ACT 129
STAKEHOLDER MEETING:
2021 TECHNICAL REFERENCE MANUAL UPDATES

PA PUC
Commonwealth Keystone Building
Hearing Room 1
January 31, 2019
Presented by PA SWE Team
Phase IV Planning: Inputs and Timeline

2017-2018: Baseline Studies
2018-2019: TRM Updates
2019: Market Potential Study
2020: Phase IV Targets
CROSS-CUTTING TRM 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.)
General Cross-Cutting Updates

- Eliminated Appendix A: Measure Lives
- Updated old references (e.g., updated values from outdated version(s) of Mid-Atlantic TRM to values from the current version)
CROSS-CUTTING TRM UPDATES:
CLIMATE-DEPENDENT VALUES
Climate-Dependent Values

- Value of climate-dependent measures like building shell and HVAC will increase with expected decline in lighting savings in Phase IV
- New Appendix A in Volume 1
- Added two new reference weather cities (Binghamton, NY & Bradford)
- Updated using more recent HDD/CDD values and newly available EFLH data
- Spreadsheet tool will be available
- EDCs can apply by project/measure location or using EDC Climate Region Weights
Phase III TRM Reference Regions
New Reference Regions
Residential HVAC EFLH Update

Objectives
• Develop a single set of EFLH$_{\text{cool}}$ and EFLH$_{\text{heat}}$ by weather zone
• Calculate separate coincidence factors for each zone
• Affects most HVAC measures and some Building Shell and Whole Building

<table>
<thead>
<tr>
<th>Climate Region</th>
<th>Reference City</th>
<th>CF</th>
<th>EFLH</th>
<th>Heating</th>
<th>EFLH$_{\text{cool}}$</th>
<th>Room AC or secondary</th>
<th>Non Heat Pump</th>
<th>Heat Pump, Primary</th>
<th>Heat Pump, Secondary</th>
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<td>0.354</td>
<td>575</td>
<td>178</td>
<td>906</td>
<td>1,235</td>
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<td>103</td>
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<td>1,494</td>
<td>1,060</td>
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<tr>
<td>G</td>
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<td>206</td>
<td>64</td>
<td>1,347</td>
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<td>1,218</td>
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<tr>
<td>I</td>
<td>Erie</td>
<td>0.265</td>
<td>468</td>
<td>145</td>
<td>1,054</td>
<td>1,422</td>
<td>1,004</td>
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<tr>
<td>E</td>
<td>Harrisburg</td>
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<td>227</td>
<td>997</td>
<td>1,319</td>
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<td>781</td>
<td>242</td>
<td>761</td>
<td>1,084</td>
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</table>
Methods – Ecobee Donate Your Data

- Time period: April 2015 – September 2017
- Thermostats in Pennsylvania and neighboring states
  - NJ, NY, OH, WV, MD, and DE
    - Excluding NYC, Brooklyn, Yonkers, Jersey City, Newark, and Hoboken
- 2,588 unique thermostats (559 in PA)
  - Floor area [sqft] ranges from 0 to 10,000 (mean = 2,667)
  - Age of home ranges from 0 to 120 years (mean = 37)
  - Number of occupants ranges from 0 to 12 (mean = 1.95)
- 5-minute interval data converted into hourly and daily for analysis
What about the embedded energy efficiency?

• All data is for connected thermostats
• We assume connected thermostats reduce runtime
• We use the ESF Values from the Connected Thermostat measure to “add back” the assumed reduction
  – \( \text{ESF}_{\text{Cool}} = 0.048 \)
  – \( \text{ESF}_{\text{Heat}} = 0.064 \)
  – \( EFLH = \frac{EFLH_{\text{Connected Tstat}}}{(1 - \text{ESF})} \)
Modeling Approach

What temp does cooling begin?

What is the slope?
Air Source Heat Pumps

Compressor

Auxiliary
CROSS-CUTTING TRM UPDATES: MIDSTREAM PROGRAM DELIVERY
• Midstream programs:
  – Provide incentives to intermediaries on eligible products, encouraging them to stock, promote, and sell more-efficient technologies

• Midstream delivery presents many advantages
  – Working directly with distributors reduces transactions
  – Increased likelihood of market transformation
  – Reduced administrative requirements for participants and contractors

• Requires compromises in TRM protocols because baseline information is not collected
  – Assumed lighting baselines based on incented lamps/fixtures
  – Loss of “usage groups” and lighting schedules
  – Composite baselines for ductless heat pumps

• SWE approach
  – Rely on historic implementation/evaluation data to develop conservative default baseline values
  – Increased evaluation requirements initially
CROSS-CUTTING TRM UPDATES: Q & A
RESIDENTIAL TRM UPDATES
Residential: General Updates

• Federal standards updates
• ENERGY STAR specification changes
• 2015 IECC
• 2018 Residential Baseline study
• Updated references to other TRMs and more recent research
RESIDENTIAL TRM UPDATES: UPDATED MEASURES
Updated Measures: Lighting

• ENERGY STAR Lighting
• Residential Occupancy Sensors
  – Now with upstream option
• LED and Electroluminescent Nightlights
  – Combines two measures in Phase III TRM
  – Lower default in-service rate based on EDC evaluation data
ENERGY STAR Lighting

• Traditionally the largest source of savings (34% of savings for PY9)
• EISA 2020 provisions will greatly reduce opportunity
• New baseline is 45 lumens/Watt regardless of lamp type
• Measure now includes specific equations and default values for cross-sector sales (7.4%)
Updated Measures: HVAC

• High Efficiency Equipment – ASHP, CAC, GSHP, PTAC, PTHP
  – Algorithms simplified
  – Properly Sized Cooling, ECM Circulation Fan, GSHP Desuperheater, AC & Heat Pump Maintenance are now standalone measures

• High Efficiency Equipment – Ductless Heat Pumps with Midstream Delivery Option
  – Requires ENERGY STAR model
  – Midstream delivery option based on composite baseline
**Updated Measures: HVAC**

- **Duct Sealing and Insulation**
  - Simplified methods
  - Adds insulation option

<table>
<thead>
<tr>
<th>Insulation</th>
<th>Location</th>
<th>Attic Heat</th>
<th>Cool</th>
<th>Basement Heat</th>
<th>Cool</th>
<th>Vented Crawl Heat</th>
<th>Cool</th>
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<tr>
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<td>HVAC Type</td>
<td>4 &amp; 5</td>
<td>6</td>
<td>4 &amp; 5</td>
<td>6</td>
<td>4 &amp; 5</td>
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<td>64%</td>
<td>61%</td>
<td>61%</td>
<td>93%</td>
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<td>Average</td>
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<td>73%</td>
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<td>85%</td>
<td>84%</td>
<td>85%</td>
<td>97%</td>
<td>97%</td>
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<tr>
<td>R-4+</td>
<td>Leaky</td>
<td>79%</td>
<td>76%</td>
<td>67%</td>
<td>70%</td>
<td>95%</td>
<td>95%</td>
</tr>
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<td>Average</td>
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<td>77%</td>
<td>78%</td>
<td>96%</td>
<td>96%</td>
</tr>
<tr>
<td></td>
<td>Tight</td>
<td>90%</td>
<td>89%</td>
<td>87%</td>
<td>88%</td>
<td>98%</td>
<td>98%</td>
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<td>78%</td>
<td>69%</td>
<td>71%</td>
<td>95%</td>
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<tr>
<td></td>
<td>Average</td>
<td>86%</td>
<td>84%</td>
<td>79%</td>
<td>80%</td>
<td>97%</td>
<td>97%</td>
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<tr>
<td></td>
<td>Tight</td>
<td>92%</td>
<td>91%</td>
<td>90%</td>
<td>90%</td>
<td>98%</td>
<td>98%</td>
</tr>
</tbody>
</table>

*Climate Regions A and G correspond to IECC Climate Zone 6, the rest of the state is IECC Climate Zone 4 or 5.*
Updated Measures: DHW

• Updated cold water inlet temperature
• Updated for Federal standards that went into effect in April 2015
• Updated to use Uniform Energy Factor
Updated Measures: Appliances

- ENERGY STAR Refrigerators
  - Updated for changes to ENERGY STAR Most Efficient specification

- ENERGY STAR Freezers
  - Corrected error in default savings calculations

- Refrigerator/Freezer Recycling
  - Eliminated default savings
  - Updated part-use factors with program data

- ENERGY STAR Clothes Washers, Dryers
  - Updated for Federal standards, ENERGY STAR specifications
Updated Measures: Appliances

• ENERGY STAR Dehumidifiers
  – Updated for Federal standards and ENERGY STAR updates
  – Added ENERGY STAR Most Efficient criteria

• ENERGY STAR Ceiling Fans
  – Updated for new ENERGY STAR specifications
Updated Measures: Building Shell

• Residential Air Sealing &
• ENERGY STAR Windows
  – Updated energy models
  – Now incorporates HVAC system efficiency
  – Climate-dependent
  – Savings increase for most locations/HVAC systems

• Ceiling/Attic, Wall, Floor, and Rim Joist Insulation
  – Incorporates previously separate Rim Joist Insulation measure
  – Adds floor insulation from IMP
  – Simplifies algorithms
Updated Measures: Whole Home

- New section that includes measures previously in Building Shell and new measures
- Res. New Construction, Home Performance with ENERGY STAR, ENERGY STAR Manufactured Homes, + two new measures
- Updated due to IECC 2015 code changes and baseline study data
- Passive House modeling software approved for use in Res. New Construction and Low-Rise MF New Construction
- New construction measures can use model outputs for quantifying all savings, not just weather-sensitive items
Updated Measures: Other

- Advanced Power Strips
  - Renamed from Smart Strip Plug Outlets
  - Updated using new research
  - Savings increase for Tier 1, decrease for Tier 2

- Variable Speed Pool Pumps
  - Removed load shifting option
RESIDENTIAL TRM UPDATES: NEW MEASURES
New Measures: HVAC

- Separated from 2.1.1 Electric HVAC:
  - Properly Sized Cooling
  - ECM Circulation Fan
    - New algorithm based on EFLH
  - GSHP Desuperheater
  - Air Conditioner & Heat Pump Maintenance
- Furnace Maintenance
- ENERGY STAR Certified Connected Thermostats
New Measures: HVAC

- ENERGY STAR Connected Thermostats
  - Savings depend on delivery method and baseline thermostat

<table>
<thead>
<tr>
<th>Installation Type</th>
<th>Baseline Thermostat</th>
<th>Cooling ESF</th>
<th>Heating ESF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream buy-down (Customer Self-Installation)</td>
<td>Unknown Mix Default</td>
<td>4.8%</td>
<td>6.4%</td>
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<tr>
<td>Customer Self-Installation with Education</td>
<td>Unknown Mix Default</td>
<td>7.5%</td>
<td>7.9%</td>
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<tr>
<td>Professional Installation</td>
<td>Manual</td>
<td>11.3%</td>
<td>11.5%</td>
</tr>
<tr>
<td></td>
<td>Conventional Programmable</td>
<td>9.3%</td>
<td>7.9%</td>
</tr>
</tbody>
</table>
New Measures: Appliances

- Heat Pump Clothes Dryers
- Dehumidifier Retirement
- ENERGY STAR Air Purifier
New Measures: Building Shell

- Weather Stripping, Caulking, and Outlet Gaskets
  - Limited to <400 kWh
- Basement Wall Insulation
- Residential Window Repair
New Measures: Whole Home

- Low-Rise Multifamily New Construction
- Home Energy Reports
Home Energy Reports

- New TRM protocol on calculation of first-year (compliance) and lifetime savings
  - Act 129 status quo was a 1-year EUL
  - Adopts a “decay” perspective
    - Based on findings of SWE HER Persistence Study
    - 31.3% annual decay rate
RESIDENTIAL TRM UPDATES: DELETED MEASURES
• 2.2.8 Programmable Thermostats
• 2.2.9 Residential Whole House Fans
• 2.3.4 Fuel Switching: Heat Pump Water Heater to Fossil Fuel Water Heater
• 2.4.9 ENERGY STAR Water Coolers
• 2.5.1 ENERGY STAR Televisions
• 2.7.1 Pool Pump Load Shifting
RESIDENTIAL
TRM UPDATES:
Q & A
NON-RESIDENTIAL TRM UPDATES
NON-RESIDENTIAL TRM UPDATES: UPDATED MEASURES
Non-Residential: General Updates

- Standardized the building type list across end uses
- Updated any inputs based on codes/standards (IECC, ENERGY STAR, EISA, etc.)
  - Within measures and Appendix C (Lighting Audit and Design Tool)
- Update relevant inputs based on 2018 Non-Residential Baseline Study
3.1.1 Lighting Improvements

• Lighting Improvements
  – Revised all general service baselines for consistency with EISA 2007 efficacy standards (45 lumens per Watt)
• Added a permanent removal option
• Added separate EUL assumptions for linear LED retrofits
  – Type A, direct installation of an LED tube into an existing fluorescent fixture: 5 years
  – Type B, line voltage linear LEDs with integrated drivers: 15 years
  – Type C, LED driver retrofit kit: 15 years
  – Mechanism to capture the type in Appendix C forms
3.1.2 New Construction Lighting

- Updated for consistency with IECC 2015. Previous version cited ASHRAE 90.1-2007
  - 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

### ASHRAE 90.1-2007

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>LPD (W/ft²)</th>
<th>Building Area Type</th>
<th>LPD (W/ft²)</th>
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</thead>
<tbody>
<tr>
<td>Automotive facility</td>
<td>0.9</td>
<td>Multifamily</td>
<td>0.7</td>
</tr>
<tr>
<td>Convention center</td>
<td>1.2</td>
<td>Museum</td>
<td>1.1</td>
</tr>
<tr>
<td>Courthouse</td>
<td>1.2</td>
<td>Office</td>
<td>1.0</td>
</tr>
<tr>
<td>Dining: bar lounge/leisure</td>
<td>1.3</td>
<td>Parking garage</td>
<td>0.3</td>
</tr>
<tr>
<td>Dining: cafeteria/fast food</td>
<td>1.4</td>
<td>Penitentiary</td>
<td>1.0</td>
</tr>
<tr>
<td>Dining: family</td>
<td>1.6</td>
<td>Performing arts theater</td>
<td>1.6</td>
</tr>
<tr>
<td>Dormitory</td>
<td>1.0</td>
<td>Police/fire station</td>
<td>1.0</td>
</tr>
<tr>
<td>Exercise center</td>
<td>1.0</td>
<td>Post office</td>
<td>1.1</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>1.1</td>
<td>Religious building</td>
<td>1.3</td>
</tr>
<tr>
<td>Health-care clinic</td>
<td>1.0</td>
<td>Retail</td>
<td>1.5</td>
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<tr>
<td>Hospital</td>
<td>1.2</td>
<td>School/university</td>
<td>1.2</td>
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<tr>
<td>Hotel</td>
<td>1.0</td>
<td>Sports arena</td>
<td>1.1</td>
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<tr>
<td>Library</td>
<td>1.3</td>
<td>Town hall</td>
<td>1.1</td>
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<tr>
<td>Manufacturing facility</td>
<td>1.3</td>
<td>Transportation</td>
<td>1.0</td>
</tr>
<tr>
<td>Motel</td>
<td>1.0</td>
<td>Warehouse</td>
<td>0.8</td>
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<tr>
<td>Motion picture theater</td>
<td>1.2</td>
<td>Workshop</td>
<td>1.4</td>
</tr>
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### IECC 2015

<table>
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<th>LPD (W/ft²)</th>
<th>Building Area Type</th>
<th>LPD (W/ft²)</th>
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<tbody>
<tr>
<td>Automotive facility</td>
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<tr>
<td>Convention center</td>
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<td>Courthouse</td>
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<td>Dining: bar lounge/leisure</td>
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<td>Parking garage</td>
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<td>Dining: cafeteria/fast food</td>
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<td>Performing arts theater</td>
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<td>Religious building</td>
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<tr>
<td>Hospital</td>
<td>1.05</td>
<td>Sports arena</td>
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<td>Hotel/Motel</td>
<td>0.87</td>
<td>Town hall</td>
<td>0.89</td>
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<td>Library</td>
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<td>Transportation</td>
<td>0.70</td>
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<tr>
<td>Manufacturing facility</td>
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<td>Warehouse</td>
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<tr>
<td>Motel</td>
<td>0.76</td>
<td>Workshop</td>
<td>1.19</td>
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</table>
Other Lighting Measures

- LED Exit Signs
  - Corrected default savings
- LED Channel Signage
  - Updated algorithms to account for the fact that savings are per linear foot and need to be multiplied by total linear feet
  - Updated default values for $kW_{base}$ and $kW_{ee}$ based on a 2016 Southern California Edison workpaper
Appendix C

- All algorithms/inputs were updated to reflect updates made in section 3.1 of the TRM
  - Baseline wattage override for incandescent and halogen screw-ins
- Use of the Appendix C form is still preferred, but it is no longer required in cases where ICSPs have developed in-house lighting inventory forms
  - Alternative forms must be approved by the SWE
  - If the ICSP tool and Appendix C disagree, the Appendix C result is considered the TRM-supported savings value
HVAC

- Updated replace-on-burnout and new construction HVAC equipment baseline efficiency parameter to match IECC 2015 and/or upcoming federal standard requirements, whichever is stricter

### 2016 TRM

<table>
<thead>
<tr>
<th>Equipment Type and Capacity</th>
<th>Cooling Baseline</th>
<th>Heating Baseline</th>
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<tr>
<td>&lt; 65,000 Btu/hr</td>
<td>13 SEER</td>
<td>7.7 HSPF</td>
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<tr>
<td>≥ 65,000 Btu/hr and &lt; 135,000 Btu/hr</td>
<td>11.0 EER 11.2 IEER</td>
<td>3.3 COP</td>
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### 2021 TRM

<table>
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<th>Equipment Type and Capacity</th>
<th>Subcategory or Rating Condition</th>
<th>Cooling Baseline</th>
<th>Heating Baseline</th>
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<td>PY13-PY14</td>
<td>PY15-PY17</td>
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<td>Single Package</td>
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<td>14.0 SEER</td>
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<td>≤ 65,000 Btu/h</td>
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<td>8.2 HSPF</td>
<td>8.2 HSPF</td>
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<tr>
<td>≥ 65,000 Btu/h and &lt; 135,000 Btu/h</td>
<td>Split System and Single Package</td>
<td>11.0 EER 12.0 EER</td>
<td>11.9 IEER 11.9 IEER</td>
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<td></td>
<td></td>
<td>3.3 COP</td>
<td>3.4 COP</td>
</tr>
</tbody>
</table>

- Updated existing HVAC equipment baseline efficiencies to align with 2018 non-residential baseline report, when applicable.
Motors and VFDs

- Changed Variable Frequency Drive algorithm
  - Removed basic Energy and Demand Saving Factor based on outdated peer TRM methodology
  - Replaced with hourly bin load profile savings approach based on control type and motor application

Table 3-74: Default Load Profiles for HVAC Fans and Pumps

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Flow Fraction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0  10  20  30  40  50  60  70  80  90  100</td>
</tr>
<tr>
<td>HVAC Fan</td>
<td>0%  0%  0%  0%  0%  10%  20%  30%  20%  10%  5%  0%</td>
</tr>
<tr>
<td>HVAC Pump</td>
<td>0%  0%  0%  0%  5%  10%  20%  30%  20%  10%  5%  0%</td>
</tr>
</tbody>
</table>

Table 3-75: Supply/Return and Cooling Tower Fan Power Part Load Ratios

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Flow Fraction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0  10  20  30  40  50  60  70  80  90  100</td>
</tr>
<tr>
<td>Constant Volume</td>
<td>1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00</td>
</tr>
<tr>
<td>Two-Speed</td>
<td>0.50  0.50  0.50  0.50  0.50  0.50  1.00  1.00  1.00  1.00  1.00</td>
</tr>
<tr>
<td>Air Fold/Backward Incline</td>
<td>0.55  0.53  0.53  0.57  0.64  0.72  0.80  0.89  0.96  1.02  1.05</td>
</tr>
<tr>
<td>Air Fold/Backward Incline with Inlet Guide Vanes</td>
<td>0.47  0.43  0.48  0.47  0.49  0.60  0.62  0.67  0.74  0.86  1.00</td>
</tr>
<tr>
<td>Forward Curved</td>
<td>0.20  0.22  0.25  0.30  0.37  0.45  0.54  0.65  0.77  0.91  1.06</td>
</tr>
<tr>
<td>Forward Curved with Inlet Guide Vanes</td>
<td>0.20  0.21  0.22  0.23  0.26  0.31  0.39  0.49  0.63  0.81  1.04</td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td>0.05  0.06  0.07  0.08  0.13  0.20  0.30  0.43  0.60  0.80  1.03</td>
</tr>
</tbody>
</table>

Table 3-76: HVAC Pump Power Part Load Ratios

<table>
<thead>
<tr>
<th>Control Type</th>
<th>Flow Fraction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0  10  20  30  40  50  60  70  80  90  100</td>
</tr>
<tr>
<td>Constant Volume</td>
<td>1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00</td>
</tr>
<tr>
<td>Throttle Valve</td>
<td>0.55  0.61  0.67  0.73  0.78  0.82  0.87  0.90  0.94  0.97  1.00</td>
</tr>
<tr>
<td>Variable Frequency Drive</td>
<td>0.27  0.19  0.14  0.13  0.15  0.21  0.30  0.43  0.60  0.79  1.03</td>
</tr>
</tbody>
</table>
Motors and VFDs

• Appendix D savings calculator has been updated to align with new methodology
  – Incorporates algorithm changes
  – Allows custom user defined load profile
• ECM Circulating Fan
  – Simplified interactive factor algorithm
  – Updated motor efficiency assumptions if unknown
Domestic Hot Water

- Heat Pump Water Heaters
  - Updated baseline energy factors to current standards
  - New ES spec did not change energy factor for the efficient unit
  - Developed new ETDFs and gallons/year assumptions
  - Added default savings for Midstream delivery

- Low Flow Pre-Rinse Sprayers
  - Combined two sections (Retrofit and Time of Sale) into one
  - Simplified savings algorithms
Domestic Hot Water

- Fuel Switching: Electric Resistance Water Heaters to Gas/Oil/Propane
  - Updated minimum uniform energy factor standards
  - Added default savings for Midstream
  - Developed new ETDFs
Refrigeration

• High Efficiency Refrigerated/Freezer Cases
  – Updated to align with Energy Star requirements

• Combined two sections for simplicity
  – High-Efficiency Evap Fan Motor for Reach-in Refrigerated Case
  – High-Efficiency Evap Fan Motor for Walk-in Freezer Case

• 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
Appliances

• ENERGY STAR Clothes Washers
  – Update standards
    • Update baseline energy factors based on new federal efficiency standards
    • Update efficient energy factors based on new ES spec
  – Updated defaults based on ES database of certified products (for example, capacity of efficient washer)
  – Updated default savings
Food Service Equipment

• Updated Energy Star measures to align with updated standards
  – High Efficiency Ice Machines
  – Electric Steam Cooker

• Beverage Machine Controls
  – Reduced baseline energy consumption to align with modern equipment
Building Shell

• Updates to initial R values:
  – For New Construction buildings, defaults were updated to reflect updates standards (IECC 2015)
  – For Existing buildings, defaults were changed to EDC Data Gathering
    • EDCs must know the final R value to calculate savings, thus they should also know the initial R value
Consumer Electronics

• Energy Star Office Equipment measure updated
  – Added permutation detail to align with 2016 Energy Star requirements (e.g. “computer” segmented into “Desktop” and “Laptop”)

• Network Power Management Enabling
  – Deemed values for desktops and laptops updated to align with Energy Star guidelines

• Advanced Power Strips
  – Algorithms updated to consider application use (e.g. integrated occupancy sensor and use of power management)
Compressed Air

- No major changes
- Updated hours of use and coincidence factors by shift type and applied to all measures
Agricultural

• No major changes
• Added clarifying language in several places
  – Related to the number of cows milked per day (each cow is assumed to be milked twice per day)
  – Related to measure unit
• Changed CFs to ETDFs
• Updated sources where possible
NON-RESIDENTIAL TRM UPDATES: NEW MEASURES
Midstream Lighting

• Incentives offered through commercial sales channels such as distributors of lighting products (not customers or trade allies)

• Eligibility
  – Fixture, lamp, or lamp/ballast replacement
  – Replace on burnout or early replacement
  – One-for-One replacements

• Code minimum baseline (where applicable) and least efficient readily available product are used to determine baseline wattage
  – EISA requires all general service lamps sold on or after 1/1/2020 to meet efficacy requirements of 45 lm/W
Midstream Lighting

- Lamps and fixtures included:
  - Omnidirectional, directional, and decorative screw-based lamps
  - LED lamps and fixtures
  - Highbay and lowbay fixtures
  - Highbay and lowbay fixtures with integrated controls
  - Exterior area and wall pack fixtures
  - Parking garage lighting
• Evaluation protocols
  – EDCs have the option to collect building type data or use a default HOU for all building types. This decision should be documented in the EM&V plan and handled consistently.
  – Using $SVG_{\text{base}}$ values from the TRM is acceptable for both implementation and evaluation. EDCs are encouraged to collect customer-specific controls information where feasible.
  – The default baseline wattage can be used to estimate savings provided that the distributor certifies the lamp type, lamp wattage, ballast type and fixture configuration (2 lamp, 4 lamp, etc.).
Other New Measures

- HVAC
  - Computer Room Air Conditioner
  - Computer Room Air Conditioner/Handler (CRAC/H) Electronically Commutated Plug Fans
  - CRAC/H VSD on AC Fan Motors
  - Circulation Fan: High-Volume Low-Speed

- Motors and VFDs
  - ECM Circulator Pump
  - High Efficiency Pumps

- Refrigeration
  - Air-Cooled Refrigeration Condenser
  - Refrigerated Case Light Occupancy Sensor
  - Refrigeration Economizers
Other New Measures

• Appliances
  – ENERGY STAR Bathroom Ventilation Fan

• Food Service Equipment
  – ES Electric Steam Cooker
  – ES Combination Oven
  – ES Commercial Convection Oven
  – ES Commercial Fryer
  – ES Commercial Hot Food Holding Cabinet
  – ES Commercial Dishwasher
  – ES Commercial Griddle

• Consumer Electronics
  – ES Servers (moved from Miscellaneous)
  – Server Virtualization
Other New Measures

- Compressed Air
  - Variable-Speed Drive Air Compressor
  - Compressed Air Controller
  - Compressed Air Low Pressure Drop Filters
  - Compressed Air Mist Eliminators
- Miscellaneous
  - High Efficiency Transformer
  - Engine Block Heat Timer
  - High Frequency Battery Chargers
NON-RESIDENTIAL TRM UPDATES:
DELETED MEASURES
Deleted Measures

- 3.1.4 Traffic Lights
- 3.7.5 Refrigerated Beverage Machine
- 3.4.5 Fuel Switching: Heat Pump Water Heaters to Gas/Oil/Propane
NON-RESIDENTIAL TRM UPDATES: Q & A
2021 TRM TIMELINE
2021 TRM TIMELINE: PRELIMINARY RECOMMENDATION FOR ANNUAL LIMITED REVIEW
Preliminary Recommendation: Annual TRM Limited Review

- 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 provides a compromise.
Preliminary Recommendation: Annual TRM Limited Review

- Code and standard changes could include:
  - IECC
  - Federal standards
  - ENERGY STAR specifications

- 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.
# Preliminary Recommendation: Annual TRM Limited Review

<table>
<thead>
<tr>
<th>Date of Program Year</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>March 15</strong></td>
<td>SWE memo analyzing impact of code or standards changes will be delivered to PUC.</td>
</tr>
<tr>
<td><strong>April 15</strong></td>
<td>PUC will determine if a simple update is warranted or if a traditional Order and comment process is required.</td>
</tr>
<tr>
<td><strong>July 1</strong></td>
<td>Codes and standards must be in effect by this date.</td>
</tr>
<tr>
<td><strong>July 15</strong></td>
<td>Tentative TRM Order and Manual on Public Meeting Agenda</td>
</tr>
<tr>
<td><strong>July 15 – November 1</strong></td>
<td>Comment and review process</td>
</tr>
<tr>
<td><strong>November 1</strong></td>
<td>Final TRM Order and Manual on Public Meeting Agenda</td>
</tr>
</tbody>
</table>
## Timeline for 2021 TRM Updates

<table>
<thead>
<tr>
<th>Date</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 28, 2019</td>
<td>Tentative 2021 TRM Order and Manual on Public Meeting Agenda</td>
</tr>
<tr>
<td>May 3, 2019</td>
<td>Tentative 2021 TRM Order and Manual comments due</td>
</tr>
<tr>
<td>May 20, 2019</td>
<td>Tentative 2021 TRM Order and Manual reply comments due</td>
</tr>
<tr>
<td>July 11, 2019</td>
<td>Final 2021 TRM Order and Manual on Public Meeting Agenda</td>
</tr>
</tbody>
</table>