

CADMUS



# Energy Efficiency Potential Study Third Stakeholder Meeting

September 17, 2020

# Webinar Logistics & Guidelines



All parties except presenter muted to avoid unnecessary noise distraction

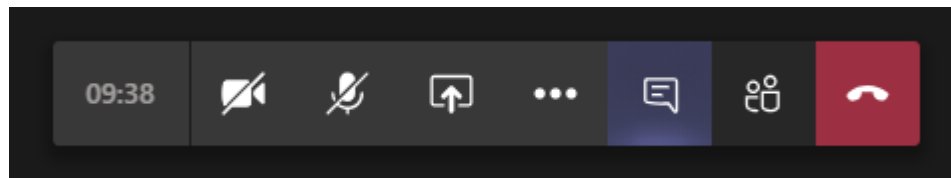


If you have an immediate question, or audio or video is poor please send an instant message to the moderator



We will stop today's presentation several times to take questions

## Your Settings



# Agenda

1

## Potential Study Measures

- Orientation to Measure List
  - Analytical Approach for Measure Characterization
  - Emerging Technologies / Behavioral & Process Measures
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## Scenario Potential Approach

- Revised Approach
  - Stakeholder engagement
- 

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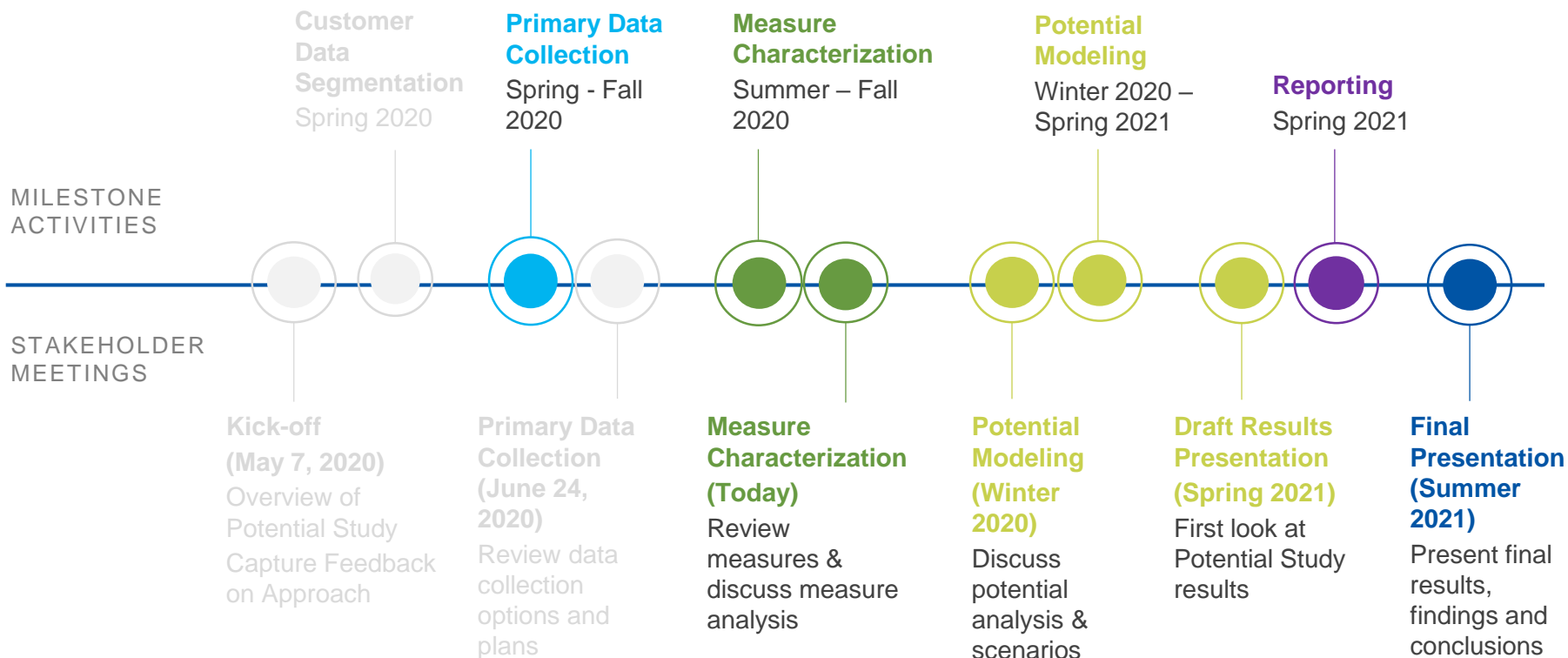
## Data Collection Update

- Virtual Site Visits
  - Commercial and Agricultural Surveys
  - Residential Panel
  - Industrial Expert Interviews
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## Q & A

# Timeline of Milestones and Meetings







# 1. Potential Study Measures

# Measure List Orientation

## Measure Description

Sector	Fuel Type	Income Type	Construction Vintage	End Use Category	Measure Name	Measure Description	Base Equipment
Residential	Electric	Standard	New	Lighting	Efficient Measure	Measure Details	Baseline Details
Commercial	Natural Gas	Income Qualified	Existing	Water Heat			
Industrial	Both		Both	HVAC			
Agriculture				Etc.			

## Measure Reference

Included in 2017 WI FOE Potential Study?	State Code Impact	Federal Standard Improvement	Behavioral Measure	Emerging Technologies	Similar Measure(s) Present in WI 2020 TRM?	Focus Program Measure in PY19 or PY20
Yes	Yes	Yes	Yes	Yes	Yes	Yes
Updated	No	No	No	No	No	No
Added						

### How to best review:

Filter by sector and end use category for areas of interest

See what's added or updated in column "Included in 2017 WI FOE Potential Study?"

Check behavioral and emerging measures

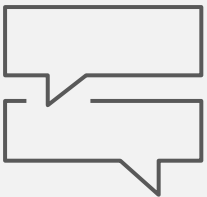
# Measure List Stakeholder Feedback

## Measure Feedback

- Measures to include?
- Measures to remove?
- Other measure considerations (e.g., emerging technologies)
- Data sources available to inform potential (other than the TRM)

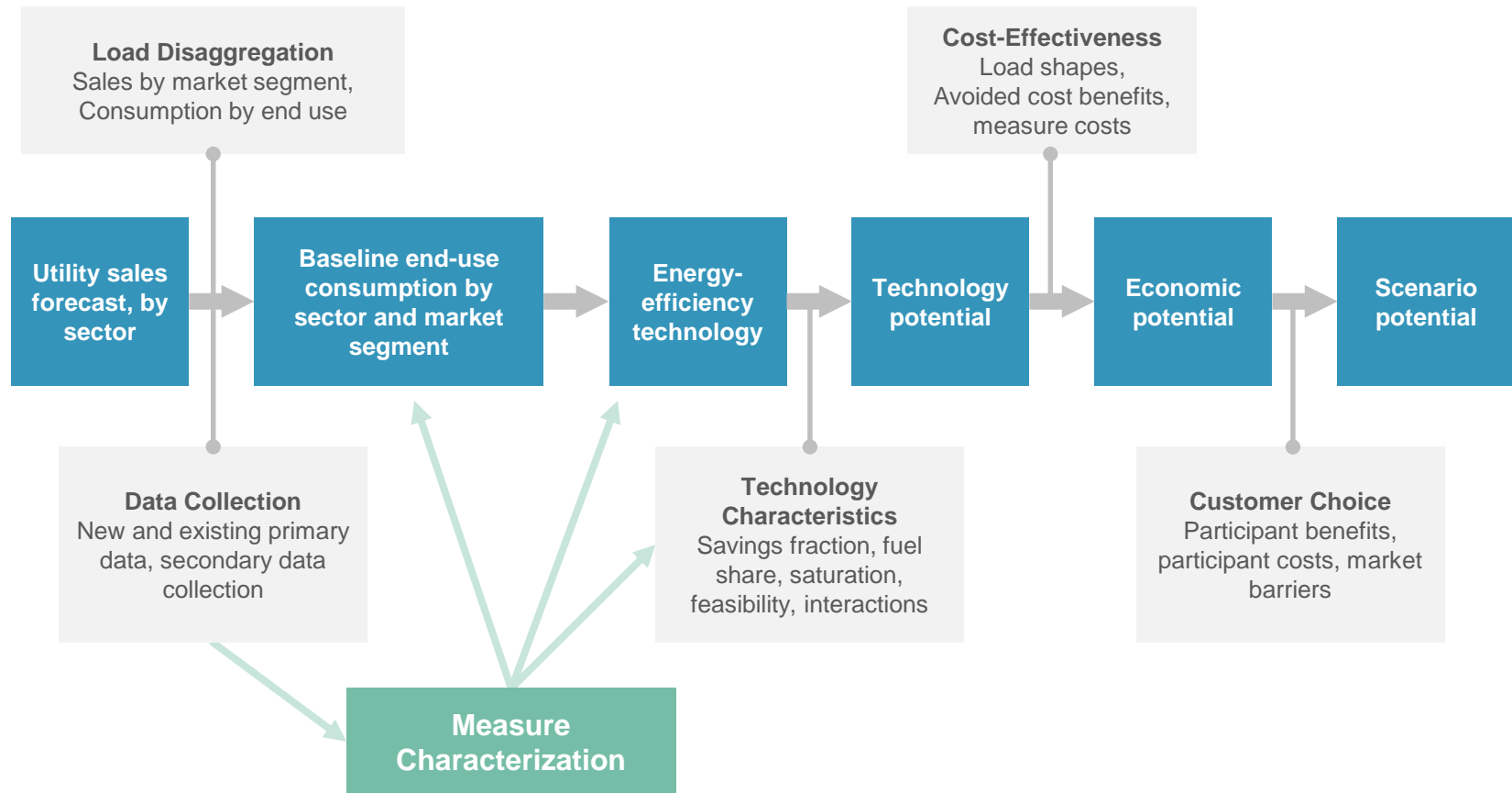
## How to Deliver Feedback – Flexible Options:

- Add note columns to the spreadsheet and include measure level feedback
- Email feedback directly with a bulleted list and any data sources
- [jeremy.eckstein@cadmusgroup.com](mailto:jeremy.eckstein@cadmusgroup.com)
- [Mitch.Horrie@wisconsin.gov](mailto:Mitch.Horrie@wisconsin.gov)



Cadmus will compile the feedback. A final measure list will be developed including a response to each comment indicating what action was taken. The final measure list will be provided by November (by email and on website).

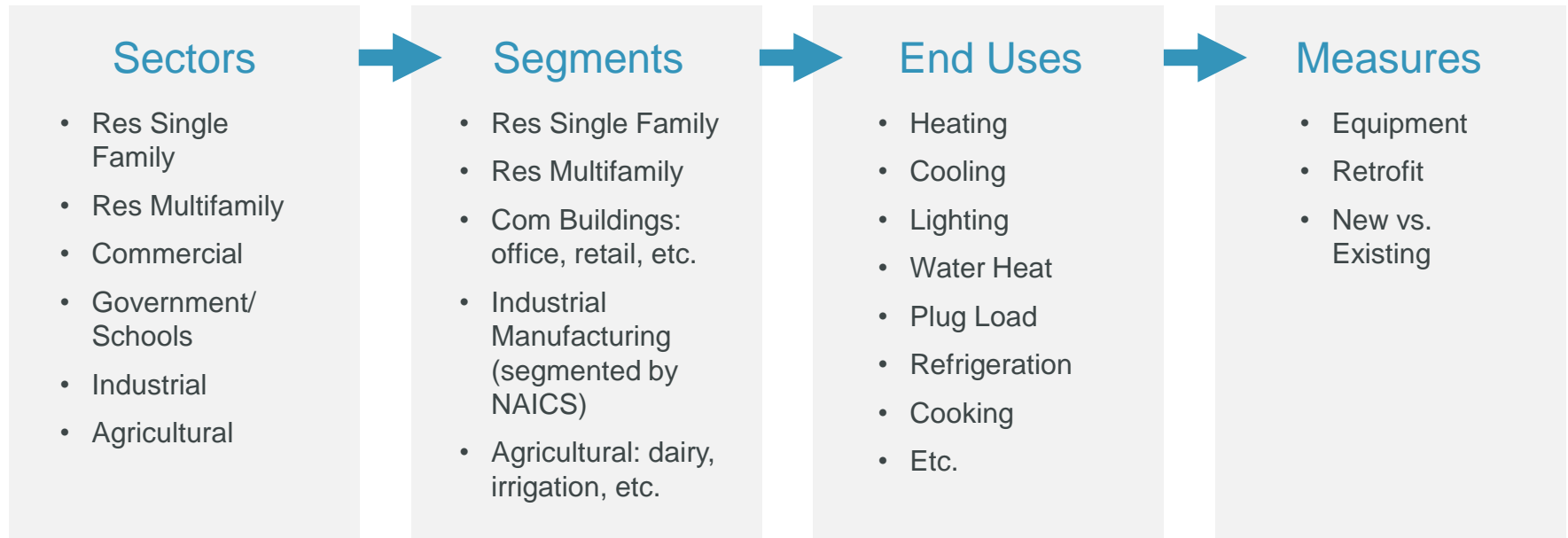
# Analytical Approach for Measure Characterization



Measure characterization is a thorough undertaking and the bedrock of the potential. It informs baseline end-use consumptions and efficient measure savings.



# Analytical Approach for Measure Characterization



Measure characterized across sectors, segments, and end-uses

Prior study had more than **26,100** measure permutations and **702** unique measures across all sectors and fuels

# Analytical Approach for Measure Characterization

## Measure characterization determines:

### Energy consumption and savings

- Primary and secondary fuel savings
  - Accounts for savings interactions (e.g., installing efficient lighting results in cooling loads decrease)
  - Water savings and other non-energy benefits (if applicable)
- 

### Equipment and labor costs

- Baseline, measure, and/or incremental cost of equipment and labor
- Annual O&M cost (if applicable)

### Effective useful life

- Baseline and measure lifetimes
- 

### Applicability factors

- Technical feasibility - percentage of homes / buildings that could feasibly install a measure (e.g., capability or space limitations)
- Percent incomplete - percentage of remaining homes / businesses yet to install a measure (one minus the current saturation of measure)

Also includes potential modeling flags (e.g., measure stacking/competition flags)

# Analytical Approach for Measure Characterization



- Wisconsin Focus on Energy
- 2020 Technical Reference Manual



## Main Source Data

Focus on Energy evaluation data – program data (SPECTRUM), D&R equipment sales, reports



Primary data collection phone survey and site visit



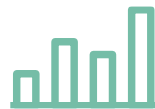
- Energy consumption and savings
- Equipment and labor costs
- Effective useful life



- Energy consumption and savings
- Equipment and labor costs
- Percent incomplete



- Energy consumption and savings
- Technical feasibility
- Percent incomplete



## For Any Data Gaps

Supplement from secondary sources

## Secondary Data Sources

2016 study

DOE technical support documents

EIA (RECS/CBECS/MECS)

ENERGY STAR

Other TRMs

Cadmus research

# Analytical Approach for Measure Characterization

## APPLICABILITY FACTORS

Fuel Type	Segment	Construction Vintage	Measure Description	Technical Feasibility	Technical Feasibility Source
Electric	Single Family	Existing	WiFi Thermostat	25%	The applicability factor reflects the technical constraints imposed by the lack of C-wires in most existing residential buildings. A vast majority of existing residential buildings lack a third electrical wire (commonly known as "C-wire"), which are necessary to install most commercially available WiFi thermostats.
Electric	Single Family	New	WiFi Thermostat	100%	Newly constructed residential buildings are equipped with more than sufficient wiring to install WiFi thermostats, which require a third C-wire.
Electric	MultiFamily	Existing	WiFi Thermostat	0%	Programmable and WiFi thermostats are rarely used in Multifamily settings in this particular region, according to prior investigation/research.
Electric	MultiFamily	New	WiFi Thermostat	0%	Programmable and WiFi thermostats are rarely used in Multifamily settings in this particular region, according to prior investigation/research.

## MEASURE LIFE: EFFECTIVE USEFUL LIFE

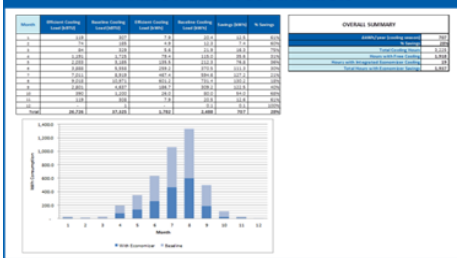
Fuel Type	Measure Description	Effective Life	Effective Useful Life Source
Electric	Air-Side Economizer	10	Database for Energy Efficient Resources (DEER) 2008
Electric	ENERGY STAR Computer	4	Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties. Jonathan G. Koomey, Michael Cramer, MaryAnn Fleitz, and Joseph H. Ebo. Ernest Orlando Lawrence Berkeley National Laboratory. December 1995. ISBN: 97383
Electric	Exterior Building Lighting	14	Measure Life Report 2007 by GDS Associates, Inc. for The New England State Program Working Group (SPWG). Measure life reflects the average between retrofit (13 years) and new construction (15 years) for HID (interior and exterior).
Electric	High Efficiency Vending Machines	10	Final Rule Technical Support Document (TSO): Energy Efficiency Standards for Commercial and Industrial Equipment: Refrigerated Bottled or Canned Beverage Vending Machines, Chapter 8: Life-Cycle Cost and Payback Period Analysis. Pg 20.
Electric	High Efficiency Cooking Equipment	12	Energy Efficiency Policy Manual Version 2, by CPUC Energy Division, August 2003. Measure life for Cooking Equipment. Pg 18.

Each measure analyzed in individual workbook

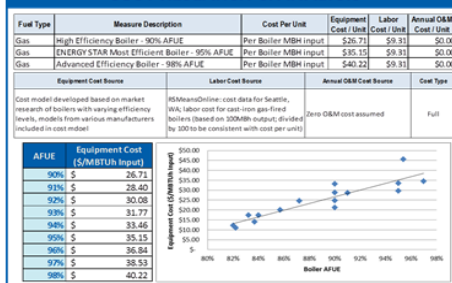
Through power query process all workbooks aggregated into single measure input model

Model contains all per unit and per building measure inputs that feed into the potential model (tech/econ/etc.)

## ENERGY SAVINGS ANALYSIS



## COST RESEARCH & ANALYSIS



- EFFICIENCY SHARES
- EQUIPMENT SATURATION
- PERCENT INCOMPLETE

## AGGREGATED POTENTIAL MODEL INPUT

Segment	Measure	Cost	Equipment	Labor	Annual O&M	Efficiency	Cost / Unit	Equipment / Unit	Labor / Unit	Annual O&M / Unit
Single Family	WiFi Thermostat	100	100	100	100	25%	10	100	100	100
Single Family	Air-Side Economizer	200	200	200	200	10%	10	200	200	200
Single Family	High Efficiency Vending Machines	300	300	300	300	10%	10	300	300	300
Single Family	High Efficiency Cooking Equipment	400	400	400	400	10%	10	400	400	400
Single Family	Exterior Building Lighting	500	500	500	500	14%	14	500	500	500
Single Family	ENERGY STAR Computer	600	600	600	600	4%	4	600	600	600

# Analytical Approach for Measure Characterization

Cadmus classifies measures into two categories:

**High-efficiency equipment measures:**

directly affect end-use equipment (e.g., high-efficiency central air conditioners), follow normal replacement patterns based on projected equipment turnover (1/lifetime).

**Non-equipment measures (retrofit):**

affect end-use consumption without replacing equipment (e.g., insulation). Do not include timing constraints from turnover (except for new construction), considered discretionary (i.e., savings could be acquired at any point over the planning horizon).

**Treatment of early replacement:** Most measures naturally turn over within the study horizon, and long-run technical potential from early replacement measures equals savings from replace-on-burnout measures. Early replacement, however, could be considered within short-run program planning. While Cadmus plans to exclude early replacement measures from analysis, it should be considered in program design.



# Measure Characterization: Codes and Standards

Study accounts for code and standards changes over the study horizon

- Affects customers' energy-consumption patterns and behaviors
- Determines which measures continue to produce savings
- State codes typically impact new construction measures
- This study does not attempt to predict how standards might change in the future

## Residential State Code

Wisconsin's Uniform Dwelling Code SPS 320-325

## Commercial State Code

Wisconsin's Commercial Code SPS 361-366 (2015 IECC with amendments)

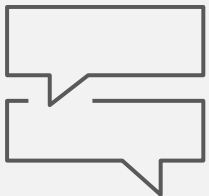
## Federal Standards

National equipment and product standards

**Residential Lighting:** Considering the uncertainty with the rapidly changing environment (EISA lawsuits and market shift), Cadmus will continue discussions with PSC staff on how to best characterize residential lighting savings. Like in the prior potential study, various scenarios may be considered.

## Emerging Technologies

- Includes: 2016 ET measures that are commercially available but nascent in the marketplace
- Examples: HP dryer, CO2 HPWH, specialty framing construction, active chilled beam cooling with DOAS, advanced/networked lighting controls, continuous commissioning, spring-loaded garage doors, boiler oxygen trim controls, natural ventilation design
- Limited data when adding new ET measures
- To avoid over-estimation of potential - adjustments to technical feasibility factors may be applied



**Feedback requested.** Other ET measures to consider? Please provide all relevant data (e.g., measure and baseline descriptions, savings and cost data, application information (sector, segment, end-use)).

This study does not plan to include non-commercially available ET measures

Thank you to those who already provided ET measure considerations

# Emerging Technologies / Behavioral & Process Measures

## Behavioral Measures

Starts with 2016 behavioral measures

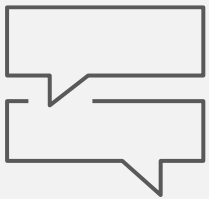
### Examples

Wi-Fi  
thermostat -  
seasonal  
savings

Indirect  
feedback

Strategic  
Energy  
Management  
(SEM)

Delivering Energy  
Efficiency Together  
(DEET) for Schools  
and Government



**Feedback requested.** Other BM measures to consider? Please provide all relevant data (e.g., measure and baseline descriptions, savings and cost data, application information (sector, segment, end-use)).

## Process Measures

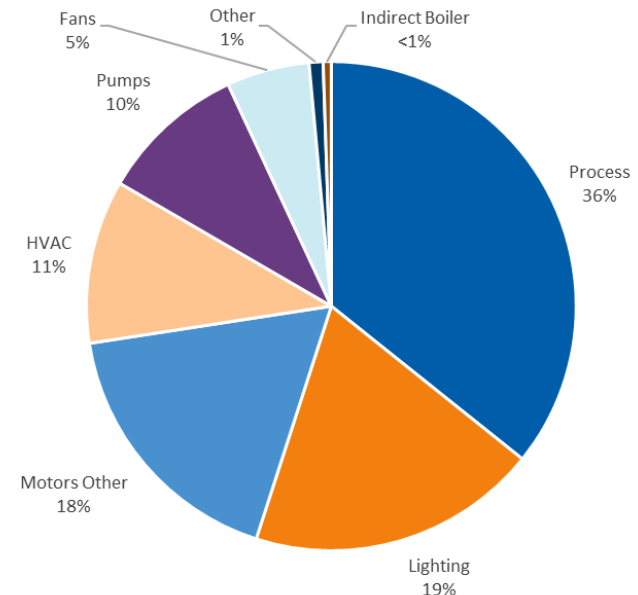
Difficult to characterize highly customized measures (e.g. custom process projects)

Prior study: 36% of electric industrial economic potential process related

Stakeholder feedback: industrial process potential likely higher

Will use data on process improvements from expert interviews

Industrial Electric Economic Energy Efficiency Potential by End Use



**Process Treatment:** Added two additional process measures

### Process Improvements To Reduce Energy Requirements Level 2

- Process improvements can be considered as continual improvements, level 2 presents incremental savings from level 1 to level 2 and would occur in the later years of the study

### Other Plant Operations Improvements To Reduce Energy Requirements

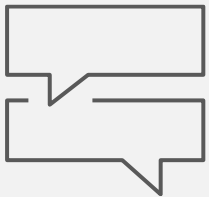
- Plant enhancements to facility operations – could be considered as behavioral

# The Floor is Open – Feedback Welcome!

## Questions/Comments?



- Questions about specific measures or measure groups?
- Questions about analytical approach?
- Questions about lighting measures?
- Other questions or comments?



**Please add your questions to the meeting chat:** we will address questions in the order that they are received & provide opportunity for clarification

Please remain muted until your question is announced



## 2. Scenario Potential

# Since the Last Stakeholder Meeting

## PSC Consultations

PSC staff developed recommendations to the study team with support from Commissioner Huebner:

**Do not rely on willingness to pay surveys as a primary data source.**

**Leverage prior potential study data and historical program data to the extent practical.**

**Continue to seek and encourage stakeholder guidance:**

Rely on expertise to inform and assess appropriateness of assumptions and fill data gaps.

**Maintain transparency regarding data sources and assumptions.**

**Understand the potential for Focus to realize savings under varying budget levels and policy assumptions.**

Present a range of outcomes under plausible futures.

**Avoid using the term “achievable potential” in the study report to address potential misinterpretation of results.**

**Convened a stakeholder sub-group to communicate the preferred direction forward.**

# Additional Research Performed

## Additional Potential Study Methodology Review (Achievable Potential)

- Expanded review of methodologies
- Reviewed multiple studies, including:
  - Utility studies (ComEd, Ameren MO, Duke OH)
  - Michigan, Pennsylvania statewide studies

## Spoke with MN CEE Staff

- Noted heavy reliance on informed opinions
- No additional primary research to determine achievable potential

## Reviewed Historical Focus program data

- Intent: determine possibility of building measure-level time series data sets to inform ramp rates
- Initial focus: residential measures (most widget-based)
- Intent: develop annual penetration estimates
- Data-related issues complicated review

# Proposal: Optimized Potential

For setting **optimized potential** as a percentage of economic potential, we propose to take a **deterministic approach**, akin to Northwest Power and Conservation Council approach.

This value will be **85%**  
**for most measures**,  
realizing there are  
differences between lost  
opportunity and retrofit  
measures

For measures with minimum  
federal efficiency standards,  
set the **optimized level to**  
**95%**

Analogous to the Maximum Incentive Achievable scenario from the 2017 report

Optimized potential: cost-effective EE savings attainable with minimized implementation constraints

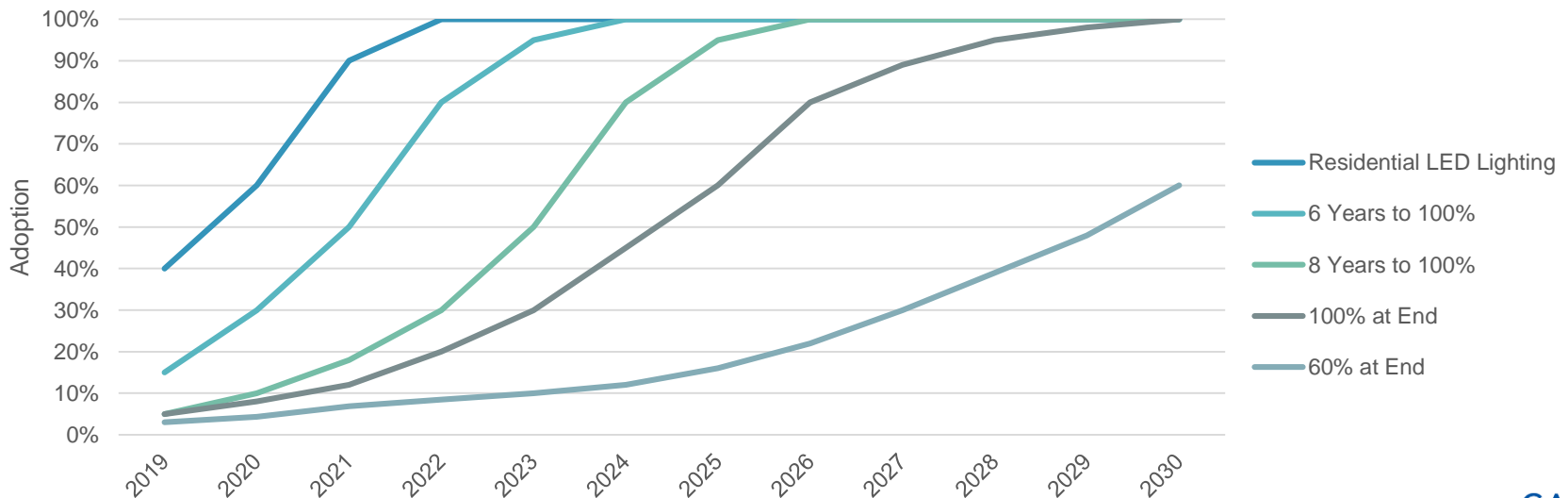
# Proposal: Ramp Rates

For **ramp rates**, first start with 2017 potential study ramp rates, which were assigned according to the hierarchy described in report

Then, we adjust the starting points and/or rates, using data from: site visits and surveys, market research, and Focus program data

Next, present the ramp rate assignments to the technical market experts (e.g. res, com, ind, ag, etc.)

Will collect expert feedback regarding reasonableness, and seek consensus approval on final ramp rate assignments





# Proposal: Current Policy Potential

**Current policy potential**, will be subset of optimized potential, constrained by annual budget amounts based on current Focus funding levels. The study will also consider additional scenarios of funding between current policy and optimized potential.

Measure incentives based on current amounts, expressed as a percent of incremental cost. Proxy incentives developed for non-program measures and emerging technologies

Total budget amounts will include both incentives and implementation and administrative costs, based on recent Focus experience

Will scale optimized potential to current policy potential, considering the equitable balance of ratepayer funding; i.e. splits between fuels and customer classes

# Proposal: Maintaining Transparency

Throughout, we will continue to educate and maintain transparency. We propose:

Make optimized and current policy potential designations, estimates, and calculations available on study website

Post the 2017 potential study measure ramp rates to the study website

# Scenarios

Potential study will consider savings potential under different scenarios of key input variables to help inform scoping for Quad Planning.

One scenario is a baseline (current policy) scenario of no changes (e.g. funding, emissions values, discount rates, etc.)

## Scenario Variables:

Budget  
Constraints

Carbon  
Emissions  
Values

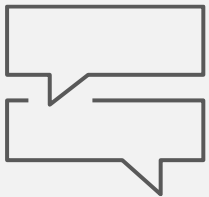
Discount  
Rates

# The Floor is Open – Feedback Welcome!



## Questions/Comments?

- Questions about potential calculation?
- Questions about stakeholder engagement?
- Other questions or comments?



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# 3. Data Collection Update

# Data Collection Update

## Commercial

9 Segments

Surveys 58 of 630

Key equipment saturation and end use data

## Industrial

Industrial Experts

Interviews 4 of 10

Collect detailed information on remaining potential opportunities of key end uses or industrial improvements

## Agricultural

Dairy / Farm

Surveys 16 of 70

Gather supplemental data to complement extensive research conducted for 2016 Study

## General Population Residential

Representative Panel

600 Members  
(not started)

Key equipment saturation and end use data

## Income Qualified Residential

Phone Survey

140  
(not started)

Key equipment saturation and end use data

# Virtual Site Visits

## Pilot Successful – Transitioned to full data collection

4 of 68 office visits completed

1 of 68 school visits completed

2 of 68 retail visits completed

### Primary Focus

- Lighting equipment saturations
- Other equipment information when available







# 4. Q&A and Next Steps

# Q & A and Next Steps



Please add questions and comments to the meeting chat.

Anything that we have or have not discussed today?

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## Next Stakeholder Meeting:

Potential Modeling (November)

Cadmus will present potential modeling approach and scenarios to be analyzed

**Your feedback and input is important, please send us feedback**

### Other feedback opportunities

Email **Jeremy Eckstein** at Cadmus ([jeremy.eckstein@cadmusgroup.com](mailto:jeremy.eckstein@cadmusgroup.com))

or contact **Mitch Horrie** at PSC ([Mitch.Horrie@wisconsin.gov](mailto:Mitch.Horrie@wisconsin.gov))

# Reference Slide: Analytical Approach for Measure Characterization

Input	Residential Single-Family and Multifamily	Commercial and Government	Industrial	Agricultural
<b>Energy Savings</b>	Primary Data Collection Phone Survey, Wisconsin Focus on Energy Program Evaluations, Wisconsin Focus on Energy 2020 TRM, ENERGY STAR, U.S. Department of Energy (DOE)/EERE, <sup>1</sup> 2016 Potential Study, Cadmus research	Primary Data Collection Phone Survey and Site Visit, Wisconsin Focus on Energy Program Evaluations, Wisconsin Focus on Energy 2020 TRM, CBECs 2013 Microdata, ENERGY STAR, DOE/EERE, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Interviews, Wisconsin Focus on Energy Program Evaluations, Wisconsin Focus on Energy 2020 TRM, DOE's Industrial Assessment Center Database, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Interview, Wisconsin Focus on Energy Program Evaluations, Wisconsin Focus on Energy 2020 TRM, 2016 Potential Study, Cadmus research
<b>Equipment and Labor Costs</b>	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations/SPECTRUM cost data, National Residential Efficiency Measures Database, <sup>2</sup> RSMMeans, <sup>3</sup> ENERGY STAR, DOE/EERE, Incremental Cost Studies, Online retailers, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations/SPECTRUM cost data, RSMMeans, ENERGY STAR, DOE/EERE, Incremental Cost Studies, online retailers, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations/SPECTRUM cost data, DOE's IAC Database, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations/SPECTRUM cost data, RSMMeans, ENERGY STAR, DOE/EERE, Incremental Cost Studies, online retailers, Cadmus research
<b>Measure Life</b>	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations, ENERGY STAR, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations, ENERGY STAR, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations, DOE's Industrial Technologies Program, Cadmus research	Wisconsin Focus on Energy 2020 TRM, Wisconsin Focus on Energy Program Evaluations, Cadmus research
<b>Technical Feasibility</b>	Primary Data Collection Phone Survey, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Survey and Site Visit, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Interviews, Wisconsin Focus on Energy Program Evaluations, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Interview, 2016 Potential Study, Cadmus research
<b>Percentage Incomplete</b>	Primary Data Collection Phone Survey, Wisconsin Focus on Energy Program Accomplishments, 2016 Potential Study, RECS, Cadmus research	Primary Data Collection Phone Survey and Site Visit, Wisconsin Focus on Energy Program Accomplishments, 2016 Potential Study, CBES, Cadmus research	Primary Data Collection Phone, Wisconsin Focus on Energy Program Accomplishments, 2016 Potential Study, Cadmus research	Primary Data Collection Phone Interview, Wisconsin Focus on Energy Program Accomplishments, 2016 Potential Study, Cadmus research

<sup>1</sup> Department of Energy Office of Energy Efficiency and Renewable Technology (EERE). <http://energy.gov/eere/office-energy-efficiency-renewable-energy>

<sup>2</sup> National Renewable Energy Laboratory National Residential Efficiency Measures Database. <http://www.nrel.gov/ap/retrofits/>

<sup>3</sup> RSMMeans Cost Data. <https://www.rsmeans.com/products/online.aspx>