

**MEMORANDUM**

**TO:** IOWA TRM OVERSIGHT COMMITTEE

**FROM:** CHERYL JENKINS, PROJECT MANAGER, SAM DENT and JAKE AHRENS, TECHNICAL LEADS - VEIC

**SUBJECT:** IOWA TRM VERSION 5 – FINAL FULL TRM

**DATE:** 07/22/2020

**Cc:** CHAZ ALLEN - IUA

VEIC is pleased to submit the final full version 5.0 Iowa TRM to the Iowa TRM Oversight Committee and uploaded to SharePoint. A clean version and redline version of each volume have been provided; the redline includes *all* changes from v4.0 of the TRM. Changes have been made to all three volumes:

- Iowa\_TRM\_V5\_Vol\_1\_Overview\_and\_User\_Guide\_07222020.docx
- Iowa\_TRM\_V5\_Vol\_2\_Residential\_Measures\_07222020.docx
- Iowa\_TRM\_V5\_Vol\_3\_Nonresidential\_Measures\_07222020.docx

Presented below is a summary table documenting the measures that have been edited during the v5.0 update cycle, with a brief description of what has changed and whether it is being considered an errata.

Measure # and Name		Errata?	Brief description of what changed
<b>Volume 1 Overview and User Guide</b>			
4.5	Gross vs. Net Savings	N	Question as to whether this language continues to reflect the current status of NTG usage and application. TAC decision that the language continues to appropriately reflect the current state. Statutory references updated.
6.4	Electrical Loadshapes (kWh)	N	Addition of two new loadshapes; NRE 17 Refrigeration Ecomomizer Loadshape. NRE 18 VFD - Cooling Tower Fans
7.0	Appendix A – High Impact Measures	N	Question as to whether we want to remove this section as now out of date. TAC decision to update with high impact measures from the latest plan filing. Changes have been applied.
Throughout		N	Standardized across each volume the use of the term “mid-life”.
Throughout		N	Standardized across each volume where weather dependent assumptions are provided, the two climate zones and their corresponding city, followed by an unknown location based on Des Moines. All example calculations that were incorrectly using the unknown value for a known location of Des Moines have been fixed. Based on TAC discussion, decision to remove the “(Des Moines)” reference from the “Average/unknown” value in all tables, to

Measure # and Name		Errata?	Brief description of what changed
			prevent confusion around what to do when measure is known to be located in Des Moines.
<b>Volume 2 Residential Measures</b>			
2.1.3	Refrigerator	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
2.1.4	Freezer	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
2.1.6	Room Air Conditioner	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
2.1.8	ENERGY STAR Air Purifier/Cleaner	N	Measure updated for ENERGY STAR v2.0 spec, to become effective in October 2020 (delayed from July due to Covid-19). Specification now relates to smoke removal rather than dust. Calculations use recent qualified product data (QPL access 4/1/2020). Measure cost updated. Source of assumptions clarified and questions posed discussed on 5/13 TAC call. Measure reworked based on updated ENERGY STAR datafile, resulting in significantly reduced per unit savings.
2.2.1	Tier 1 Advanced Power Strip (APS)	N	Updated sunset data (reviewed last year but not updated).
2.4.3	Boiler	N	Baseline update due to Federal Standard update for units manufactured from January 15,2021. Measure cost updates.
2.4.4	Furnace	N	Fixed measure code and updated sunset date (reviewed last year but not updated).
2.4.11	Central Air Source Heat Pump Tune-Up	N	Reliability review. Default rated efficiency of existing system being tune-up provided. New shortened measure life for clean and tune type measure in contrast to HVAC SAVE tune up. Following discussion on 5/13 TAC call, the HVAC SAVE protocol sections of this measure have been removed, leaving it as a standard tune-up measure.
2.4.12	Central Air Conditioner Tune-Up	N	Reliability review. Default rated efficiency of existing system being tune-up provided. New shortened measure life for clean and tune type measure in contrast to HVAC SAVE tune up. Following discussion on 5/13 TAC call, the HVAC SAVE protocol sections of this measure have been removed, leaving it as a standard tune-up measure.
2.4.18	Advanced Thermostats	N	Reliability review. Minor edit to Gas_Heating_Consumption default value to utilize Dunsky / Opinion Dynamics baseline study results for homes with furnaces v boilers. Note the Illinois TRM is likely to update the cooling savings % later this year based on significant evaluation results, therefore sunset date set to review next year 1/1/2022.
2.4.20	Advanced Thermostat Optimization Services	N	Reliability review – no recommended changes at this stage, however sunset date set to 1/1/2022 to review cooling assumptions.
2.5.3	LED Lamp – Standard	N	Changes due to late 2019 DOE determination that the more stringent standards (45 lu/W) prescribed in the 2007 EISA Regulations were not economically justified. Analysis now reflects natural baseline LED

Measure # and Name		Errata?	Brief description of what changed
			<p>growth over time. 1<sup>st</sup> year baseline mix, mid-life adjustment, measure and O&amp;M costs all updated. Sunset date set for annual review and adjustment.</p> <p>Defaults for unknown lamp type based on weighted average of program sales provided.</p> <p>Lamp forecast has been updated based on adjustments to IL forecast following inclusion of 2019 LightTracker data. The impact was the baseline omnidirectional reduced LED share in the early years. The updated forecasts impacts the baseline LED v baseline assumption, the mid-life adjustment, the measure and O&amp;M costs.</p> <p>Note also decision on 5/13 TAC to explore option of adding Low Income specific assumptions in the v6 update.</p> <p>Additional guidance added for the case where lumen range is known but efficiency level and CRI are not.</p>
2.5.4	LED Lamp – Specialty	N	<p>Changes due to late 2019 DOE repeal of 2017 expansion of General Service Lamp definitions to include specialty lamps. Analysis now reflects natural baseline LED growth over time. 1<sup>st</sup> year baseline mix, mid-life adjustment, measure and O&amp;M costs all updated. Sunset date set for annual review and adjustment.</p> <p>Defaults for unknown lamp type based on weighted average of program sales provided.</p> <p>Lamp forecast has been updated based on adjustments to IL forecast following inclusion of 2019 LightTracker data. The impact was the baseline decorative and directional increased LED share in the early years, but forecast flattened over the years. The updated forecasts impacts the baseline LED v baseline assumption, the mid-life adjustment, the measure and O&amp;M costs.</p> <p>Note also decision on 5/13 TAC to explore option of adding Low Income specific assumptions in the v6 update.</p> <p>Additional guidance added for the case where lumen range is known but efficiency level and CRI are not.</p> <p>Fixing directional unknown value to be based on statewide average.</p>
2.5.6	LED Fixtures	N	<p>Changes made, consistent with Specialty Lamp assumptions. Analysis now reflects natural baseline LED growth over time. 1<sup>st</sup> year baseline mix, mid-life adjustment, measure and O&amp;M costs all updated. Sunset date set for annual review and adjustment.</p> <p>Updates to measure based upon updated lighting forecast described above.</p>
2.6.3	Rim/Band Joist Insulation	Y	<p>Fixing error in v4 which had heating efficiency assumptions switched for sealed and unsealed ducts.</p>
2.6.5	Insulated Doors	N	<p>Since measure not currently offered, note provided after sunset date that measure needs review before use.</p>
2.6.6	Floor Insulation Above Crawlspace	N	<p>Reliability review provided. No recommended changes.</p>
2.6.7	Basement Sidewall Insulation	N	<p>Reliability review provided. No recommended changes.</p>

Measure # and Name		Errata?	Brief description of what changed
2.6.8	Efficient Windows	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
2.7.1	Residential Pool Pumps	N	Reliability review – No changes were made. Discussed in TAC on March 4 <sup>th</sup> ; the decision was made to move the reliability review to next year in order to coincide with new federal and ENERGY STAR standards going into effect on 7/19/2021.
<b>Volume 3 Nonresidential Measures</b>			
3.1.1	Circulation Fans	N	Updated measure life Added Poultry and Unknown hours of use.
3.1.2	Ventilation Fans	N	Reliability review - Updated the measure life. It was previously being calculated based on an incorrect default run time. Made other minor text edits to the measure. The baseline and efficient wattages, costs, and run times are all reasonable and valid; no need to make any revisions to those assumptions at this time. Added Poultry and Unknown hours of use.
3.1.3	High Volume Low Speed Fans	N	Reliability review - Updated the measure life. It was previously being calculated based on an incorrect default run time. Made other minor text edits to the measure. The baseline and efficient wattages, costs, and run times are all reasonable and valid; no need to make any revisions to those assumptions at this time. Added Poultry and Unknown hours of use. Updated NCows assumption.
3.1.4	Temperature Based On/Off Ventilation Controller	N	Reliability review – Made only minor text edits to the measure. Added Poultry and Unknown hours of use.
3.1.5	Automatic Milker Take Off	Y	A formatting issue resulted in the “kWh/cow/milking” value being presented as 5031, when the “31” was a reference to the footnote – i.e., the value should be have been 50 <sup>31</sup> . This has been made an errata to ensure that this is not incorrectly applied in 2020.
		N	Reliability review – Updated the measure life to more reasonably approximate that this measure is considered industry standard practice. Updated the default number of cows variable to coincide with the 2017 U.S. Ag Census data.
3.1.6	Dairy Scroll Compressor	N	Updated the default number of cows variable to coincide with the 2017 U.S. Ag Census data. Since measure not currently offered, note provided after sunset date that measure needs review before use. Updated Milk Density assumption to 8.6lb/gal.
3.1.7	Heat Lamp	N	Reliability review – Made only minor edits to the measure.
3.1.8	Heat Reclaimer	N	Reliability review - Revised the measure life from 14 years to 15 years as the original source was using DEER 2014 for HVAC Rotary Heat Recovery, which is a much different measure. Opted to align with Illinois TRM, reworking the algorithm for ease of use and maintain consistency with other characterizations. Removed unnecessary variables and algorithms as well (Heat Needed). Updated Milk Density assumption to 8.6lb/gal.

Measure # and Name		Errata?	Brief description of what changed
3.1.9	Heat Mat	N	Reliability review – Made only minor edits to the measure. Incorporated 125W as a baseline lamp option, complete with default savings estimates. Added use of actual assumptions where known.
3.1.11	Live Stock Waterer	N	Reliability review – Only minor edits to the measure. A discussion of expanding the product line to energy free livestock waterers was held in TAC and on the Share Point discussion boards, but that was declined.
3.1.12	Low Pressure Irrigation	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
3.1.13	Variable Speed Frequency Drive for Dairy Vacuum Pump and Milking Machine	N	Updated the default number of cows variable to coincide with the 2017 U.S. Ag Census data.
3.1.14	Dairy Plate Cooler	N	Reliability review - Reworked the algorithm for ease of use and to maintain consistency with other characterizations. Incorporated a default incremental cost estimate. Elaborated and clarified the negative hot water interactive effects for farms with heat reclaimers. Updated the average number of cows variable to coincide with the 2017 U.S. Ag Census data.
3.1.15	LED Grow Lights	N	New measure Added New Construction as an applicable market. Updated measure life from 15 years to 9.5 years. Added heating penalty in to the energy savings algorithms. Restructured the waste heat factors and interactive effects. Expanded the horticultural applications covered. Added other default baseline options, such as T5HO. Default hour table added. O&M benefits of HPS and T5HO lamp replacements provided. Removed negative symbol from \$65 term in measure cost algorithm since this is labeled as an offset.
3.1.16	Grain Bin Fan Aeration Controls	N	New measure added
3.2.3	Gas Water Heater	N	Addition of Residential-duty Commercial Gas-Fired Storage Water Heater and Residential Gas Instantaneous assumptions to the characterization.
3.3.1	Boiler	N	Addition of >300,000 Btu/hr boiler assumptions. Update to <300,000 Btu/hr boilers due to Federal Standard update for units manufactured from January 15,2021. Measure cost updates. Therm example calculation updated for consistency, though result is identical.
3.3.2	Furnace	N	Updated sunset date (reviewed last year but not updated).
3.3.6	Single-Package and Split System Unitary Air Conditioners	N	Clarified language in the characterization around IECC being the “principle authoritative” source for code baseline. IECC gives more specificity around split vs. packaged systems. Included directions for the user to be aware of this, as IECC in new construction will require a higher EER for some single packed units that is overlooked by the Code of Federal Regulations.

Measure # and Name		Errata?	Brief description of what changed
3.3.7	Electric Chiller	N	Reliability review provided. No recommended changes.
3.3.12	Small Commercial Programmable Thermostat	N	Adjusted name to “Small Commercial Thermostats” and included Advanced Thermostats in language. VEIC recommend assuming the same savings for programmable and advanced thermostats until there is clear evidence that advanced thermostats provide incremental savings. Sunset date set for next year to review again if there is evidence. Added if unknown efficiency assumption based on code minimum.
3.3.13	Variable Frequency Drives for HVAC Pumps	N	Added Cooling Tower Fans to measure name and language. Updated energy and demand savings factors to be consistent with the hours assumptions. Both now are derived from the IA commercial modeling that have been developed. Loadshape added to volume 1 for this measure. Hours table adjusted to represent “Heating” and “Cooling” hours and appropriate use for each application provided.
3.3.18	Hydronic Heating Pipe Insulation	N	This measure was reviewed to determine if new boiler federal standards going into effect on January 15, 2021 should apply. It was determined that because this is a retrofit measure, those new standards need not apply. Amended the footnote detailing the baseline system efficiency value to clarify this.
3.3.20	Room Air Conditioner	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
3.3.23	Electric HVAC Tune up	N	New measure added
3.4	Lighting End Use	N	Fixed footnote for WHFe since the calculation is only including impacts on cooling, not both cooling and heating.
3.4.3	LED Lamp Standard	N	Changes due to late 2019 DOE determination that the more stringent standards (45 lu/W) prescribed in the 2007 EISA Regulations were not economically justified. Analysis now reflects natural baseline LED growth over time. 1 <sup>st</sup> year baseline mix, mid-life adjustment, measure and O&M costs all updated. Sunset date set for annual review and adjustment. Defaults for unknown lamp type based on weighted average of program sales provided. Lamp forecast has been updated based on adjustments to IL forecast following inclusion of 2019 LightTracker data. The impact was the baseline omnidirectional decreased LED share in the early years. The updated forecasts impacts the baseline LED v baseline assumption, the mid-life adjustment, the measure and O&M costs. Additional guidance added for the case where lumen range is known but efficiency level and CRI are not.
3.4.4	LED Lamp Specialty	N	Changes due to late 2019 DOE repeal of 2017 expansion of General Service Lamp definitions to include specialty lamps. Analysis now reflects natural baseline LED growth over time. 1 <sup>st</sup> year baseline mix, mid-life adjustment, measure and O&M costs all updated. Sunset date set for annual review and adjustment.

Measure # and Name		Errata?	Brief description of what changed
			<p>Defaults for unknown lamp type based on weighted average of program sales provided.</p> <p>Lamp forecast has been updated based on adjustments to IL forecast following inclusion of 2019 LightTracker data. The impact was the baseline decorative and directional increased LED share in the early years, but forecast flattened over the years. The updated forecasts impacts the baseline LED v baseline assumption, the mid-life adjustment, the measure and O&amp;M costs.</p> <p>Additional guidance added for the case where lumen range is known but efficiency level and CRI are not.</p> <p>Fixing directional unknown value to be based on statewide average.</p>
3.4.12	Occupancy Sensor Lighting Controls	N	<p>Reliability review performed. Addition of integrated occupancy controls. Update to watts controlled assumptions based on IA program data (note this currently only reflects Alliant data and will be reviewed once MidAmerican data is provided).</p> <p>Question asked as to whether with the addition of dual controls (occupancy and daylighting) it would make sense to combine 3.4.12 and 3.4.13 in to a single Lighting Controls measure (VEIC preference), or whether we want to add a new measure for dual controls.</p> <p>Based on TAC feedback this measure name has been revised to Lighting Controls and now includes all occupancy sensor, daylighting, and dual controls.</p>
3.4.13	Daylighting Control	N	<p>Reliability review performed. Addition of integrated, fixture and remote mounted dual (occupancy and daylighting) controls. Update to watts controlled assumptions based on IA program or Efficiency Vermont data (where IA data quantity is insufficient). Note IA data currently only reflects Alliant data and will be reviewed once MidAmerican data is provided.</p> <p>Savings factor for dual sensors is dependent on whether the additional daylighting savings is verified.</p> <p>Question asked as to whether with the addition of dual controls (occupancy and daylighting) it would make sense to combine 3.4.12 and 3.4.13 in to a single Lighting Controls measure (VEIC preference), or whether we want to add a new measure for dual controls.</p> <p>Based on TAC feedback this measure has been retired and the assumptions for daylighting added to the revised 3.1.12 lighting Controls measure.</p>
3.4.14	Multi-Level Lighting Switch	N	<p>Since measure not currently offered, note provided after sunset date that measure needs review before use.</p>
3.5.2	Clothes Washer	N	<p>Since measure not currently offered, note provided after sunset date that measure needs review before use.</p> <p>Fixed loadshape reference number.</p>
3.6.1	Dishwasher	N	<p>VEIC reviewed Version 3.0 of the ENERGY STAR specification for this measure, and determined it is still in development. Sunset date set for next year to review.</p>

Measure # and Name		Errata?	Brief description of what changed
3.6.7	Convection Oven	N	VEIC reviewed current ENERGY STAR Commercial kitchen equipment savings calculator and confirmed that the variables match the TRM, so no changes recommended. Sunset date pushed back to 2024.
3.6.8	Conveyor Oven	Y	Fixing error in calculation. Preheat assumptions are per preheat, not a rate (Btu/hr).
3.7	Shell Measures	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown load hour assumptions.
3.7.1	Infiltration Control	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown assumptions.
3.7.2	Foundation Wall Insulation	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown assumptions.
3.7.3	Roof Insulation	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown assumptions.
3.7.4	Wall Insulation	N	Removal of CRF (Correction Factor for framing) from the algorithm and clarification that the existing and new R-value must be the complete structural assembly. Reference to ASHRAE 90.1 as good resource for assembly R-value assumptions.
3.7.5	Efficient Windows	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown assumptions.
3.7.6	Insulated Doors	N	Reordering and clarifying Zone 5, Zone 6 and Average/unknown assumptions. Clarification added that only for exterior doors.
3.8.4	Night Covers for Open Refrigerated Display Cases	N	Reliability review – Measure’s assumptions were reasonable and no changes were made to the measure at this time
3.8.5	Refrigerated Beverage Vending Machine	N	Reliability review – Updated baseline to coincide with new federal appliance standards (Code of Federal Regulations, 10 CFR 431.296, effective January 8, 2019). And incorporated new ENERGY STAR specifications (version 4.0, effective April 29, 2020).
3.8.7	Scroll Refrigeration Compressor	N	New code of federal regulation standards for walk-in coolers and freezers go into effect on July 10, 2020. Code was reviewed to see impact on this measure, and it was deemed not to have any. Clarified footnotes in the characterization to this matter. Revised footnote to make evaporator temperatures consistent.
3.8.8	Strip Curtain for Walk-in Coolers and Freezers	N	Since measure not currently offered, note provided after sunset date that measure needs review before use.
3.8.11	Adding doors to refrigeration display cases	N	New measure Added ability to use actual compressor efficiency values. Fixed other typos.
3.8.12	Refrigeration Economizers	N	New measure Added recommended system characteristics for best applicability - compressors 8 hp or less in size (individually) and a temperature setpoint within the range of 15-55 degrees Fahrenheit.
3.9	Compressed Air	N	New End Use Category
3.9.1	Air Compressor with Integrated VSD	N	New measure Added clarification on hour and cost assumptions.
3.9.2	High Efficiency Air Nozzles	N	New measure

Measure # and Name		Errata?	Brief description of what changed
			Added ability to use actual SCFM of the nozzles and hours of operation, if known. Clarification of holiday and down-time schedule added.
3.9.3	No Loss Condensate Drains	N	New measure Updated measure life from 10 to 13 years and added reference.

The following Tracker Items have not resulted in any changes to the TRM volumes at this time. They are listed together with the status of or outcome of TAC discussions.

Tracker Item	Provided by:	Status
<a href="#">Open Studio Modeling</a>	Sue Hanson, Tetra Tech on behalf of MidAmerican Energy	VEIC provided responses to the questions posed, on the SharePoint Discussion Board. Upon review, Tetra Tech agreed with the responses and methodologies presented.
<a href="#">Review savings algorithm for nonres infiltration control</a>	Sue Hanson, Tetra Tech on behalf of MidAmerican Energy	VEIC, Tetra Tech and MidAmerican met to discuss the MF evaluation that initiated this request. VEIC have reviewed the two memos and request further discussion before proposing any adjustments to the TRM. VEIC proposed that the group consider a modeling/calibration effort for v6, using the OpenStudio models developed last year, to give broader direction based on building type. The major concern we have with using the pilot outcomes to revise the TRM is that we'd need to make it's application so specific that we'd essentially be limiting to program designs that mirror that of the pilot. With such a specific use case, that may not add much to the overall usability of the TRM as much as hoped/needed. TetraTech are in agreement with this approach. VEIC will consider what would be required to perform this effort in the v6 cycle and be ready to discuss when plans and budgets for next year are decided.
<a href="#">New Measure - Economizer with Demand Control Ventilation</a>	MidAmerican Energy	As discussed on 3/4/2020 TAC call, MidAmerican are currently running these measures as custom, but are using 2020 to compare their custom methodology to the prescriptive approach in the Illinois TRM to assess whether or not this is something they would like to pursue in the future.
<a href="#">Possible new measure ideas?</a> [VEIC Suggestion to add HVAC Economizers]	VEIC	VEIC suggested HVAC Economizers might be another measure that could be developed. Upon review we suggest a similar approach as described above for all HVAC economizers, and if a prescriptive approach makes sense, this could be tackled in a future cycle. These measures require significant modeling work so we should ensure the need justifies the effort.
<a href="#">Building energy code</a>	VEIC	VEIC confirmed that IA energy code continues to be largely based upon IECC 2012, with some amendments which we

Tracker Item	Provided by:	Status
		reviewed to ensure no changes to the TRM were necessary. We are not aware of any plans to update the code.
<a href="#">Nonresidential Desuperheater</a>	Aquila Velonis, Cadmus on behalf of Alliant Energy	<p>A number of Tracker items were added significantly after the deadline for v5.0 updates, and after VEIC’s final list of proposed changes was delivered.</p> <p>VEIC reached out to Aquila asking him to provide which were the highest priority, and the following were identified:</p> <ul style="list-style-type: none"> <li>• Nonresidential electric HVAC System Tune-up</li> <li>• Agriculture Grain Bin Aeration Fan Controls</li> <li>• Nonresidential Variable Refrigerant Flow / Ductless Heat Pumps</li> </ul> <p>Assuming there is no objection from the TAC, VEIC will endeavor to produce drafts of these new measures in the next phase of development to be ready for review in Deliverable 2, if not before. The remaining measures will be kept on the Tracker for development in v6.0.</p> <p>VEIC have developed and added to the second draft the first two listed measures. Upon review, VEIC determined that the nonresidential VRF/Ductless Heat Pump measure would be best suited to be developed using modeling. TAC members also expressed concerns around not making a measure too prescriptive and thereby potentially missing savings. VEIC will review budgets after v5 update is complete with the potential view to setting up a working group to work on this measure in time for inclusion in v6.</p>
<a href="#">Nonresidential Variable Refrigerant Flow/ Ductless Heat Pumps</a>		
<a href="#">Auto-Closers for Walk-In Doors</a>		
<a href="#">Vending Machine Controllers</a>		
<a href="#">Refrigeration System - Remote Condensing Unit/Self Contained Unit Tune-Ups</a>		
<a href="#">Nonresidential Heat Pump Water Heater</a>		
<a href="#">Nonresidential Electric HVAC System Tune-Up</a>		
<a href="#">Agriculture Dairy Refrigeration Tune-Up</a>		
<a href="#">Agriculture Grain Bin Aeration Fan Controls</a>		