



Minnesota TRM 4.1 Update

Jenna Lipscomb | Senior Specialist | Cadmus

Lauren Sweeney | Energy Planner | MN Department of Commerce

11/8/2023

mn.gov/commerce

1

Agenda

- Housekeeping
- TRM Schedule and Process
- CARD & Other Primary Research - TRM Tie In
- Measures Updated – Completed
- Measures Yet to be Updated – On the radar to complete shortly
- Informal comment period through November

Housekeeping



Lauren Sweeney, Energy Planner
Lauren.sweeney@state.mn.us



Dr. Amalia Hicks, Principal
Amalia.Hicks@cadmusgroup.com

Jenna Lipscomb, Senior Specialist
Jenna.Lipscomb@cadmusgroup.com

Lauren will be the primary point of contact for the below items. In an ideal world however, you would also copy Jenna on TRM inquiries.

- TRM Suggestions/Questions
- CARD research inquiries/results
- Modifications to the TRMAC distribution list

Housekeeping – TRMAC Members

Name	Organization
Anthony Fryer	MN Department of Commerce
Adam Zoet	
Laura Silver	
Lindsay Anderson	
Lauren Sweeney	
Jenna Lipscomb	Cadmus
Amalia Hicks	
Eduardo Ramirez-Lopez	Avant Energy
Anna Harmon	
Kim Lillyblad	Center for Energy and Environment
Andy Baeten	
Ben Schoenbauer	
Carl Nelson	
Chidinma Emenike	
Isaac Smith	
Kristen Funk	
Q Gagne	CenterPoint Energy
Ranal Tudawe	
Eric Johansen	
Ethan Warner	
Tyler Glewwe	
Isaac Evans	City of Minneapolis
Stacy Miller	Connexus Engery
Cory Hetchler	

Name	Organization
David Reinke	Dakota Electric Association
Patrick Mathwig	
Dean Laube	Franklin Energy Services
Eric Flower	
George Roemer	
Eric Fowler	Fresh Energy
Joe Dammel	
Cole Cameron	Frontier Energy
Doug Eli	
Janhavi Datar	
Matt Haley	
Tanuj Gulati	
Tom Vagts	GDS Associates, Inc.
Travis Hinck	
Kathy Baerlocher	Great Plains Natural Gas Company
Larry Oswald	
Zach Klabo	
Amelinda Hendrickx	Great River Energy
Jamie Stallman	
Jeff Haase	
Kelsey Kopp	
Rodney De Fouw	
Grey Staples	Mendota Group
Joel Pertsch	Michaels Energy
Jen Kimmen	Minnesota Energy Resources

Name	Organization
Huei Wong	Minnesota Energy Resources - Applied Energy Group
Jay Sandberg	
Joe Reilly	
Katie O'Rourke	
Zach Froio	
Cassie Theisen	Minnesota Power
Chad Trebilcock	
Wyatt Miller	Minnkota Power Cooperative
Lisa Severson	
Darlene Weber-Scott	Missouri River Energy Services
Jesse Robertson	
Kurt Hauser	
Joe Plummer	Opinion Dynamics
Cristina Zuniga	Otter Tail Power Company
Jason Grenier	
Jon Fabre	
Luke Meech	
Andy Lick	Slipstream
John O'Neil	Southern Minnesota Municipal Power Agency
Joel Haskard	UMN - Clean Energy Resource Teams
Josh Westphal	Xcel Energy
Karl Shlanta	
Nick Minderman	
Sam Steinwert	

TRM Schedule and Process – Original

Date	Event Description	Topic or Note
9/13/2023	Meeting 1	Proposed TRM v4.1+ Updates Introduced
9/26/2023	CARD Presentation to TRMAC	ASHP Field Research in MN
10/11/2023	Meeting 2	Proposed TRM v4.1+ Updates Discussion
Mid-Late October	Email and Huddle Communication	Proposed TRM v4.1 Updates Chosen
10/25/2023	CARD Presentations to TRMAC	AWHP and Residential Fan Controls Field Research in MN
11/8/2023	Meeting 3	Proposed TRM v4.1 Updates Progress Discussion
Mid-November	Email and Huddle Communication	TRMAC Non-Regulatory Comments Due on TRM v4.1
11/29/2023	CARD Presentation to TRMAC	VRF Demonstration
Mid-December	Letter + TRM v4.1 posted on eDockets	TRM v4.1 Regulatory Process
Late-December	Written Comments	
January 2024	Reply Comments	
February 2024	Deputy Commissioner Decision	

TRM Schedule and Process – Updated

Date	Event Description	Topic or Note
9/13/2023	Meeting 1	Proposed TRM v4.1+ Updates Introduced
9/26/2023	CARD Presentation to TRMAC	ASHP Field Research in MN
10/11/2023	Meeting 2	Proposed TRM v4.1+ Updates Discussion
Mid-Late October	Email and Huddle Communication	Proposed TRM v4.1 Updates Chosen
10/25/2023	CARD Presentations to TRMAC	AWHP and Residential Fan Controls Field Research in MN
11/8/2023	Meeting 3	Proposed TRM v4.1 Updates Progress Discussion
11/17/2023	Res ASHP Working Group Meeting	Res ASHP Discussion
11/29/2023	CARD Presentation to TRMAC	VRF Demonstration
12/1/2023	Email and Huddle Communication Concludes	TRMAC Non-Regulatory Comments Due on TRM v4.1
Mid-December	Letter + TRM v4.1 posted on eDockets	TRM v4.1 Regulatory Process
Late-December	Written Comments	
January 2024	Reply Comments	
February 2024	Deputy Commissioner Decision	

CARD & Other Primary Research Interim Results Presentations

Scheduled CARD Presentations:

Research Title	Grantee	PI	Presentation to the TRMAC
Ductless Cold Climate Heat Pumps for Multifamily Applications	CEE	Ben Schoenbauer	9/26/2023
Optimized Installations of Air Source Heat Pumps for Single Family Homes	CEE	Ben Schoenbauer	
Air-to-Water Heat Pumps	CEE	Dr. Samantha Hill	10/25/2023
Residential Fan Controls	CEE	Grant Baumgardner	
VRF Demonstration	Slipstream	Kevin Frost	11/29/2023
Field Demonstration of ASHRAE Guideline 36-2018	Slipstream	Joe Zhou	To be discussed with Research Teams
Optimizing the New Generation of Grocery Refrigeration Equipment	CEE	Russ Landry	
Field study of phase change material (PCM) use for PTR	LHB	Maureen Colburn	
Ground Source Tech in Urban Buildings	Michaels Energy	Jeff Prichard	Tentative - 2024 or 2025

We would welcome other relevant primary research presentations to the group, this year or beyond:

- Slipstream?
- U of M?
 - MCAP – [Climate Mapping and Analysis Tool](#)
- State of MN – IRA tie in?
- Suggested others?

TRM Schedule and Process

Huddle (Internal)

- Direct Link: <https://my.huddle.net/workspace/38755106/files/#/folder/root/list>
- Will continue to use as filesharing service
- Username = “mntrmac@cadmusgroup.com”
- Password = “MNTRMPassword1!”
- E-mail comments to Lauren or Jenna, will post to Huddle for TRMAC reference
- If preferred, can get personal Huddle account and comment directly

MN TRM Webpage (External)

- Direct Link: <https://mn.gov/commerce/energy/industry-government/cip/technical-reference-manual/>
- Find Information on
 - Previous TRM Releases
 - Recordings and slide decks from past meetings
- This will not be maintained during the next couple of months but should be updated soon after the regulatory process of TRM v4.1 is complete to include the information that we’ll all work on for the next couple of months.

TRM v4.1 Updates Completed to Date

✓ Residential Lighting - Table of Deemed Values

- Should round down rather than round up when calculating based on 45 lumens/watt. Effects a few of the rows on this table

✓ Residential Boiler – Baseline Efficiency Table

- Table 2 indicates 82% efficiency baseline, but table note and reference indicates 84% for gas fired hot water boiler, which is defined as average boiler type. Modify table to 84%

✓ Commercial Boiler – Baseline Efficiency Table 4

- Amendment to title 10 code to the pre 2022 manufactured gas fired steam commercial packaged units. Efficiency change from 79% to 77%.

✓ Commercial Hot Water Heater (Gas)

- Typo in example updated

✓ Commercial Heat Pumps – EFLH Heat Tables 1

- In error since v2.0... when MF space type was removed, values below manufacturing line incorrect, fixed
- Removed the Multifamily space type from the EFLH Heat table in the C/I Mini split HP measure – believe the intention in the 2.0 update was to direct the measure to use residential EFLH for multi family applications – any legacy context here?

✓ ASHP algorithm

- Typo, extra "x" at end of algorithm for ASHP to ASHP, removed

TRM v4.1 Updates Completed to Date

✓ EER to SEER Conversion

- Some linear references remained, modify to polynomial only. Linear backward conversion SEER to EER doesn't really make sense, actuals needed

✓ SEER to SEER2, etc M1 Conversions

- Referenced CEE conversion table, modified a bit for format in inclusion into all measures that require SEER, EER and HSPF inputs.
- Have not yet modified all SEER inputs to SEER2, want to take time to get that completely right
- Have added notes that where SEER2 is available, can use M1 metrics if used in both baseline and efficient for algorithms instead of SEER, etc.

✓ ECO Definitions and Layout

- Have added some clarification language through EFS measures, will receive review from COMM
- Have added to the EFS measure algorithm to outline not just savings final value, but the KWH added and Dth saved, for consistency

TRM v4.1 Updates Yet to Complete – On the Radar

- Unique Measure IDs
- Web Link Updates
 - Updates needed given Commerce Department website revamp
 - Ensure CARD research links to presentation material if published papers not yet available
 - Check through all reference links for function
- Gas/Elec/Dual Fuel measure savings indicators
 - Make more prominent/clear, head table of measure, and linked to an index after the table of contents.
- Deemed Values Reference Tables
- Load Shapes
 - Preliminary step to add in EnerNex load shapes as appendix pending more MN specific research for each measure
- In Service Rate
 - Add metric to measures, particularly shower heads, aerators. Provide default value, or actuals if known

TRM v4.1 Updates Yet to Complete – On the Radar

- Review recent ENERGY STAR criteria updates for performance requirements:
 - Commercial Ovens (v3.0)
 - Commercial Electric Cooktop (v1.0)
 - Res AC and ASHP (v6.1)
 - Light Commercial Heating & Cooling (v4.0)
 - Water Heater (v5)
- Switched Reluctance Motors for Comm Buildings
 - Slipstream study, coming from the IL TRM

TRM v4.1 Updates Yet to Complete – On the Radar

- Review EULs for products with lifetimes reasonably over 20 years
 - Air Sealing, Insulation, etc:
 - See Lit Review spreadsheet on Huddle, feedback?
 - Most TRMs range from 15 -30 years for these related measures, IL has 30 for most. IL reference: As recommended in Guidehouse 'EMV Group A, Deliverable 16 EUL Research – Residential Insulation', prepared for California Public Utilities Commission, June 2021
 - High Performance Windows:
 - See Lit Review spreadsheet on Huddle, feedback?
 - Most TRMs range from 20 – 40 years, IL has 40 years, reference is The Northwest Power Plan (NPCC). Please see sheet "Source Summary" within file: Com-Windows-2021P_V17.xlsx. Link: <https://nwcouncil.app.box.com/s/u0dgjxkoxoj2tttym81uka3wrjcy6bo6/file/655810989510>
- Incremental Costs
 - Also see Lit Review spreadsheet on Huddle, feedback?
 - ASHP – all the permutations not just ASHP to ASHP
 - HVAC equipment in particular. Data from Triennial plans? Utility provided?

TRM v4.1 Updates

First Draft for Comment

- Heat Pump DHW Heater
 - Removed heating penalty, our original algorithm simplified this but in effect penalized too greatly, other TRMs still have this but significant complexity for marginal modifier to the savings. Thoughts?
 - Set up as EFS measure with gas WH as baseline option
 - Please review
- ASHP Tune Up
 - Now includes heating savings
 - Please review

TRM v4.1 Updates

First Draft for Comment

- Residential ASHP

- 8760 Model created in BEopt

- Based on TISH data for an 'average' MN home, model equipment defined by baseline metrics and minimum performance metrics on TRM – potential area of expansion later
 - Have added tabs to the Appendix G calculator with the model inputs, model outputs for each model and climate zone, and summary tab of savings
 - Will use summary data to update the TRM deemed values table
 - Please review the inputs to the model for discussion and potential mods we should consider
 - TMY3 data used, requires weather data in form of .epw file, can create this but much heavier lift than putting together dry bulb temp data like we did for the excel calculator – would want to agree on a dataset and methodology before we consider this
 - Default performance curve for ASHP in BEopt, not as nuanced as could be, cannot currently model ccASHP well – expected update to BEopt might provide a path forward for that. Variable speed compressor is an option in BEopt now, but not currently part of the model – area of potential expansion (another model) in future versions.

- Algorithm simplified

- Driven by baseline capacity rather than mix of baseline and ASHP to balance out – reduces variable inputs
 - %Backup now referenced from the 8760 model rather than the excel calculator, however mostly similar value
 - Other small modifications/clarifications

- Excel based Calculator tabs

- Mostly defunct now, but still available to use if needed/wanted.

TRM Future Updates

- Commercial ASHP
 - Would like to adopt the RES algorithms, but %backup undefined, more variables difficult to fix as static in commercial setting. Could outline this and leave user inputs for many things, but that doesn't really fit a prescriptive measure
- Rest of the measures listed as potential updates from last meeting
 - Will be working through these updates as time allows for additions into v4.2 and v5.0
 - Have larger list of potential updates (priority list) that we will work through
 - Please continue to submit your ideas and suggestions and we'll prioritize them

Discussion and Next Steps

Next Steps:

- Check that you have access to Huddle – please reach out to Lauren if you do not have access
- You'll receive a follow up email soon with:
 - Slide deck
 - Link to recorded meeting (on Huddle)
 - Working TRM v4.1 List of Updates
 - TRM v4.1 Draft red lined – current static copy (not the live updated one)
 - Current version is currently on Huddle, updated version with small edits by end of week, and another end of next week, etc
 - Updated Appendix G is on Huddle, likely another update or two post meeting next week
 - Lit review of EUL and Incremental Costs for review and input
- Next TRM Meeting (Optional, ASHP model discussion focused):
 - Friday, November 17, 2023 12:00-1:00pm
 - Meeting invite already sent, let Lauren know if you were not included and would like to be
 - To discuss in more detail ASHP model, suggested modifications, etc.
 - If possible, please review the model inputs, outputs and summary data within Appendix G (on Huddle) before meeting
- Comments on v4.1 modifications via email, phone, notes on Huddle, etc to Lauren and Jenna through December 1st.

Thank You



Lauren Sweeney,
Energy Planner, MN Department of Commerce
Lauren.sweeney@state.mn.us

The logo for Cadmus, consisting of the word 'CADMUS' in white, uppercase letters on a solid blue rectangular background.

Jenna Lipscomb,
Senior Specialist, Cadmus
Jenna.Lipscomb@cadmusgroup.com