EER, and HSPF values are to be updated to reflect the higher efficiencies of the new standards. However, to allow the market time to adjust to the new generation of efficiency units (e.g., SEER2 and HSPF2), the EDCs can calculate energy and peak demand savings using the first generation of efficiency units (e.g., SEER and HSPF). The equations in Table 1-9 are the result of modeled trendlines developed from equivalent values as stated in the federal code and ENERGY STAR criteria (e.g., 14 SEER = 13.4 SEER2; see Table 1-9).

Table 10-9: Efficiency Unit Conversions

Translation	Conversion
SEER2 to SEER	$SEER = 1.2476 * SEER2 - 2.8674$
EER2 to EER	$EER = 1.0578 * EER2 - 0.1769$
HSPF2 to HSPF	$HSPF = 1.1702 * HSPF2 + 0.0700$

[15] Calculated as $EFLH_{Primary\ HP} \times HDD68 \div HDD60$. The HDD ratio is used to reflect a lower heating requirement for secondary spaces since the thermostat set point in these spaces is generally lowered during unoccupied time periods. Primary spaces are defined as dining rooms, family rooms, hallways, living rooms, kitchen areas, and recreation rooms. Secondary spaces are defined as basements, bathrooms, bedrooms, laundry/mudrooms, offices/studies, storage rooms, and sunrooms/seasonal rooms.

[16] ENERGY STAR Program Requirements for Central Air Source Heat Pumps and Central Air Conditioners

APPENDIX B: RELATIONSHIP BETWEEN PROGRAM SAVINGS AND EVALUATION SAVINGS

There is a distinction between activities required to conduct measurement and verification of savings by Implementation CSPs at the program participant level and the activities conducted by EDC Evaluation Contractors and the SWE to verify those savings. However, the underlying standard for the measurement of the savings for both of these activities is the measurement and verification protocols approved by the Commission. These protocols are of two different types:

1) TRM specified protocols for standard measures with EDC data gathering for open variables as appropriate
2) Interim Protocols for standard measures, reviewed and recommended by the SWE, subject to modification and incorporation into succeeding TRM versions to be approved by the Commission

These protocols are to be uniform and used to measure and calculate savings throughout Pennsylvania. The TRM protocols are comprised of Deemed Measures and Partially Deemed Measures. Deemed Measures specify savings per energy efficiency measure and require verifying that the measure has been installed as intended or, in cases where that is not feasible, that the measure has been purchased by a utility customer. Partially Deemed Measures require both verification of installation and the measurement or quantification of open variables in the protocol if no default values are provided for the open variables.

Stipulated and deemed numbers are valid relative to a particular classification of “standard” measures. In the determination of these values, a normal distribution of values should have been incorporated. Therefore, during the measurement and verification process, participant savings measures cannot be arbitrarily treated as “custom measures” if the category allocation is appropriate.

Custom measures are outside the scope of the TRM. The EDCs are not required to submit savings protocols for custom measures to the Commission or the SWE for each measure/technology type prior to implementing the custom measure. The Commission recommends that these protocols be established in general conformity to the IPMVP or Federal Energy Management Program M&V Guidelines. The SWE reserves the right to audit and review claimed and verified impacts of all custom measures as part of its role to perform EM&V services for the Commission.

EDC Evaluation Contractors and the SWE will adjust the savings reported by Implementation CSPs based on the application of the Commission approved protocols to a sample population and realization rates will be based on the application of these same standards. To the extent that the protocols or deemed values included in these protocols require modification, the appropriate statewide approval process will be utilized. These changes will be prospective.

APPENDIX C: LIGHTING AUDIT AND DESIGN TOOL

The Lighting Audit and Design Tool is located on the Public Utility Commission's website at: https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/

APPENDIX D: MOTOR & VFD AUDIT AND DESIGN TOOL

The Motor and VFD Inventory Form is located on the Public Utility Commission's website at: https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/

APPENDIX E: ELIGIBILITY REQUIREMENTS FOR SOLID STATE LIGHTING PRODUCTS IN COMMERCIAL AND INDUSTRIAL APPLICATIONS

The solid state lighting (SSL) market includes a variety of products of varying levels of quality. The Commission believes it is important that Act 129 program funds support quality products that live up to manufacturer claims. The Design Lights Consortium (https://www.designlights.org/) develops standardized testing procedures and sets minimum requirements to be identified as "DLC Certified" and included on a Qualified Product List (QPL). Design Lights Consortium maintains multiple QPLs including interior and exterior SSL, Horticulture, and Network Lighting Controls. LED lighting equipment must be DLC certified to be eligible for Act 129 program support.

The current DLC technical requirements for SSL are Version 5.1, but the requirements will inevitably evolve over the course of Act 129 Phase V. When DLC technical requirements change, EDCs shall have a grace period covering the remainder program year during which the effective date occurs. The updated technical requirements shall take effect June 1st of the following program year.

Products that are not included on the Design Lights Consortium QPL can still be considered for inclusion in Act 129 energy efficiency programs by submitting the documentation from independent lab testing demonstrating the equipment meets the minimum applicable technical requirements. All supporting documentation must include a specific, relevant model or part number.

APPENDIX F: BUILDING OPERATOR CERTIFICATION AUDIT AND DESIGN TOOL

The Building Operator Certification Audit and Design Tool is located on the Public Utility Commission's website at:
https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/

APPENDIX G: ADJUSTMENT OF PROGRAMMABLE THERMOSTATS FOR COMMERCIAL AND INDUSTRIAL BUILDINGS CALCULATOR

The Adjustment of Programmable Thermostats for Commercial and Industrial Buildings calculator is located on the Public Utility Commission's website at:

https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/