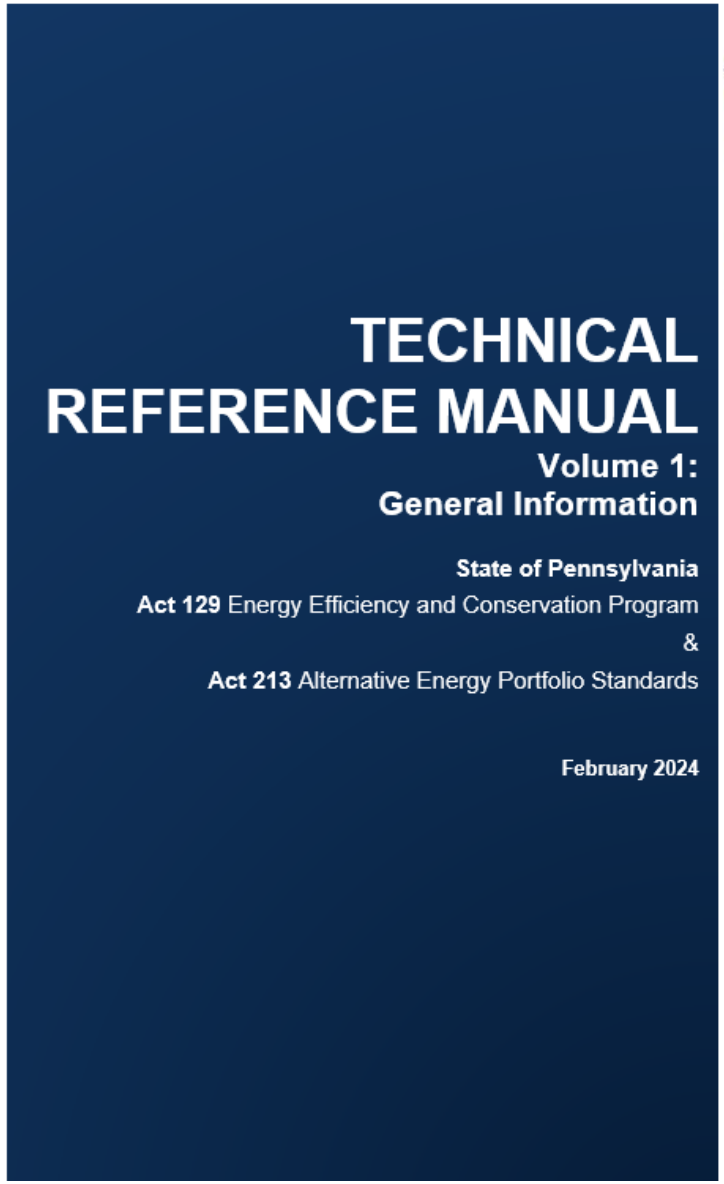
ACT 129 STAKEHOLDER MEETING: 2026 TECHNICAL REFERENCE MANUAL UPDATES

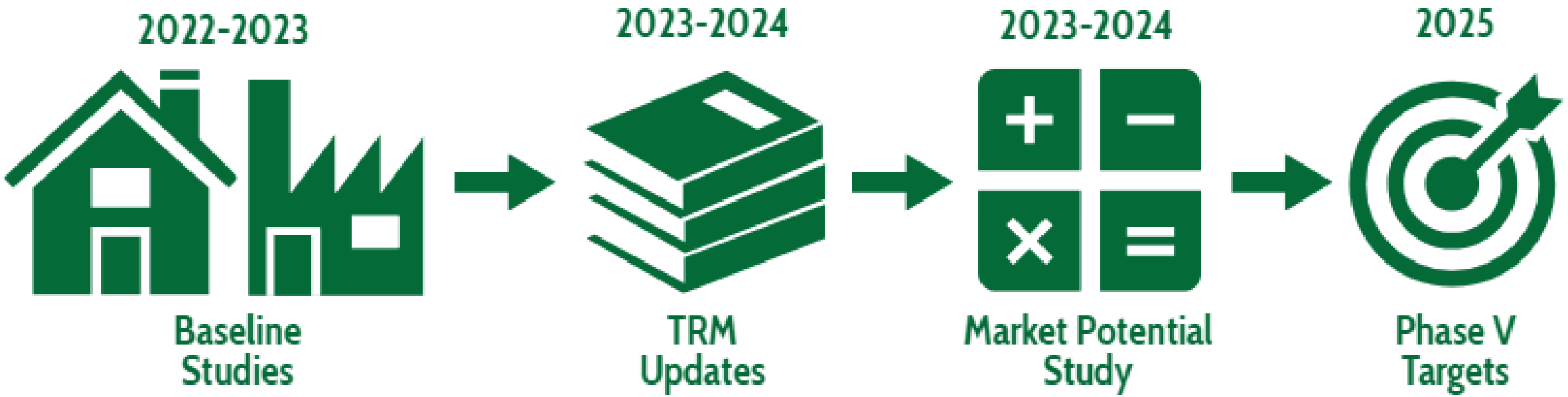
PA PUC
Commonwealth Keystone Building
Hearing Room 1
February 8, 2024
Presented by PA SWE Team



PENNSYLVANIA PUC
PUBLIC UTILITY COMMISSION

NMR Group, Inc.
Demand Side Analytics
DATA DRIVEN RESEARCH AND INSIGHTS
Optimal ENERGY
Integrated Energy Resources
brightline GROUP

Phase V Planning: Inputs and Timeline



CROSS-CUTTING TRM UPDATES

General Cross-Cutting Updates

- Three Volumes:
  - Vol. 1: General
  - Vol. 2: Residential Measures
  - Vol. 3: Commercial and Industrial Measures
- Updated relevant inputs based on Residential and Non-Residential Baseline Studies
- Updated any inputs based on changes to codes/standards (IECC, Federal standards, ENERGY STAR, etc.)

Bifurcation of the Peak Demand Definition

- Affects virtually every measure in the TRM
- Increased attention to winter planning regionally due to extreme weather events
- Heating electrification efforts in nearby states will impact winter peaks
- Winter kW is required for EE resources nominated to PJM

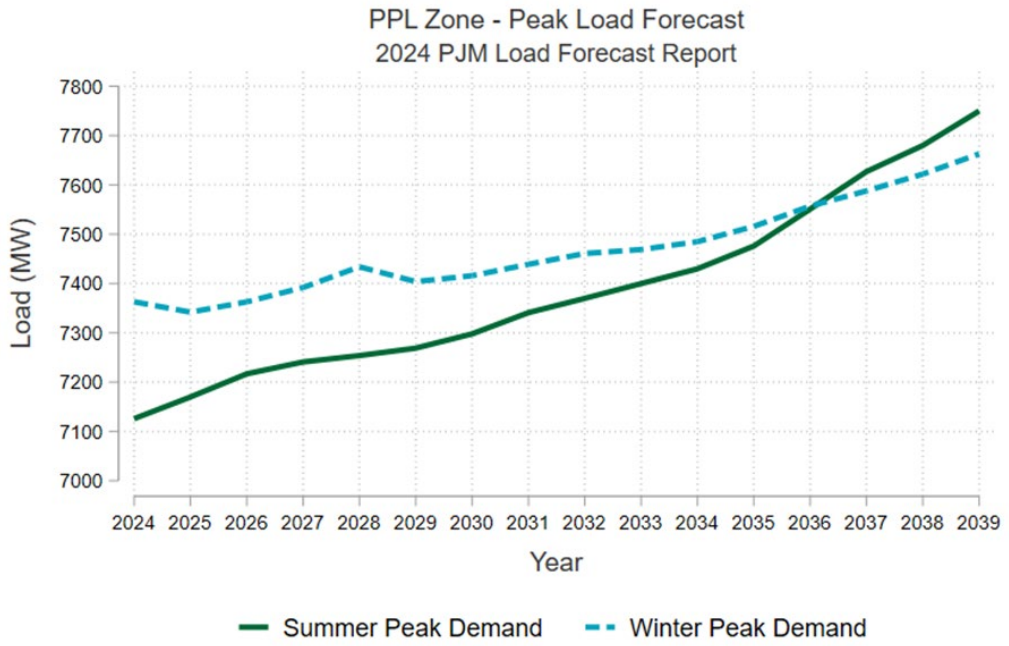


Table 1-4: Periods for Coincident Peak Demand Savings

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)

ALGORITHMS

For all lighting fixture improvements (without control improvements), the following algorithms apply:

$$\Delta kWh = DeltakW \times [HOU \times (1 - SVG_{base}) \times (1 + IF_{energy})]$$

$$\Delta kW_{summer\ peak} = DeltakW \times [CF_s \times (1 - SVG_{base}) \times (1 + IF_{demand\_s})]$$

$$\Delta kW_{winter\ peak} = DeltakW \times [CF_w \times (1 - SVG_{base}) \times (1 + IF_{demand\_w})]$$

$$DeltakW = (kW_{base} - kW_{ee})$$

Codes and Standards Updates to 2021 TRM

TRM Measure #	TRM Measure Name	Type of Change
2.1.1	ENERGY STAR Lighting	Change to Federal Standard
2.2.1	High Efficiency Equipment: ASHP, CAC, GSHP, PTAC, PTHP	Change to Federal Standard and ES Standard
2.2.2	High Efficiency Equipment: Ductless Heat Pumps	Change to Federal Standard and ES Standard
2.3.1	Heat Pump Water Heaters	Changes to ES standard
2.3.3	Fuel Switching: Electric Resistance to Fossil Fuel Water Heater	Change to ES standard
2.4.4	ES Clothes Washers	Change to ES standard
2.4.9	ES Dehumidifiers	Changes to federal minimum and ES standards
2.4.12	ES Air Purifier	Change to ES standard
2.7.1	Residential New Construction	Adopt IECC 2018
2.8.1	Variable Speed Pool Pumps	New federally regulated equipment class, and new ES standards
3.1.2	New Construction Lighting	IECC 2018 reduces interior and exterior lighting power allowances
3.1.7	Lighting Improvements for Midstream Delivery	Change to Federal Standard for General Service
3.2.4	Ductless Heat Pumps < 5.4 Tons	Change to ES Standard
3.4.1	Heat Pump Water Heaters	ENERGY STAR qualification update changes default efficient case UEF
3.4.2	Low Flow Pre-Rinse Sprayers	Federal standard increases baseline flow rate.
3.5.1	ES Refrigeration/Freezer Cases	Change to ES Standard
3.4.3	Fuel Switching: Electric Resistance to Fossil Fuel Water Heater	Change to ES standard
3.7.5	ES Combination Oven	Change to ES standard
3.7.6	ES Commercial Convection Oven	Change to ES standard
3.7.9	ES Commercial Dishwasher	Change to ES standard
3.9.1	ES Office Equipment	Change to ES standard

- 20 measure updates effective PY15
- Four more pending for PY16
- Starting point for 2026 TRM update

IECC 2021 Is Expected to Become the State Building Code for Phase V

- Adoption timeline weblink
- Raises the TRM baselines for commercial new construction lighting and residential new construction
- Could impact commercial HVAC baselines although federal standards appear to remain the more stringent requirement

Date	Days	Running	Activity
1/31/2021			ICC Officially Publishes 2021 ICC Family of Codes
11/15/2021			Open Public Comment for Sections Not Changing from 2018 to 2021
2/13/2022	90		Close Public Comment for Sections Not Changing from 2018 to 2021
3/10/2022			RAC Meeting
5/12/2022			RAC Meeting
7/14/2022			RAC Meeting
9/8/2022	207		Publish list of additional sections to be considdered
10/13/2022	620	20.66667	RAC Initiate PA Review of 2021 ICC Family of Codes
11/12/2022	30		Rac Opens Public Comment on 2021 ICC Family of Codes
			TAC Committee Applications are Opened
12/12/2022	30		TAC Committee Applications are Closed
3/12/2023	120		Public Comment Closed
3/16/2023	4		RAC Receives Public Comment and Assigns Comments to TAC's
9/14/2023	182		RAC Meets With Update From TAC Committee's Being Presented
12/7/2023	84		TAC Review Completed with Final Reports to Dept L&I
1/4/2024	28		RAC Recieves Final Report From TAC Committee's
1/15/2024	11		TAC Final Reports are Posted for Public Review
2/1/2024	17		RAC First Public Hearing (EAST)
2/29/2024	28		RAC Second Public Hearing (Harrisburg)
3/28/2024	28		RAC Third Public Hearing (WEST)
4/18/2024	21		RAC Meeting to Deliberate
5/2/2024	14		RAC Meeting to Deliberate
5/16/2024	14		RAC Meeting to Deliberate
5/30/2024	14		RAC Meeting to Deliberate
6/13/2024	14		RAC Meeting to Deliberate
6/27/2024	14		RAC Meeting to Deliberate
7/25/2024	70		Draft Report Presented to the RAC
9/12/2024	49		Final Report Approved by RAC
10/1/2024	19		Final Report Submitted to Dept L&I
2/27/2025			RAC Meeting
5/8/2025			RAC Meeting
7/13/2025	285		Go Live

NMR Group, Inc.

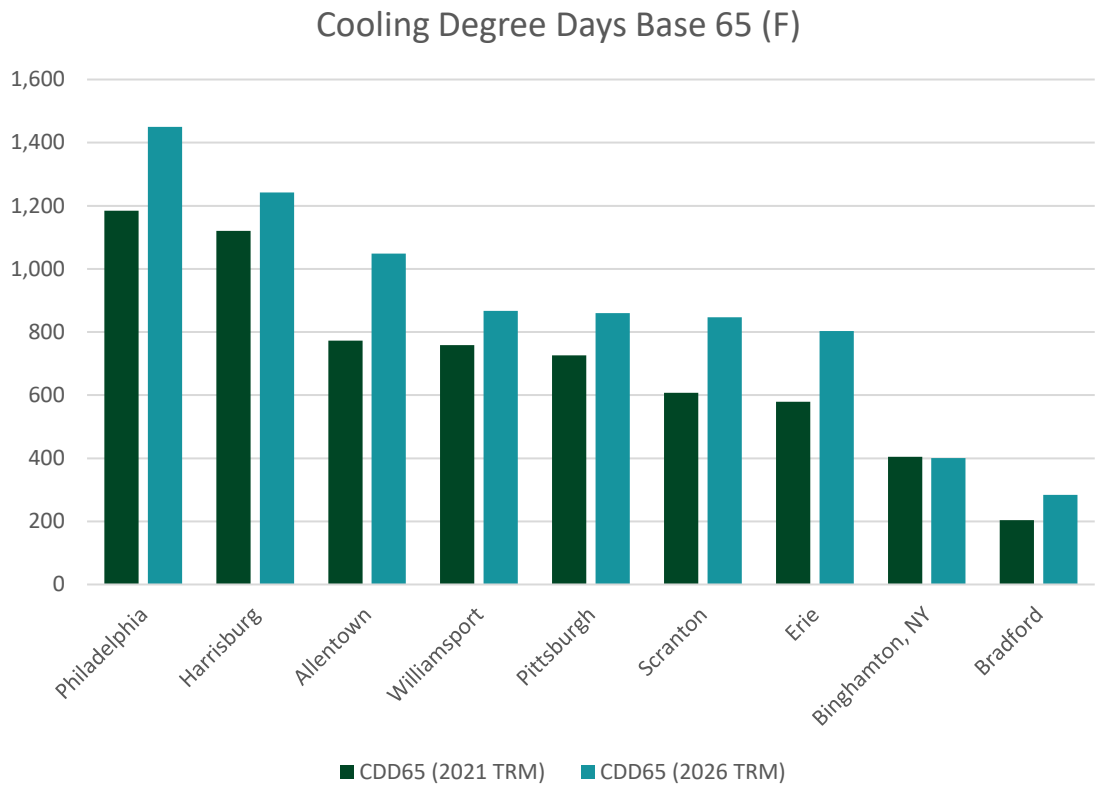
CROSS-CUTTING TRM UPDATES: CLIMATE-DEPENDENT VALUES

Climate-Dependent Values

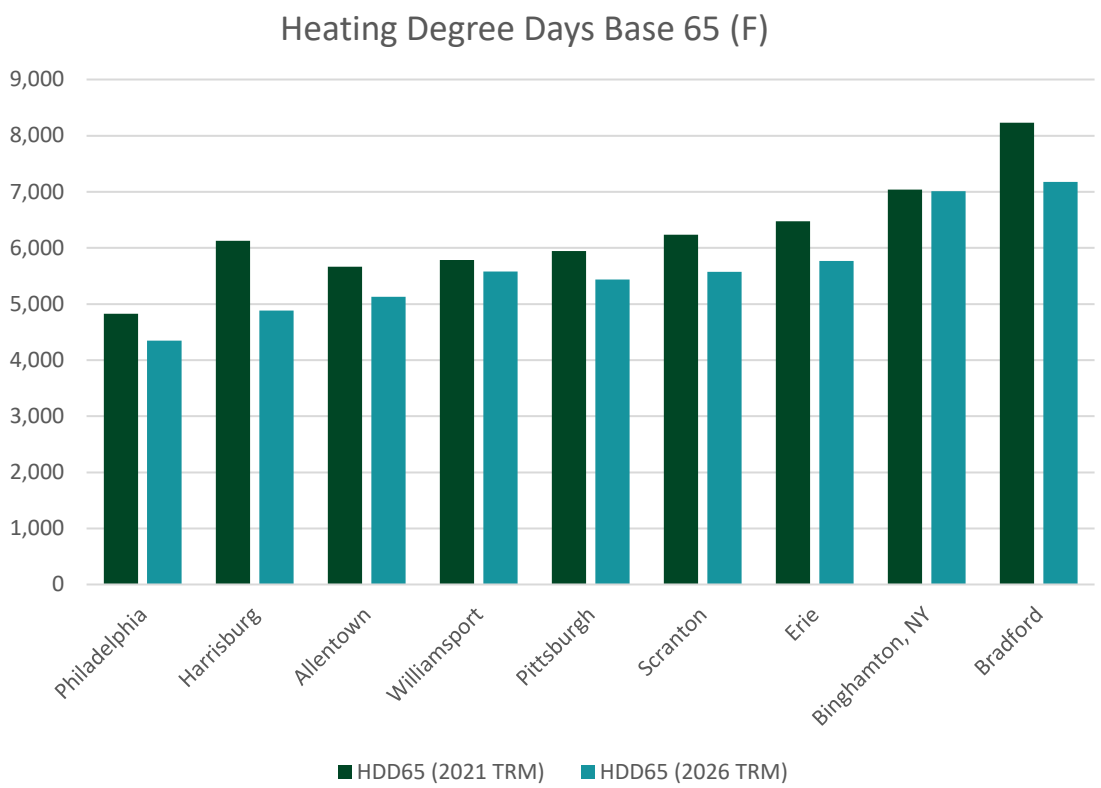
- Transition climate assumptions from TMY3 to 15-year weather normals (2006-2020)
- Changes the HDD/CDD and EFLH values for weather-dependent measures
- Updated Climate Regions
- Added winter coincidence factors (CF) and energy-to-demand factors (ETDF) to calculate winter peak demand savings
- Updated Appendix A in Volume 1. Spreadsheet tool will be available

TMY3 Replaced by NOAA 15-Year Normals (2006-2020)

Increase in Cooling Savings



Decrease in Heating Savings



Residential HVAC EFLH Update

- Update $EFLH_{cool}$ and $EFLH_{heat}$ to reflect updated climate assumptions
- Update Summer CF and add Winter CF
- Leverages the thermostat runtime analysis from 2021 TRM Update
- Affects most residential HVAC and Building Shell measures

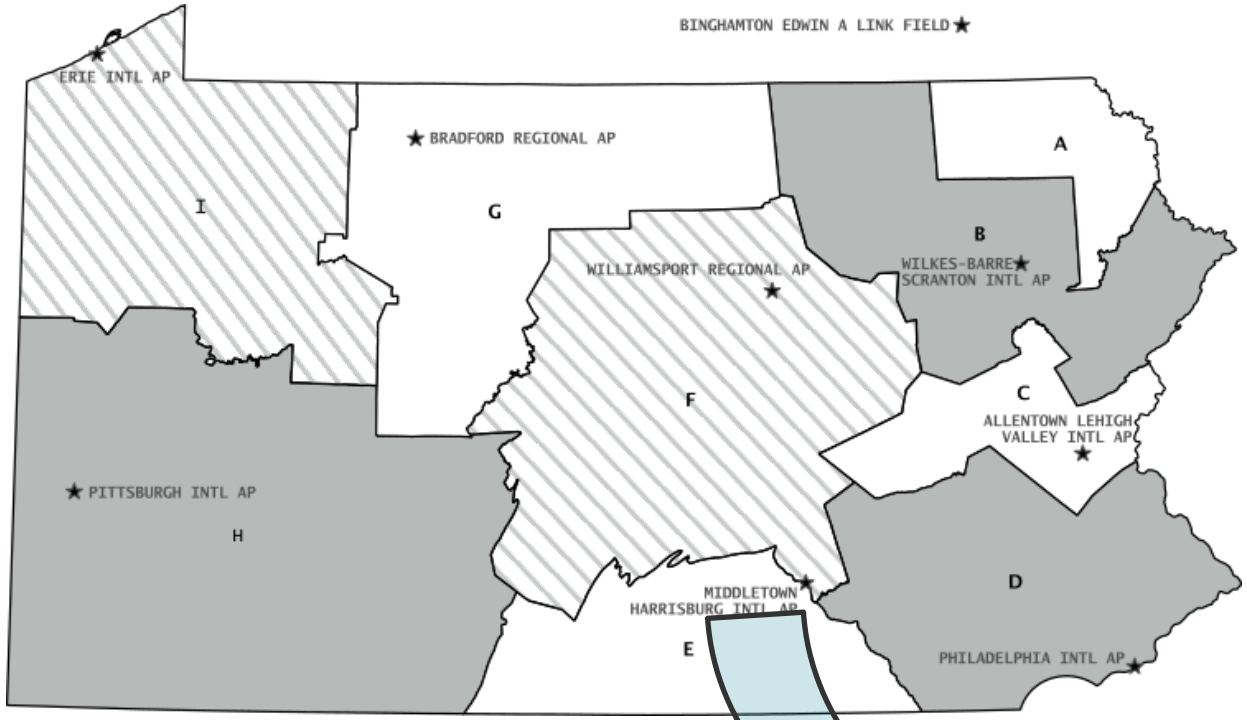
Results

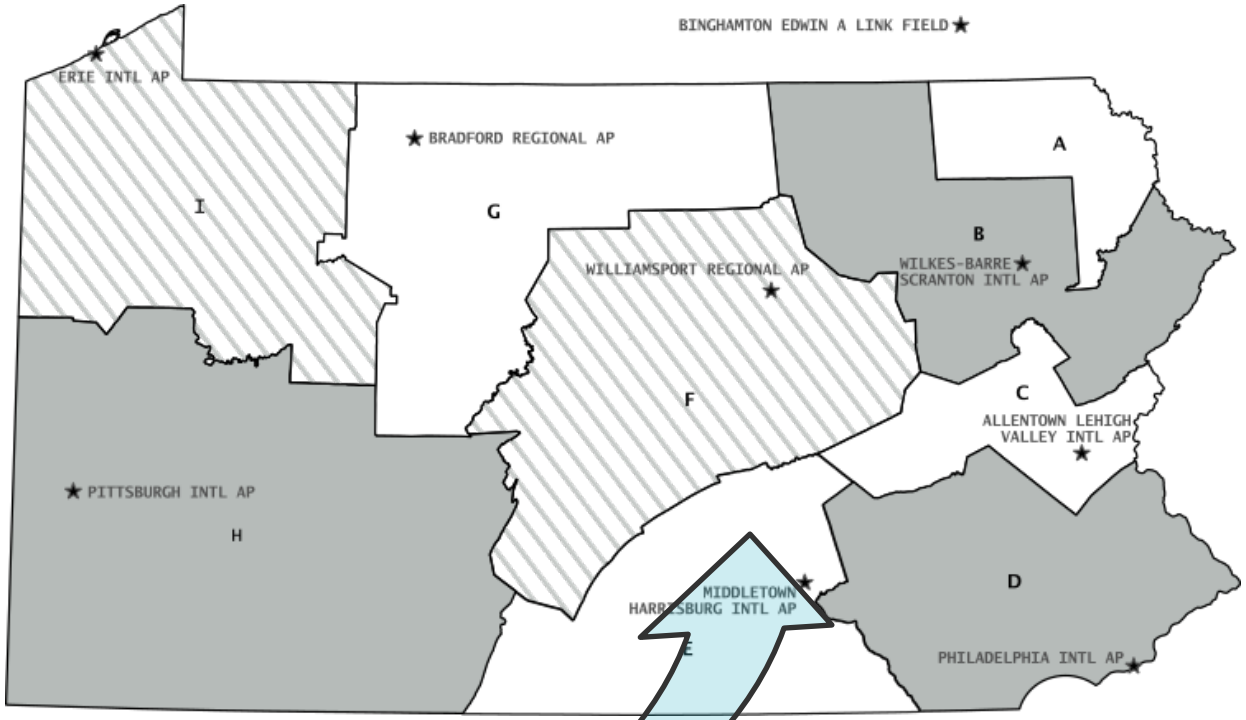
Reference City	Summer CF	Winter CF	EFLH				
			Cooling		Heating		
			CAC & HP	Room AC or secondary	Non Heat Pump	Heat Pump, Primary	Heat Pump, Secondary
Allentown (C)	0.419	0.351	759	235	825	1,200	817
Binghamton (A)	0.246	0.445	386	120	1,170	1,516	1,093
Bradford (G)	0.236	0.458	306	95	1,191	1,545	1,105
Erie (I)	0.296	0.386	627	194	945	1,331	931
Harrisburg (E)	0.438	0.337	858	266	782	1,145	773
Philadelphia (D)	0.477	0.290	972	301	682	1,027	672
Pittsburgh (H)	0.367	0.363	670	208	886	1,262	876
Scranton (B)	0.358	0.382	651	202	908	1,285	892
Williamsport (F)	0.405	0.376	662	205	909	1,278	888

2021 TRM Reference Regions

VS

2026 TRM Reference Regions





Winter kW NREL ETDFs

- Energy to Demand Factor (ETDF) is the average energy consumption (or savings) during peak hours divided by the total annual energy usage (or savings)
- Allows for a straightforward calculation of peak kW impacts from ΔkWh
- ETDFs are end use-specific. For example:

$$ETDF_{summer} = \frac{Avg.Summer\ Peak\ Cooking\ kWh}{Total\ Annual\ Cooking\ kWh}$$

$$ETDF_{winter} = \frac{Avg.Winter\ Peak\ Cooking\ kWh}{Total\ Annual\ Cooking\ kWh}$$

- NREL End-Use Load Profiles for the U.S. Building Stock provides energy usage data for a variety of end uses that can be used to calculate ETDFs

Winter kW NREL ETDFs

building_type	timestamp	models used	units represented	ceiling fan kWh	clothes dryer kWh	clothes washer kWh	dishwasher kWh	freezer kWh	heating kWh
Single-Family Attached	1/1/2007 0:15	4,271	1,034,142	812	2,289	458	294	1,847	113,012
Single-Family Attached	1/1/2007 0:30	4,271	1,034,142	802	5,378	594	172	1,847	112,020
Single-Family Attached	1/1/2007 0:45	4,271	1,034,142	777	8,617	625	148	1,847	110,040
Single-Family Attached	1/1/2007 1:00	4,271	1,034,142	769	9,163	345	148	1,847	109,122
Single-Family Attached	1/1/2007 1:15	4,271	1,034,142	735	7,398	228	83	1,847	103,595
Single-Family Attached	1/1/2007 1:30	4,271	1,034,142	731	5,847	145	83	1,847	106,137
Single-Family Attached	1/1/2007 1:45	4,271	1,034,142	723	4,560	38	246	1,847	106,745
Single-Family Attached	1/1/2007 2:00	4,271	1,034,142	722	3,556	47	135	1,847	108,355
Single-Family Attached	1/1/2007 2:15	4,271	1,034,142	715	2,773	64	103	1,847	110,686
Single-Family Attached	1/1/2007 2:30	4,271	1,034,142	712	2,032	43	26	1,847	110,780
Single-Family Attached	1/1/2007 2:45	4,271	1,034,142	708	1,795	25	31	1,847	112,222
Single-Family Attached	1/1/2007 3:00	4,271	1,034,142	707	1,596	17	31	1,847	112,900
Single-Family Attached	1/1/2007 3:15	4,271	1,034,142	709	1,387	1	31	1,847	116,526
Single-Family Attached	1/1/2007 3:30	4,271	1,034,142	708	926	-	6	1,847	116,711
Single-Family Attached	1/1/2007 3:45	4,271	1,034,142	707	423	16	42	1,847	118,629
Single-Family Attached	1/1/2007 4:00	4,271	1,034,142	708	444	82	44	1,847	119,270
Single-Family Attached	1/1/2007 4:15	4,271	1,034,142	722	637	65	103	1,847	122,298
Single-Family Attached	1/1/2007 4:30	4,271	1,034,142	724	597	80	92	1,847	122,540
Single-Family Attached	1/1/2007 4:45	4,271	1,034,142	732	843	58	76	1,847	124,544
Single-Family Attached	1/1/2007 5:00	4,271	1,034,142	734	921	108	76	1,847	125,493
Single-Family Attached	1/1/2007 5:15	4,271	1,034,142	801	1,082	85	50	1,847	127,131
Single-Family Attached	1/1/2007 5:30	4,271	1,034,142	805	1,307	162	85	1,847	126,963
Single-Family Attached	1/1/2007 5:45	4,271	1,034,142	850	2,001	400	122	1,847	128,880
Single-Family Attached	1/1/2007 6:00	4,271	1,034,142	858	2,570	500	143	1,847	129,523
Single-Family Attached	1/1/2007 6:15	4,271	1,034,142	1,077	3,015	481	195	1,847	129,955
Single-Family Attached	1/1/2007 6:30	4,271	1,034,142	1,076	4,263	448	256	1,847	130,175

Example: Raw NREL load shape data for single-family attached buildings

- NREL provides 15-minute energy usage data for a variety of commercial/residential building types and for a range of end uses (e.g., ceiling fans, cooling, heating)

- ETDFs were calculated by:
  - (1) Aggregating the 15-minute data to an hourly level
  - (2) Calculating the average consumption for each end use during summer and winter peak hours
  - (3) Summing all consumption for the year of data provided
  - (4) Dividing the average summer and winter peak consumption by the total annual consumption

Winter kW NREL ETDFs

- NREL load shape data is provided for different:
  - Geographic areas (states, counties)
  - Building types
  - Weather conditions (AMY vs. TMY)
    - AMY: Actual Meteorological Year (building energy usage is modeled using the actual weather conditions during 2018
    - TMY: Typical Meteorological Year (building energy usage is modeled using average weather conditions between 1991 and 2005
- Multiple releases of data between 2021-2023
- SWE chose to rely on NREL's 2022 TMY load shape data for residential building types and NREL's 2023 AMY load shape data for commercial building types

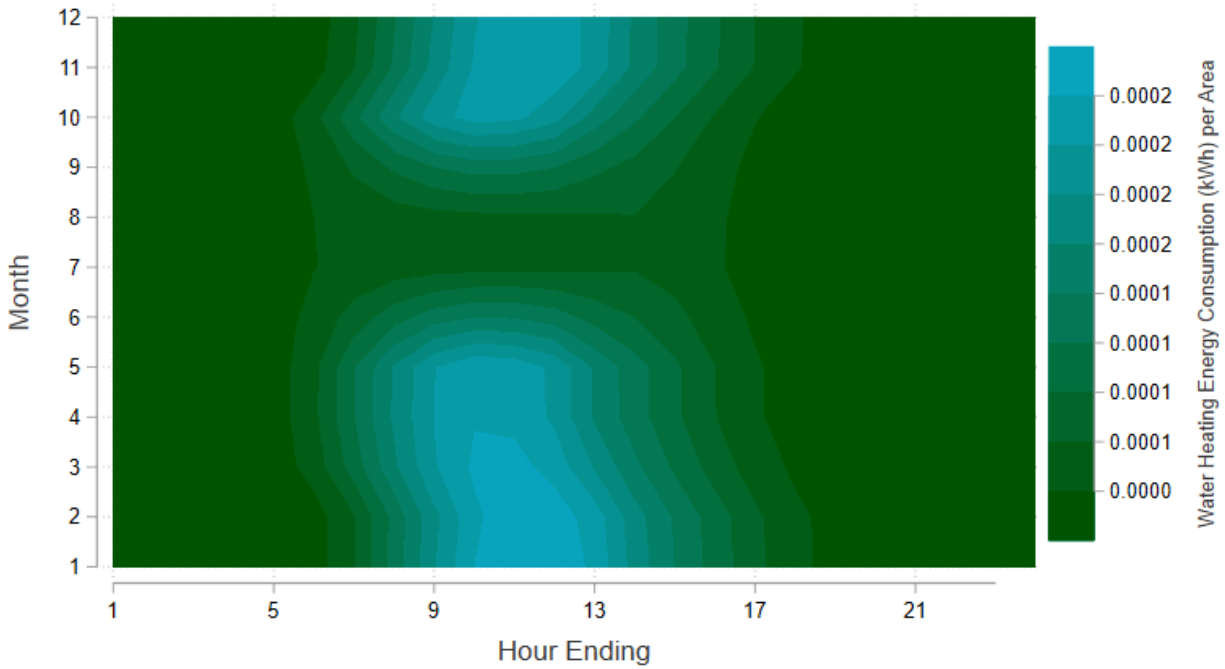
Residential	Commercial
Single-Family Attached	Full-Service Restaurant
Single-Family Detached	Hospital
Mobile Home	Large Hotel
Multi-Family 2-4 Units	Large Office
Multi-Family 5+ Units	Medium Office
	Outpatient
	Primary School
	Quick Service Restaurant
	Retail Standalone
	Retail Strip Mall
	Secondary Hotel
	Small Hotel
	Small Office
	Warehouse

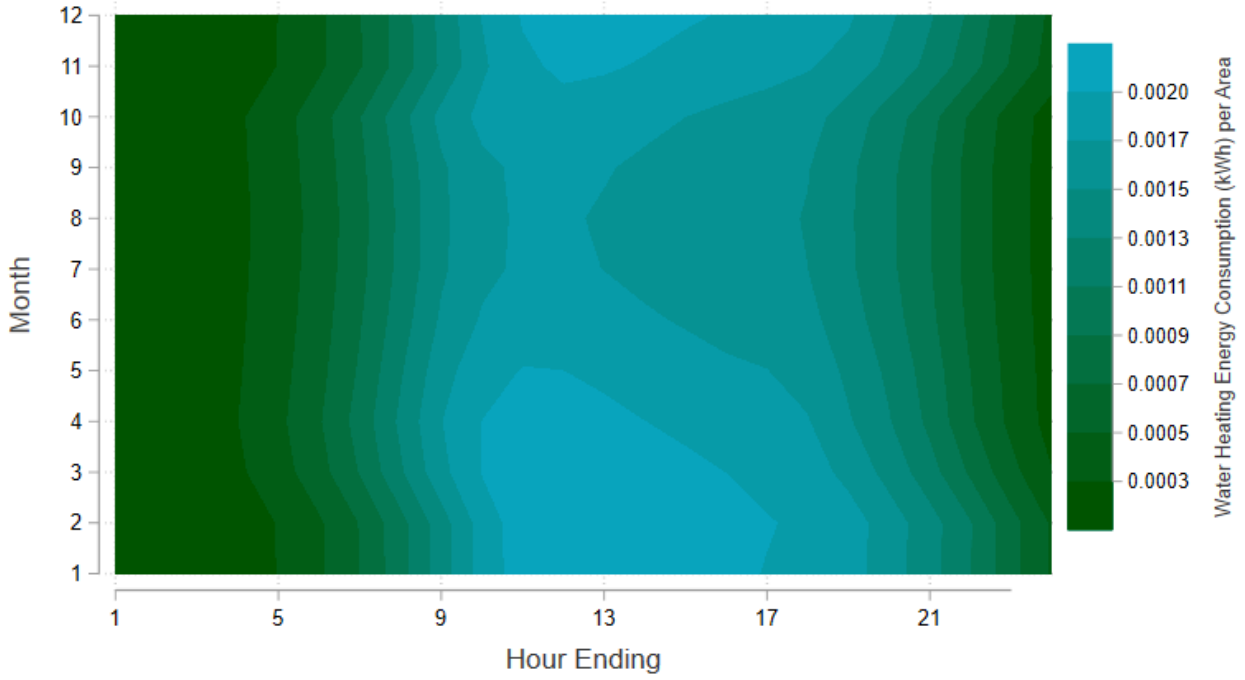
NREL building types modeled in the NREL load shape data

DHW Shape for High Schools

VS

DHW Shape for Restaurants



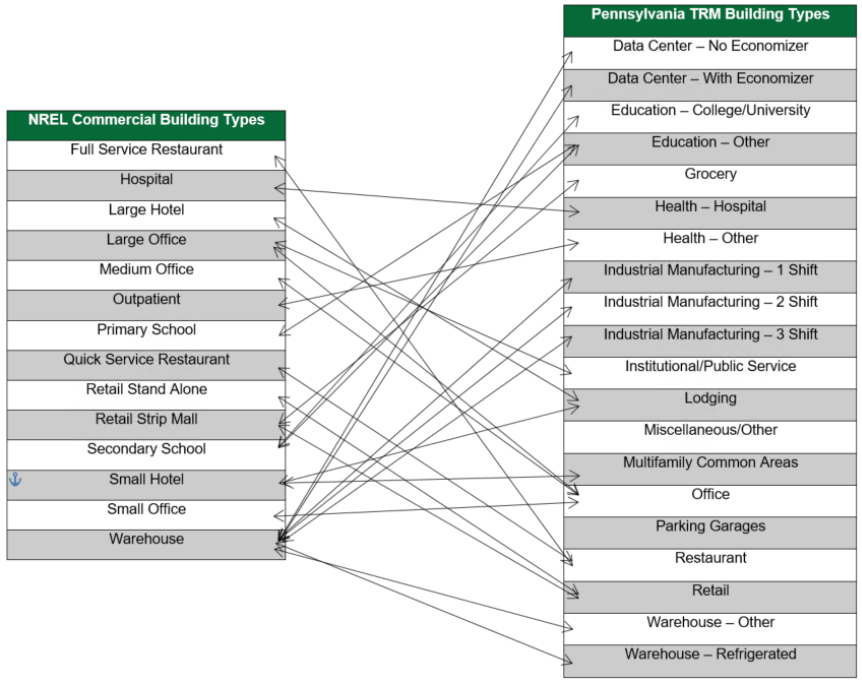


Winter kW NREL ETDFs

- In incorporating NREL load shape data into the peak demand savings, the SWE:
  - Created a single set of composite residential ETDFs using a sales-weighted average based on the results of the 2023 Residential Baseline Study
  - Determined which combination of NREL commercial building types should be averaged (weighted by floor area) to create a composite ETDF on a case-by-case basis
  - Determined when to use ETDFs in lieu of coincidence factors on a case-by-case basis
- The SWE did not develop any of the underlying load shape data that was used to calculate the summer and winter ETDFs

Building Type	Energy Consumption	Customers
Single-Family Detached	31,794,384 (58%)	2,892,894 (66%)
Single-Family Attached	8,316,509 (19%)	940,063 (17%)
Mobile Home	6,596,807 (20%)	1,004,747 (14%)
Multi-Family	1,645,838 (3%)	171,551 (3%)

Residential building type weighting options



Building type mapping between NREL and PA TRM

CROSS-CUTTING TRM UPDATES: Q & A

RESIDENTIAL TRM UPDATES

Residential: General Updates

- Federal standards updates
- ENERGY STAR specification changes
- 2021 IECC
- 2023 Residential Baseline study
- Added winter demand savings
- Updated outdated references

RESIDENTIAL TRM UPDATES: UPDATED MEASURES

Updated Measures: Lighting

- 2.1.1: Residential LED Lighting
  - GSLs limited to direct install
    - Baseline = replaced wattage
  - Non-GSLs eligible for all delivery channels
  - Linear LED fixtures are eligible
    - Linear LED fixtures rely on efficacy (Lumens/Watt) baseline
    - Simplifies the measure characterization and savings calculations
    - LED fixtures that effectively replace GSLs, such as downlighting, are not eligible lamps

Updated Measures: Other Residential Lighting

- Residential Occupancy Sensors
  - Updated controlled wattage with 2023 Residential Baseline study
  - Added plug-in controls
- LED and Electroluminescent Nightlights
  - Updated default in-service rate based on Phase IV EDC evaluation data

Updated Measures: HVAC

- Baseline efficiencies: Updated to match federal standards and IECC 2021 in all applicable measures
- Algorithms:
  - Updated to reflect new efficiency metrics (EER2, SEER2, HSPF2) in applicable measures
  - Differentiated algorithms for equipment types using legacy metrics
- Eligibility:
  - Updated references to Energy Star specifications as applicable
  - Room AC: Removed Energy Star criteria as Federal Standards exceed Energy Star requirements
- Measure life: Updated to reference more recent and applicable sources
- Default savings: Updated with refreshed EFLH values

Updated Measures: DHW

- Heat Pump Water Heaters
  - Updated ES standards (version 5.0)
  - Simplified reference table for baseline Uniform Energy Factors (based on rated storage volume and draw pattern)
- Water Heater Temperature Setback
  - Updated number of clothes washer cycles per year based on 2020 RECS
  - Update volume of hot water used per clothes washer cycle
  - Updated default UEF of HPWHs and electric storage WHs
  - Updated default COP
- Low-flow faucet aerators, showerheads, thermostatic shower restriction valves
  - Updated average number of persons per household (US Census)
  - Updated average number of faucets & showerheads in the home and % of water heaters that are electric and HPWH (Residential Baseline)
  - Updated assumed temperature of water entering house
  - Updated kit ISRs

Updated Measures: Appliances

- ENERGY STAR Refrigerators & Freezers
  - Updated for changes to ENERGY STAR Most Efficient specification
  - Adding announced updates to federal standards
    - Effective date of the rule is 5/16/24 (accepting public comments until 5/6/24)
    - Standards are effective January 31, 2029 & January 31, 2030
  - If standards change, will address the changes in a Codes & Standards review
- ENERGY STAR Clothes Washers
  - Updated number of cycles per year based on 2020 RECS
- ENERGY STAR Dishwashers
  - Incorporated new ES standard (v. 7.0)

Updated Measures: Appliances

- ENERGY STAR Dehumidifiers
  - Updated annual hours of use (HOU)
- ENERGY STAR Ceiling Fans
  - Removed lighting savings
- ENERGY STAR Air Purifiers
  - Incorporated new federal minimum standards for integrated energy factor (IEF)

Updated Measures: Building Shell

- Weather Stripping, Caulking, and Outlet Gaskets
  - Updated default savings
  - Added kit ISRs for outlet gaskets, based on Ph IV evaluations
- Ceiling/Attic, Wall, Floor, and Rim Joist Insulation; Basement or Crawl Space Wall Insulation
  - Updated default efficient R-values to 2021 IECC
- ENERGY STAR Windows
  - Updated baseline
  - Added new ES standard (v. 7.0)
  - Added RAC savings

Updated Measures: Whole Home

- Residential New Construction
  - Updated to IECC 2021 and updated with baseline study data
  - Incorporated MF New Construction IMP; now includes high-rise MFNC
- ENERGY STAR Manufactured Homes
  - Updated baseline to new federal minimum (effective July 1, 2025)
  - Updated to new ENERGY STAR manufactured homes program v3 standards

Updated Measures: Other

- Advanced Power Strips
  - Updated ISRs based on Phase IV evaluations
- Variable Speed Pool Pumps
  - Updated to include new federal minimum standards
  - Updated to new ES standards (v. 3.1)

RESIDENTIAL TRM UPDATES: NEW MEASURES

New Measures: HVAC

- Separated from 2.2.1 Electric HVAC:
  - Midstream delivery
- Window Heat Pump

New Measures: Domestic Hot Water

- Smart Water Heater Controller

New Measures: Appliances

- ENERGY STAR Bathroom Exhaust Fan
- ENERGY STAR Coolers
- Cooler Recycling with and without replacement
- Residential Induction Cooktops

RESIDENTIAL TRM UPDATES: DELETED MEASURES

Deleted Measures

- 2.2.6: Fuel Switching: Electric Heat to Gas/Propane/Oil Heat
- 2.3.3: Fuel Switching: Electric Resistance to Fossil Fuel Water Heater
- 2.4.7: Fuel Switching: Electric Clothes Dryer to Gas Clothes Dryer
- 2.5.1: ENERGY STAR Office Equipment

RESIDENTIAL TRM UPDATES: Q & A

NON-RESIDENTIAL TRM UPDATES

Non-Residential: General Updates

- Updated climate dependent values to 15-year normals
- Codes and standards updates
  - 2021 IECC, ENERGY STAR, Federal Standards
- 2023 Non-Residential Baseline
- Added winter demand savings
- New ETDF approach for summer and winter demand

NON-RESIDENTIAL TRM UPDATES: UPDATED MEASURES

Lighting Retrofits (and App C)

Section 3.1.1

- Limited to early replacement vintage
- Removed the override of T12 wattages to T8
- Screw-in lamps are no longer eligible
- New interactive effect assumptions
- Networked lighting controls added (SVG=49%)

New MS Excel Interactive Effect Calculator

Analysis Parameters

Parameter Selection	
Building Type	Default
Location	Default Values
HVAC Mix Options	Unknown - use market average

Key Parameters			
Term	E Heat	F Heat	Cool
Percent HVAC (square footage basis)	6.44%	85.56%	59.00%
HVAC Efficiency	191.0%	84.3%	399%
Change Point (F)	50	50	60
Behavior Gate Hours Required	3	3	3
Internal Gain Contribution	55.0%	55.0%	55.0%
kWh to MMBtu		0.003412	

Concurrency		
Term	Heat	Cool
Demand	100.00%	100.00%
Energy	44.22%	41.57%

Applicability: is the space heated?		
Term	Heat	Cool
Applicability	92.0%	59.0%

Percent Heat Type & Interior/Exterior Adjustment	
Percent Electric Heat	7.0%
Percent of Lamps Interior	100.0%
Percent of Lamps Exterior	0.0%

TRM Table | **Inputs - Outputs** | Input Options | Lighting_Profiles | Weather_Profiles | Energy Demand Definitions | Concurrency

Analysis Outputs

Base	Energy
Heat	0.22375
Cool	0.13489

Base	Demand
Heat	0.50600
Cool	0.32450

Account for Fuel Shares and Efficiency	Energy	
Electric Heat	0.00820	kWh
Fossil Fuel Heat	0.0008425	MMBtu
Cool	0.03381	kWh

Account for Fuel Shares and Efficiency	Demand
Winter	0.01854
Summer	0.08133

Convert to HVAC Factors	IF_energy_electric	IF_energy_ff	IF_demand_s	IF_demand_w
	0.02561	-0.00084	0.08133	-0.01854

Account for Exterior	IF_energy_electric	IF_energy_ff	IF_demand_s	IF_demand_w
	0.02561	-0.00084	0.08133	-0.01854
Units:	kWh	MMBtu	kW	kW

Results Table			
Building Type	Default		
Location	Default Values		
HVAC Mix	Unknown - use market average		
IF_energy_electric	IF_energy_ff	IF_demand_s	IF_demand_w
0.02561	-0.00084	0.08133	-0.01854

HVAC Configuration	IF_{energy}	IF_{demand_s}	IF_{demand_w}	IF_{fossil_MMBtu}	Source
AC with Fossil Fuel Heat	0.0573	0.1379	0.0000	-0.0010	18
AC with Electric Heat	-0.0700	0.1379	-0.2880	0.0000	
Fossil Fuel Heat Only	0.0000	0.0000	0.0000	-0.0010	
Electric Heat Only	-0.1273	0.0000	-0.2880	0.0000	
Unknown (Market Average)	0.0256	0.0813	-0.0185	-0.0008	

New Construction Lighting

Section 3.1.2

- Updated for consistency with IECC 2021
- IECC 2015 (2021 TRM) -> IECC 2018 (C&S)
  - Lighting Power Density (LPD) allowances
    - By building area
    - By space type
  - Exterior Lighting Power Densities
  - Baseline Savings Control Factors
  - Updated App C calculator to reflect these changes

Updated New Construction LPDs

IECC 2015

Building Area Type	LPD (W/ft^2)	Building Area Type	LPD (W/ft^2)
Automotive facility	0.80	Multifamily	0.51
Convention center	1.01	Museum	1.02
Courthouse	1.01	Office	0.82
Dining: bar lounge/leisure	1.01	Parking garage	0.21
Dining: cafeteria/fast food	0.90	Penitentiary	0.81
Dining: family	0.95	Performing arts theater	1.39
Dormitory	0.57	Police station	0.87
Exercise center	0.84	Post office	0.87
Fire station	0.67	Religious building	1.00
Gymnasium	0.94	Retail	1.26
Health care clinic	0.90	School/university	0.87
Hospital	1.05	Sports arena	0.91
Hotel/Motel	0.87	Town hall	0.89
Library	1.19	Transportation	0.70
Manufacturing facility	1.17	Warehouse	0.66
Motion picture theater	0.76	Workshop	1.19

IECC 2021

Building Area Type	LPD (W/ft^2)	Building Area Type	LPD (W/ft^2)
Automotive facility	0.75	Multifamily	0.45
Convention center	0.64	Museum	0.55
Courthouse	0.79	Office	0.64
Dining: bar lounge/leisure	0.80	Parking garage	0.18
Dining: cafeteria/fast food	0.76	Penitentiary	0.69
Dining: family	0.71	Performing arts theater	0.84
Dormitory	0.53	Police station	0.66
Exercise center	0.72	Post office	0.65
Fire station	0.56	Religious building	0.67
Gymnasium	0.76	Retail	0.84
Health care clinic	0.81	School/university	0.72
Hospital	0.96	Sports arena	0.76
Hotel/Motel	0.56	Town hall	0.69
Library	0.83	Transportation	0.50
Manufacturing facility	0.82	Warehouse	0.45
Motion picture theater	0.44	Workshop	0.91

Midstream Lighting

Section 3.1.7

- Limited to replace on burnout vintage
- Least efficient readily available technology sets the baseline
- Linear lamps, fixtures, and retrofit kits rely on efficacy (Lumens/Watt) baseline
  - Simplifies the measure characterization and savings calculations
  - Lumen output of the program-supported LED equipment was already required under the lumen bin approach in 2021 TRM

Baseline Efficacy Values

- LED Exit Signs
  - Updated default savings to reflect new interactive effects and add winter kW
- LED Channel Signage
  - Proposed removal from the TRM
  - No Phase IV participation

Table 3-24: Baseline Wattage, Linear Lamps & Fixtures, HID Interior and Exterior Fixtures

Efficient Lamp or Fixture	$Efficacy_{base}$ (Lumens/watt)	Source
Linear Lamps, Fixtures, and Retrofit Kits, 2 ft	67.4	11, 12
Linear Lamps, Fixtures, and Retrofit Kits, 3 ft	72.5	11, 12
Linear Lamps, Fixtures, and Retrofit Kits, 4 ft	75.8	11, 12
Linear Lamps, Fixtures, and Retrofit Kits, 5 ft	80.4	11, 12
Linear Lamps, Fixtures, and Retrofit Kits, 8 ft	82.3	11, 12
Linear Lamps, Fixtures, and Retrofit Kits, 8 ft HO	78.2	11, 12
Highbay & Lowbay LED Fixture and Retrofit Kits	51.1	11, 12
Exterior Fixture (Wall Pack, Flood, Area, Pole, or Parking Garage)	51.4	11, 12

HVAC

Section 3.2

- Revised baseline efficiencies to IECC 2021
- Updated efficiency metrics to new EER2, SEER2, and HSPF2 standards
  - EER, SEER, and HSPF remain in place for equipment using legacy efficiencies
- Aligned methodologies and inputs with updated ENERGY STAR standards where applicable
- Removed ENERGY STAR criteria from Room ACs. New baseline is set by more stringent Federal Standards
- Updated equipment EULs to more recent or applicable sources

Motors & VFDs (and App D)

Section 3.3

- Updated NEMA Design A and B motors to new September 2023 Federal Standards
- Revised VFD HVAC Fan load profile to align with ASHRAE Handbook
- Added Summer and Winter ETDFs with permutations for building type and end-use
- Appendix D savings calculator has been updated to align with new methodology
  - Incorporates all changes listed above

Domestic Hot Water

Section 3.4

- Heat Pump Water Heaters
  - Updated COP adjustment factor for midstream delivery based on a weighted average of heat pump placements (provided by the PA 2023 baseline study)
  - Added winter ETDFs
  - Added UEFs corresponding to different draw patterns
- Pipe Insulation
  - Updated heat loss savings rates and annual energy savings values

Refrigeration

Section 3.5

- High Efficiency Refrigerated/Freezer Cases
  - Updated to align with Energy Star requirements
- Updated algorithms and parameters for twelve measures to align with more contemporary studies, including:
  - NEEP Commercial Refrigeration Loadshape Project
  - Commercial refrigeration focused studies by DOE and Oak Ridge National Lab
- Added interactive effects to savings methodologies
- Revised default savings to split statewide values into distinct value per Pennsylvania weather zones

Appliances

Section 3.6

- ENERGY STAR Clothes Washers
  - Updated default baseline and energy efficient clothes washer capacities based on ENERGY STAR database of certified products
  - Updated default values
- Bathroom Ventilation Fan
  - Moved measure to HVAC category
  - Updated assumed fan capacity (CFM) based on HVI Certified Products Directory
  - Updated default values

Food Service Equipment

Section 3.7

- Updated baseline and efficient equipment to align with Federal Standard, IECC 2021, and ENERGY STAR updates
- Combined beverage and snack machine controls into a single measure
  - Added savings components for refrigeration and lighting
- Commercial Griddles were revised with an updated preheat methodology and savings for double sided equipment were added
- Added Electric and Induction cooktops

Building Shell

Section 3.8

- Added IECC climate zones 4 and 6 to the assumed base case insulation values
- Updated baseline R-Value for new construction buildings to align with IECC 2021 code

Consumer Electronics

Section 3.9

- Provided more recent documentation on Advanced Power Strips savings that aligns with previous research
- Updated ENERGY STAR Server methodology and savings to align with v4.0 (April 2023)
- Recommended removal of two measures with zero Ph IV participation and decreasing unit savings

Compressed Air

Section 3.10

- Updated the efficient load factor for VSD Air Compressors
- Reduced kW/CFM assumption for Thermal Mass Dryer, Air Nozzle, and Condensate Drains

Miscellaneous

Section 3.11

- Added two new measures from IMPs
  - ENERGY STAR Uninterruptable Power Supplies
  - Building Operator Certification with new calculator (Appendix F?)

Agricultural

Section 4.1

- Revised Dairy Scroll Compressor baseline efficiency based on NY/NJ approach
- Added baseline water heater efficiency from 2023 Pennsylvania study
- Added mid-steam evaluation approach for fans, VSDs, heat reclaimers, and waterers

NON-RESIDENTIAL TRM UPDATES: NEW MEASURES

Indoor Horticultural Lighting

- Includes, but not limited to, cannabis
- Efficiency parameter is photosynthetic photon efficacy (PPE) measured in µmol/Joule
  - Baseline is 1.6 per IECC 2021
  - Design Lights Consortium Horticulture Technical Requirements V3.0 requires 2.3 µmol/J
- Default HOU and CF values based on DOE analysis
  - EDC Data Gathering allowed for key parameters
- Horticulture-specific interactive effects
  - More cooling / less heating than commercial

Other New Measures

- HVAC
  - Demand Control Ventilation
  - Advanced Rooftop Controls
  - C&I Energy Star Connected Thermostats
  - Duct Sealing and Insulation
  - Chilled Water Pipe Insulation
  - Tune-Up
    - HVAC, Chillers
  - Midstream Delivery
    - HVAC, DHP, HVAC VFD
- Refrigeration
  - Novelty Cooler Controls

Other New Measures

- Hot Water
  - Hot Water Pipe Insulation
- Food Service Equipment
  - Commercial Electric Cooktops
  - Commercial Induction Cooktops
- Miscellaneous
  - ENERGY STAR Uninterruptible Power Supplies
  - Building Operator Certification

NON-RESIDENTIAL TRM UPDATES: DELETED MEASURES

Deleted Measures

- 3.1.5 LED Channel Signage
- 3.2.5 Fuel Switching: Small Commercial Electric Heat to Natural Gas/Propane/Oil Heat
- 3.4.3 Fuel Switching: Electric Resistance Water Heaters to Gas/Propane
- 3.5.11 Door Gaskets for Walk-in and Reach-in Coolers and Freezers

Deleted Measures

- 3.5.16 Air-Cooled Refrigeration Condenser
- 3.5.18 Refrigeration Economizers
- 3.9.1 ENERGY STAR Office Equipment
- 3.9.2 Office Equipment Network Power Management

NON-RESIDENTIAL TRM UPDATES: Q & A

2026 TRM TIMELINE: RECOMMEND CONTINUING ANNUAL CODES & STANDARDS (C&S) REVIEW

Recommendation: Continue Annual TRM C&S Review

- Began with 2021 TRM
- A five-year fixed TRM can become misaligned with codes, standards, and the marketplace.
- Full annual updates are cumbersome.
- An annual review limited to codes & standards updates allows aligning the TRM with new codes and standards

Recommendation: Continue Annual TRM Limited Review

- Code and standard changes could include:
  - IECC
  - Federal standards
  - ENERGY STAR specifications
- Phase IV Reviews:
  - 2022 (initial review): 21 affected measures, but limited impact on EDC's EE&C planned savings
    - Issued C&S guidance memos to EDCs for incorporating the C&S changes
  - 2023 review: 4 affected measures
- Potential upcoming changes are generally known about well before they are enacted.
- Defined triggers, based on estimated impacts, would determine whether a particular measure would be updated, or whether any updates will be made in a program year.

Recommendation:
Continue Annual TRM C&S Review

Date of Program Year	Action
March 15	SWE memo analyzing impact of code or standards changes will be delivered to PUC.
April 15	PUC will determine if a simple update is warranted or if a traditional Order and comment process is required.
July 1	Codes and standards must be in effect by this date.
July 15	Tentative TRM Order and Manual on Public Meeting Agenda
July 15 – November 1	Comment and review process
November 1	Final TRM Order and Manual on Public Meeting Agenda

2026 TRM TIMELINE

Timeline for 2026 TRM Updates

Date	Item
May 16, 2024	Tentative 2026 TRM Order and Manual on Public Meeting Agenda
June 1, 2024	Tentative 2026 TRM Order and Manual entered into the PA Bulletin
July 1, 2024	Tentative 2026 TRM Order and Manual comments due
July 21, 2024	Tentative 2026 TRM Order and Manual reply comments due
September 12, 2024	Final 2026 TRM Order and Manual on Public Meeting Agenda

Thank You

Questions:

Greg Clendenning
NMR Group
gclendenning@nmrgroupinc.com
617-544-2011

Jesse Smith
Demand Side Analytics
jsmith@demandsideanalytics.com
770.401.9018

Andrew Dionne
Brightline Group
andrew@brightlinegroup.com
720.465.5435

Matt Socks
Optimal Energy
Matthew.Socks@nv5.com
802.482.5614