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Review and Categorization of TRMs in the Midwest

Presented at the 2017 ACEEE National Conference on Energy Efficiency as a Resource



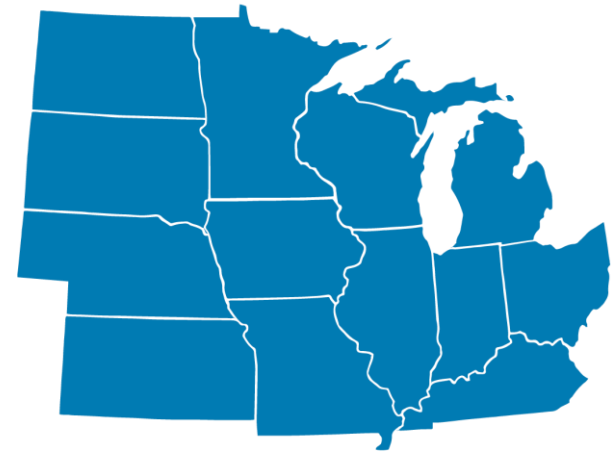
About MEEA

The Trusted Source on Energy Efficiency

We are a nonprofit membership organization with **160+ members**, including:

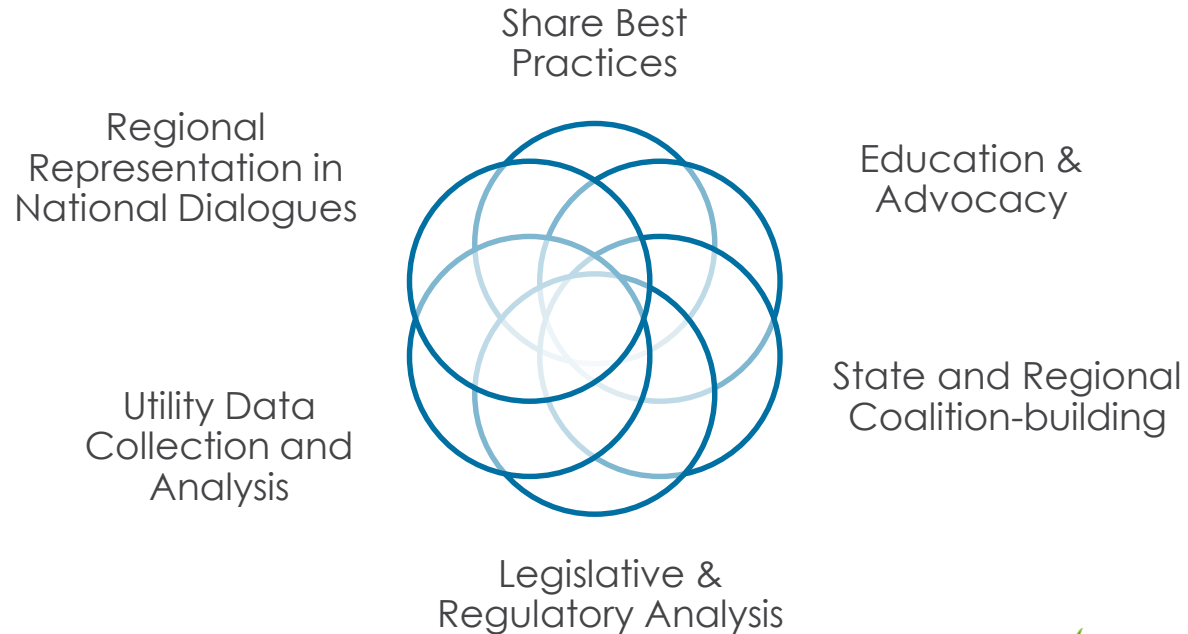
- Utilities
- Research institutions
- State and local governments
- Energy efficiency-related businesses

As the key resource and champion for energy efficiency in the Midwest, MEEA helps a diverse range of stakeholders understand and implement cost-effective energy efficiency strategies that provide economic and environmental benefits.



MEEA's Role as a Resource

Supporting Energy Efficiency Policy in the Midwest



What is a TRM?

Technical Reference Manual*

* *Nomenclature varies*

- A guide for energy efficiency program planning & evaluation
- A list of efficiency measures along with deemed values or algorithms to calculate savings from those measures
- Can be common statewide or utility-specific

What's good about a statewide TRM?

Consistency

- Everyone has the same list of measures to work from
- Everyone uses the same values for savings

Authority

- Definitive source
- Notes & source references
- Approved by commission

Cons

What's bad about a statewide TRM?

Can get stale

- Has to be updated regularly
- New measures, updated values and equations, remove outdated or incorrect info

Limited scope

- Not every possible measure can be included
- New technologies & pilots not necessarily covered

Needs buy-in

- If all stakeholders don't participate, process can break down
- Not everyone recognizes value of TRMs

TRM Inventory

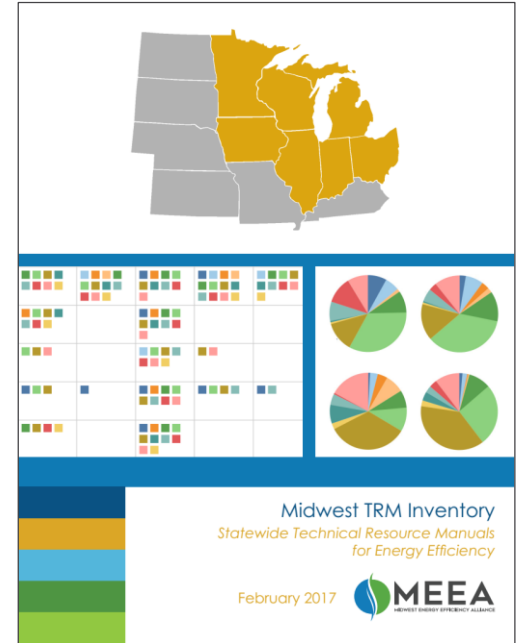
Project Overview

Not included:
Utility-specific TRMs

Statewide TRMs & Deemed Savings Databases

Review TRMs & Processes

Extract & Categorize Measures

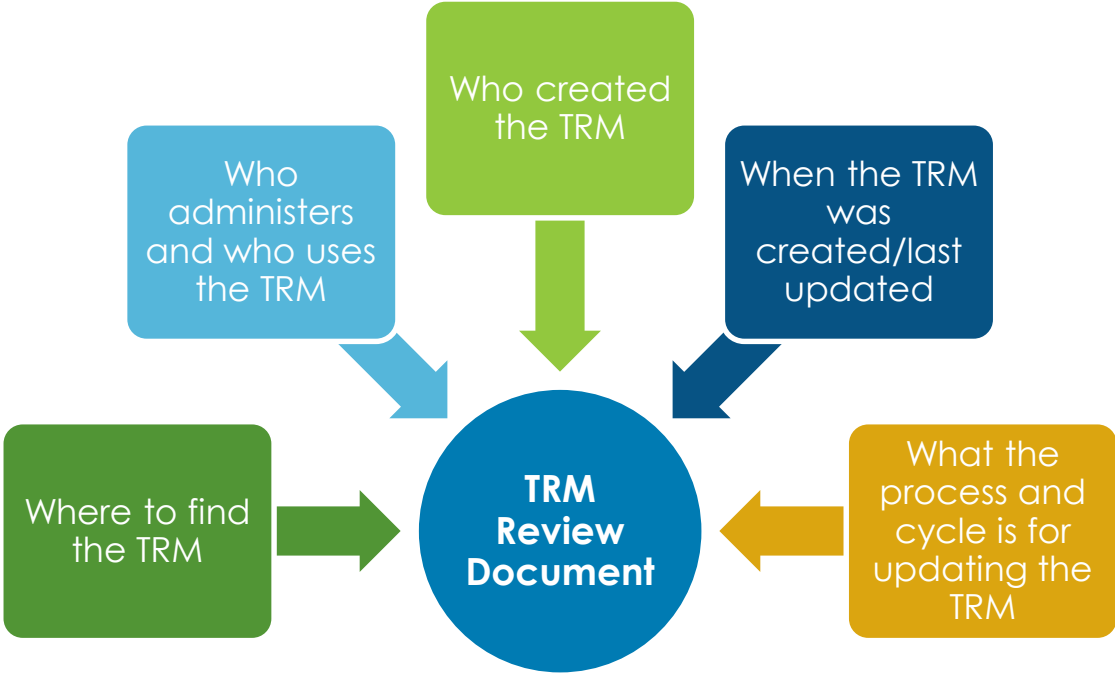




Review TRMs
&
Processes

TRM Inventory

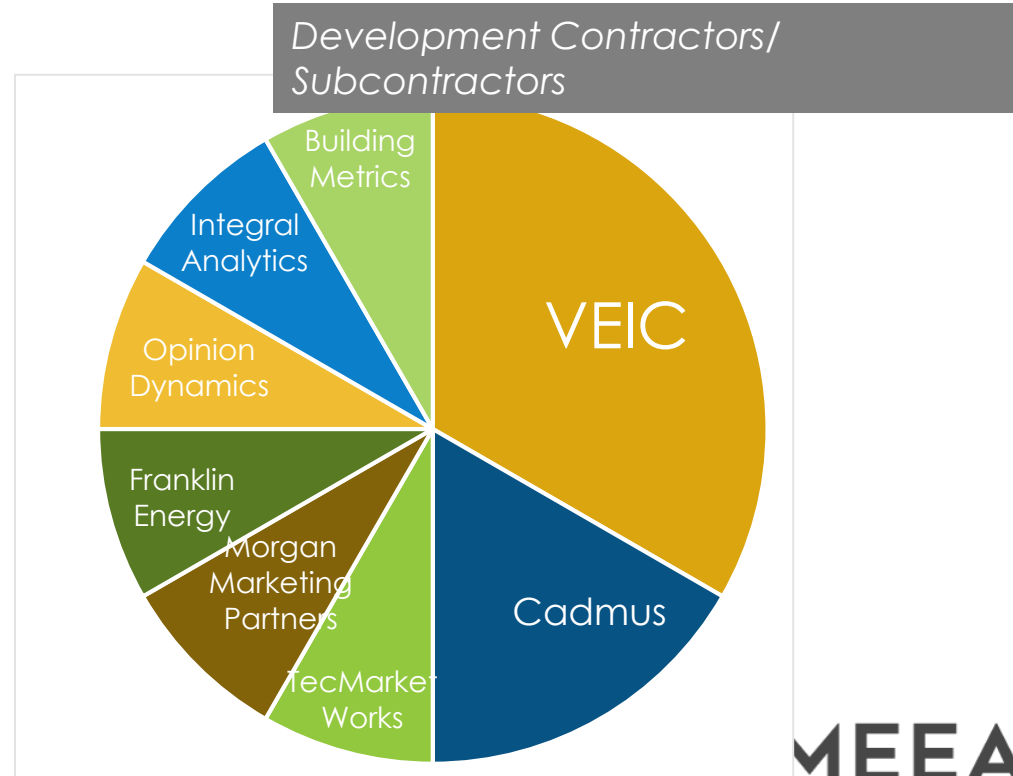
Review of TRMs & Processes



State TRM Information

What do we know about each TRM?

- Name
- Version
- Current status
- Availability/URL
- Coverage
- TRM administrator
- Update process & schedule
- Stakeholders
- Development notes



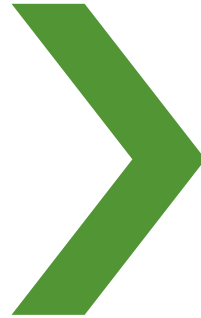
Advisory Review Group

Members & stakeholders

- Interviews about development & process
- Review of state information

Advisory Review Group

IA	Iowa Office of Consumer Advocate	Jennifer Easler
IL	Future Energy Enterprises	Celia Johnson
IN	Citizens Action Coalition	Jennifer Washburn
IN	Indianapolis Power & Light	Zac Elliot
KY	TVA	James Linder
MI	Consumers Energy	Joe Forcillo
MI	Morgan Marketing Partners	Rick Morgan
MI	Michigan Public Service Commission	Dave Walker
MN	Franklin Energy Group	Joe Plummer
MN	Minnesota Dept. of Commerce	Mark Garofano
MO	Missouri Dept. of Commerce	Brenda Wilbers, Jane Epperson, Barb Meisenheimer, Kristy Manning, Candice Hubbard
WI	CB&I representing Focus on Energy	Levi Kingery
WI	Wisconsin PSC	Joe Fontaine



Extract &
Categorize
Measures

TRM Measure Inventory

Extract & Categorize Measures

EXTRACT

- Digital extraction
- Depends on file format
- PDF (most common), Word, Excel (rare)
- Measure name, measure code, measure category, other data as available/extractable
- Dump everything into Excel format

TRANSFORM

- Data prep & low level normalization
- *Talend Data Prep*
- Merge into single data table
- Consistent metadata & nomenclature
- Categorization schema based on BPA
 - Categorized each measure at **Sector, End Use, Category,** and **Technology** levels

LOAD

- *Tableau Desktop*
- Analysis & visualization
- Compare and contrast categories between states
- Gaps = opportunities

State TRMs Included in TRM Measure Inventory

Illinois	TRM v5.0 (2016); updated to v6.0 (2018)
Iowa	TRM v01 (2016)
Indiana	TRM v2.2 (2015)
Michigan	2017 MEMD Master Database; updated to 2018
Minnesota	TRM v2 (2017)
Wisconsin	Focus on Energy TRM Fall 2015; updated to TRM 2017
Missouri	TRM v1.0 (2017)

**Ohio (draft 2010) not included*

TRM Measure Inventory

What *is* in the Measure Inventory?

- All of the measures
 - 3950 records
 - 2011 distinct measure names
- Measure codes
- Measure categorization
 - Sector
 - End Use
 - Category
 - Technology
- **Think *index* rather than *encyclopedia***
 - Some measure-specific data – depends on the state
 - **Can't** take the place of the definitive TRMs
 - **Can** help find what is in them
 - **Can** explore the contents



Measure Categorization

Sector / End Use / Category / Technology

Sector		End Use	Category	Technology
Agriculture	Agriculture	Behavior/Education	Air Conditioning	Hot Food Holding Cabinets
Commercial	Appliances	Computers	Air Sealing	Ice Makers
Industrial	Compressed Air	Controls/Sensors	Behavior	Infrared Heater
Multifamily	Electronics	Cooking	CFL	Insulation - Duct
Public	Food Service Equipment	Envelope	Clothes Dryers	Insulation - Other
Residential	HVAC	Heat Recovery	Clothes Washers	Insulation - Pipe
Upstream	Lighting	Motors/Drives	Computer Power Management	Insulation - Shell
	Other	Other	Comp	
	Lighting	Plug Load	Cont	
	Process Loads	Process Loads System Improvements	Deco	
	Refrigeration	Pumps/Fans	Delar	
	Shell	Refrigeration System Improvements	Dishw	
	Water Heating	Refrigerators/Freezers	Doors	
		Signs/Signals	Drives	
		Transformers	Duct Sealing	Ovens
		Water Heaters	Fans	Power Strips
		Water Management	Fluorescent	Pre Rinse Spray Valves
		Water-Using Devices	Freeze Resistant Stock Tanks	Pumps
		Whole Building	Freezers	Refrigerators
			Fryers	Sensors
			Furnace/Boiler	Showerhead/Aerators
			Gasket Replacement	Split Systems
			Grain Dryer	Steam Cookers
			Griddles	Strip Curtains
			Heat Pumps	Television/Monitor/AV
			Heat Recovery - HVAC	Thermostats
			Heat Recovery - Other	Training
			Heat Recovery - Stack	Tune-Up
			Heat Recovery - Water/Liquid	Vending Machines
			HID	Water Heaters
				Windows

25
Categories

62
Technologies

TRM Measure Inventory

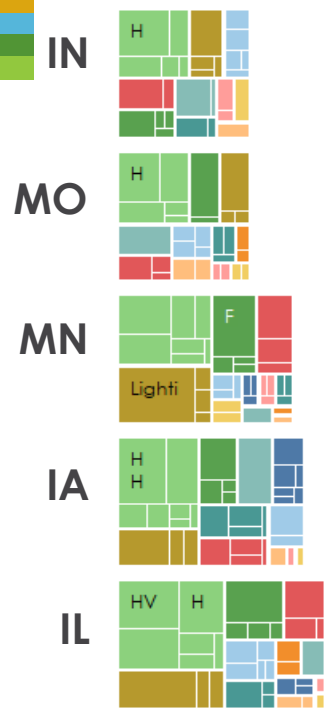
What **is NOT** in the Measure Inventory?

- Formatted text
- Formulae & equations
- Lookup & reference tables
- Sources & notes
- Complete field values for every measure
- Lacks sufficient comparable data for broad quantitative comparison of **measure values** between states

R3852 0.211

State	TRM Version	Measure Code	Measure Name	Sector	End Use	Category	Technology	Description	Definition	Definition of Baseline Equipment
3823	WI	Fall 2015	3505	Variable Speed EC	Commercial	Water Heat Pumps/Fans	Pumps			
3824	WI	Fall 2015	3505	Variable Speed EC	Industrial	Water Heat Pumps/Fans	Pumps			
3825	WI	Fall 2015	3505	Variable Speed EC	Multifamily	Water Heat Pumps/Fans	Pumps			
3826	WI	Fall 2015	3505	Variable Speed EC	Public	Water Heat Pumps/Fans	Pumps			
3827	WI	Fall 2015	3504	Variable Speed EC	Agriculture	Water Heat Pumps/Fans	Pumps			
3828	WI	Fall 2015	3504	Variable Speed EC	Commercial	Water Heat Pumps/Fans	Pumps			
3829	WI	Fall 2015	3504	Variable Speed EC	Industrial	Water Heat Pumps/Fans	Pumps			
3830	WI	Fall 2015	3504	Variable Speed EC	Multifamily	Water Heat Pumps/Fans	Pumps			
3831	WI	Fall 2015	3504	Variable Speed EC	Public	Water Heat Pumps/Fans	Pumps			
3832	IA	V01	NR-AGE-VDVP-V01-170101	Variable Speed Fr	Agriculture	Agriculture Motors/Driv	Drives			
3833	MN	v2.0		Variable Speed Po	Residential	Other Pumps/Fans	Pumps	This measure involves installation of variable speed po		
3834	MI	2017	N-CO-KR-000317-E-XX-XX-XX-	Vending Equipmer	Commercial	Food Servic Plug Load	Vending Machines		Refrigerated v	Refrigerated vending ma
3835	IN	v2.2	CI-Plug-Vending-1	Vending Machine	Commercial	Food Servic Plug Load	Vending Machines	This measure i	The efficient e	The baseline equipment
3836	IA	V01	NR-AGE-VENT-V01-170101	Ventilation Fans	Agriculture	Agriculture Pumps/Fans	Fans			
3837	WI	Fall 2015	3677	VFD Fan Motor Cor	Agriculture	HVAC	HVAC System Tune-Up			
3838	WI	Fall 2015	3677	VFD Fan Motor Cor	Commercial	HVAC	HVAC System Tune-Up			
3839	WI	Fall 2015	3677	VFD Fan Motor Cor	Industrial	HVAC	HVAC System Tune-Up			
3840	WI	Fall 2015	3677	VFD Fan Motor Cor	Public	HVAC	HVAC System Tune-Up			
3841	MI	2017	N-CO-MP-000560-E-XX-XX-XX	VFD for CHW and C	Commercial	HVAC	Motors/Driv	Drives	Pump with VFI	CHW and CW Pump with
3842	MI	2017	N-CO-MP-000562-E-XX-XX-XX	VFD for CHW and C	Commercial	HVAC	Motors/Driv	Drives	Pump with VFI	CHW and CW Pump with
3843	MI	2017	N-CO-MP-000561-E-XX-XX-XX	VFD for CHW and C	Commercial	HVAC	Motors/Driv	Drives	Pump with VFI	CHW and CW Pump with
3844	MI	2017	N-CO-MP-000563-E-XX-XX-XX	VFD for CHW and C	Commercial	HVAC	Motors/Driv	Drives	Pump with VFI	CHW and CW Pump with
3845	MI	2017	N-CO-MP-000267-E-XX-XX-XX	VFD for fixed spee	Industrial	Process Loa	Motors/Driv	Drives	Pump with VFI	Process pump, bypass co
3846	MI	2017	N-CO-MP-000269-E-XX-XX-XX	VFD for fixed spee	Industrial	Process Loa	Motors/Driv	Drives	Pump with VFI	Process pump, throttled
3847	MI	2017	N-CO-MP-000268-E-XX-XX-XX	VFD for fixed spee	Industrial	Process Loa	Motors/Driv	Drives	Pump with VFI	Process pump, bypass co

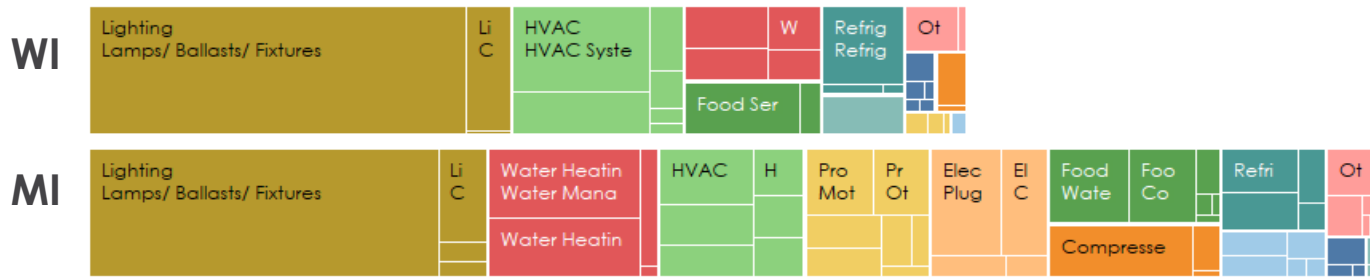
Number of Measures



- MI MEMD has the most measures, followed by WI Focus TRM
- IN TRM has least measures
- Structural differences in TRMs is a factor (lookup tables vs. individual listings)
- Broad diversity of end uses in all of the TRMs

End Use

- Agriculture
- Appliances
- Compressed Air
- Electronics
- Food Service Equipment
- HVAC
- Lighting
- Other
- Process Loads
- Refrigeration
- Shell
- Water Heating





Electric and Natural Gas EE Measures

Energy types and end uses

State	Agriculture	Appliances	Compressed Air	Electronics	Food Service Equipment	HVAC	Lighting	Other	Process Loads	Refrigeration	Shell	Water Heating
IA	Electric	Electric, Gas, Both/Either		Electric	Electric, Gas, Both/Either	Electric, Gas	Electric, Both/Either	Electric	Electric	Electric, Both/Either	Both/Either	Gas, Both/Either
IL	Electric	Electric, Gas, Both/Either	Electric	Electric	Electric, Gas, Both/Either	Electric, Gas	Electric, Both/Either	Electric, Both/Either	Electric	Electric	Both/Either	Electric, Gas, Both/Either
IN		Electric		Electric	Electric	Electric, Gas	Electric	Electric	Electric	Electric	Electric	Electric
MI	Electric, Gas	Electric, Gas, Both/Either	Electric, Gas	Electric, Both/Either	Electric, Gas, Both/Either	Electric, Gas	Electric, Both/Either	Electric, Both/Either	Electric, Gas	Electric, Gas	Electric, Gas	Electric, Gas
MN	Electric	Electric	Electric	Electric	Electric, Gas, Both/Either	Electric, Gas	Electric	Electric, Both/Either	Electric, Gas	Electric	Electric, Gas	Electric, Gas
MO		Electric, Both/Either	Electric	Electric	Electric, Gas, Both/Either	Electric, Gas	Electric	Electric, Both/Either	Electric, Both/Either	Electric	Both/Either	Electric, Gas
WI	Electric, Gas	Electric, Gas	Electric		Electric, Gas	Electric, Gas	Electric	Electric, Both/Either	Electric, Gas	Electric	Electric, Gas, Both/Either	Electric, Gas, Both/Either

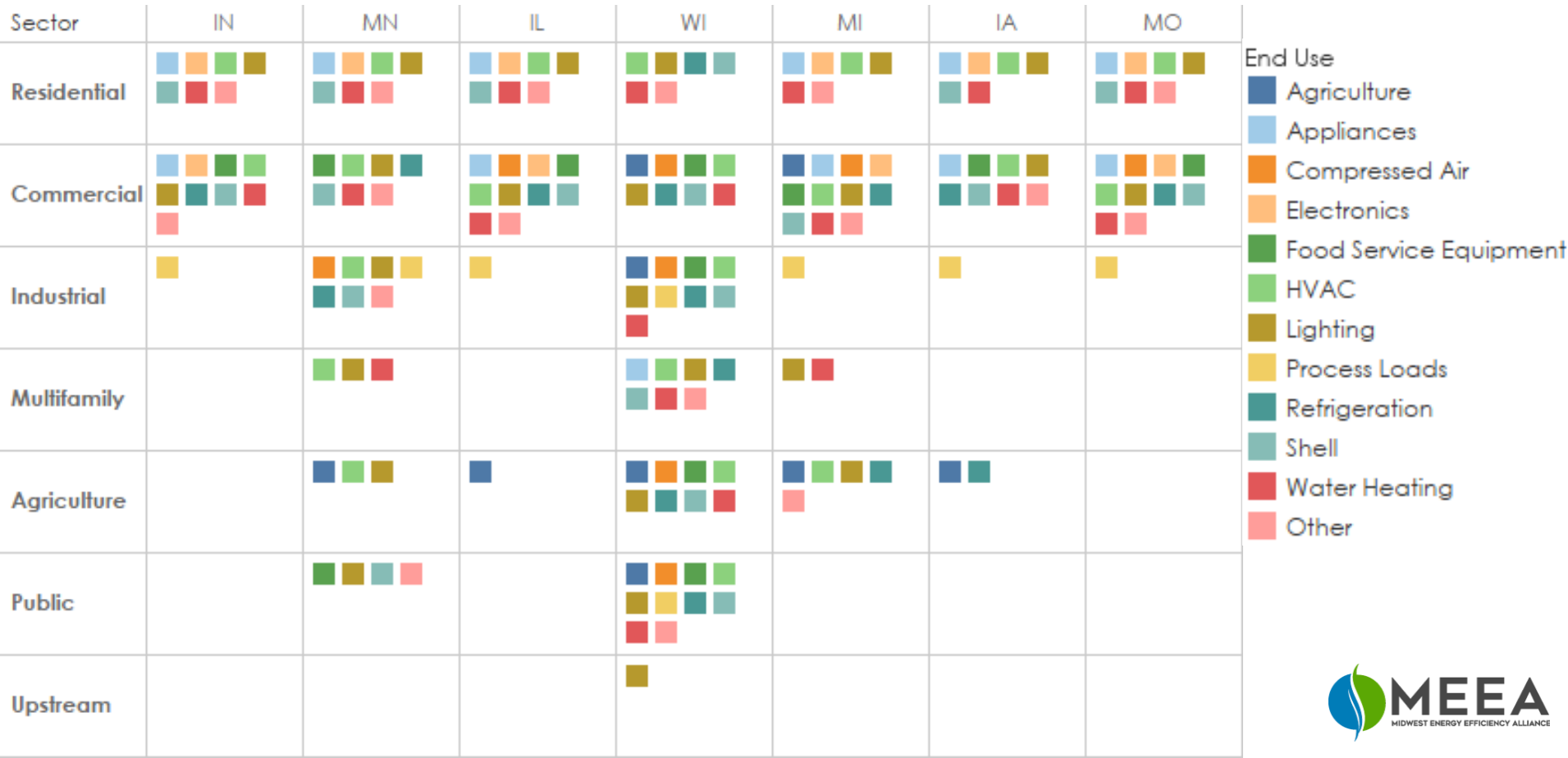
Electric/Gas

- Electric
- Gas
- Both/Either



Sectors & Measure End Uses

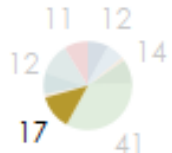
Sector specificity varies between states



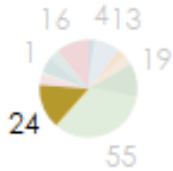
Measure Count Comparison

Lighting is a big part of TRMs

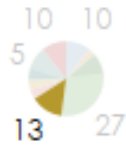
IA



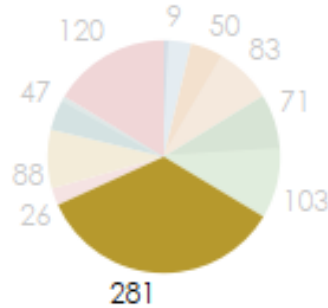
IL



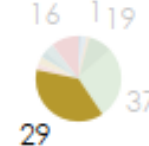
IN



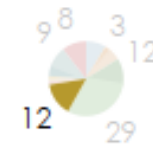
MI



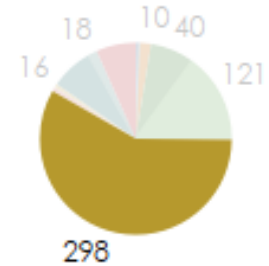
MN



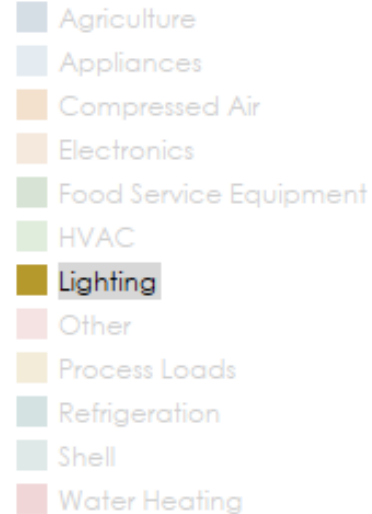
MO



WI



End Use

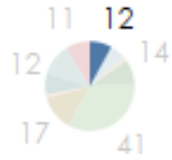


- The **Lighting** end use is the largest single component of several of the TRMs and a substantial component of all of them
- CFL and Fluorescent technologies are a significant portion, though LED is gaining ground

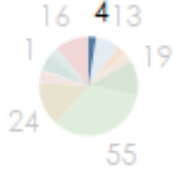
Measure Count Comparison

Surprisingly for the Midwest...

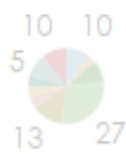
IA



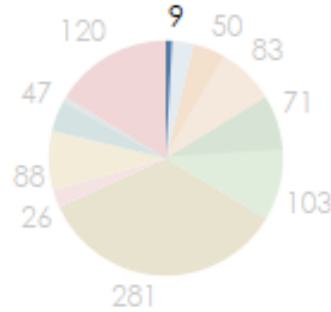
IL



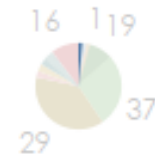
IN



MI



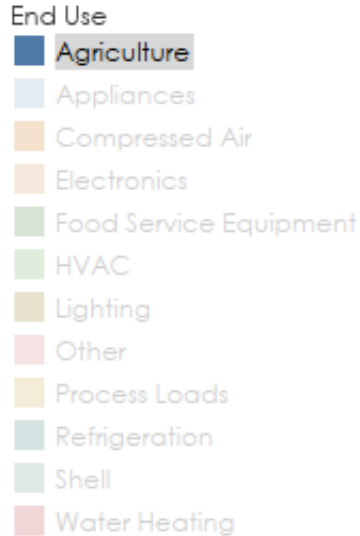
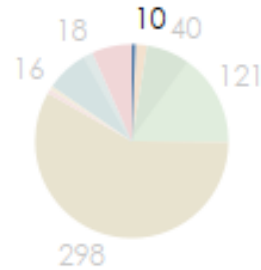
MN



MO



WI



- The **Agriculture** end use has very limited penetration in Midwest TRMs
- Some end-uses (e.g. Lighting, HVAC) may also apply to agricultural customers – this is only ag-specific measures
- Some states have no Ag measures



Inside of the End Uses

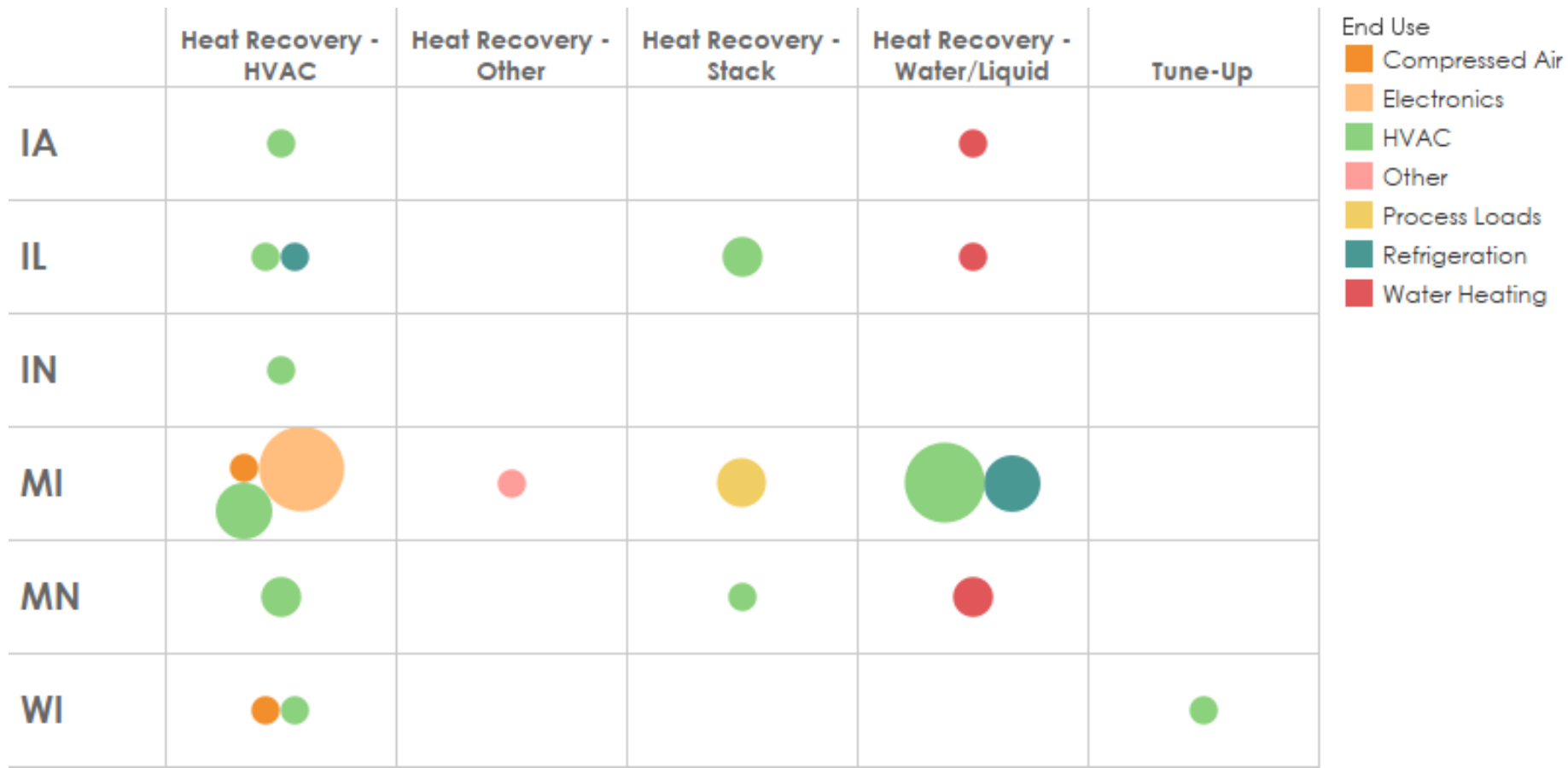
Example: Count of HVAC measures by Category

	HVAC											
	Controls/Sensors	Heat Recovery	HVAC System	HVAC System Improvements	Motors/ Drives	Other	Pumps/ Fans					
IN	● 5	● 1	● 14	● 5	● 2							
MN	● 6	● 3	● 12	● 9	● 2	● 1	● 4					
IL	● 13	● 3	● 17	● 16	● 4		● 2					
WI	● 12	● 2	● 32	● 65	● 3		● 7					
MI	● 21	● 12	● 11	● 29	● 17		● 13					
IA	● 4	● 1	● 12	● 18	● 3	● 2	● 1					
MO	● 8		● 12	● 6	● 2		● 1					



Technologies cross end uses

Example: Heat recovery technologies in various end uses



Logical next steps

Where could the project go?

Data updates

- Error checking/fixing
- Refine categorizations
- Lookup tables in TRMs as individual measures
- Move from Excel to relational database
- Link to source files
- Dashboards, queries & such

Uses for the inventory

- Template/turn-key TRM – just pick your measures
- State “have you considered?” guides

Pie in the sky

- Usage data – heatmaps – how much does each measure/sector/end use category/technology actually get used and where?

Possible Benefits of Regional TRM

MEEA Member Discussion, Summer 2017

A regional TRM/database could help with:

- A closer-to-home alternative to DEER
- Providing a single reference source – avoiding circular & outdated references
- Providing a source of updated measure information for utilities in states with no update mechanism
- Simplifying program development for small utilities & states that don't already have TRMs

Thank you!

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