2018 AND BEYOND POTENTIAL STUDY

MEASURE SELECTION WORKSHOP

AUGUST 29, 2016

NAVIGANT

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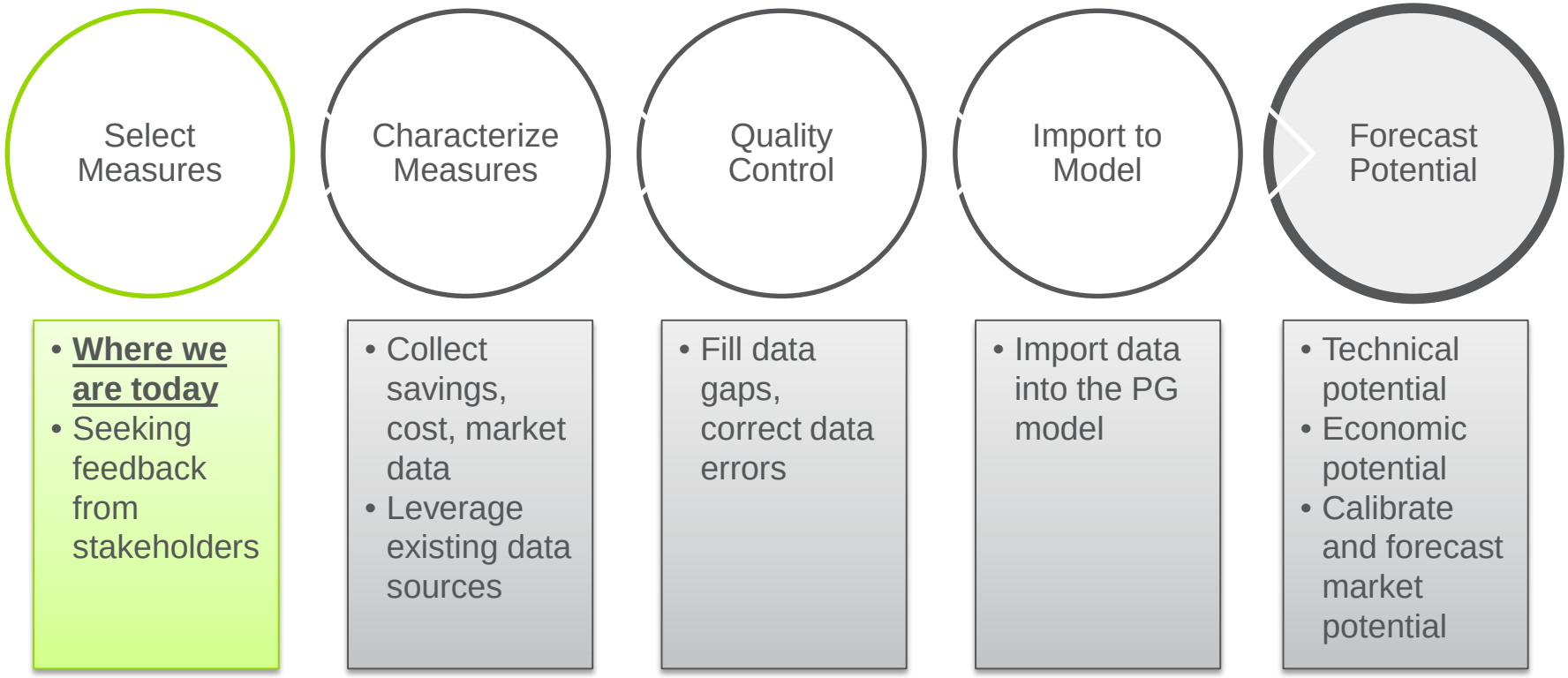
OBJECTIVE FOR TODAY'S MEETINGS

- Introduce members of the Navigant team
- Review Navigant's measure selection process
- Review Navigant's technology database
- Discuss data sources to be used for measure characterization
- Solicit stakeholder feedback

MEASURE SELECTION IS THE FIRST STEP IN FORECASTING



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MEASURES VS REPRESENTATIVE MEASURES

- PG study models representative measures, **not** every single measure possible
  - All major end uses are represented
  - Allows for more efficient project timeline and budget
- Requires a selection process
  - Focus on high impact technologies and those with large future promise
  - Deprioritize niche, low impact technologies

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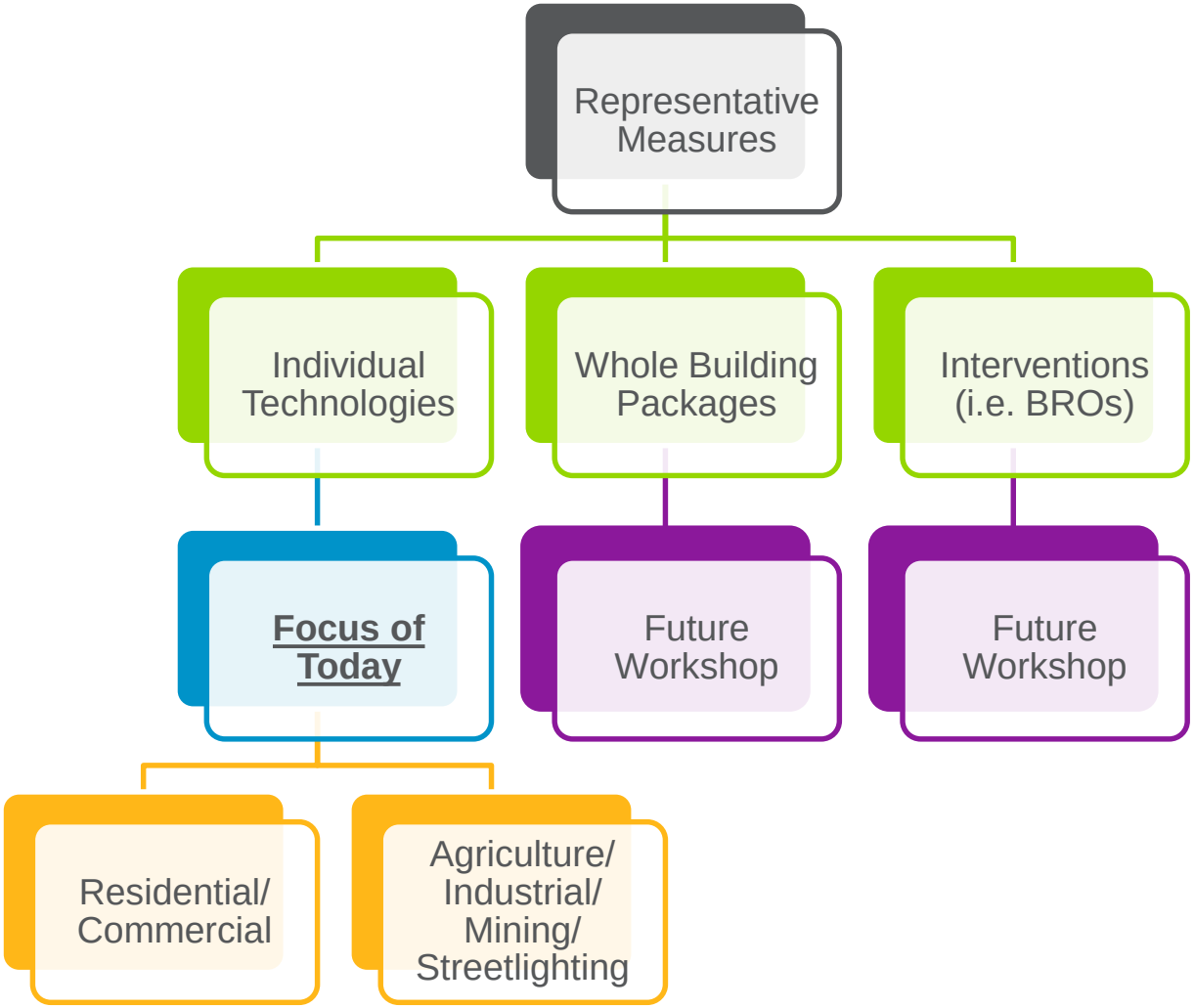
SPECTRUM OF REPRESENTATIVE MEASURES



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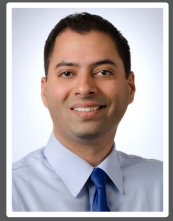
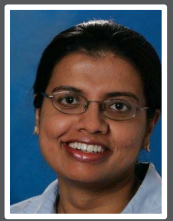
NAVIGANT TEAM MEMBER ROLES

Greg Wikler -
Project Director



Amul Sathe -
Project Manager

Surya Swamy -
Lead Modeler



Debyani Ghosh -
Res/Com

Matt O'Hare -
AIMS

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WHY ARE WE REFRESHING THE MEASURE LIST?

- Last update to the measure list was in 2012
- Update allows us to:
  - Better align with current programs
  - Consider additional below-code savings opportunities
  - Consider new above code technologies

- Representative technology selection informs technical potential. We are not going to discuss:
  - Code vs. existing baseline
  - Replace on burnout vs. repair eligible, etc.
  - Cost effectiveness
  - Market potential or calibration
  - SB350

- **Seeking to identify: What technologies offer energy savings opportunities absent program policy filters?**

THE FEEDBACK PROCESS

- **August 22 (last week)** – Measure database released for public review
- **August 29 (today)** – Review process and measure database, collect verbal feedback
- **September 9** – Stakeholder informal written comments on measures due via e-mail to:
    - Paula Gruendling paula.gruendling@cpuc.ca.gov
    - Chris Ann Dickerson cadickerson@cadconsulting.biz
    - Amul Sathe amul.sathe@navigant.com

THE FEEDBACK PROCESS

- Is the measure list representative of current programs?
- Is the measure list appropriately capturing major future opportunities?
- Are there technologies that should be removed from our study (i.e. no longer relevant)?
  - If so, why?
- Are there representative technologies we are missing from our suggested list?
  - **Any information or data** you have would be very helpful to the team
    - Why should these technologies be included?
    - Does it offer more promise than the technologies already in our suggested list?
    - What is the target market, market applicability, and size of the market for the suggested technology?
    - Any data on the savings, cost, EUL?

WHAT IS MEASURE CHARACTERIZATION?

- Modeling requires many data points to characterize a measure
- Data comes from multiple sources

Descriptive Info
Technology Name
Sector
End Use
Fuel Type

Energy Use
Baseline Energy Use
Code Energy Use
Efficient Energy Use
Interactive Effects

Other
EUL
RUL
NTG Ratio

Market Info
Applicability
Maximum Saturation
Current Saturation

Cost
Baseline Repair Cost
Code Equip. Cost
Efficient Equip. Cost
Installation Cost

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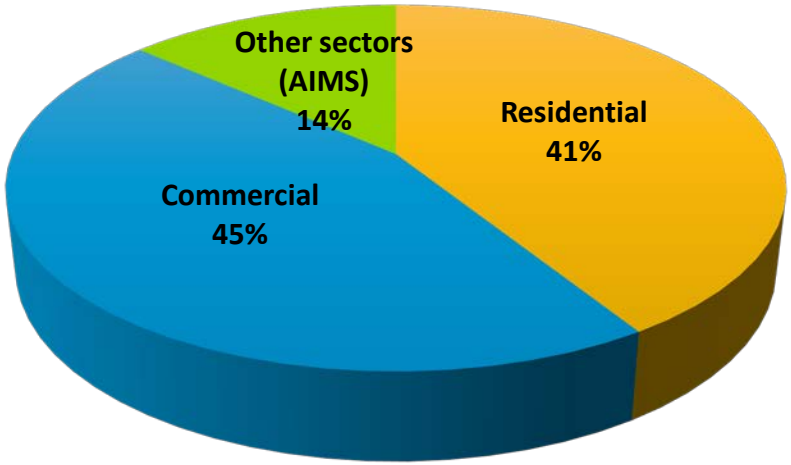
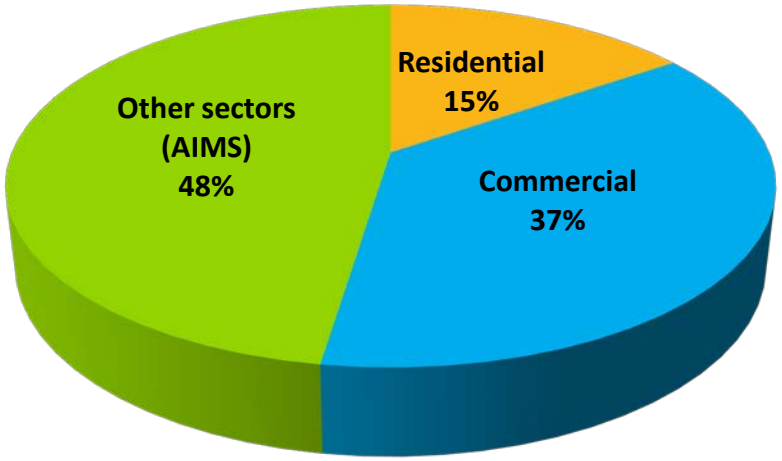
RESIDENTIAL AND COMMERCIAL SECTOR CONTRIBUTIONS IN IOU SAVINGS

Electric Savings from IOU Programs
2014 Ex Post First Year Gross kWh Savings



Gas Savings from IOU Programs
2014 Ex Post First Year Gross Therm Savings



Source: Ex Post 2014 IOU Program Data

- Approximately 85% of the total IOU electric savings come from residential and commercial sectors.
  - Commercial sector total electric savings is slightly greater than residential.
- Slightly more than 50% of the total IOU gas savings come from residential and commercial customers.
  - Commercial sector total gas savings is two and a half times that of residential.

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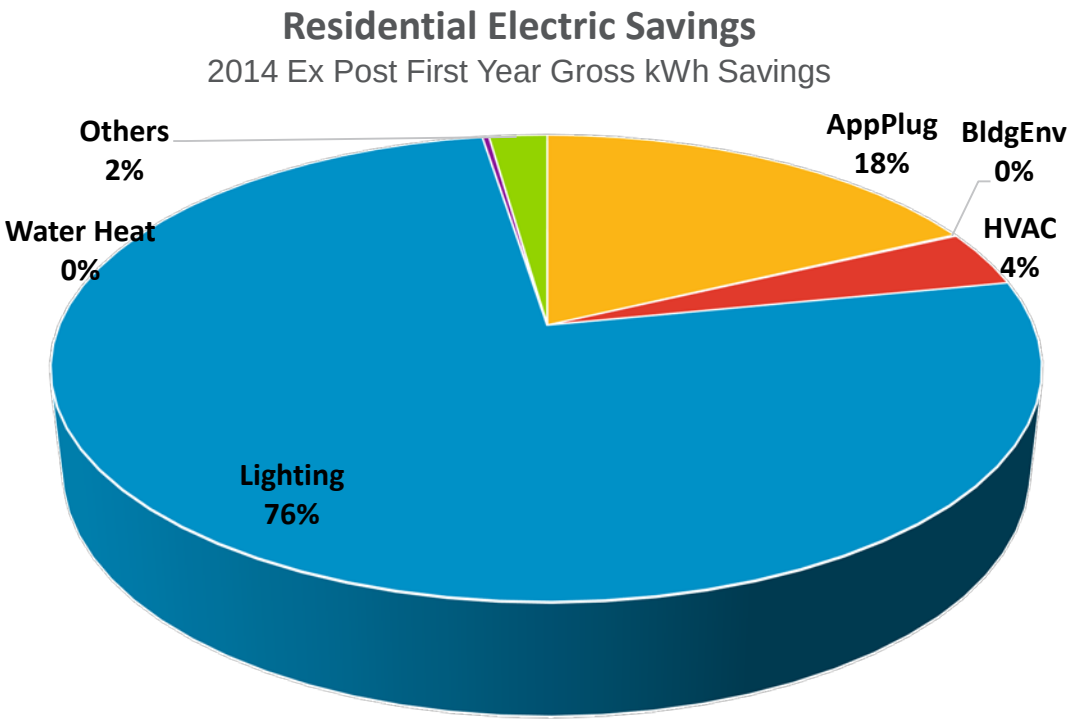
RESIDENTIAL ELECTRIC SAVINGS FROM IOU PROGRAMS



Source: Ex Post 2014 IOU Program Data

Breakup by end-use

- Lighting constitutes bulk (more than three-quarters) of the historic savings.
- Appliances and plug loads have significant contribution.
- Residential HVAC contribution in savings is less than 5%.

Representative measure groups

- Out of a total of ~80 measure groups represented under residential electric savings, more than **98% of the savings** come from **ONLY 30 measure groups.**

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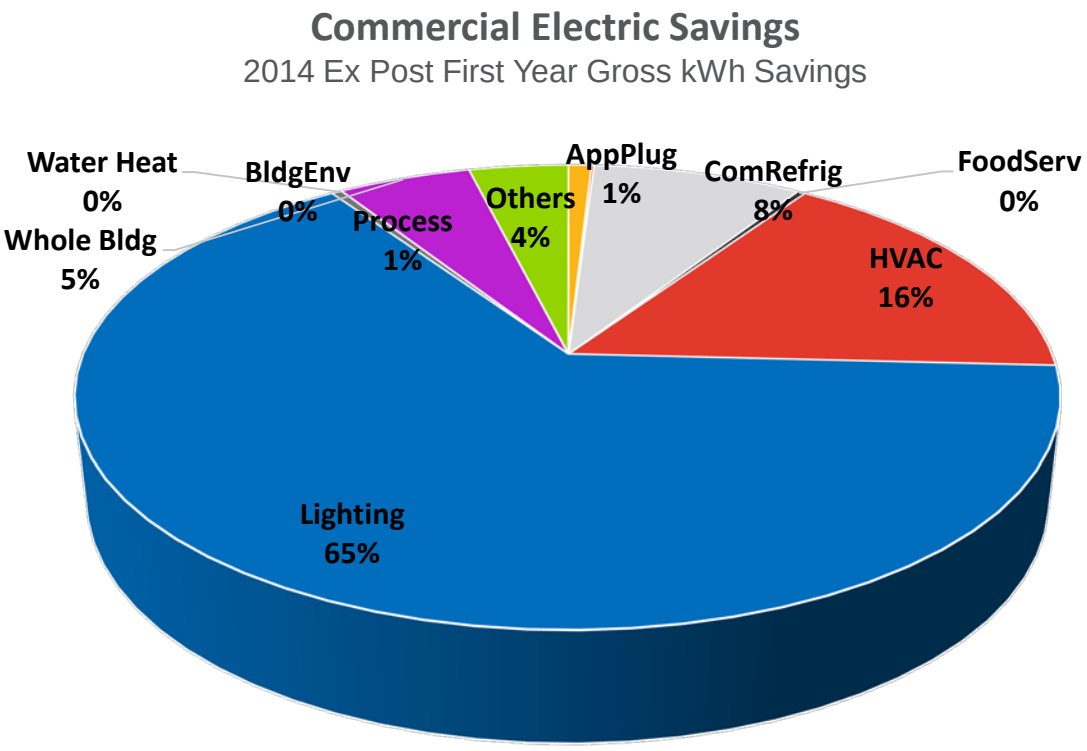
COMMERCIAL ELECTRIC SAVINGS FROM IOU PROGRAMS



Source: Ex Post 2014 IOU Program Data

Breakup by end-use

- Lighting constitutes bulk and whole building measure(~65%) of the historic savings.
- Commercial HVAC has significant savings.
- Other notable end-uses are commercial refrigeration and whole building measures.

Representative measure groups

- Out of a total of ~120 measure groups, represented under commercial electric savings, more than **98% of the savings** come from **ONLY 60 measure groups.**

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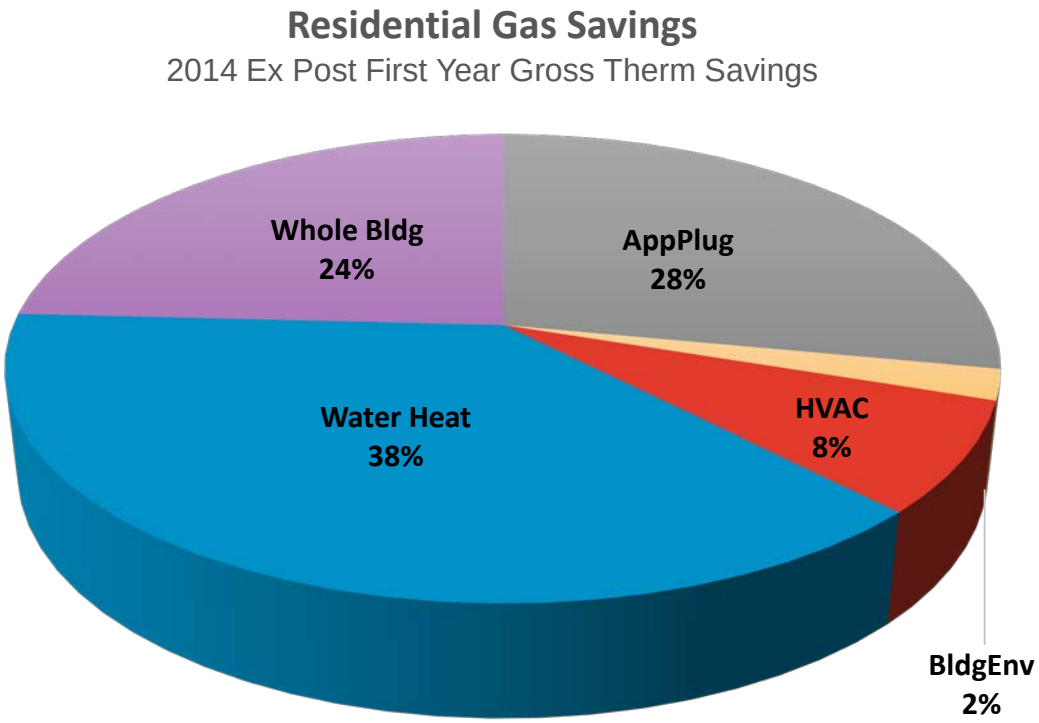
RESIDENTIAL GAS SAVINGS FROM IOU PROGRAMS



Source: Ex Post 2014 IOU Program Data

Breakup by end-use

- Water heating constitutes bulk (~40%) of the historic savings.
- Appliances and plug loads, and Whole Building measures have significant contribution.
- HVAC contribution in savings is less than 10%.

Representative measure groups

- Out of a total of ~40 measure groups represented under residential gas savings, more than **98% of the savings** come from **ONLY 15 measure groups.**

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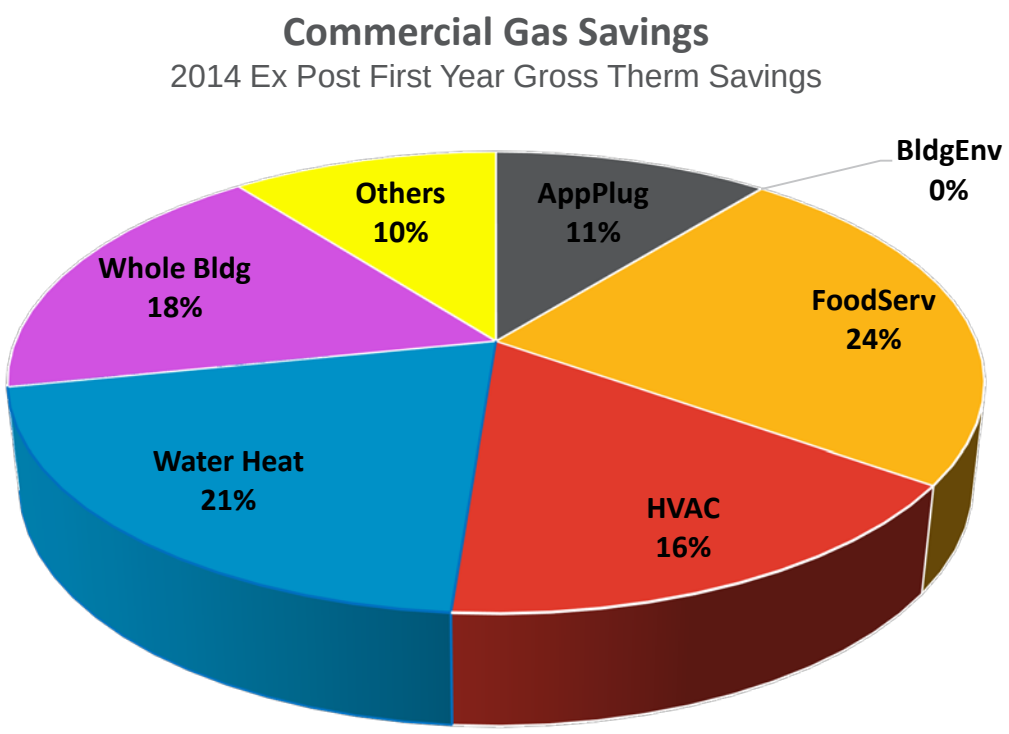
COMMERCIAL GAS SAVINGS FROM IOU PROGRAMS



Source: Ex Post 2014 IOU Program Data

Breakup by end-use

- Food Serve and Water Heating are the top contributors.
- Whole Building and HVAC contributions are significant.
- Appliances and plug loads have ~10% share.

Representative measure groups

- Out of a total of 60 measure groups represented under commercial gas savings, approx. **97% of the savings** come from **ONLY 30 measure groups.**

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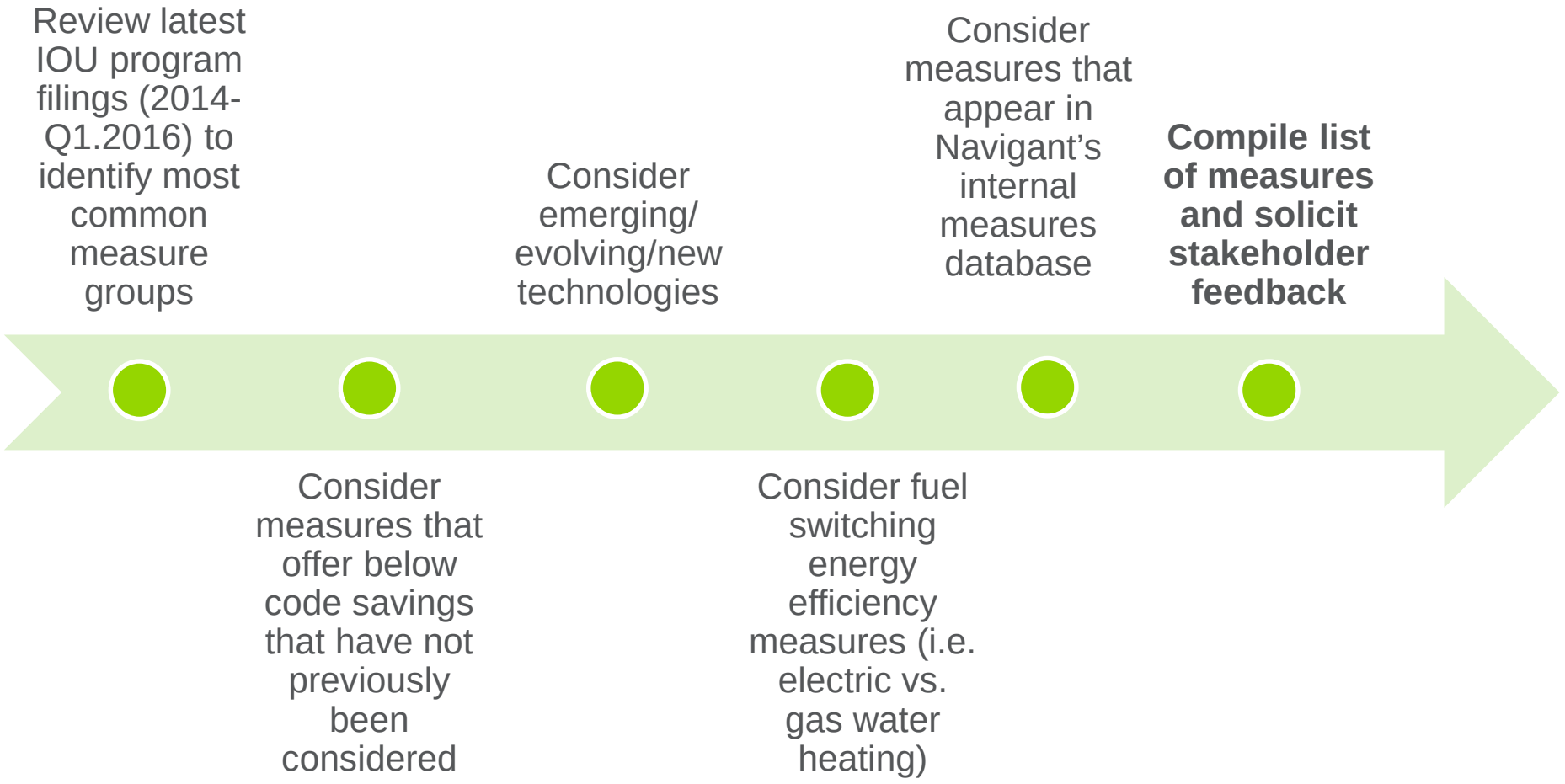
RESIDENTIAL/COMMERCIAL MEASURE SELECTION PROCESS

Process for Selecting Res/Com Measures



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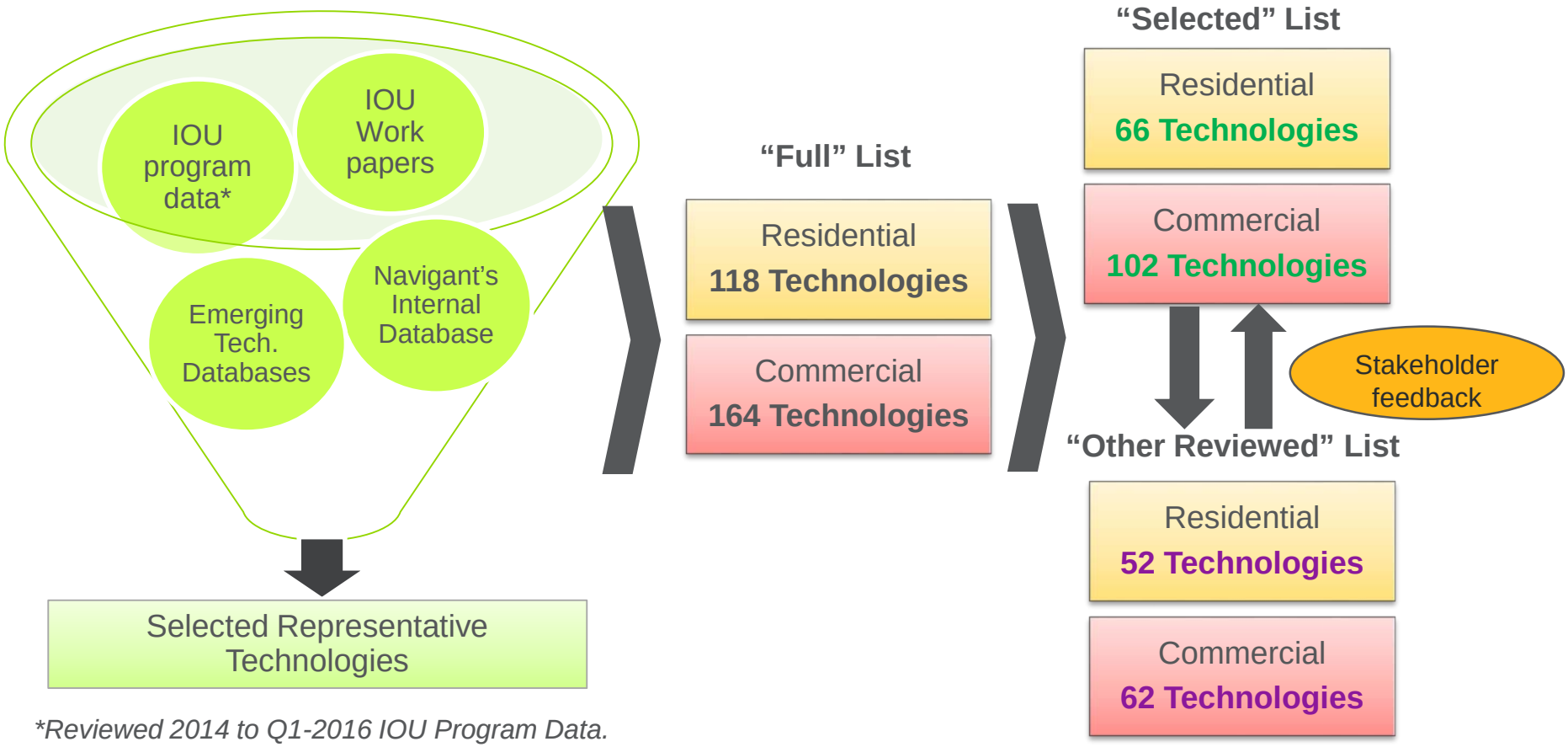
MEASURE SELECTION PROCESS DIAGRAM



**Reviewed 2014 to Q1-2016 IOU Program Data.*

Note that the current list of measures ONLY includes **"Technologies"**, and does not include "Interventions (BROS)" and "Whole Building Packages" (to be addressed in subsequent workshops).

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PLANNED DATA SOURCES AND HIERARCHY FOR MEASURE CHARACTERIZATION

Energy Use
1. DEER
2. IOU Workpapers i. With CPUC Disposition ii. Other Workpapers
3. CMUA TRM (from Cal TF)
4. CA IOU Emerging Technology Database
5. IOU Program Data
6. Non-California source examples: o Regional Technical Forum (RTF) from Pacific Northwest o Navigant's Internal Database

Saturation Values
1. California Lighting & Appl. Saturation Survey (CLASS)
2. Commercial Saturation Survey (CSS)
3. DEER
4. Commercial End-use Survey (CEUS)
5. Non-California source examples: o NEEA Residential Building Stock Assessment o Res. Energy Consumption Survey (RECS) o NEEA Comm. Building Stock Assessment o DOE Comm. Bldg. Energy Cons. Survey (CBECS)

Costs
1. CA Measure Cost Study
2. DEER
3. IOU Workpapers i. With CPUC Disposition ii. Other Workpapers
4. CMUA TRM (Cal TF)
5. IOU Program Data
6. Secondary Sources

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RES/COM MEASURES DATABASE REVIEW

- Review will be organized by Sector and End Use
- Two lists:
  - Selected Technologies
  - Other Reviewed Technologies
- Keep in mind data availability
- On to the spreadsheet…

	A	B	C	D
1	Sector	Fuel	End Use Category	Technology Name
2	Residential	Electric	AppPlug	Advanced Power Strip
3	Residential	Electric	AppPlug	Audio Equipment
4	Residential	Electric	AppPlug	Blu-Ray and DVD Players
5	Residential	Electric	AppPlug	Gas Clothes Dryer (Fuel Switch)
6	Residential	Electric	AppPlug	Clothes Washer Replacement (Electric)
7	Residential	Electric	AppPlug	Freezer Recycle
8	Residential	Electric	AppPlug	Heat Pump Clothes Dryer
9	Residential	Electric	AppPlug	Variable Speed Pool Pump
10	Residential	Electric	AppPlug	Refrigerator Replacement
11	Residential	Electric	AppPlug	Refrigerator Recycle
12	Residential	Electric	AppPlug	Set Top Boxes
13	Residential	Electric	AppPlug	Television Replacement
14	Residential	Gas	AppPlug	Clothes Washer Replacement (Gas)
15	Residential	Both	BldgEnv	Ceiling/Roof Insulation
16	Residential	Both	BldgEnv	High Performance Windows
17	Residential	Both	BldgEnv	Wall Insulation
18	Residential	Both	BldgEnv	Weatherization
19	Residential	Both	HVAC	Duct Sealing
20	Residential	Both	HVAC	HVAC Controls Upgrade
21	Residential	Both	HVAC	Programmable Thermostat

Read Me | Selected Technologies | Other Reviewed Technologies

READY

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AGRICULTURE, INDUSTRIAL, MINING AND STREETLIGHTING INPUTS

- **Convert** Industrial and Agriculture model inputs:
  - Convert to a Bass diffusion approach
  - Measure focused, bottoms-up
  - Select representative technologies

Source: SCE

- **Refresh** Mining and Street Lighting:
  - Currently structured with the Bass diffusion, bottoms-up methodology
  - Updating key measure inputs

Source: SCE

Industrial and Agriculture are a specific focus today

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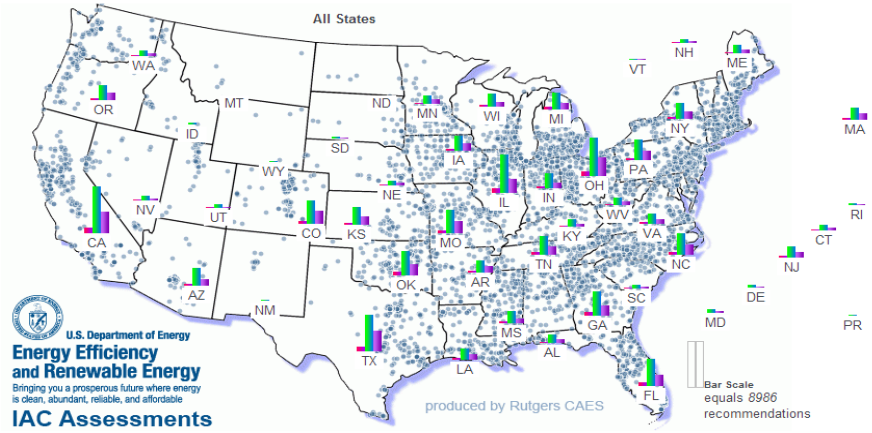
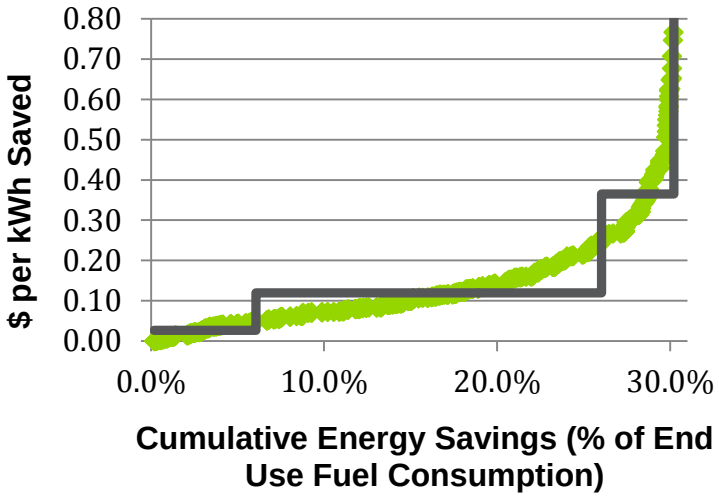
A BRIEF LOOK BACK AT THE PREVIOUS MEASURES/MODEL

- The previous study:
  - Industrial Assessment Centers (IAC)
    - The basis for Industrial measures
    - Informs some Agriculture measures



Source: DOE/IAC

Example: Lighting Equipment in Fabricated Metals (NAICS 332)



- Sourced data from approximately 1,000 assessments (audits) and 9,000 implementation recommendations
  - Created **167 supply curves** (subsector, end-use, fuel, measure type)

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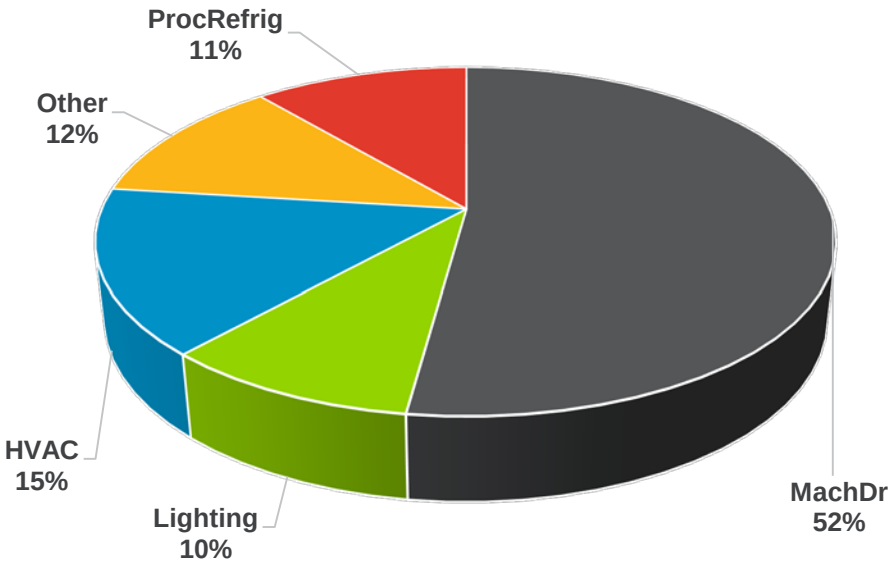
INDUSTRIAL END USES: WHERE IS CONSUMPTION?

- From previous study (QFER data, forecasts)

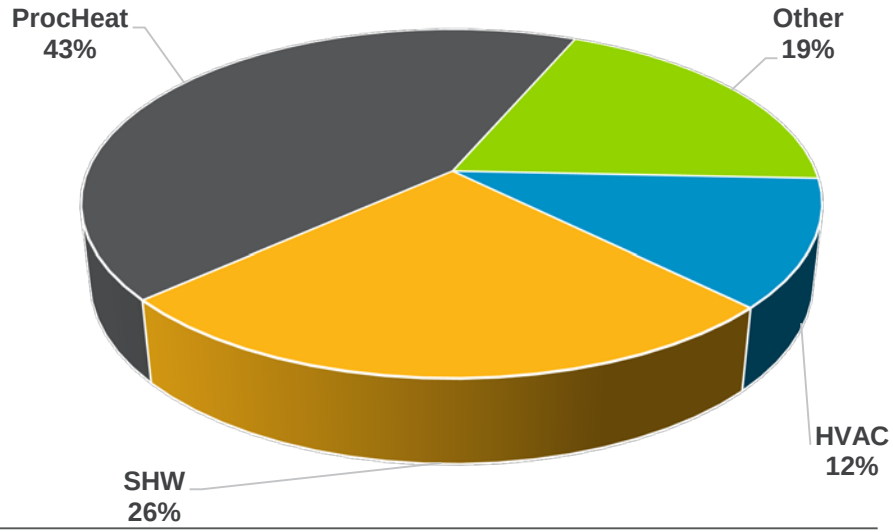
Industrial Electric Consumption

Approximation for 2006 to 2026



Industrial Gas Consumption

Approximation for 2006 to 2026



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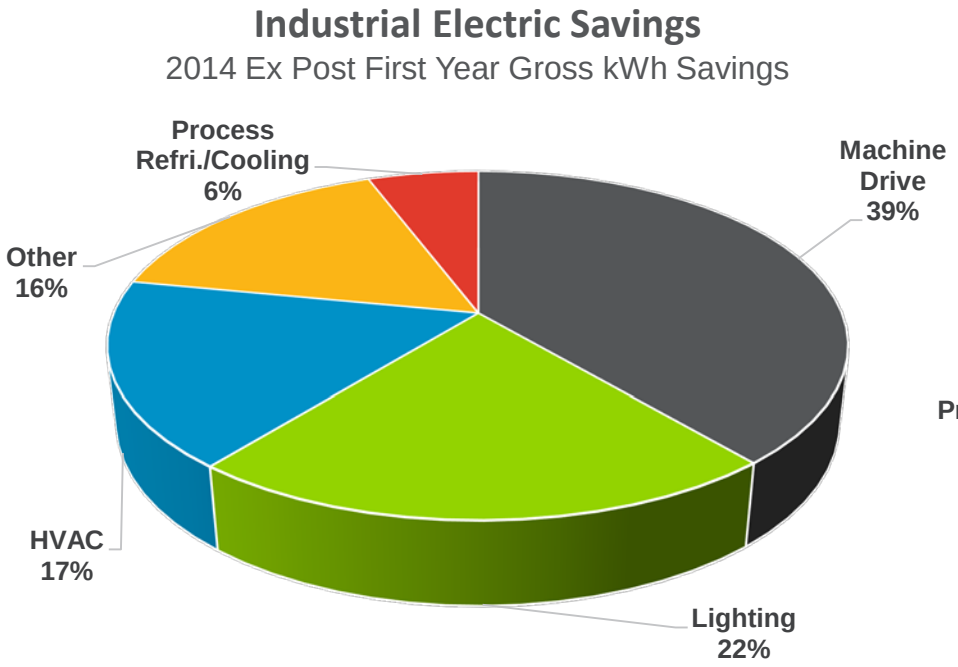
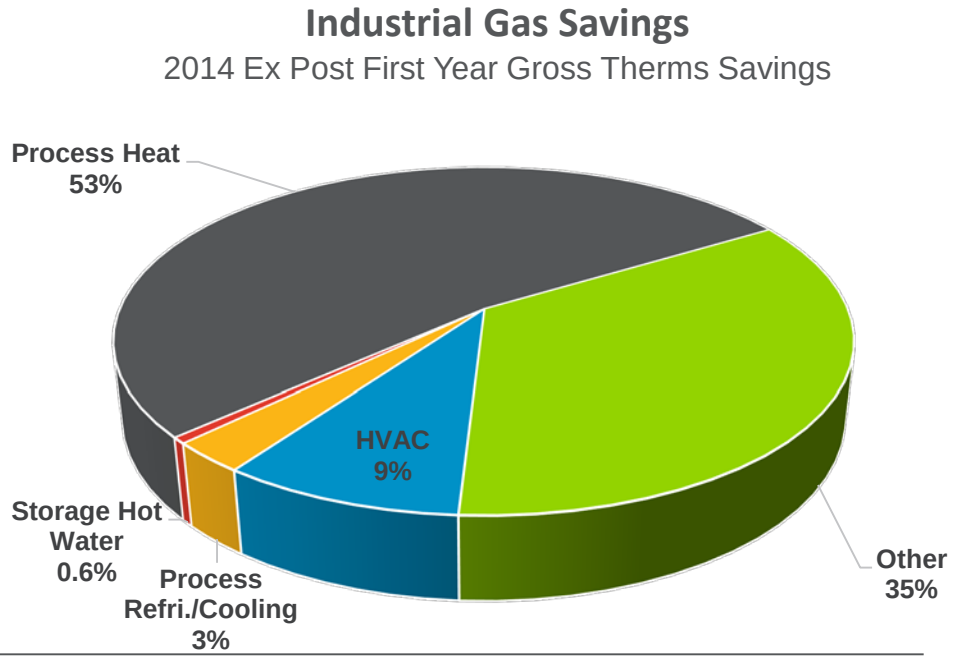
INDUSTRIAL END USES: WHAT HAVE PAST PROGRAMS TARGETED?

- From Navigant's review of EEStats/program data.





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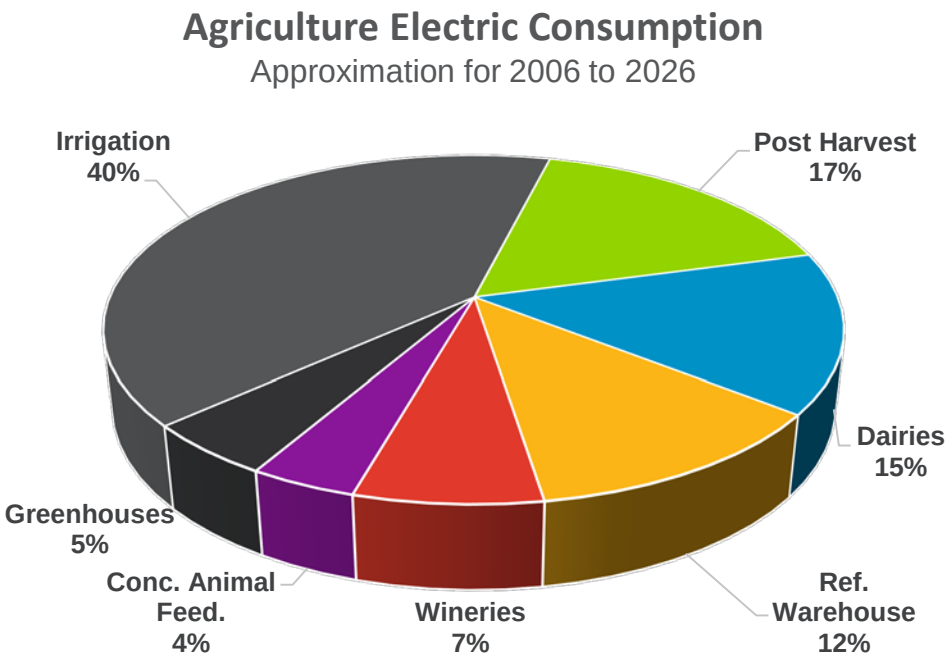
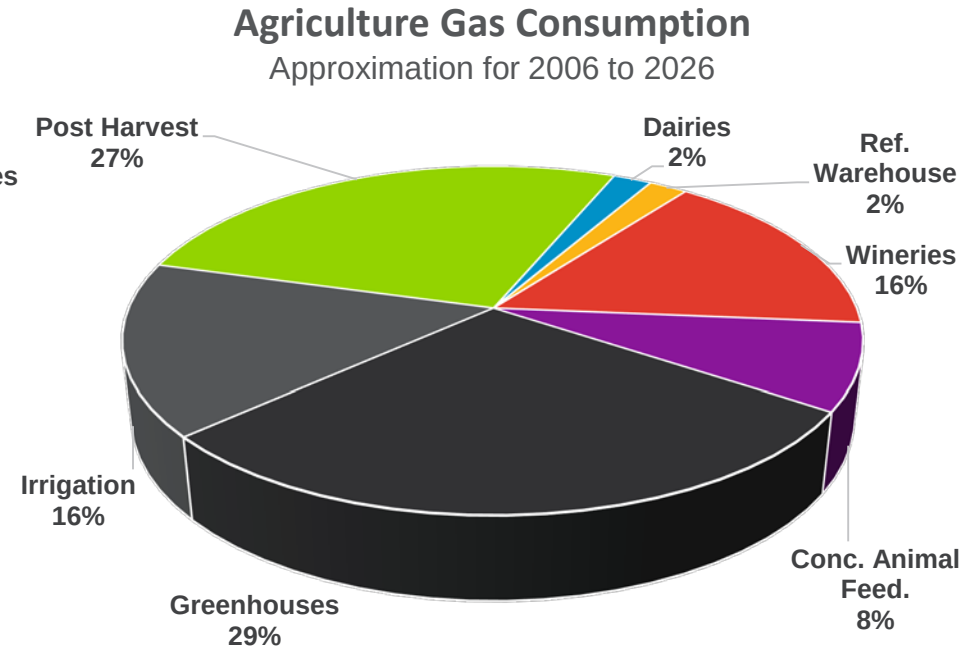
AGRICULTURE SUBSECTORS: WHERE IS CONSUMPTION?

- From previous study (QFER data, forecasts) [note: a subsector view]





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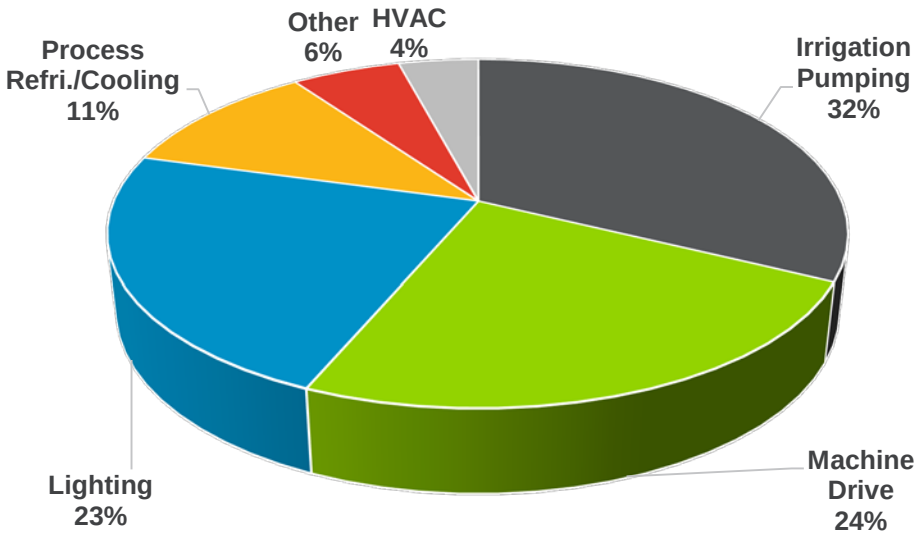
AGRICULTURE END USES: WHAT HAVE PAST PROGRAMS TARGETED?

- From Navigant's review of EEStats/program data.

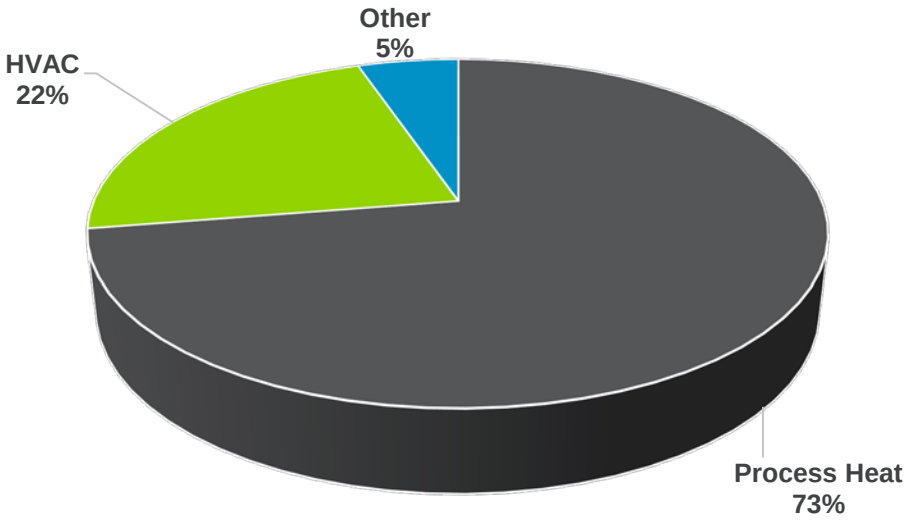
Agriculture Electric Savings

2014 Ex Post First Year Gross kWh Savings



Agriculture Gas Savings

2014 Ex Post First Year Gross Therms Savings



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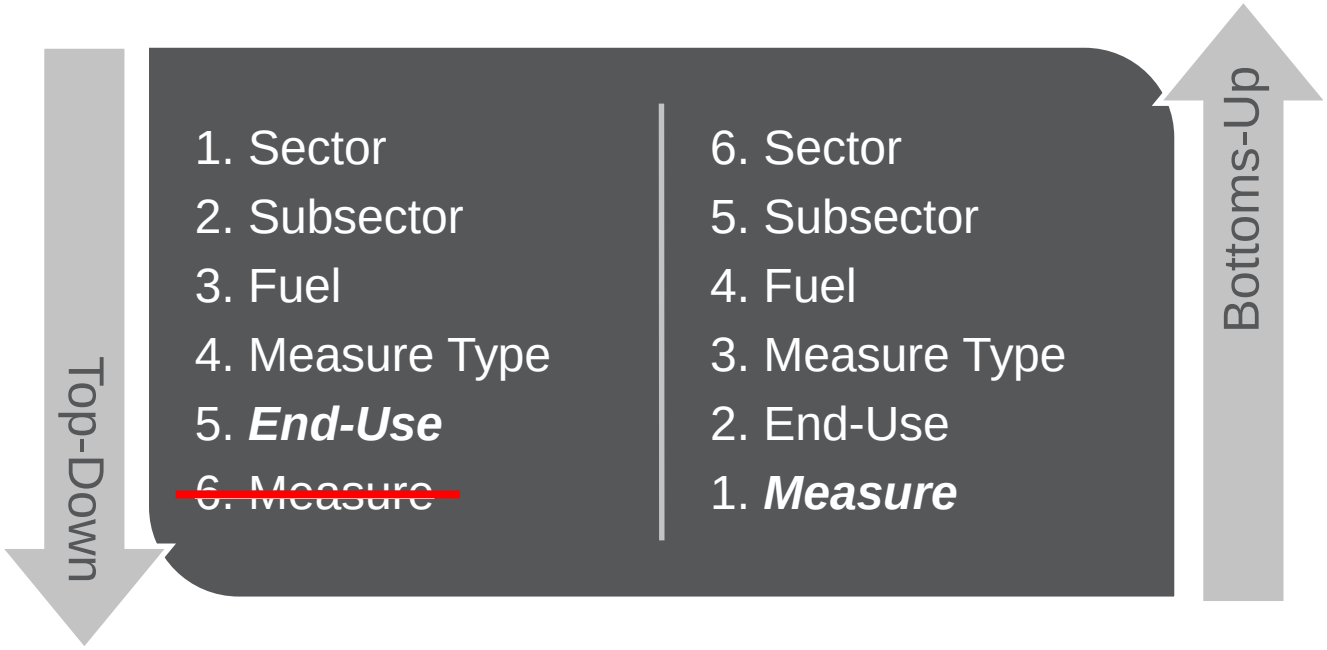
CONVERTING FROM TOP-DOWN TO BOTTOMS-UP

- The top-down approach only reached end-use characterizations
- For this update, starting at the bottom with measures
  - *The goal: Improve transparency, increase consistency with Residential/Commercial model, add granularity to facilitate stakeholder interaction*



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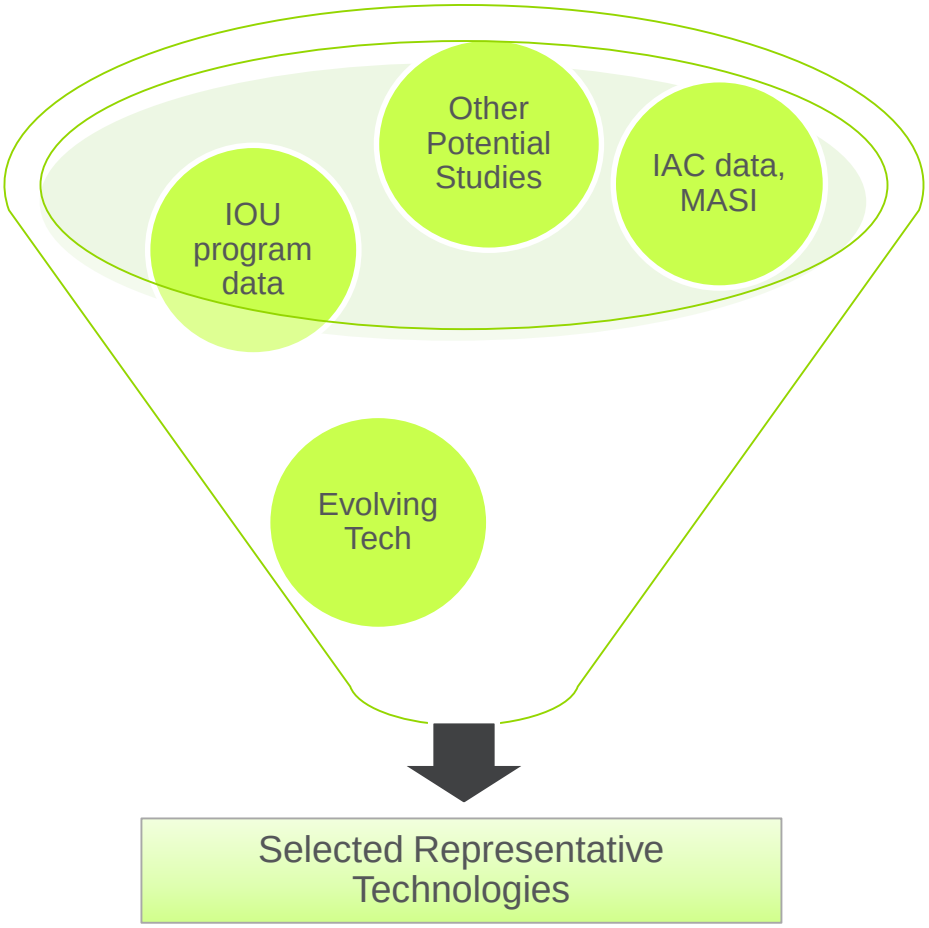
REPRESENTATIVE TECHNOLOGY SELECTION PROCESS

- Start with California program data
  - California Energy Efficiency Statistics (EEStats) serves as the basis
- Next, identify gaps and other technologies
  - Other potential studies outside of CA
  - Evolving Technologies
  - Industrial Assessment Center
    - Crossed-checked against the large database of IAC measure activity
  - Previous MASI studies



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ORGANIZING CALIFORNIA PROGRAM DATA

- Identify high impact or significant measure activities
  - EEStats data contains many **Measure Groups**, counts:
    - Industrial: 162
    - Agriculture: 119
  - Ranking Measure Groups by energy savings (separately for electric and gas)
    - Measure Groups represent anywhere from **~0% to 31% of savings activities**
  - Combine Measure Groups where appropriate and categorize as **Representative Technologies**
    - *Descriptions are limited for some (e.g., Process Other, Refrigeration Other)*

Measure Groups	Representative Technology
Refrigeration Condenser	Refrigeration System Optimization
Process Cooling	
Refrigeration Other	
Process Compressed Air Compressor	Compressed Air Optimization
Process Compressed Air System Configuration	
Process Compressed Air Controls	
Process Compressed Air VFD	
Process Compressed Air Other	

DEFINING AIMS MEASURES

- Representative Technologies will guide the measure characterization work that follows
  - Are the appropriate technology **applications** being targeted for measure development research?
  - What **subsectors (NAICS)** offer the most promise for adoption?
  - What **other** technology considerations can refine the Representative Technology description?

  - ***Any information or data you have would be very helpful to the team***

Measure characterization and related stakeholder engagement will also rely on other established descriptors to guide the process:

- End Use
- Measure Type
- Subsector (NAICS)

END USES

- End uses were identified in previous studies
  - Going forward: continue to rely on these to target potential and organize measure characterization

Industrial and Agriculture: End Uses	Examples
Lighting	Fixtures and controls
HVAC	Building/shell related
Machine Drives (motors and related)	Air compressors, belt drives, process motors (excludes Ag Irrigation)
Irrigation Pumping	Irrigation
Process Heating	Process related, food processing (heat recovery)
Process Refrigeration/Cooling/Water Cooling	Process related, food/milk, refrigeration
Storage Hot Water	Process related, food processing
Other Process (non-Machine Drive)/Other and Miscellaneous	Other process

MEASURE TYPES

- Equipment and Operational Efficiency
  - The technologies presented to stakeholders here relate to both measure types
  - Equipment: typically relates to deemed measures
  - Operational Efficiency:
    - Category: **Behavioral, Retrocommissioning, Operational technologies (BROs)**
      - Custom (beyond custom equipment that can be readily characterized)
      - Strategic Energy Management (SEM)
      - Continuous Energy Improvement (CEI)
      - Other Operational Efficiency opportunities as they may relate to AB802 or other efforts not currently represented by IOU EE activities

- Technology implementations related to **Equipment** appear to represent the majority of IOU program activities

Operational Efficiency will be explored further during a future stakeholder workshop

SUBSECTORS

- Subsectors defined by NAICS were identified in previous studies
  - [Similar to end uses] Going forward: continue to rely on these to target potential and organize measure characterization

Industrial Subsectors	Industrial NAICS	Agriculture Subsectors	Agriculture NAICS
Petroleum	324	Irrigated Agriculture	1111, 1119, 1112, 1113
Food	311, 312	Post-Harvest Processing	115114, 115111
Electronics	334, 335	Dairies	112120
Stone-Glass-Clay	327	Refrigerated Warehouses	493120
Chemicals	325	Wineries and Vineyards	111332
Plastics	326	Concentrated Animal Feeding Operation	112
Fabricated Metals	332	Greenhouses	1114
Primary Metals	331		
Industrial Machinery	333		
Transportation Equipment	336		
Paper	322		
Printing & Publishing	323, 511, 516		
Textiles	313, 314, 315, 316		
Lumber & Furniture	337, 321, 1133		
All Other Industrial	339		

PLANNED DATA SOURCES AND HIERARCHY FOR MEASURE CHARACTERIZATION

- California-specific data will be the focus.
- Other data sources will be used to supplement.

Data Sources (Energy Use, Market Characteristics [e.g., saturations], Costs, etc.)
CA DEER
CA IOU Workpapers i. With CPUC Disposition ii. Other Workpapers
CMUA TRM (from Cal TF)
CA Measure Cost Study
CA MASI Studies
CA IOU Emerging Technology Database
CA IOU Program Data
Other CA Studies (Evaluations, Market Assessments/Characterizations, etc.)
DOE Industrial Assessment Center (IAC)
Other Non-California Secondary Sources, examples: o Regional Technical Forum (RTF) from Pacific Northwest o Other Industrial/Agriculture Potential Studies o Navigant's Internal Database

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AIMS MEASURES DATABASE REVIEW

- Review will be organized by Sector and End Use
- Two lists:
  - Selected Technologies
  - Other Reviewed Technologies
- Keep in mind data availability
- On to the spreadsheet…

	A	B	C	D
1	Sector	Fuel	End Use Category	Technology Name
170	Industrial	Electric	Other	Process Optimization Controls
171	Industrial	Electric	MachDr	Injection Molding
172	Industrial	Electric	MachDr	Process Vacuum Pump
173	Industrial	Electric	MachDr	Fan VFD
174	Industrial	Electric	MachDr	Pump VFD
175	Industrial	Electric	MachDr	Pump Sizing and Optimization
176	Industrial	Electric	MachDr	Air Compressor Leak Repair
177	Industrial	Electric	MachDr	Air Compressor Control and Optimization
178	Industrial	Electric	MachDr	VFD Air Compressor
179	Industrial	Electric	MachDr	Wastewater Aerators (in Industrial Facilities: Food, Paper, Lumber)
180	Industrial	Electric	MachDr	Premium Motors
181	Industrial	Electric	Lighting	Lighting Upgrades- LED
182	Industrial	Electric	Lighting	Lighting Upgrades- Other
183	Industrial	Electric	Lighting	Lighting Controls
184	Industrial	Electric	HVAC	HVAC System Controls
185	Industrial	Electric	HVAC	HVAC VFD Upgrade
186	Industrial	Electric	HVAC	HVAC Equipment Upgrade
187	Industrial	Electric	HVAC	HVAC Chiller Upgrade
188	Industrial	Gas	HVAC	HVAC Equipment Upgrade
189	Industrial	Electric	ProcRefrig	Refigeration System Optimization

Read Me | Selected Technologies | Other Reviewed Technologies | ...

READY 42 OF 229 RECORDS FOUND

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NEXT STEPS AND CLOSING

- Next Steps
  - Collect comments from stakeholders
  - Comments will inform Navigant's final representative measure selection
  - Measure characterization will start immediately after final selection

- Reminder for feedback:
  - Are we missing measures in our selected list?
  - Are some measures no longer relevant?
  - If you are suggesting new measures, please point us to data (savings, cost, EUL, market share) to help the team.
  - Are there other data sources beyond those listed we should consider for measure characterization?

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