



Technical Reference Manual
Advisory Committee
August 5, 2015 Meeting

Measure Categories

- 9:00-10:00 Gas Non-HVAC and Envelope
- 10:00-10:30 Codes and Standards Changes
- 10:30-12:00 Electric and Gas HVAC
- 12:00-1:00 Lunch Break
- 1:00-1:30 Lighting
- 1:30-2:30 Other Electric Measures

Gas Non-HVAC and Envelope

- Draft Workpapers
 - Commercial Water Heater
 - Commercial Dishwasher
 - Thermostatic Shower Valve
 - Loading Dock Seals
- General Items
 - Confirming water temperatures

Gas Non-HVAC and Envelope

- Commercial Water Heater
 - New standard
 - Savings vary by size, under and over 55 gal
- Commercial Dishwasher
 - ENERGY STAR calculator and assumptions
 - Many types and options, but savings vary considerably

Gas Non-HVAC and Envelope

- Thermostatic Shower Valve
 - Algorithm similar to showerheads, main new variable is time of savings, obtained from a recent study



Gas Non-HVAC and Envelope

- Loading Dock Seals
 - Algorithm and approach developed, simplified inputs are next step
- General Items
 - Confirming water temperatures, Aerators, showerheads, spray valves
 - Sources welcome



Agenda

- 2017-2019 evaluation and update
- Review measure findings and draft workpapers
- Next meeting / next steps
- Q/A

TRMAC Mission

- **In a nutshell...**
 - **Advisory body** to Commerce
 - Recommend new measures or changes to existing measures
 - Recommend field studies, evaluations, research
 - Recommend policies, protocols, and guidelines related to evaluation and TRM
- **Stay out of weeds**

Update on Recent Work

- TRM 2.0 (2016) in progress
- RFP for 2017-2019 TRM
 - Quick Review

TRM Evaluation & Update

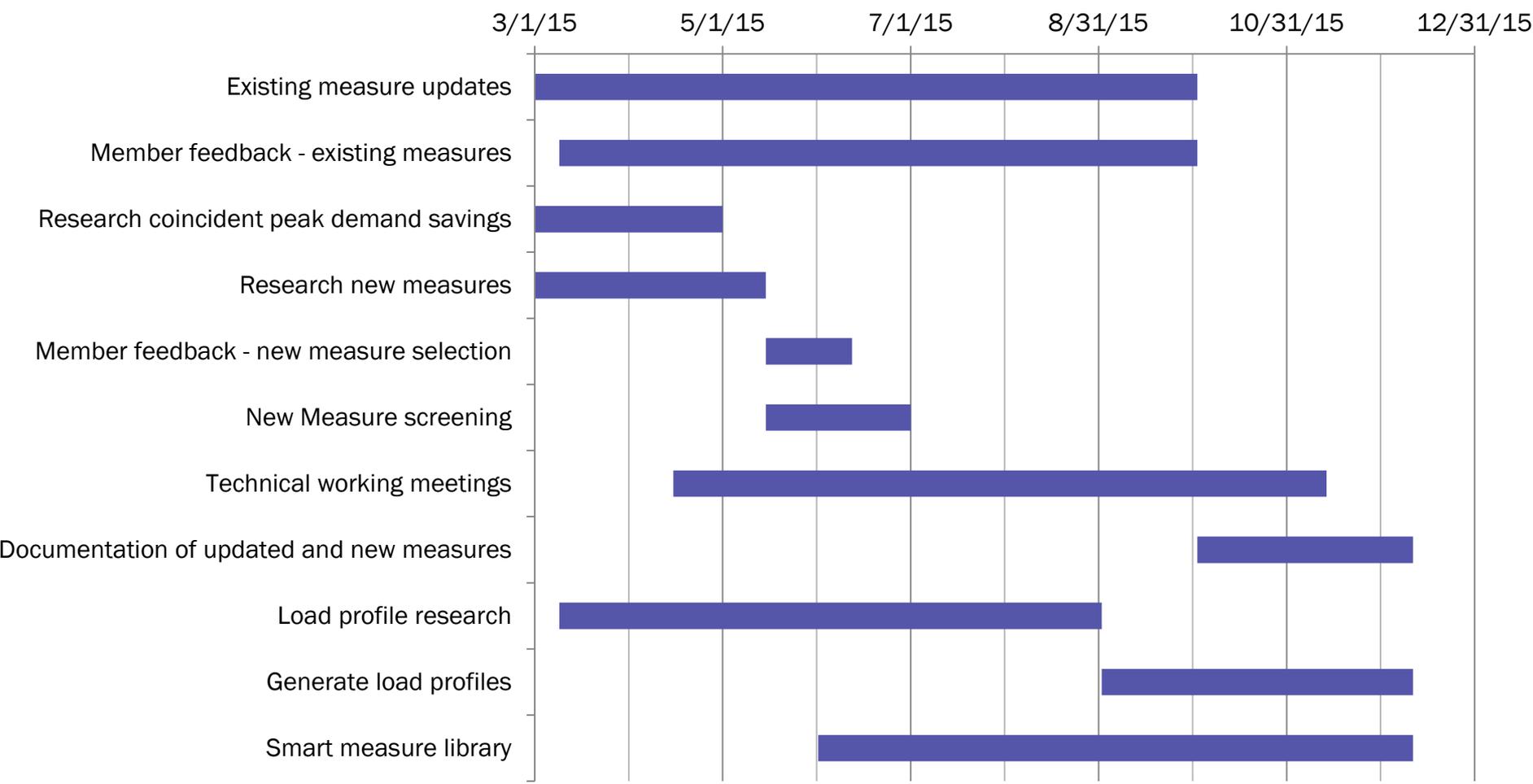
- Three major tasks:
 - Evaluation and update for 2017-2019
 - Generate load profiles
 - Build Smart Measures

TRM Evaluation & Update

- Major deliverables

Date	Deliverable
January 30, 2015	Kick-off meeting with the Department and TRMAC
June 1, 2015	List of codes and standards changes
November 13, 2015	Draft TRM delivered
December 11, 2015	Final TRM delivered
December 11, 2015	Smart Measure library complete
December 11, 2015	Electric and gas load profiles delivered

Timeline



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Code and Standard Changes

- Summary Spreadsheet
- Main updates 2015/2016
- Main updates 2017/2019

Main updates 2015/2016

- ASHRAE 90.1-2010 C/I
 - January 25, 2015
 - Lighting and Lighting Controls
 - HVAC VSD
 - Chillers
 - Economizer and Energy Recovery
 - Unitary and Split Systems

Main updates 2015/2016

- New Federal Standards
 - Water Heaters
 - Higher Minimum Efficiencies
 - >55 gal Electric Resistance Phased Out

HVAC Gas and Electric

- Draft Workpapers
 - Boilers – algorithm changes
 - Boiler Modifications – tune-up requirements
 - Condensing Unit Heater - new
 - ERV – added kW savings

HVAC Gas and Electric

- Draft Workpapers
 - Parking Garage Fan Control
 - hp base unit (need to collect hp)
 - Electric and gas savings
 - Guest Room Energy Management (GREM)
 - Many equipment types possible
 - PTAC, PTHP, chilled/hot water covered
 - Required inputs are size, heating/cooling type and fuel

HVAC Gas and Electric

- Draft Workpapers
 - Duct Sealing – new, includes locations, requires cfm measurements
 - Furnace Tune-up – new, includes requirements list
 - Mini-Split – savings provided for multiple equipment and fuel types
 - Res GSHP
 - Commercial Air Conditioning – incorporates IEER

HVAC Gas and Electric

- Thermostats
- QI/QM
- General Items
 - HDD vs EFLHrs
 - Steam Trap Hours

Smart Thermostats

Three tiers:

- I. Programmable
- II. Communicating
- III. Analytics Capable

Smart Thermostats

MN TRM

- Gas and electric programmable t-stat measures for heating only
- Current algorithm uses 6.2% savings with ISR = 100% for direct install or 56% for other

Tier I Findings

- Wide range of savings estimates
- 3.5% ($= 6.2\% \times 56\%$) for non-direct install is within range of recent estimates in MI (2.0%), MA (3.6%), Xcel (3.9%), CenterPoint (4.2%)
- 6.2% ($= 6.2\% \times 100\%$) for direct installs may be high if 1° F average setback is assumed (Xcel and CPE)
- Lifetime estimates vary from 5-15 years. MN 10 year figure is within range.

Smart Thermostats

Tier II and Tier III Findings

- Not many 3rd party studies so far, no MN results
 - Different baselines (programmable, manual, or mixed)
 - Robustness varies
 - Modeling vs. billing analysis, sub-metering
 - Sample sizes
 - Studies have usually included just one product
 - Features vary by device and may impact savings
 - Bring Your Own Thermostat (BYOT) program designs include multiple devices
- No info on savings persistence yet
 - Fewer overrides because more customer engagement

Smart Thermostats

Tier II and Tier III Findings

- Only two TRM examples
 - MI MEMD to adopt

	Tier I: Programmable Thermostats	Tier II: Communicating Thermostats	Tier III: Analytics Capable Thermostats
% Savings of Heating and Cooling Energy Consumption	2.0%	5.4%	8.9% **

- MA (Tier II)
 - 6.6 MMBtu savings (gas heating)

Smart Thermostats

Savings results

- Generally cooling savings are larger than heating
- Not clear if Tier III > Tier II savings
- Savings vs. manual device are higher than savings vs. programmable tstat with one exception (Oregon heat pump study)

Tier	vs Prog	vs Manual	vs Mixed
Tier I	N/A	2.0% (MI), 2.5% (ECW), 3.6% (MA), 6.2% (MN,IL)	N/A
Tier II	8% (NH)	10% (MA)	4.5% (Honeywell)
Tier III	3% (IL), 5.6% (N. IN), 6.5% (OR-HP), 7.5% (S. IN)	2.9% (OR-HP), 12.5% (S. IN), 13.4% (N. IN)	N/A

Tier	vs Prog	vs Manual	vs Mixed
Tier I	N/A	Inconclusive	N/A
Tier II	16% (MA)	16% (MA)	1.5-3% (S. CA), 16% (MA), 19.4% (Honeywell)
Tier III	0.8% (S. IN), 1.1% (N. IN), 8.7% (IL)	13.9 (S. IN), 16.1% (N. IN)	N/A

Smart Thermostats

ENERGY STAR certification

- Old certification for programmable tstats removed 12/31/09 due to lack of savings evidence
- New specification for connected tstats proposed 6/17/15
 - Details TBD but will be based on demonstrated savings over aggregate data

Smart Thermostats

In summary...

- Current Tier I measures appear reasonable. Could investigate decreasing direct install savings.
- Options for Tier II/III
 1. Add to TRM now based on early study results, update next year
 - TRM as planning figures only?
 2. Wait and consider adding next year, leverage ENERGY STAR rating

Residential QI/QM

- MN TRM includes QI for A/C and ASHP, AC Tune-Up, Furnace Tune-Up
 - 25% savings factor for QI
 - 5% savings factor for AC tune-up
 - 2% savings factor for furnace tune-up
- Reviewed existing QI, tune-up measures and investigated creation of new QI and QM measures

Residential QI/QM

- Findings (cooling)
 - 25% QI savings seems high based on 2008 ECW report “Air-Conditioning in Wisconsin”
 - Refrigerant undercharging is prevalent but not much impact if thermostatic expansion valve (TXV). In 2008 > 50% of new AC’s sold in WI had TXVs.
 - Not much energy impact from over-sizing correction
 - Airflow correction can either increase or decrease EER
 - In addition modeling results show treatment effects are not always additive
 - 5% savings from AC tune-up seems reasonable however
 - Average savings of 7% in ECW study from condenser coil cleaning
 - Other studies found were based on modeling, lab testing, or took place in other regions with different climates and housing construction

Residential QI/QM

- Findings (heating)
 - HVAC Save field study in Iowa suggests most furnaces can reach 90% conversion efficiency (ratio of actual Btu's delivered to theoretical Btu's) through inexpensive fixes (airflow adjustments and combustion tuning)
 - Average starting conversion eff = 81%
 - Reaching 100% conversion efficiency requires more costly repairs: duct sealing and duct optimization
 - Furnace tune-up savings (2%) seem low given HVAC Save results
 - Early results from MN CARD study inconclusive

Residential QI/QM

- Decision Options
 - Move forward with QI and QM updates now or wait until CARD study completed end of 2015?

Lighting

- General Items
 - CI Lighting Format
 - T8 Ballast Standard
 - CF review
 - ISRs
 - Residential Motion Sensors
 - Costs

Lighting

– CI Lighting Format

- General lighting section with common information
- Algorithm, tables of values (IF, CF, Hrs, ML)
- Specific technology sections
- Plan to expand adding LED troffers, possible T8 baselines
- Wattage table, mostly unchanged

Lighting

- T8 Ballast Standard – EPC Act 2005/2011
 - Effective 11/14/2014
 - Introduces Ballast Luminous Efficiency (BLE) standards
 - Minimum BLE levels comparable to Premium T8 / High Performance T8 levels
- Recommendation – Allow T8 technology as the baseline with reduced measure lives

Other Electric Measures

- Draft Workpapers
 - Ag Engine Block Heater
 - Ag High Speed Fans
 - Ag Lighting
 - Ag Livestock Waterer
 - Compressed Air Leak Repair
 - ECM Circulators
 - VSD Pool Pumps

Wrap-up

- Next Meeting/Next steps
- Questions/comments?

Thank you!

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