NAVIGANT

ENERGY

2015 California Potential and Goals Study

Draft Results Presentation to DAWG

March 17, 2015

Content of Report

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Four primary uses of the 2015 and Beyond Potential Study correspond to the four task descriptions that will be used throughout the project.

» **Task 1: Potential and Goals Study Update**
  – Inform IOU goals

Topic of today's meeting

» **Task 2: Additional Achievable Energy Efficiency (AAEE) Savings Forecast**
  – Inform planning efforts of the CPUC, CEC, and CAISO

» **Task 3: Energy Efficiency Targets for Greenhouse Gas Reductions**
  – How can IOU programs and energy efficiency can help meet AB32 goals?

» **Task 4: Metrics to Support the Strategic Plan Update**
  – Support development of strategic plan by providing potential analysis

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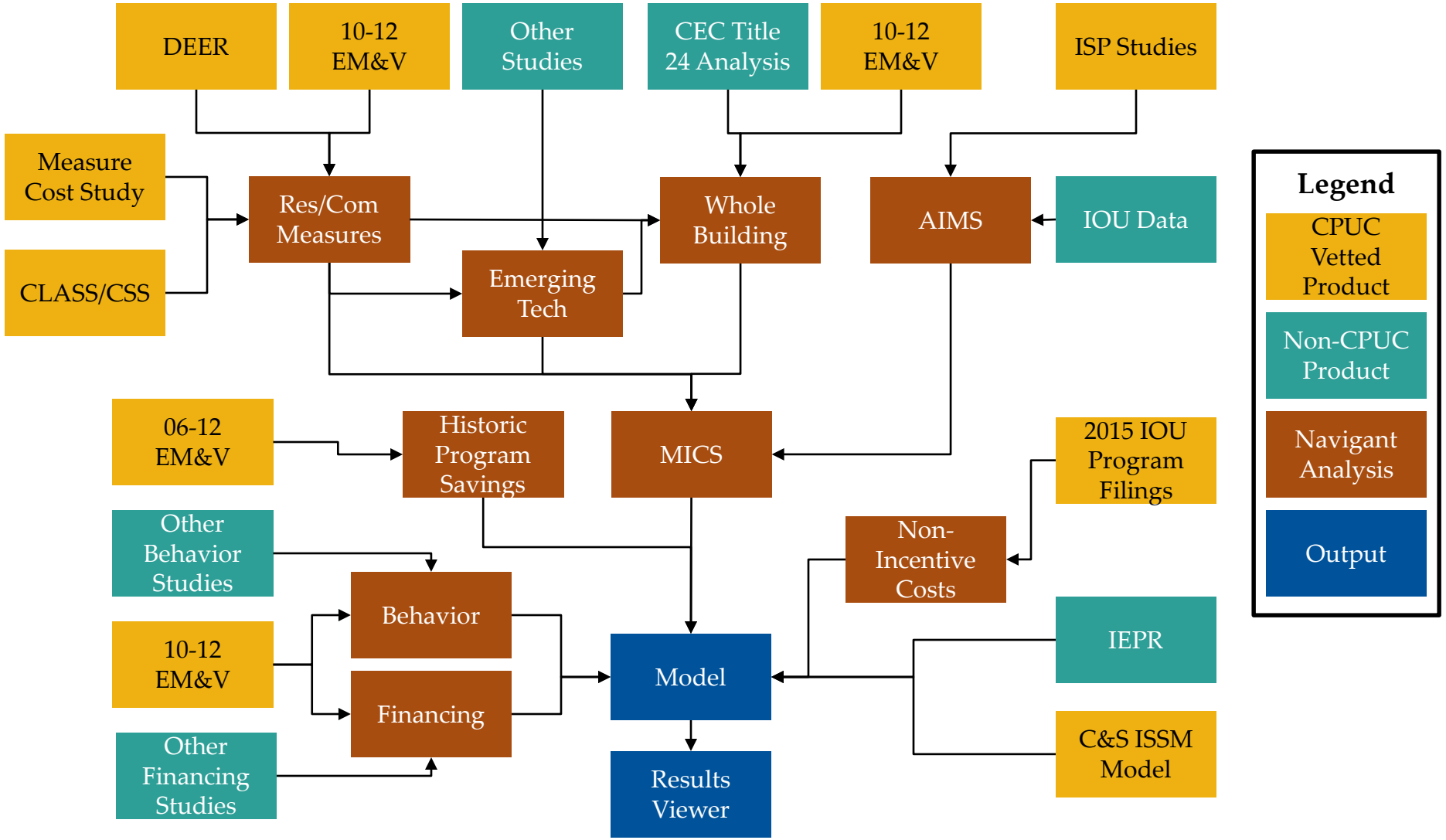
This is one of multiple stages to the 2015 Potential and Goals Study; Stage 1 was primarily focused on updating data inputs.

» Stage 1 incorporates the following data:
- 2015 DEER
- 2010-12 EM&V studies
- Measure Cost Study
- CLASS/CSS Saturation Studies
- IEPR Data: Retail Rates, Building Stock, and Energy Consumption Forecasts
- New research on behavior and financing
- CPUC vetted Industry Standard Practice Studies
- Updated data on the street lighting market
- Updated program cost data (non-incentive costs)

» The modeling methodology remains the same as the 2013 goals and potential study.
- See the 2013 study report for more details. Available at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm

» Stage 2 will consider additional data updates and methodology changes

Data Update Mapping



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The results we present today are for the Mid-Case Scenario; the Mid-Case Scenario informs the goal setting process.

» The Mid Case scenario matches the same scenario assumptions used in the 2013 study

» We have not run the model or vetted the low or high case scenarios given the project timeline constraints. Low and high model runs will be prepared to inform CEC forecasting.

Metric	Low EE Penetration	Mid EE Penetration	High EE Penetration
Building Stock	High Demand Case from 2014 IEPR	Mid Case from 2014 IEPR	Low Demand Case from 2014 IEPR
Retail Prices	High Demand Case from 2014 IEPR	Mid Case from 2014 IEPR	Low Demand Case from 2014 IEPR
Avoided Costs	High Demand Case from 2014 IEPR	Mid Case from 2014 IEPR	Low Demand Case from 2014 IEPR
UES	Estimate minus 25%	Best Estimate UES	Estimate plus 25%
Incremental Costs	Estimate plus 20%	Best Estimate Costs	Estimate minus 20%
Incentive Level	25% of incremental cost	50% of incremental cost	Varies by market maturity
TRC Threshold	1	0.85	0.75
ET TRC Threshold	0.85	0.5	0.4
Measure Densities	Best estimate minus 20%	Best Estimate	Best estimate plus 20%
Marketing Effect	1%	2%	3%
Word of Mouth Effect	39%	43%	47%
Implied Discount Rate (Non-Res)	20%	18%	14%
Implied Discount Rate (Res)	70%	63%	50%
C&S Policy View	On-the-Books Initiatives	Expected Initiatives	Possible Initiatives
Code compliance	No compliance enhancements	Compliance enhancements	Compliance enhancements
Title 24 Tiers Included	2005, 2008, 2013	2005, 2008, 2013, 2016	2005, 2008, 2013, 2016, 2019, 2022
Title 20 Tiers Included	2005, 2006, 2008, 2009, 2011	2005, 2006, 2008, 2009, 2011, 2013, 2016	2005, 2006, 2008, 2009, 2011, 2013, 2016
Federal Standards Included	Already adopted	Already adopted	Already adopted and possible future standards

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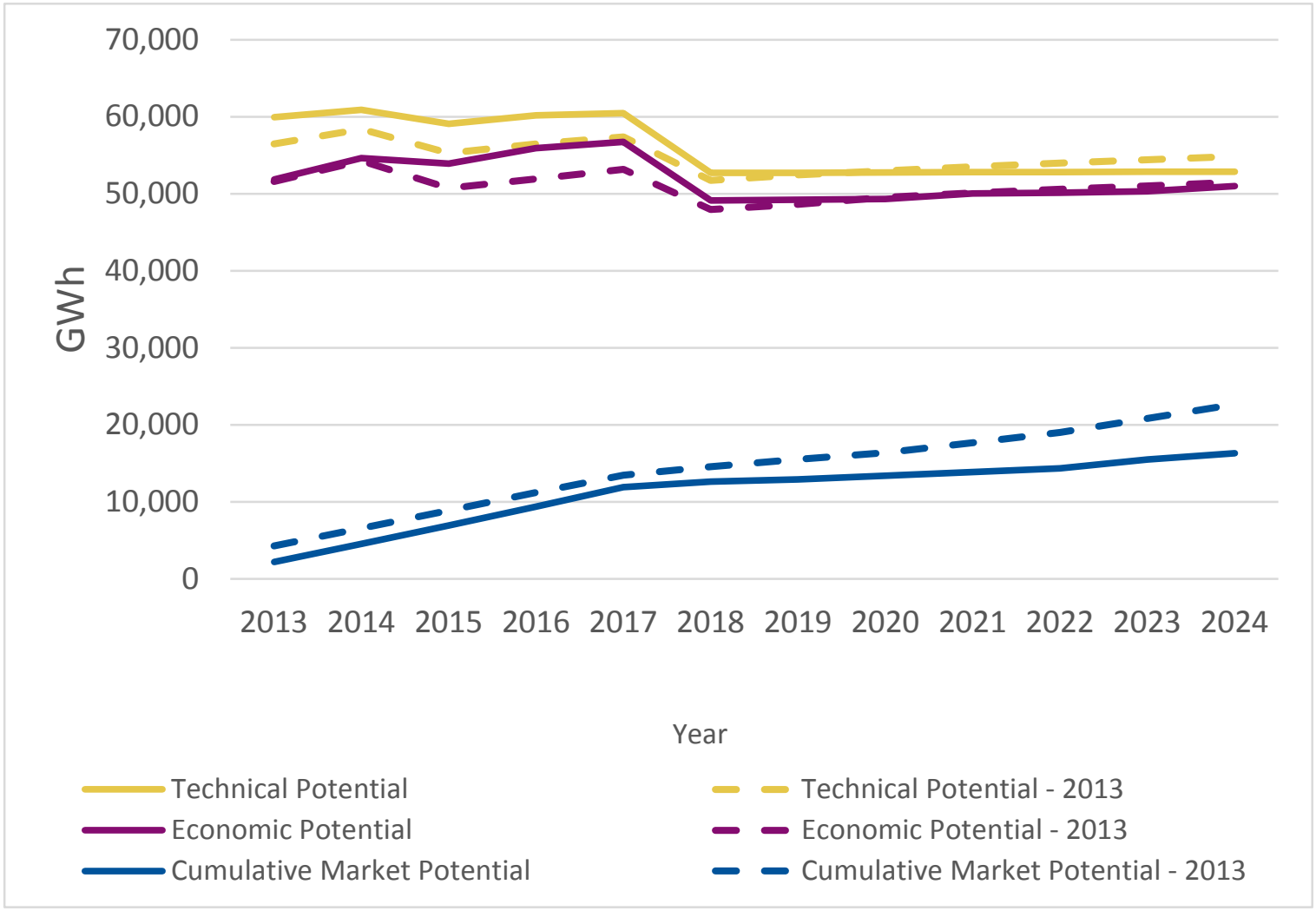
All IOUs: Technical, Economic, and Cumulative Market Potential – 2013 vs. 2015 Study (GWh)



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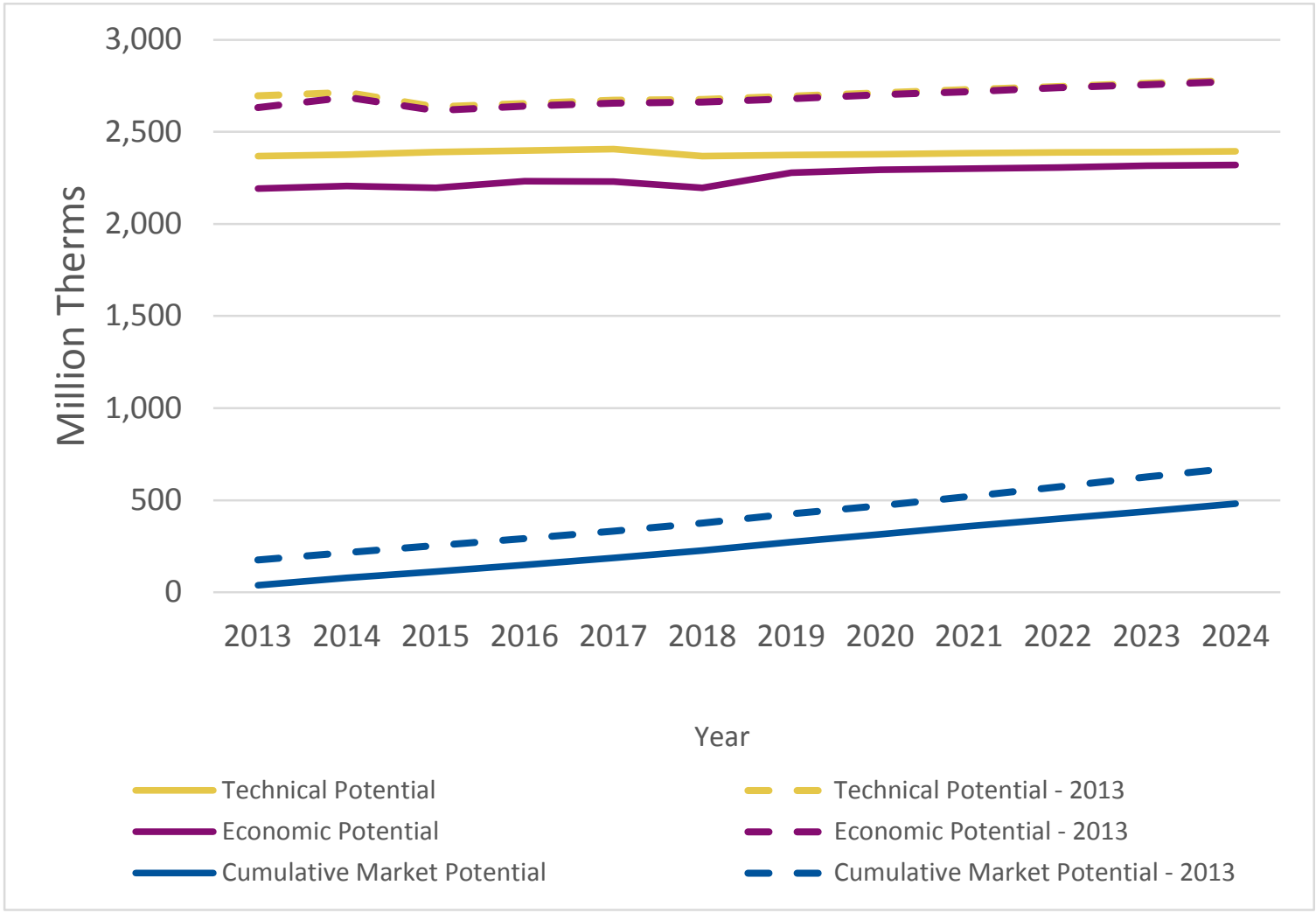
All IOUs: Technical, Economic, and Cumulative Market Potential – 2013 vs. 2015 Study (MM Therms)



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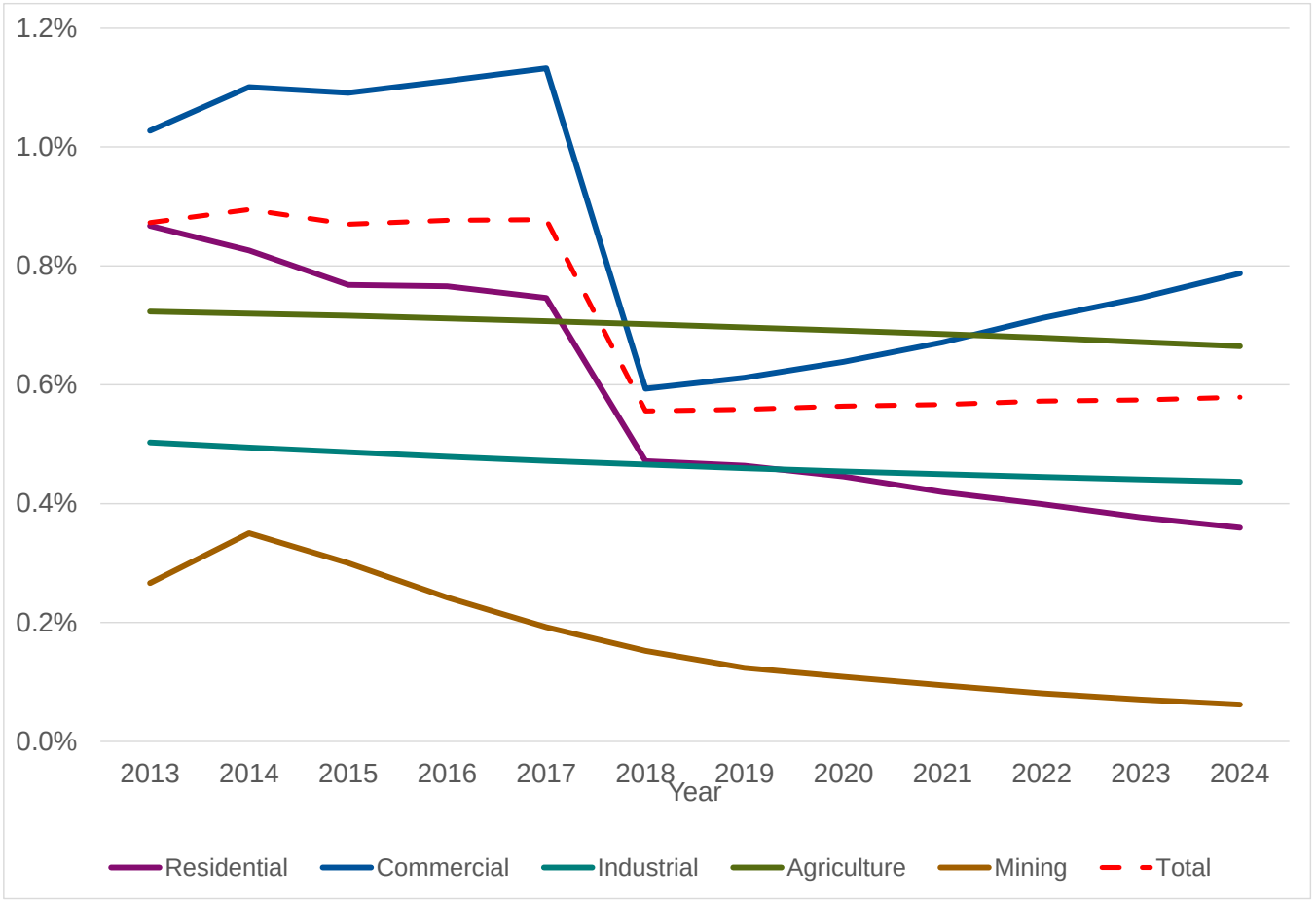
All IOUs: Incremental Market Potential as a Percent of Electric Consumption



Streetlighting is not displayed for ease of viewing trends in other sectors; it averages at 5%. Behavior programs savings are included, C&S program savings are excluded.

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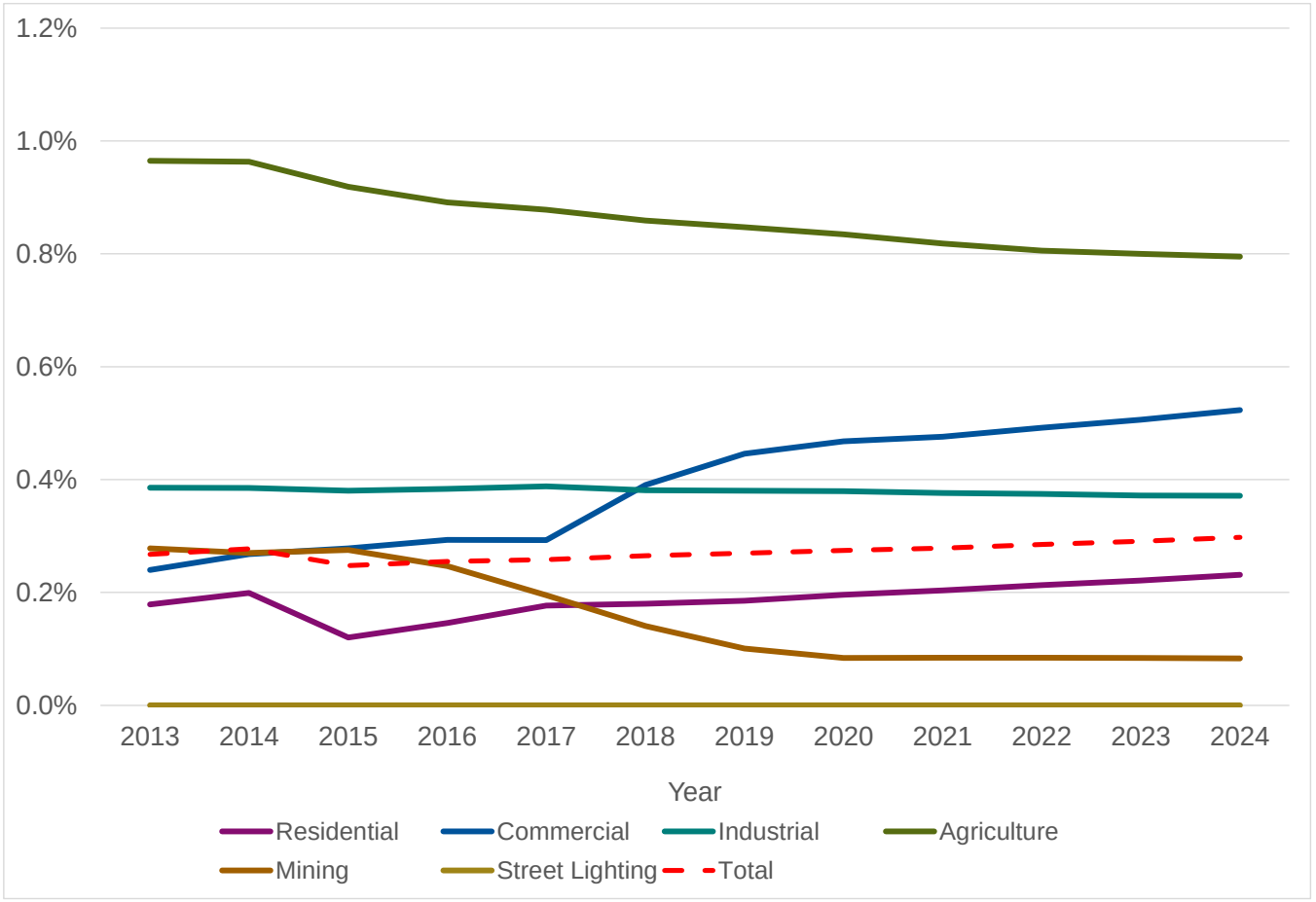
All IOUs: Incremental Market Potential as a Percent of Natural Gas Consumption



Behavior programs savings are included, C&S program savings are excluded.

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Multiple draft deliverables are available to stakeholders for review in addition to this slide deck.

» 2015 Potential and Goals Model (Analytica model file)

» 2015 Potential and Goals Results viewer (Excel spreadsheet)

» 2015 MICS – measure inputs to model, measure descriptions and source documentation (Excel spreadsheet)

» AIMS market data and adjustment factors (Excel spreadsheet)

» Codes and Standards Impact Vectors (Excel spreadsheet)

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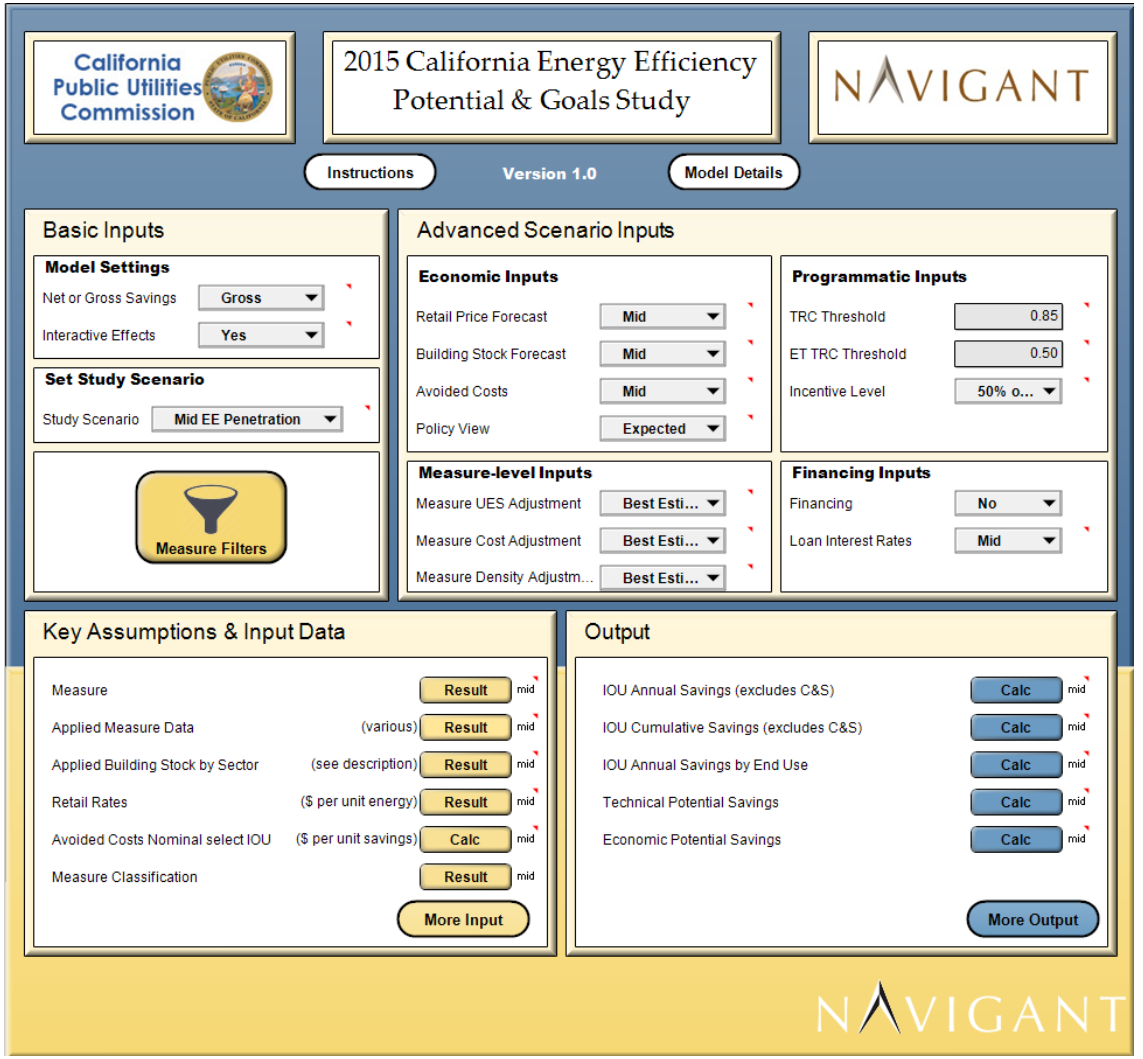
The Navigant team maintained the core Analytica modeling platform from the 2013 study improving its operation.

- All key features of the 2013 Model remain:
  - Bass diffusion adoption algorithms
  - Variable sensitivity analysis
  - IOU, sector, end use, and measure level results
  - Flexibility for users to run alternate scenarios
- Users should download and install the latest version of Analytica's free player:

http://downloads.analyticaonline.com/ana/Ana64Setup4_53.exe



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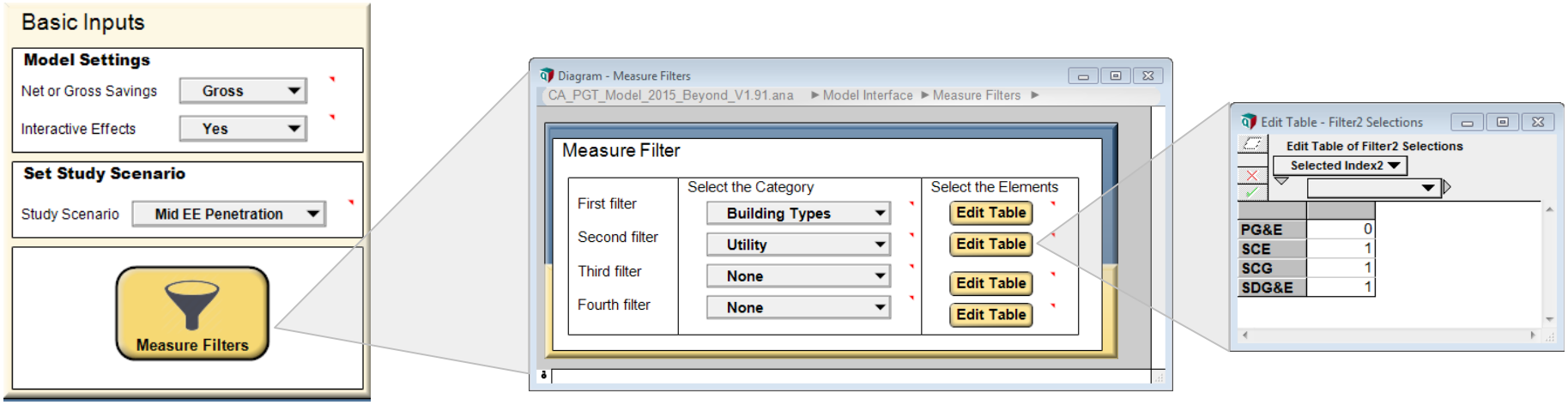
Several model updates have been made to enhance user experience.

» Measure Filters

– Users can filter measures on four different categories (Building Types, Utility, Measure Name, Vintage)



» Model Size and minimum RAM requirements

– Model file size reduced by a factor of 16 (now 56 MB; 2 MB when zipped)

– Model requires a 64 bit Windows OS with minimum 4 GB of RAM.

– Mode includes new functionality to reduce memory usage when running multiple sectors. However, this can increase run times. It is recommended to run the model one sector at a time to keep memory usage low while allowing for reasonable run times.

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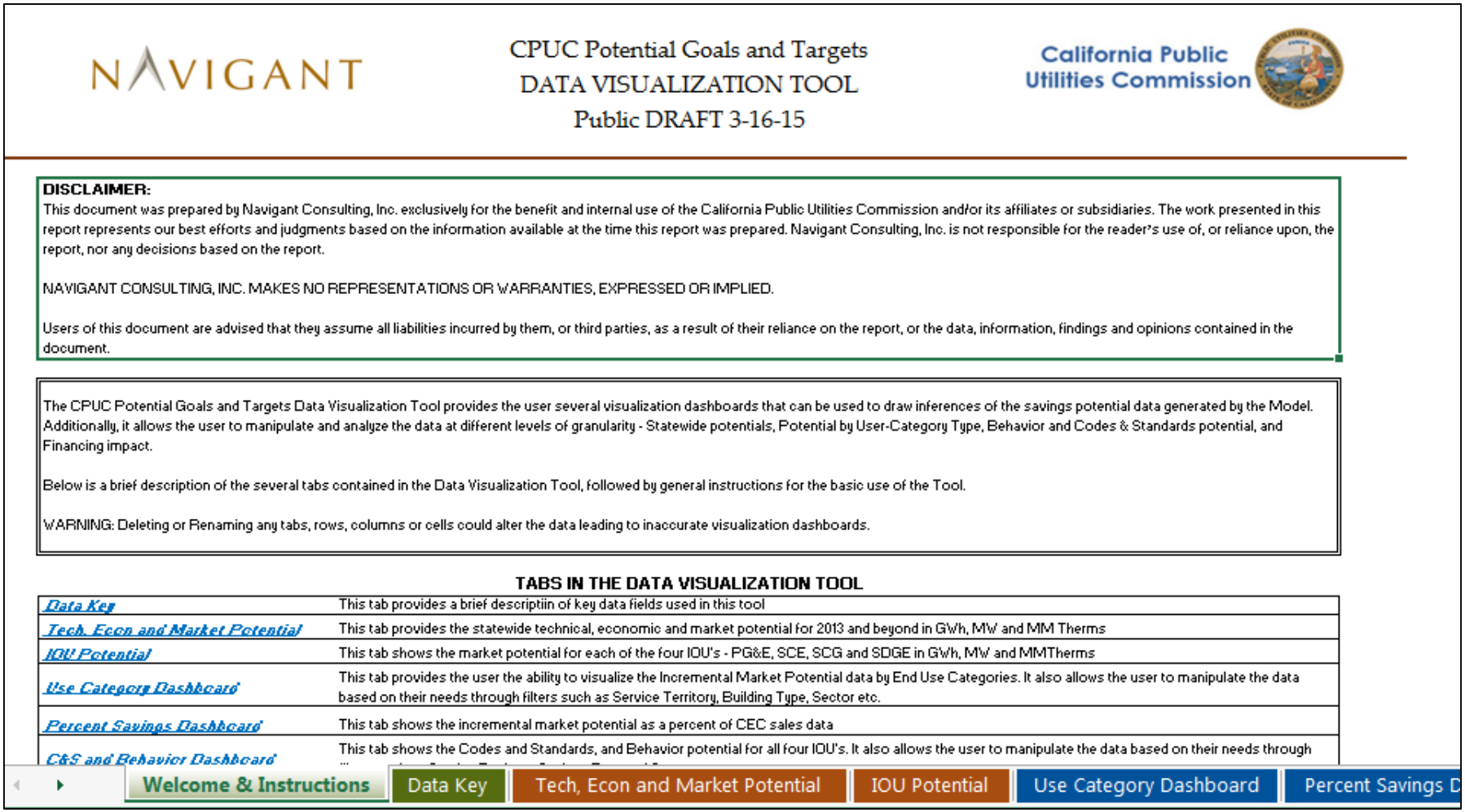
The Navigant team developed a results viewer to help stakeholders review results for the mid-case without having to run the model.



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CPUC Potential Goals and Targets
DATA VISUALIZATION TOOL
Public DRAFT 3-16-15

California Public Utilities Commission

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The CPUC Potential Goals and Targets Data Visualization Tool provides the user several visualization dashboards that can be used to draw inferences of the savings potential data generated by the Model. Additionally, it allows the user to manipulate and analyze the data at different levels of granularity - Statewide potentials, Potential by User-Category Type, Behavior and Codes & Standards potential, and Financing impact.

Below is a brief description of the several tabs contained in the Data Visualization Tool, followed by general instructions for the basic use of the Tool.

WARNING: Deleting or Renaming any tabs, rows, columns or cells could alter the data leading to inaccurate visualization dashboards.

TABS IN THE DATA VISUALIZATION TOOL

Data Key	This tab provides a brief descriptiin of key data fields used in this tool
Tech, Econ and Market Potential	This tab provides the statewide technical, economic and market potential for 2013 and beyond in GWh, MW and MM Therms
IOU Potential	This tab shows the market potential for each of the four IOU's - PG&E, SCE, SCG and SDGE in GWh, MW and MMTherms
Use Category Dashboard	This tab provides the user the ability to visualize the Incremental Market Potential data by End Use Categories. It also allows the user to manipulate the data based on their needs through filters such as Service Territory, Building Type, Sector etc.
Percent Savings Dashboard	This tab shows the incremental market potential as a percent of CEC sales data
C&S and Behavior Dashboard	This tab shows the Codes and Standards, and Behavior potential for all four IOU's. It also allows the user to manipulate the data based on their needs through

Welcome & Instructions | Data Key | Tech, Econ and Market Potential | IOU Potential | Use Category Dashboard | Percent Savings D

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The results viewer is structured with multiple tabs to view summary results as well as detailed model outputs.

Results Viewing

- Data Key
- Technical, Economic and Market Potential
- IOU Potential
- Use Category Dashboard
- Percent Savings Dashboard
- C&S and Behavior Dashboard
- Financing Dashboard

Detailed Model Outputs

CEC Sales Data	Incremental Codes and Standards
Incremental Market Potential	Cumulative Codes and Standards
Technical Potential	Behavior
Economic Potential	Incremental Market Potential Financing
Cumulative Market Potential	Cumulative Market Potential Financing

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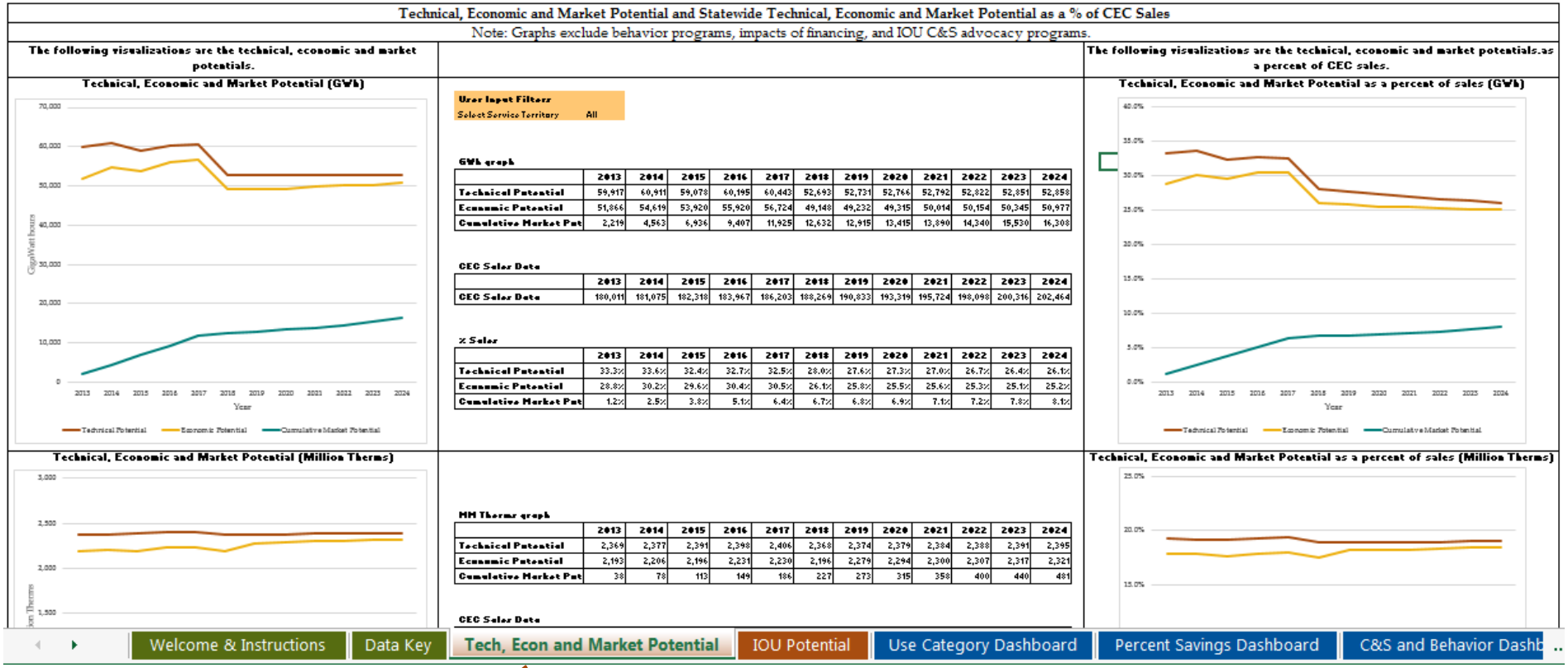
Several tabs focus on high level data (i.e. technical, economic, and cumulative market potential).



Technical, Economic and Market Potential

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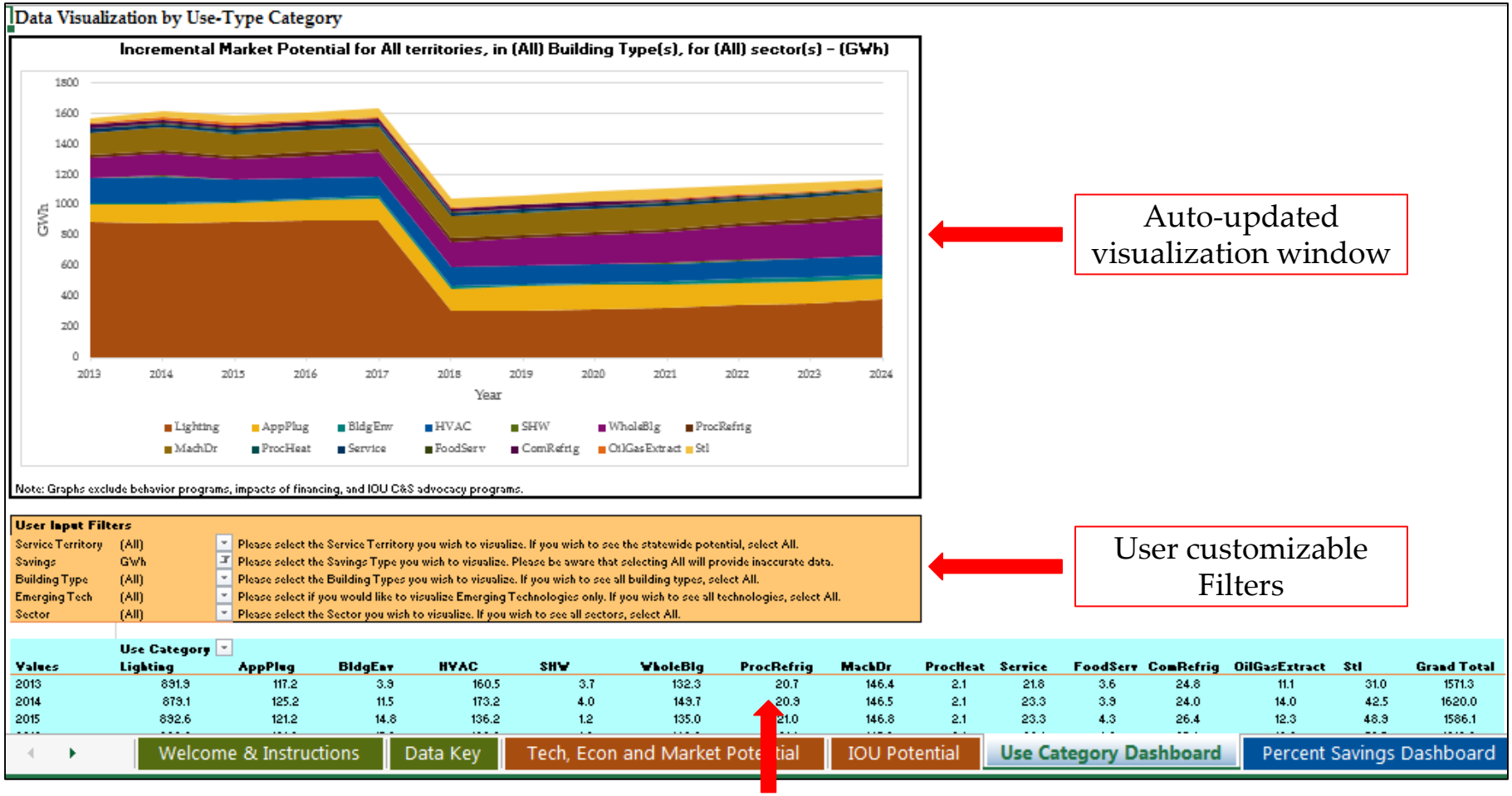
The Use Category Dashboard tab allows more than 300 different views of the results in a single graph based on user selections.



Auto-updated visualization window

User customizable Filters

Auto-updated data table

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Measure level savings from the model is also available to query in database format.

Service Territory	Savings	Sector	Building Type	Use Category	Emerging Tech	Measure	2013	2014	2015	2016	2017	2018	2019	2020	2021	202
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - Clothes Washer (Electric) - Emerging	0.04	0.05	0.04	0.05	0.06	0.06	0.07	0.08	0.10	0.1
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - Clothes Washer (Gas) - Emerging	-0.01	-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.0
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - Dishwasher (Electric) - Emerging	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.0
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - HP Clothes Dryer - Emerging	0.00	0.00	0.00	0.00	0.06	0.13	0.21	0.31	0.41	0.5
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - Smart Strip Home Office - Emerging	0.23	0.24	0.27	0.29	0.31	0.32	0.32	0.32	0.31	0.3
PG&E	GWh	Residential	Res - Multi Family	AppPlug	Yes	AppPlug - Smart Strip Home Theater - Emerging	0.24	0.25	0.28	0.30	0.32	0.33	0.33	0.33	0.32	0.3
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Clothes Washer (Electric)	0.26	0.28	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.0
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Clothes Washer (Gas)	-0.38	-0.39	-0.20	-0.20	-0.20	-0.14	-0.14	-0.14	-0.14	-0.1
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Computer Monitor	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.13	0.13	0.1
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Desktop Computer (Res - ES Plus)	0.00	0.00	0.13	0.18	0.24	0.29	0.35	0.40	0.46	0.5
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Desktop Computer (Res - ES)	0.00	0.00	0.00	0.00	0.26	0.30	0.34	0.38	0.43	0.4
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Dishwasher (Electric)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Recycle Refrigerator	0.75	0.75	0.87	0.98	1.09	1.17	1.21	1.22	1.17	1.0
PG&E	GWh	Residential	Res - Multi Family	AppPlug	No	AppPlug - Self-Contained Refrigerator	0.21	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	BldgEnv	No	BldgEnv - Attic Batt Insulation	0.17	0.16	0.15	0.14	0.13	0.11	0.09	0.08	0.06	0.0
PG&E	GWh	Residential	Res - Multi Family	BldgEnv	No	BldgEnv - Wall Spray On Insulation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	BldgEnv	No	BldgEnv - Window Film	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	HVAC	No	HVAC - SEER Rated Split System AC (SEER 15)	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Basic High - Indoor) - Emerging	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.03	0.06	0.1
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Basic High - Outdoor) - Emerging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Basic Low - Indoor) - Emerging	0.01	0.02	0.05	0.09	0.15	0.04	0.07	0.11	0.16	0.2
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Basic Low - Outdoor) - Emerging	0.00	0.00	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Reflector - Indoor) - Emerging	0.00	0.02	0.03	0.06	0.10	0.14	0.17	0.20	0.23	0.2
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Reflector - Outdoor) - Emerging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Specialty - Indoor) - Emerging	0.02	0.02	0.07	0.13	0.21	0.28	0.32	0.36	0.45	0.5
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Lamp (Specialty - Outdoor) - Emerging	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Plug-In Indoor Fixture - Emerging	0.08	0.15	0.15	0.15	0.15	0.01	0.01	0.01	0.01	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	Yes	Lighting - LED Plug-In Outdoor Fixture - Emerging	0.01	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Fixture (Indoor)	0.05	0.11	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Fixture (Outdoor)	0.04	0.08	0.07	0.07	0.07	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Basic High - Indoor)	2.41	2.06	1.76	1.53	1.35	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Basic High - Outdoor)	0.32	0.21	0.19	0.18	0.17	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Basic Low - Indoor)	4.79	4.26	3.99	3.60	3.17	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Basic Low - Outdoor)	0.66	0.52	0.51	0.47	0.42	0.00	0.00	0.00	0.00	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Reflector - Indoor)	0.41	0.58	0.68	0.77	0.83	0.86	0.84	0.81	0.72	0.6
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Reflector - Outdoor)	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0
PG&E	GWh	Residential	Res - Multi Family	Lighting	No	Lighting - Compact Fluorescent Lamp (Specialty - Indoor)	0.99	1.21	1.46	1.64	1.73	1.66	1.48	1.22	1.12	1.0

... CEC Sales Data | Incremental Market Potential | Technical Potential | Economic Potential | Cumulative Market Potential | Incremental Codes and Standards | Cumulative ...

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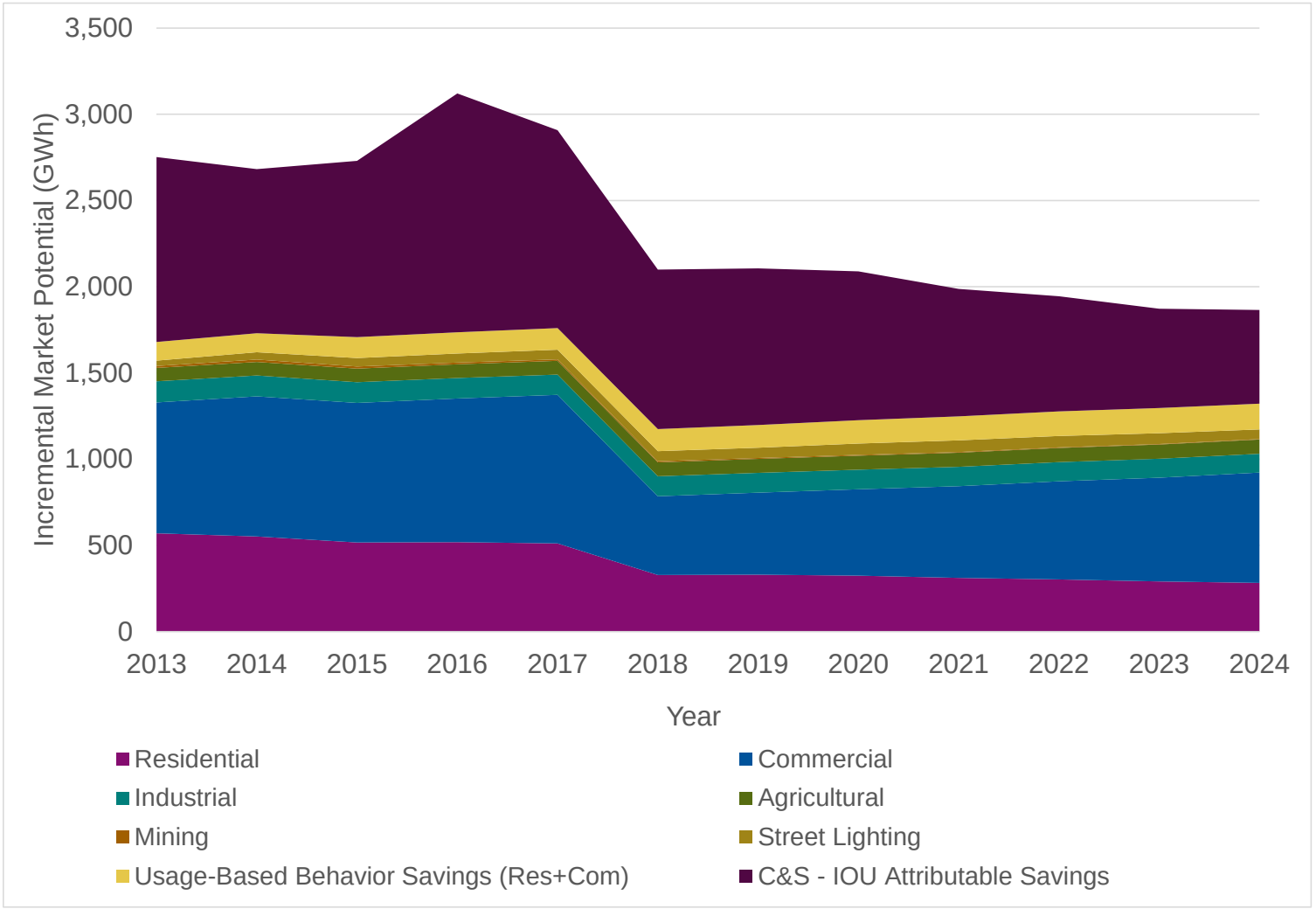
All IOUs: Incremental Market Potential from all Program Types (GWh)



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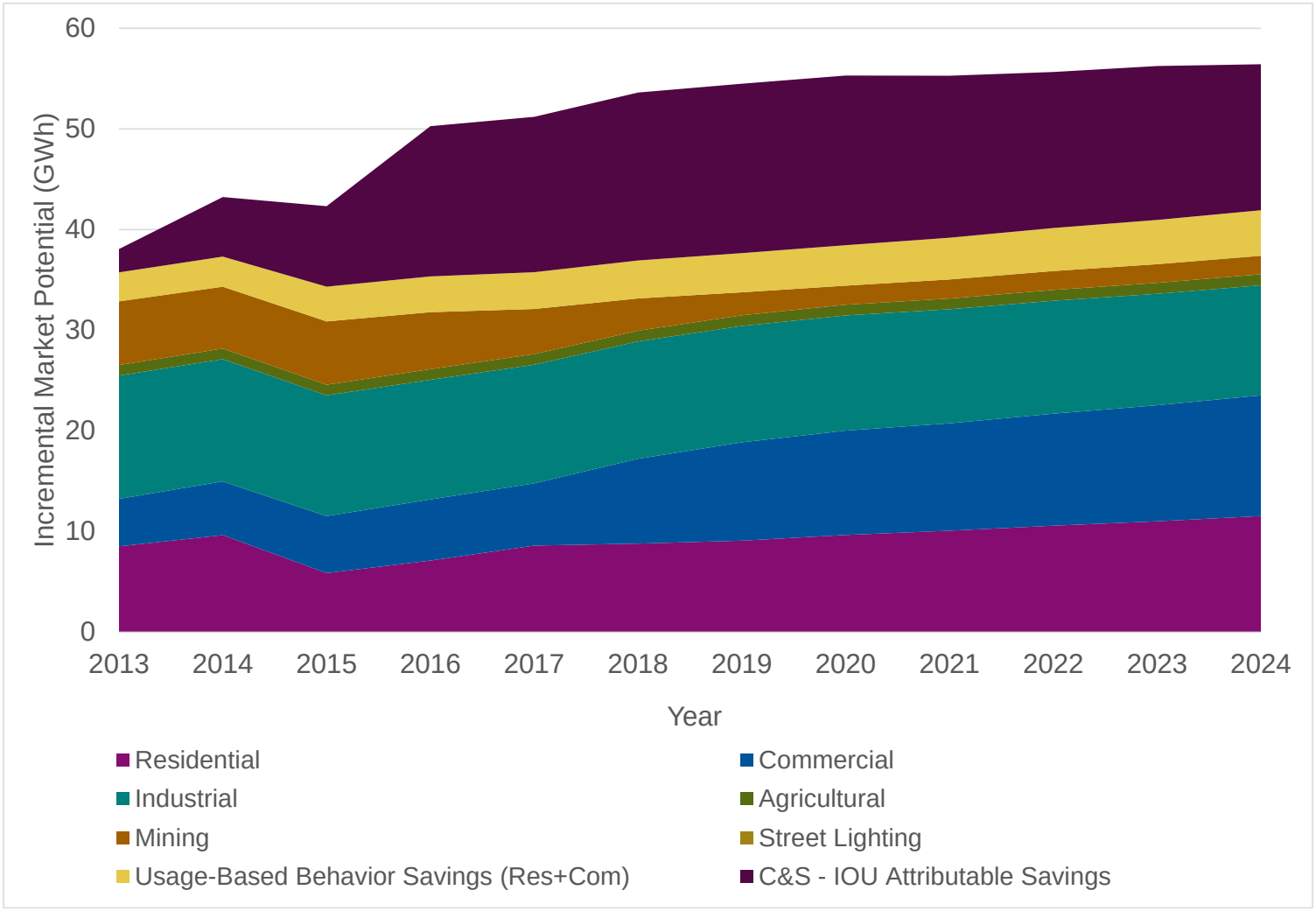
All IOUs: Incremental Market Potential from all Program Types (MM Therms)



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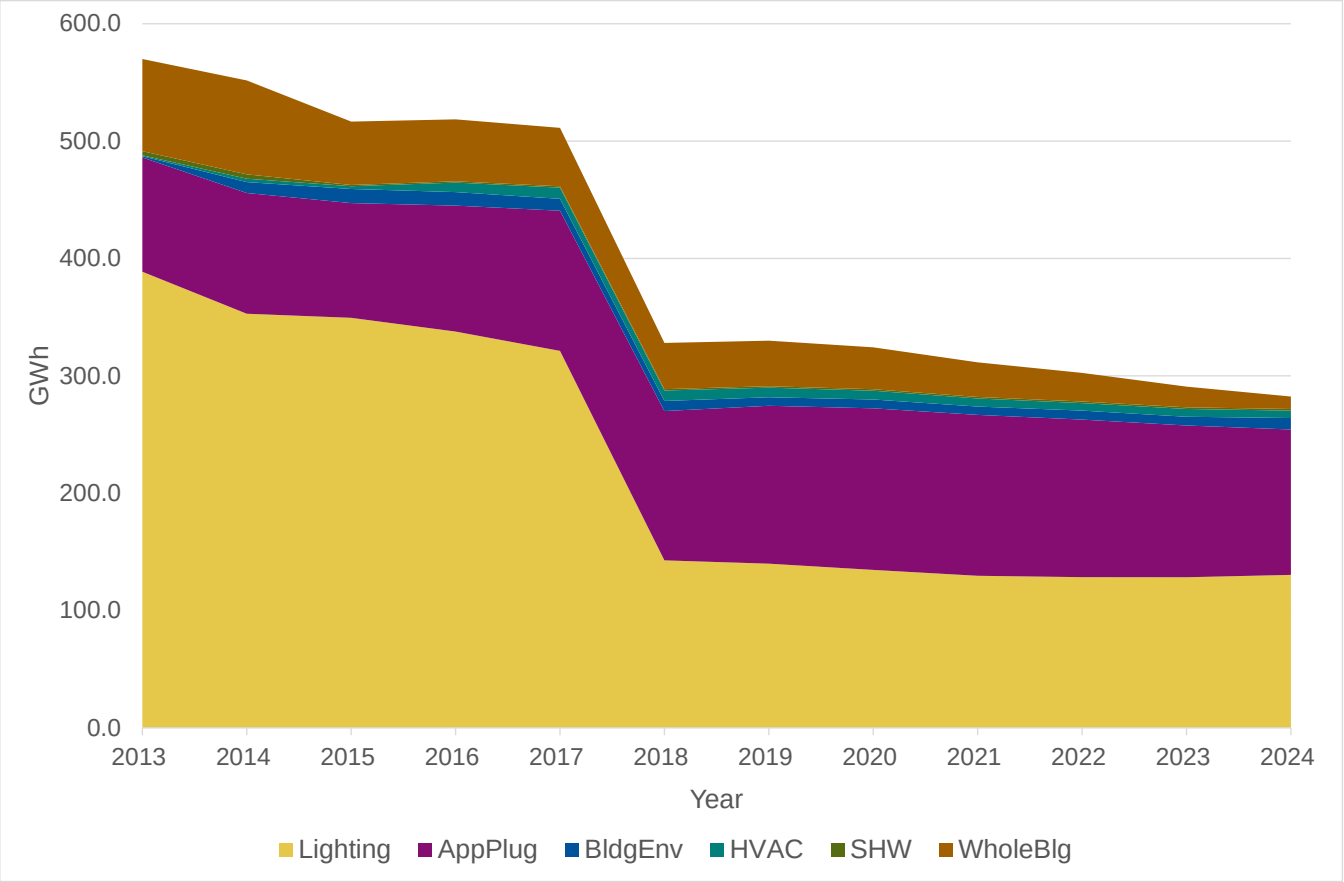
All IOUs: Residential Incremental Market Potential (GWh)



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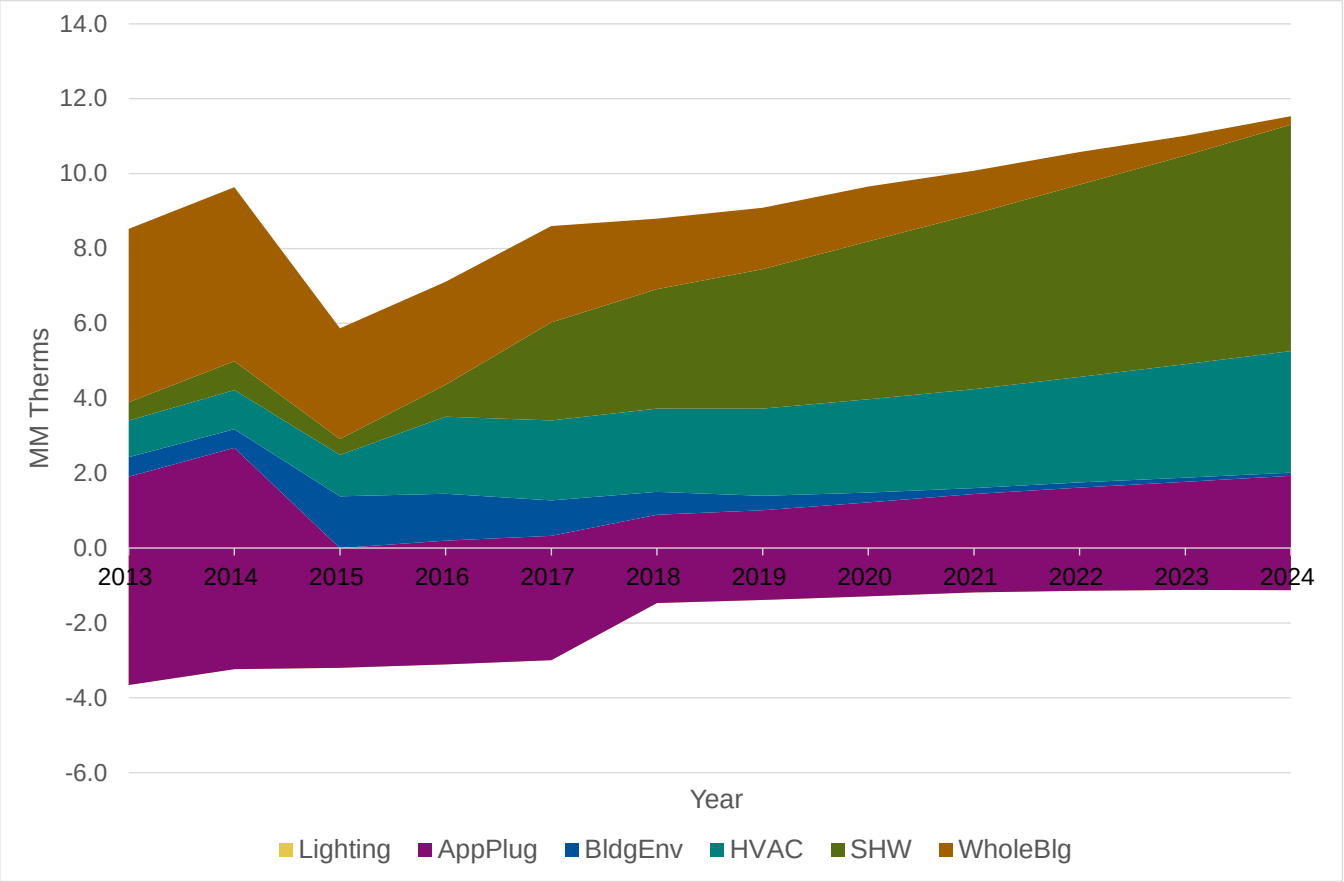
All IOUs: Residential Incremental Market Potential (MM Therms)



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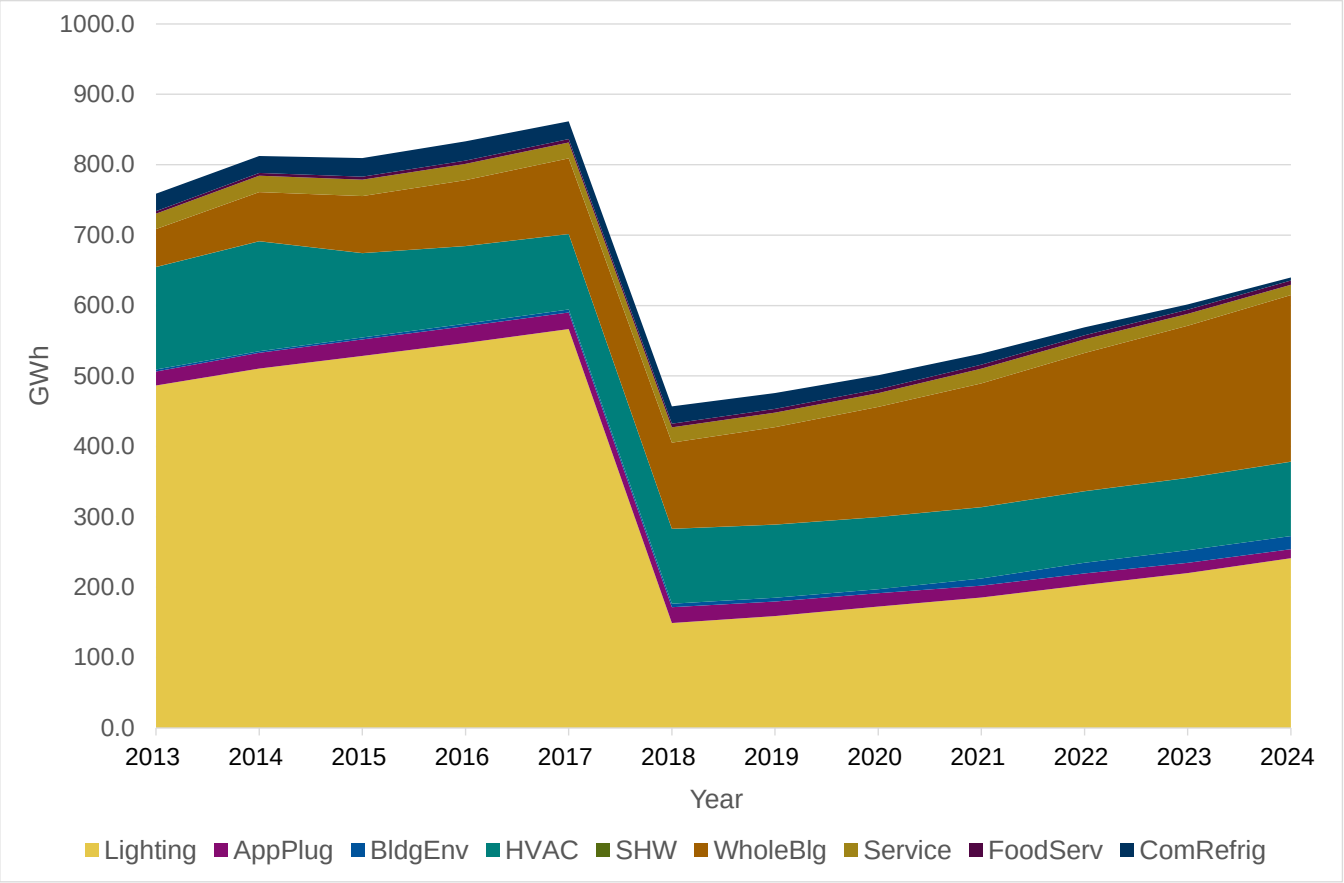
All IOUs: Commercial Incremental Market Potential (GWh)



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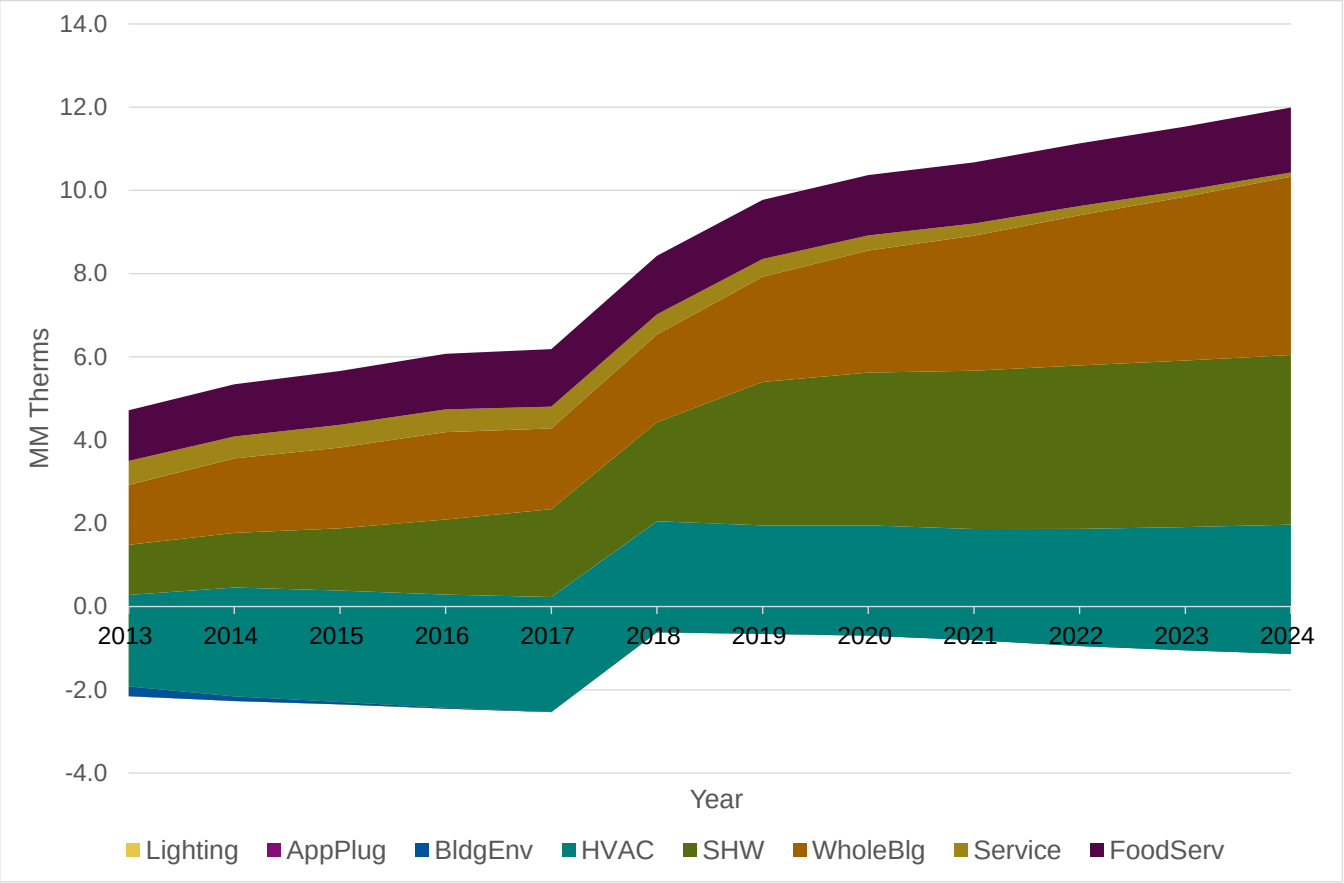
All IOUs: Commercial Incremental Market Potential (MM Therms)



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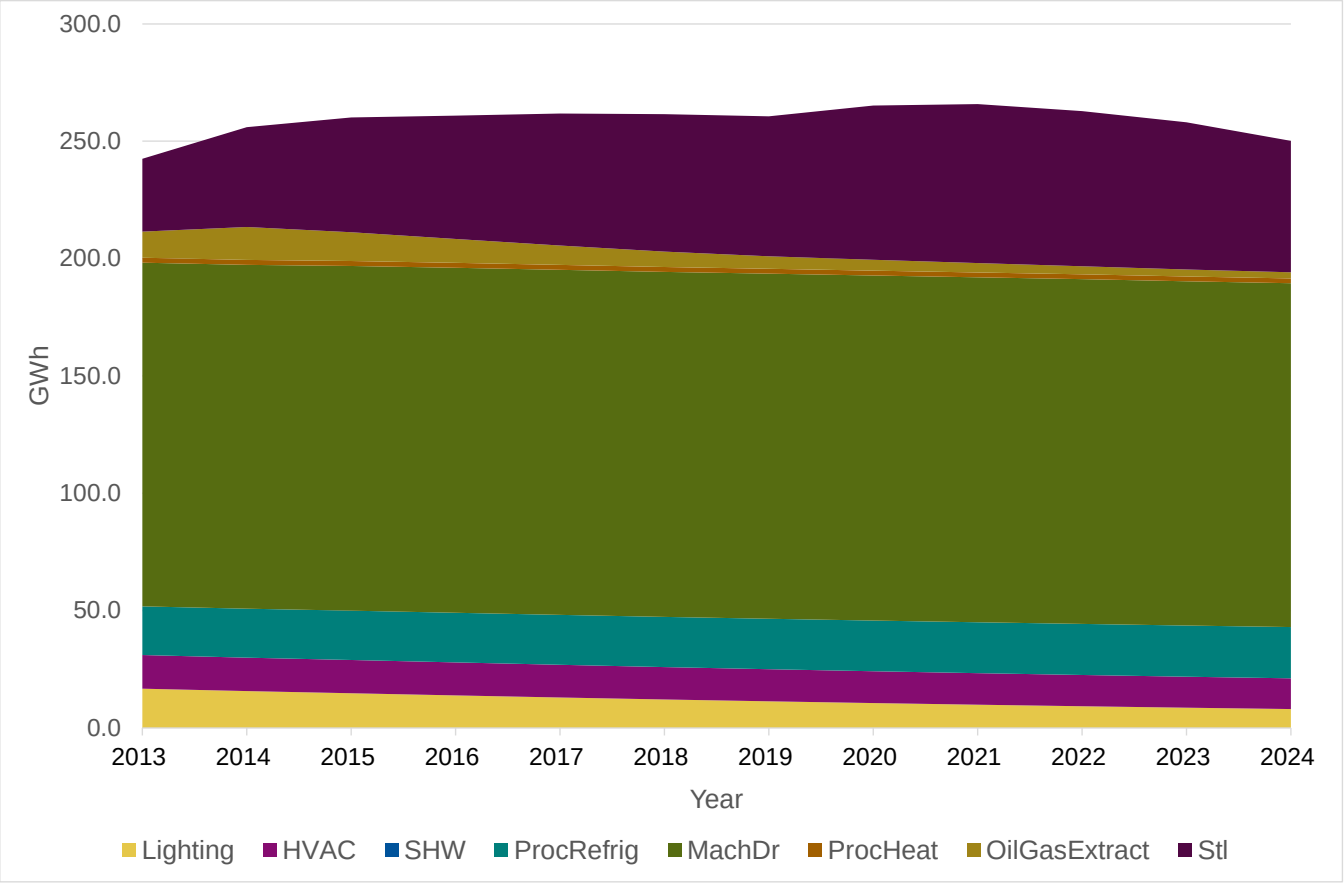
All IOUs: AIMS Incremental Market Potential (GWh)



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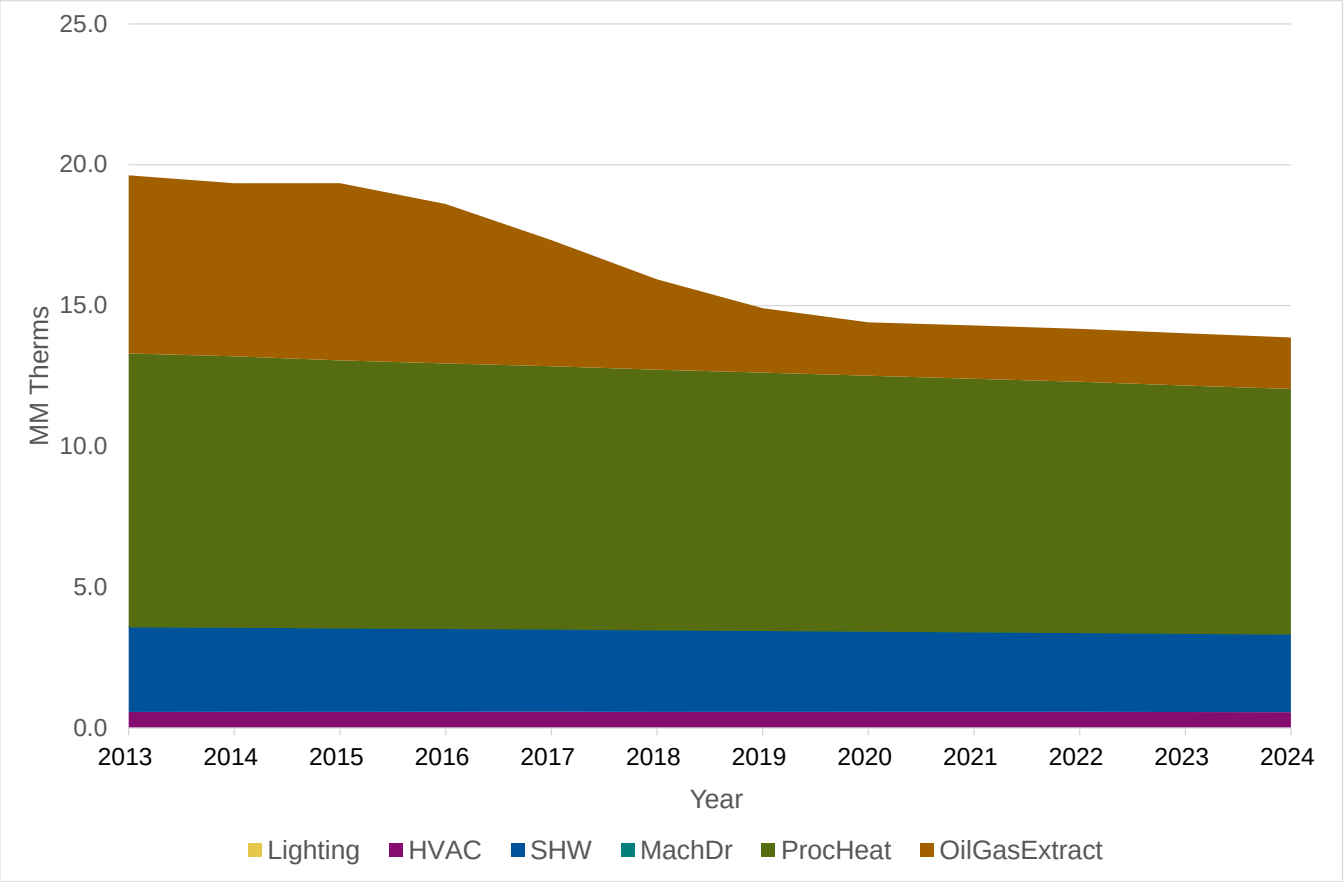
All IOUs: AIMS Incremental Market Potential (MM Therms)



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1 » Overview, Scope and Summary Results

2 » Model Overview

3 » Results Overview

4 » Input Sources: Global Inputs

5 » Input Sources: Residential/Commercial Measures

6 » Agriculture, Industrial, Mining and Street lighting

7 » Codes and Standards

8 » Emerging Technologies

9 » Whole Building Packages

10 » Financing

11 » Behavior Programs

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Global inputs are inputs that are not specific to any measure but rather apply to market segments or sectors.

- Updated Global Inputs :
  (High, Medium, and Low Demand Scenarios updated where applicable)
  - Building Stocks & Weights
    - Utilized Service Territory to Planning Area ratios from CEC
  - Program Non-Incentive Costs
  - Calibration Data
  - Retail Energy Rates ($/kWh, $/therm)
  - Energy Sales Forecasts (kWh, Therms by sector and utility)
- Unchanged from 2013 Study:
  - Avoided costs
- Data Sources for 2015 and Beyond Study updates
  - CEC. *2014 Integrated Energy Policy Report (IEPR) Update.* Adopted Feb. 2015.
    - *http://www.energy.ca.gov/2014_energypolicy/documents/*
    - Utilized for: Building Stocks, Retail Rates, Sales Forecasts
  - CPUC. *EE Program Tracking Database.* Accessed: November 2014
    - Utilized for: Calibration Data
  - 2015 IOU Planning Submissions. *IOU-2015-Filing-Review-4-17-204.xlsm.* Accessed: March 2015.
    - *ftp://ftp.deeresources.com/E3CostEffectivenessCalculators/2015IOUsubmissions/*
    - Utilized for: Program Non-Incentive Costs

Program Non-Incentive costs were reviewed and updated.

- Utilized 2015 IOU Compliance Filings
  - Most indicative of projected non-incentive costs for 2015 and beyond
- Includes Marketing/Outreach and Implementation (Customer Service) costs in addition to the designated Administration costs.
  - Implementation (Cust. Serv.) constitutesmore than half of portfolio wide non-incentive costs in many IOU programs
- State and Local Gov. Partnerships are excluded
- A weighted average of non-incentive costs of Ag and Ind was applied to the all of AIMS

Non-Incentive Cost Summary – 2015 Compliance Filings

Includes: Admin, M&O, and Implementation (Cust. Service)

	$/kWh Saved			$/Therm Saved		
	RES	COM	AIMS	RES	COM	AIMS
PG&E	$0.164	$0.147	$0.095	$3.879	$3.393	$1.637
SCE	$0.141	$0.166	$0.216	NA	NA	NA
SCG	NA	NA	NA	$6.580	$9.536	$13.063
SDG&E	$0.201	$0.095	$0.234	$5.627	$2.262	$7.710

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The model is calibrated using historic program activity.

- Calibration inputs are the gross evaluated program achievements from 2006-2012.
- Compliance Filings and 2013 Reported Savings are used for benchmarking purposes
- 2006-2009 numbers remained the same from the 2013 PGT Study
- Updated 2010-2012 calibration data to Ex-Post Gross program savings as reported in the CPUC's Program Tracking database
  - 2013 PGT Study was based on Ex-Ante savings
    - The 2010-2012 program cycle was not fully reported or evaluated when calibration data was pulled for the 2013 PGT Study
  - Database last accessed November 2014
  - Ex-Post Gross Savings

2010-2012 Portfolio Gross Ex-Post Program Savings (GWh and MMTherms)

	Energy Savings (GWh)		Gas Savings (MM Therms)	
	RES	COM	RES	COM
PG&E	1,743.7	1,249.7	-19.3	23.1
SCE	2,312.4	1,235.1	NA	NA
SCG	NA	NA	24.4	30.1
SDG&E	308.3	300.6	-0.6	7.0

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1 » Overview, Scope and Summary Results

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4 » Input Sources: Global Inputs

5 » **Input Sources: Residential/Commercial Measures**

6 » Agriculture, Industrial, Mining and Street lighting

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NAVIGANT ENERGY

Using the 2013 Study as its foundation, the 2015 Study relied on several key data sources for measure updates, including DEER updates.

Source	Last Accessed	Relevant Data
DEER2014 Code Update	February 2015	Weather-sensitive measure energy use; Lighting HVAC interactive effects
DEER2015 Code Update	February 2015	Code updates for: • Split and Packaged AC Equipment • Small Gas and Electric Storage Water Heaters • Small Gas and Electric Instantaneous Water Heaters • Gas Furnaces

* DEER data was accessed with assistance from James J. Hirsch & Associates through the SQL database portal.

The 2015 Study also used data from several key studies published after the completion of the 2013 Study.

Author	Study Title	Publication Date	Relevant Data
DNV GL	*Appliance Recycling Program Impact Evaluation*	October 2014	Unit energy savings for refrigerator recycling measure
DNV GL	*California Upstream and Residential Lighting Impact Evaluation Final Report*	August 2014	Residential lighting HOU and wattage distributions
DNV GL	*Residential On-site Study: California Lighting and Appliance Saturation Survey (CLASS 2012)*	November 2014	Residential density data
Itron, Inc.	*2010-2012 WO017 Ex Ante Measure Cost Study Final Report*	May 2014	Full measure cost data
Itron, Inc.	*California Commercial Saturation Survey*	August 2014	Commercial density data and wattage distributions
Itron, Inc.	*Nonresidential Downstream Lighting Impact Evaluation Report*	August 2014	Commercial lighting HOU

* This list represents only those studies used in the 2015 Study that were not available during the 2013 Study. Several other sources were used in the 2013 Study.

Navigant has provided an Excel workbook with line-level detail for the measures used in the 2015 Study.

» The workbook contains three tabs:

1. **Field Definitions**: The tab includes a list of the data fields included in the MICS Master Build with a brief description of the data.

2. **Measure Update Data Sources**: This tab includes a table of the unique measures by sector and fuel type in the MICS Master Build. The table shows the Efficient Case, Base Case, and Code Case for each measure, as well as the relevant data sources used in the 2015 Study update.

3. **MICS Master Build**: This tab includes the complete line-level detail for all sectors included in the 2015 Study model.

Screenshot of the Field Definitions tab.

	A	B
1	**Field Name**	**Description**
2	Measure ID	Unique Model Measure Identifier
3	Measure Name	Name of the measure in model
4	IOU	Applicable Utility
5	Sector	Applicable Market Sector (Res, Com, Ind, Ag, Mining, Streetlights)
6	Fuel Type	Applicable Fuel Type (Elec or Gas)
7	Efficiency Measure	Efficient Measure Description
8	Base Case Description	Base Measure Description
9	Code Description	Code Measure description
10	Use Category	Use Categories describe how or where technologies are used
11	Use SubCategory	Use Sub-Categories describe in more detail how or where technologies are used
12	Technology Group	All Technology Types are associated with a high-level Technology Group consistent with the 0.98 SPTdb specifications where applicable
13	Technology Type	Technology types are based on common parameters used to define the technology consistent with the 0.98 SPTdb specifications where applicable
14	Technology SubType	Detailed description of Technologies within a Tech Group and SubType Pair where applicable
15	Is Replace on Burnout	Identifies if a measure is a replace on burnout application
16	Is Emerging Technology	Identifies if a measure is an Emerging Technology
17	Is HIM	Identifies if a measure is a High Impact Measure
18	Net to Gross Factor	The Net-to-Gross factor applied to savings values to asses net savings consistent with the 0.98 SPTdb specifications
19	NTGID	SPTdb Net-to-Gross Factor ID consistent with the 0.98 SPTdb specifications where applicable
20	Measure Market Introduction Year	Year that the measure becomes available to the market (if applicable) - Generally for emerging technologies
21	Technology Applicability	The applicable portion of the total population for which the technology can be installed
22	Competition Group	Identifier for measures that compete for a mutually exclusive installation.
23	Units	The common units of measurement for savings, costs and densities
24	Building Type Code	Modeling code for the applicable building type consistent with the 0.98 SPTdb specifications
25	Building Type Description	Detailed building type description consistent with the 0.98 SPTdb specifications
26	Building Vintage	Applicable building vintage (New or Existing buildings)

Field Definitions | Measure Update Data Sources | MICS Master Bu ...

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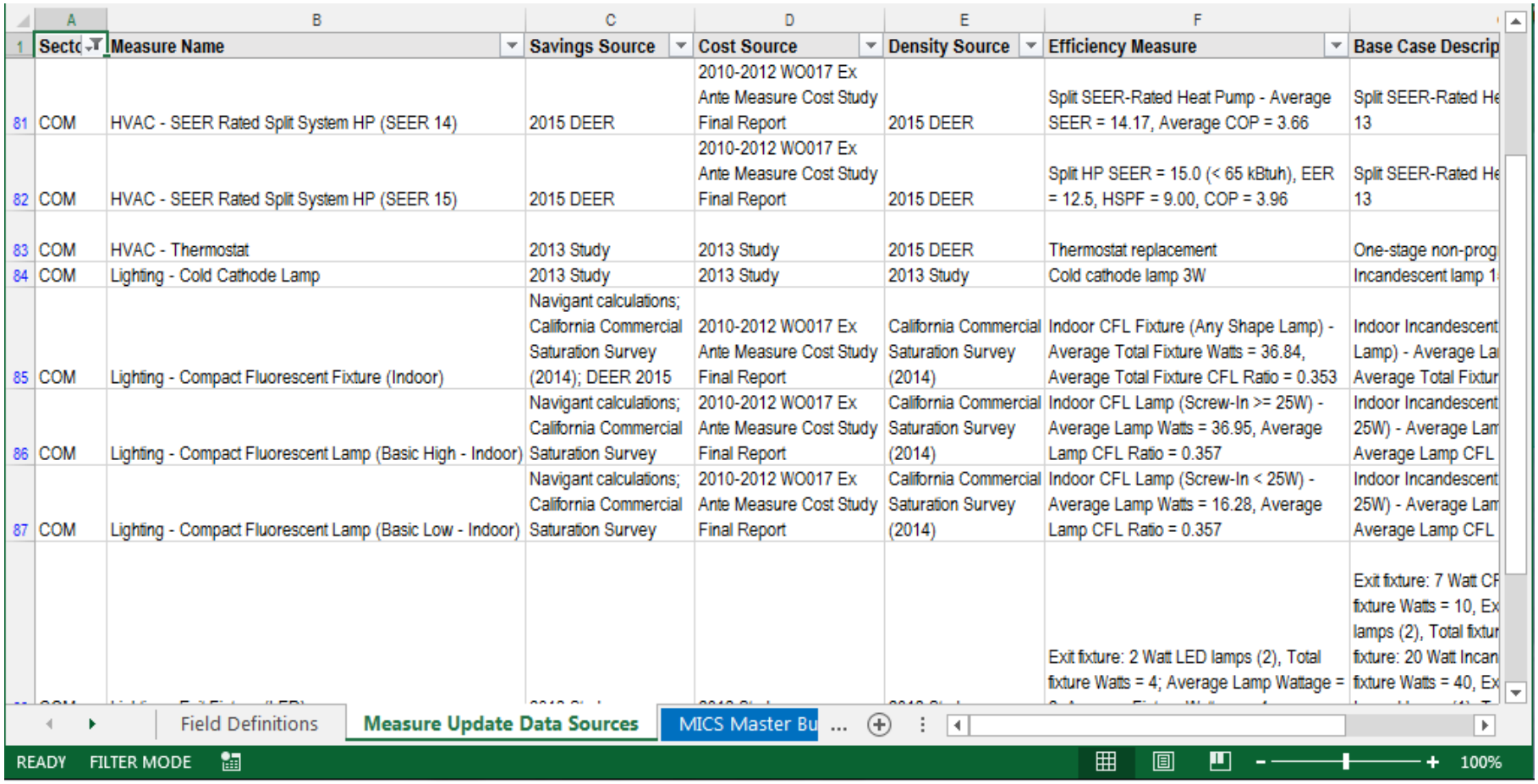
Screenshot of the Measure Update Data Sources tab.



	A	B	C	D	E	F	
1	Sectc	Measure Name	Savings Source	Cost Source	Density Source	Efficiency Measure	Base Case Descrip
81	COM	HVAC - SEER Rated Split System HP (SEER 14)	2015 DEER	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	2015 DEER	Split SEER-Rated Heat Pump - Average SEER = 14.17, Average COP = 3.66	Split SEER-Rated He 13
82	COM	HVAC - SEER Rated Split System HP (SEER 15)	2015 DEER	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	2015 DEER	Split HP SEER = 15.0 (< 65 kBtuh), EER = 12.5, HSPF = 9.00, COP = 3.96	Split SEER-Rated He 13
83	COM	HVAC - Thermostat	2013 Study	2013 Study	2015 DEER	Thermostat replacement	One-stage non-prog
84	COM	Lighting - Cold Cathode Lamp	2013 Study	2013 Study	2013 Study	Cold cathode lamp 3W	Incandescent lamp 1
85	COM	Lighting - Compact Fluorescent Fixture (Indoor)	Navigant calculations; California Commercial Saturation Survey (2014); DEER 2015	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	California Commercial Saturation Survey (2014)	Indoor CFL Fixture (Any Shape Lamp) - Average Total Fixture Watts = 36.84, Average Total Fixture CFL Ratio = 0.353	Indoor Incandescent Lamp) - Average La Average Total Fixtur
86	COM	Lighting - Compact Fluorescent Lamp (Basic High - Indoor)	Navigant calculations; California Commercial Saturation Survey	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	California Commercial Saturation Survey (2014)	Indoor CFL Lamp (Screw-In >= 25W) - Average Lamp Watts = 36.95, Average Lamp CFL Ratio = 0.357	Indoor Incandescent 25W) - Average Lam Average Lamp CFL
87	COM	Lighting - Compact Fluorescent Lamp (Basic Low - Indoor)	Navigant calculations; California Commercial Saturation Survey	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	California Commercial Saturation Survey (2014)	Indoor CFL Lamp (Screw-In < 25W) - Average Lamp Watts = 16.28, Average Lamp CFL Ratio = 0.357	Indoor Incandescent 25W) - Average Lam Average Lamp CFL
						Exit fixture: 2 Watt LED lamps (2), Total fixture Watts = 4; Average Lamp Wattage =	Exit fixture: 7 Watt CF fixture Watts = 10, Ex lamps (2), Total fixtur fixture: 20 Watt Incan fixture Watts = 40, Ex

Field Definitions | Measure Update Data Sources | MICS Master Bu ...

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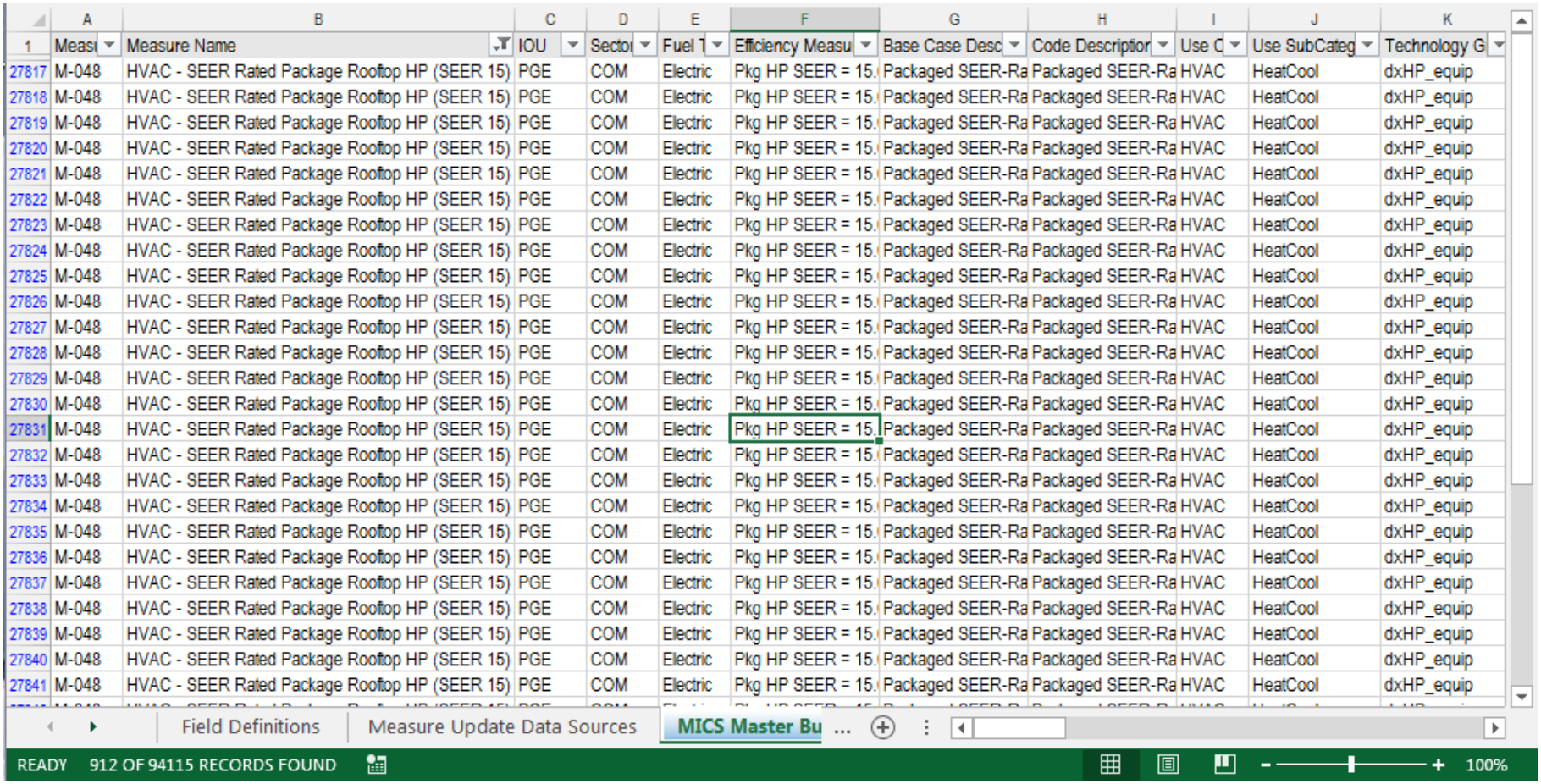
First screenshot of the MICS Master Build.



	A	B	C	D	E	F	G	H	I	J	K
1	Meası	Measure Name	IOU	Sector	Fuel T	Efficiency Measu	Base Case Desc	Code Description	Use C	Use SubCateg	Technology G
27817	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27818	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27819	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27820	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27821	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27822	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27823	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27824	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27825	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27826	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27827	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27828	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27829	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27830	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27831	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27832	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27833	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27834	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27835	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27836	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27837	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27838	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27839	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27840	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip
27841	M-048	HVAC - SEER Rated Package Rooftop HP (SEER 15)	PGE	COM	Electric	Pkg HP SEER = 15.	Packaged SEER-Ra	Packaged SEER-Ra	HVAC	HeatCool	dxHP_equip

Field Definitions | Measure Update Data Sources | MICS Master Bu ...

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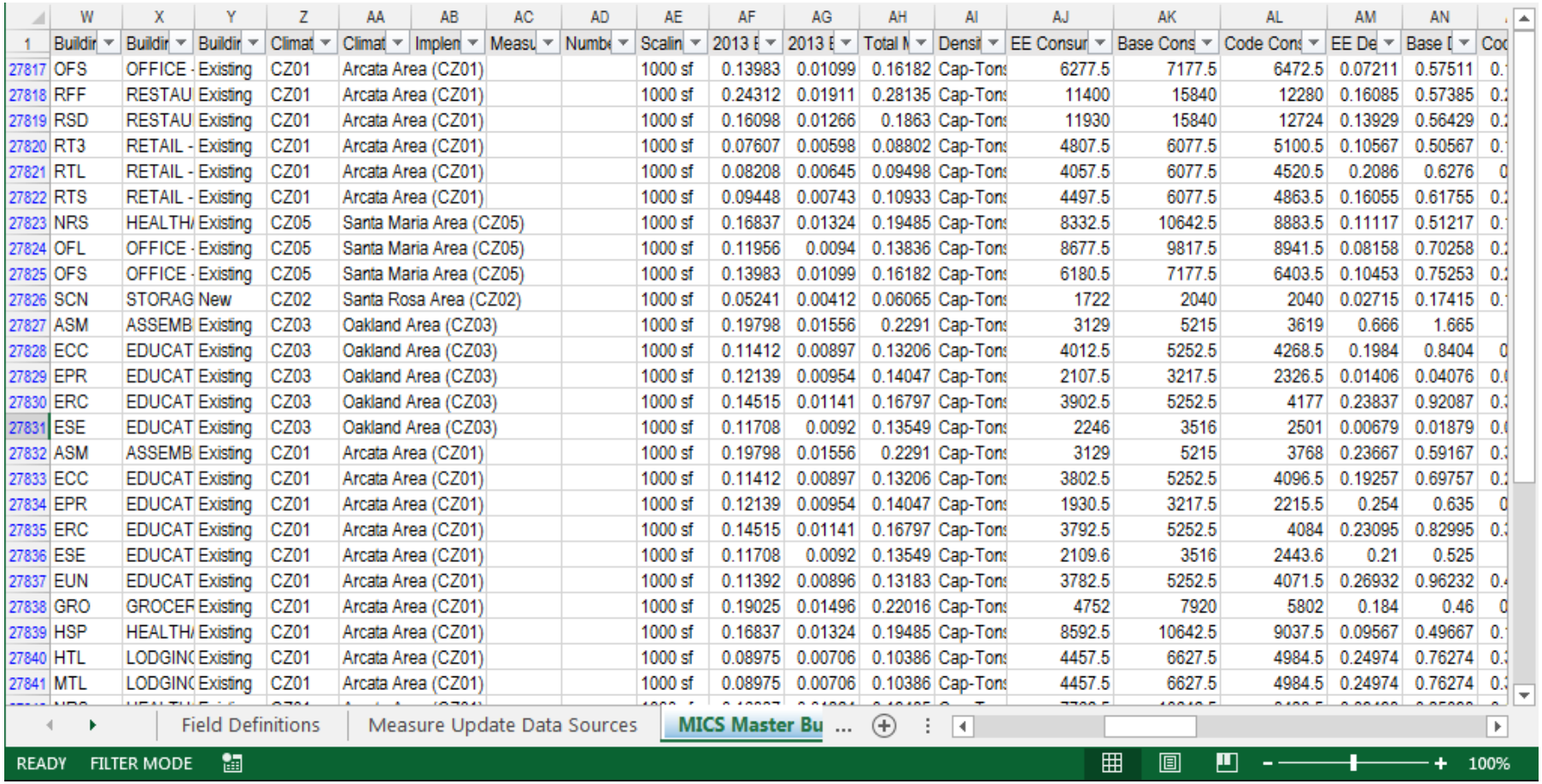
Second screenshot of the MICS Master Build.



	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	
1	Buildir	Buildir	Buildir	Climat	Climat	Implen	Measu	Numbe	Scalin	2013 E	2013 E	Total M	Densi	EE Consur	Base Cons	Code Cons	EE De	Base D	Coc
27817	OFS	OFFICE -	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.13983	0.01099	0.16182	Cap-Tons	6277.5	7177.5	6472.5	0.07211	0.57511	0.
27818	RFF	RESTAU	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.24312	0.01911	0.28135	Cap-Tons	11400	15840	12280	0.16085	0.57385	0.
27819	RSD	RESTAU	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.16098	0.01266	0.1863	Cap-Tons	11930	15840	12724	0.13929	0.56429	0.
27820	RT3	RETAIL -	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.07607	0.00598	0.08802	Cap-Tons	4807.5	6077.5	5100.5	0.10567	0.50567	0.
27821	RTL	RETAIL -	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.08208	0.00645	0.09498	Cap-Tons	4057.5	6077.5	4520.5	0.2086	0.6276	0
27822	RTS	RETAIL -	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.09448	0.00743	0.10933	Cap-Tons	4497.5	6077.5	4863.5	0.16055	0.61755	0.
27823	NRS	HEALTH/	Existing	CZ05	Santa Maria Area (CZ05)				1000 sf	0.16837	0.01324	0.19485	Cap-Tons	8332.5	10642.5	8883.5	0.11117	0.51217	0.
27824	OFL	OFFICE -	Existing	CZ05	Santa Maria Area (CZ05)				1000 sf	0.11956	0.0094	0.13836	Cap-Tons	8677.5	9817.5	8941.5	0.08158	0.70258	0.
27825	OFS	OFFICE -	Existing	CZ05	Santa Maria Area (CZ05)				1000 sf	0.13983	0.01099	0.16182	Cap-Tons	6180.5	7177.5	6403.5	0.10453	0.75253	0.
27826	SCN	STORAG	New	CZ02	Santa Rosa Area (CZ02)				1000 sf	0.05241	0.00412	0.06065	Cap-Tons	1722	2040	2040	0.02715	0.17415	0.
27827	ASM	ASSEMB	Existing	CZ03	Oakland Area (CZ03)				1000 sf	0.19798	0.01556	0.2291	Cap-Tons	3129	5215	3619	0.666	1.665	
27828	ECC	EDUCAT	Existing	CZ03	Oakland Area (CZ03)				1000 sf	0.11412	0.00897	0.13206	Cap-Tons	4012.5	5252.5	4268.5	0.1984	0.8404	0
27829	EPR	EDUCAT	Existing	CZ03	Oakland Area (CZ03)				1000 sf	0.12139	0.00954	0.14047	Cap-Tons	2107.5	3217.5	2326.5	0.01406	0.04076	0.
27830	ERC	EDUCAT	Existing	CZ03	Oakland Area (CZ03)				1000 sf	0.14515	0.01141	0.16797	Cap-Tons	3902.5	5252.5	4177	0.23837	0.92087	0.
27831	ESE	EDUCAT	Existing	CZ03	Oakland Area (CZ03)				1000 sf	0.11708	0.0092	0.13549	Cap-Tons	2246	3516	2501	0.00679	0.01879	0.
27832	ASM	ASSEMB	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.19798	0.01556	0.2291	Cap-Tons	3129	5215	3768	0.23667	0.59167	0.
27833	ECC	EDUCAT	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.11412	0.00897	0.13206	Cap-Tons	3802.5	5252.5	4096.5	0.19257	0.69757	0.
27834	EPR	EDUCAT	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.12139	0.00954	0.14047	Cap-Tons	1930.5	3217.5	2215.5	0.254	0.635	0
27835	ERC	EDUCAT	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.14515	0.01141	0.16797	Cap-Tons	3792.5	5252.5	4084	0.23095	0.82995	0.
27836	ESE	EDUCAT	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.11708	0.0092	0.13549	Cap-Tons	2109.6	3516	2443.6	0.21	0.525	
27837	EUN	EDUCAT	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.11392	0.00896	0.13183	Cap-Tons	3782.5	5252.5	4071.5	0.26932	0.96232	0.
27838	GRO	GROCER	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.19025	0.01496	0.22016	Cap-Tons	4752	7920	5802	0.184	0.46	0
27839	HSP	HEALTH/	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.16837	0.01324	0.19485	Cap-Tons	8592.5	10642.5	9037.5	0.09567	0.49667	0.
27840	HTL	LODGINC	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.08975	0.00706	0.10386	Cap-Tons	4457.5	6627.5	4984.5	0.24974	0.76274	0.
27841	MTL	LODGINC	Existing	CZ01	Arcata Area (CZ01)				1000 sf	0.08975	0.00706	0.10386	Cap-Tons	4457.5	6627.5	4984.5	0.24974	0.76274	0.

Field Definitions | Measure Update Data Sources | MICS Master Bu ...

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Industrial: 2015 Update Highlights

» **Stage 1 Scope**
- Key update: Accounting for industry standard practices (ISPs)
- Other data sources also reviewed for any significant updates for all of AIMS

» **Key Sources: Vetting and Updates**
- Recent data additions (2013-2014) in the Industrial Assessment Centers Database
  - Impact on potential was less than 5%; excluded for this update
- California historical (QFER) consumption to inform subsector distributions
- Consumption and retail rate forecast data (IEPR) to inform energy efficiency potential
  - Marginal impact on previous results before baseline adjustment (note: no updates for gas consumption data)

» **Industry Standard Practice Assignments and Factors Update**
- ***Result: Confirmed the collective opinion of stakeholders developed in 2013; new ISPs incorporated***
- Reviewed 11 CPUC-approved ISP studies (**deemed rigorous studies, eligible for consideration**)
  - ISPs are very application and subsector-specific
    - Result: minimal number of updates made to assessment recommendation codes (ARCs); resulting in minimal impacts to the previous 2013 potential results
- Vetted baseline and total maximum densities for subsectors and end-uses
  - Result: confirmed applicability of measures to California and current program/policy constraints
- Initiated expanded ISP considerations: Majors versus minors, changes over time, etc.

» ***See the accompanying AIMS Preliminary Results Supporting Data spreadsheet***
- Additional data sources that will inform Stage 2 (e.g., IOU customer consumption data)
- Data details supporting Stage 1 updates

Industrial Sector Stage 1:

- Incorporate current ISPs issued by CPUC (approved for Study consideration) into existing structure
- Vet data inputs:
  - Applicability to California market and program/policy constraints
  - Applicable and prevalent in California industrial subsectors (baseline/efficient densities)
  - Against key California resources:
    - Program solicitations and reports/activities (IOU Compliance Filings, 2010/12, 2013 reports)
- Update subsector consumption distributions, consumption forecasts, and retail rate forecasts

Source(s)	Comment
DOE. Industrial Assessment Center Database. Last accessed: March 2015 http://www.energy.gov/eere/amo/industrial-assessment-centers-iacs	Informs inputs. Recent updates vetted to determine impact on model outputs; investigation found negligible changes and therefore these inputs are unchanged from previous analysis.
EIA. Manufacturing Enduse Consumption Surveys. Last accessed: March 2015 http://www.eia.gov/consumption/manufacturing/	Informs subsector enduse energy distributions.
CEC. Quarterly Fuel and Energy Report. January 2015	Informs subsector distributions; equipment stocks Updated with electric consumption data
IEPR Forecasts: CEC. IEPR. California Energy Demand 2015-2025 Final Forecast Mid-Case Final Baseline Demand Forecast Forms. Last accessed: March 2015. http://www.energy.ca.gov/2014_energypolicy/documents/demand_forecast_sf/Mid_Case/ CEC. 2015 Integrated Energy Policy Report. Last accessed: March 2015 http://www.energy.ca.gov/2015_energypolicy/	Consumption used as a basis for savings (savings as a % of consumption) Retail rates inform payback periods on energy efficiency
CPUC. Ex Ante Review Custom Process Guidance Documents. Last accessed: March 2015 http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Ex+Ante+Review+Custom+Process+Guidance+Documents.htm	Industry Standard Practices (ISPs). Approved ISPs by CPUC for consideration in these updates.
ASWB Engineering Expert Advice	Expert input augments existing data, including input from other experts. Including reviews for measure applicability to California markets and current program/policy constraints.
DEER. IOU Compliance Filings. Last accessed March 2015. ftp://ftp.deeresources.com/E3CostEffectivenessCalculators	Provides the potential study results a point of comparison. These aid the QC process reviews of the preliminary release. These will be used for Stage 2 activities as well.

NAVIGANT ENERGY

Agriculture Sector Stage 1:

- Update subsector consumption distributions, consumption forecasts, and retail rate forecasts
- Considered impacts on consumption related to drought conditions

Source(s)	Comment
DOE. Industrial Assessment Center Database. Last accessed: March 2015 http://www.energy.gov/eere/amo/industrial-assessment-centers-iacs	Informs inputs. Recent updates vetted to determine impact on model outputs; investigation found negligible changes and therefore these inputs are unchanged from previous analysis.
CEC. Quarterly Fuel and Energy Report. January 2015	Informs subsector distributions; equipment stocks Updated with electric consumption data
IEPR Forecasts: CEC. IEPR. California Energy Demand 2015-2025 Final Forecast Mid-Case Final Baseline Demand Forecast Forms. Last accessed: March 2015. http://www.energy.ca.gov/2014_energypolicy/documents/demand_forecast_sf/Mid_Case/ CEC. 2015 Integrated Energy Policy Report. Last accessed: March 2015 http://www.energy.ca.gov/2015_energypolicy/	Consumption used as a basis for savings (savings as a % of consumption) Retail rates inform payback periods on energy efficiency
DEER. IOU Compliance Filings. Last accessed March 2015. ftp://ftp.deeresources.com/E3CostEffectivenessCalculators	Provides the potential study results a point of comparison. These aid the QC process reviews of the preliminary release. These will be used for Stage 2 activities as well.
California Drought Data: USDA. California Drought 2014: Farms. Last accessed March 2015 http://ers.usda.gov/topics/in-the-news/california-drought-2014-farm-and-food-impacts/california-drought-2014-farms.aspx	Sector-wide consumption fluctuations result from drought conditions. Data informs adjustments to the Agriculture inputs to reflect normal operating conditions.

Mining Sector Stage 1:

- Confirm ISP considerations and Major versus Minor producers
  - ISP considerations confirmed
    - Pump off controllers
    - VFDs
- Update subsector consumption distributions, consumption forecasts
- Findings (electric and gas related): Oil production trending down, but well counts and water/steam injection on the rise.

Source(s)	Comment
CEC. Quarterly Fuel and Energy Report. January 2015	Informs subsector distributions; equipment stocks Updated with electric consumption data
CPUC. Ex Ante Review Custom Process Guidance Documents. Last accessed: March 2015 http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Ex+Ante+Review+Custom+Process+Guidance+Documents.htm	Industry Standard Practices (ISPs). Approved ISPs by CPUC for consideration in these updates.
ASWB Engineering Expert Advice	Expert input augments existing data, including input from other experts. Including reviews for measure applicability to California markets and current program/policy constraints.
DEER. IOU Compliance Filings. Last accessed March 2015. ftp://ftp.deeresources.com/E3CostEffectivenessCalculators	Provides the potential study results a point of comparison. These aid the QC process reviews of the preliminary release. These will be used for Stage 2 activities as well.
SCE. Oil Industry Major and Minor Company Guidance. Last accessed March 2015 http://www.caasupport.com/2013/09/oil-industry-major-minor-company-guidance/	Applying ISPs to the portion of the market that is considered "major." Augmenting previous guidance from CPUC ED.
Oil and Gas Extraction Statistics: CA Dept. of Conservation. 2012 Preliminary Report of California Oil and Gas Production Statistics. Last accessed: March 2015 ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2012/PR03_PreAnnual_2012.pdf CA Dept. of Conservation. 2009 Annual Report of the State Oil and Gas Supervisor. Last accessed: March 2015 ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2009/PR06_Annual_2009.pdf	Update of oil well inventories and oil production totals (barrels) for California (the latest reports available).
CEC. California Energy Consumption Database. Last accessed: March 2015 http://ecdms.energy.ca.gov/	ECDMS data informs the IOU breakouts for mining consumption.

NAVIGANT ENERGY

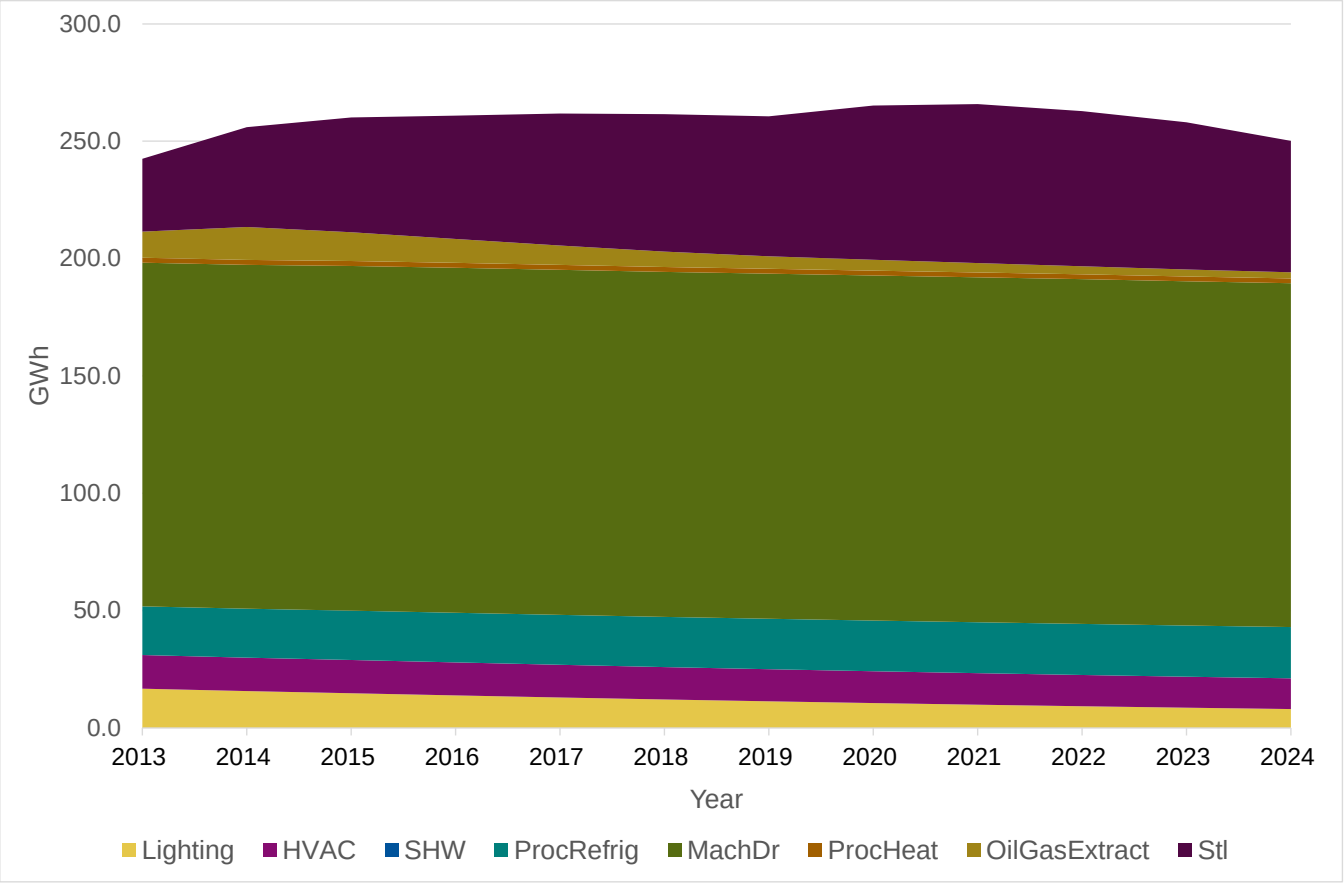
Street Lighting Sector Stage 1:

- Updated LED costs and emerging technology vectors (as informed by our emerging technologies analyses)
- Sourced new lamp count inventories for the IOUs and secondary sources
  - Used for modeling QC
  - Primary data: PG&E, SCE
  - Secondary source update: SDG&E

Source(s)	Comment
CEC. Quarterly Fuel and Energy Report. January 2015	Informs subsector distributions; equipment stocks Updated with electric consumption data
IOUs. Street Lighting lamp inventories. Supplied to Navigant via email December 2014 to January 2015	Informing equipment stocks and distinguishing customer-owned and IOU-owned lamps.
SDG&E Street Lighting retrofit activities: National Lighting Bureau. $16 Million San Diego Lighting Upgrade Uses Broad-Spectrum Induction Technology. Last accessed March 2015 http://www.nlb.org/index.cfm?cdid=10839&pid=10213 City of San Diego. Citywide Broad Spectrum Street Lighting Retrofits. Last accessed March 2015 http://www.sandiego.gov/environmental-services/energy/programsprojects/saving/broadspectrumretrofit.shtml City of San Diego. Retrofit Activities Summary. Last accessed March 2015 http://www.sandiego.gov/environmental-services/energy/pdf/energysavings.pdf	To estimate the change in equipment stocks from 2013 to 2015 for SDGE.

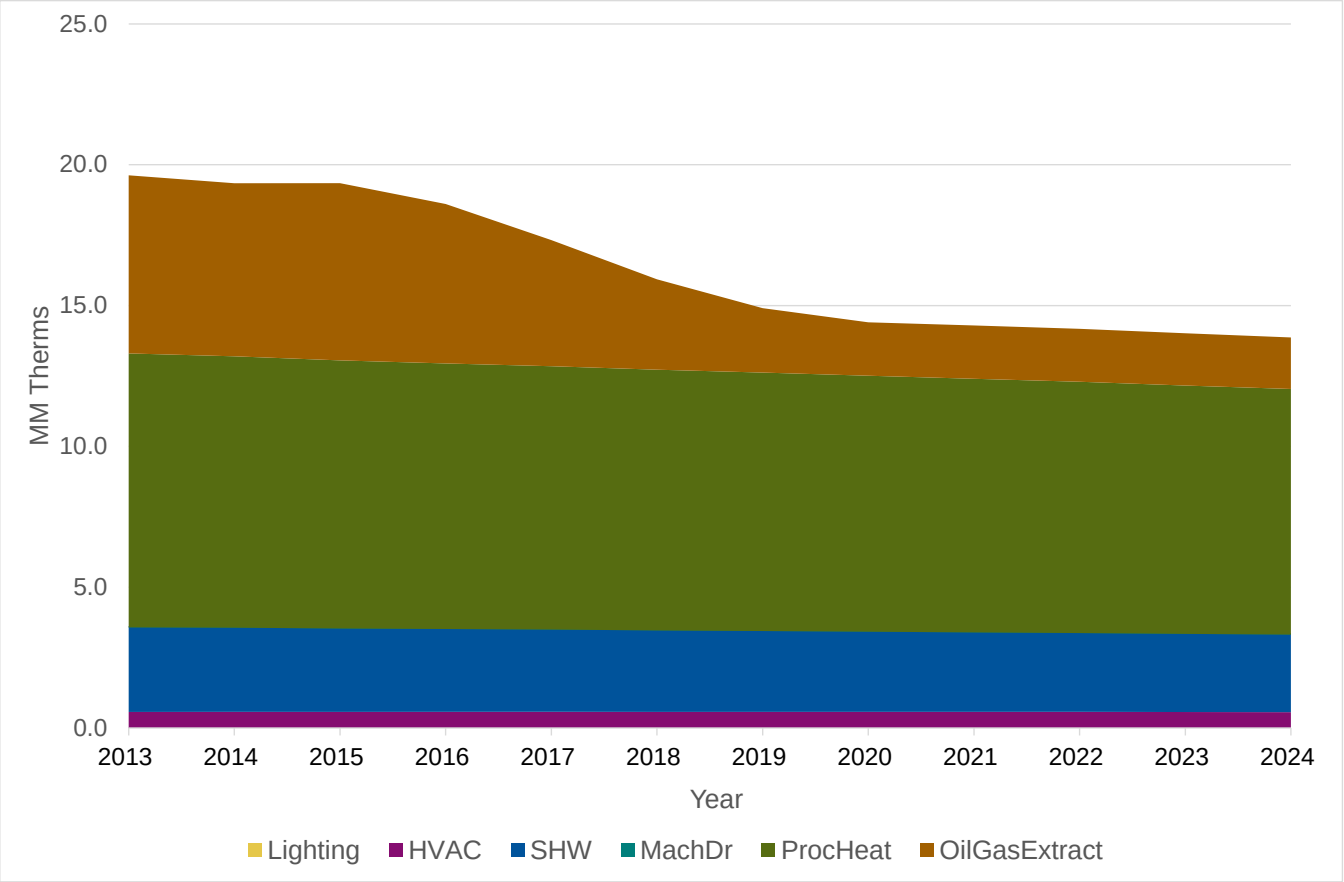
NAVIGANT ENERGY

All IOUs: AIMS Incremental Market Potential (GWh)



NAVIGANT ENERGY

All IOUs: AIMS Incremental Market Potential (MM Therms)



NAVIGANT ENERGY

1 » Overview and Scope Highlights

2 » Model and Results Overview

3 » Input Sources: Global Inputs

4 » Input Sources: Residential/Commercial Measures

5 » Agriculture, Industrial, Mining and Street lighting

» **6 » Codes and Standards**

7 » Emerging Technologies

8 » Whole Building Packages

9 » Financing

10 » Behavior Programs

NAVIGANT ENERGY

C&S impacts are modeled two ways: 1) C&S reduces the UES for IOU rebated measures and 2) IOUs can claim a portion of savings from C&S.

» C&S Impacts on IOU Rebated Measures

- Similar to the 2013 Study, the 2015 Study used Codes & Standards (C&S) impact vectors to quantify the percentage change of the impact for each measure in each year.
- See the 2013 Study for additional details on the methodology.
  - Navigant Consulting, Inc. *2013 California Energy Efficiency Potential and Goals Study*. February 2014.
- See the supplemental provided spreadsheet with our resulting C&S vectors for each measure.

» IOU Claimable Savings from C&S Advocacy Programs

- C&S savings are forecasted into the future using the CPUC's Integrated Standards Savings Model (ISSM) used for the CPUC's 2010-12 impact evaluation of IOU C&S programs.
- The Potential Study C&S model follows the same methodology as ISSM.
- For C&S that were modeled in ISSM, the Potential Study C&S model uses ISSM data as inputs.
  - Cadmus, Energy Services Division and DNV GL. *Integrated Standards Savings Model (ISSM).* Last accessed: January 2015.
  - Cadmus, Energy Services Division and DNV GL. *Statewide Codes and Standards Program Impact Evaluation Report For Program Years 2010-2012.* August 2014.
- For all other C&S, the Potential Study C&S model uses data from the 2013 Study Model.
  - Navigant Consulting, Inc and HMG. *2013 California Energy Efficiency Potential and Goals Study Model*. February 2014.
  - Removed realization rate for future (unevaluated) C&S, realization rate set to 100%

The model accounts for a methodology update in IOU C&S program savings analysis referred to as "Layering".

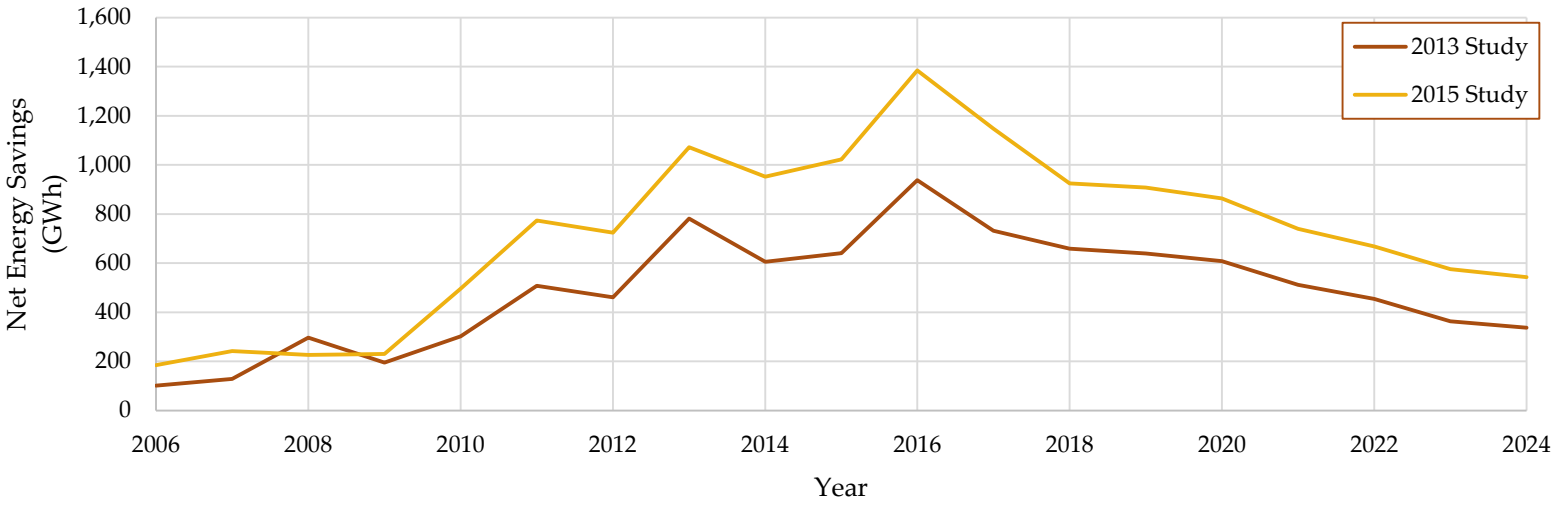
- Some new California standards supersede efficiency levels set by earlier standards. Two options are available for accounting for these types of standards:
  - **Layering**: The first standard produces the first "layer" of savings and each later standard adds another layer of savings.
  - **No Layering**: Savings from earlier superseded standards end when a new, more stringent standard takes effect. Only incremental savings from the most recent standard are included.
- CPUC staff and evaluators reviewed all of the codes and standards being evaluated in the ISSM model. To qualify as an instance of layering:
  - Standards must be adopted separately (not at the same time, as happens when one standard includes two tiers that take effect at different times).
  - The superseding code or standard must regulate the same feature(s) of a product.
- The 2015 PGT study used the **no layering** methodology, consistent with CPUC direction to IOUs in their program filings
- Measures that were superseded by later standards:
  - General Service Incandescent Lamps, Tier 2
  - Consumer Electronics - TVs
- For more information see: Cadmus, Energy Services Division and DNV GL. *Statewide Codes and Standards Program Impact Evaluation Report For Program Years 2010-2012*. August 2014.

The C&S model includes several options that can be selected by the user. The default options used to produce model results are below.

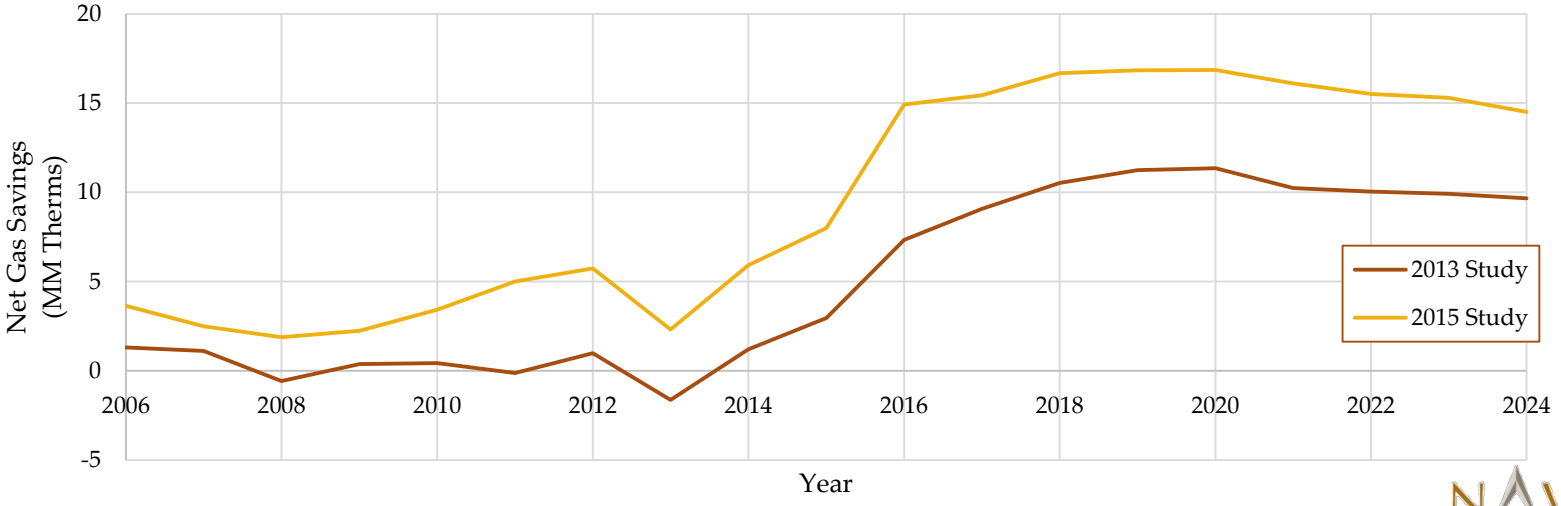
- No Layering
- Adjust New Construction in Title 24 Analysis (for unevaluated T24 measures): Yes
  - Most Future Title 24 analysis is based on IPER building stock assumptions that pre-date the 2008 recession. This adjustment decreases construction rates for 2008 onwards to better reflect actual market activity.
- Include Interactive Effects: Yes
  - Interactive effects are secondary energy impacts that may result from saving energy on a particular end-use.
  - They are associated with savings in total electricity usage and end-uses that are within conditioned space.
  - When energy for a particular end-use, such as lighting, is reduced, there are two types:
    - Negative gas savings due to increased heating
    - Positive electric savings due to reduced cooling
  - Source data: ISSM
- Compliance Enhancement: Yes
  - Incremental improvement in compliance rate due to code compliance efforts as a result of the Strategic Plan.
  - Compliance ramps up to 100% over a set number of years after the C&S comes into effect. Assumptions unchanged from the 2013 Model.

C&S Model: Results

Net IOU Attributable Energy Savings: 2013 Study vs. 2015 Study



Net IOU Attributable Gas Savings: 2013 Study vs. 2015 Study



NAVIGANT ENERGY

1 » Overview, Scope and Summary Results

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NAVIGANT ENERGY

The Stage 1 update for Emerging Technologies maintained the same measure list as the 2013 study, focused on updating technology data.

» Emerging Technologies (ETs) are defined as meeting one or more of the following criteria:
  – Not widely available in today's market but expected to be available in the next 1-3 years.
  – Widely available but representing less than 5% of the existing market share.
  – Costs and/or performance are expected to improve in the future.

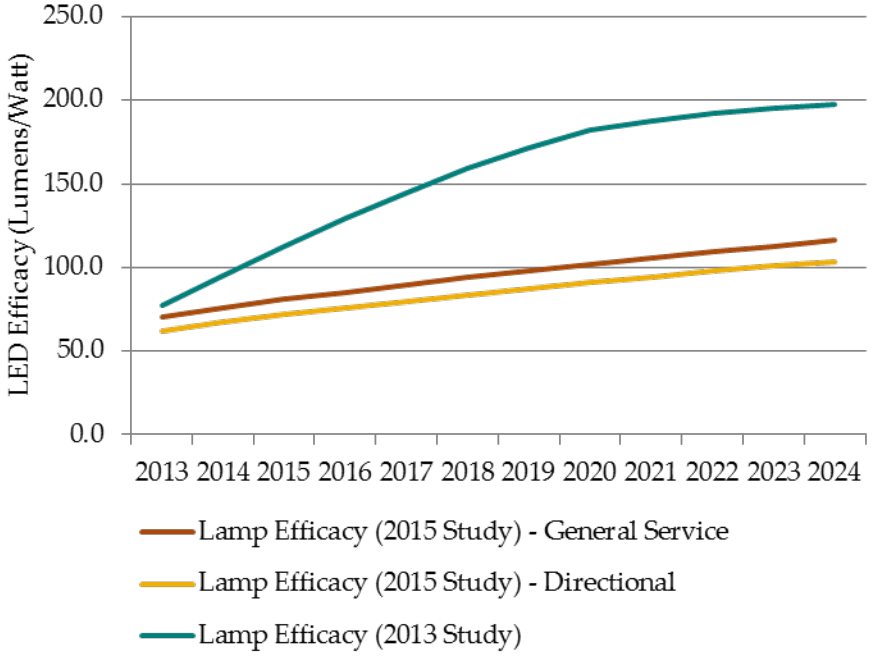
» ETs discussed in this section are only for the residential and commercial sectors.

» The Stage 1 update focused on updating the data where we had better availability; majority of focus was on LEDs.
  – Navigant extrapolated or used directly cost and performance data from DEER where possible.
  – IOU work papers and other case studies provided additional cost and performance data.
  – 2010 – 2012 EM&V studies such as "WO017 Ex Ante Measure Cost Study " provided more CA specific market data.
  – In absence of any CA specific verified data, mostly for LEDs, Navigant leveraged data from national studies published by DOE and PNNL and adjusted to CA specific values based on CA regulatory and market conditions.
  – Navigant revised cost reduction and performance improvement vector assignments based on the further market intelligence developed for the ET measures since the 2013 study.

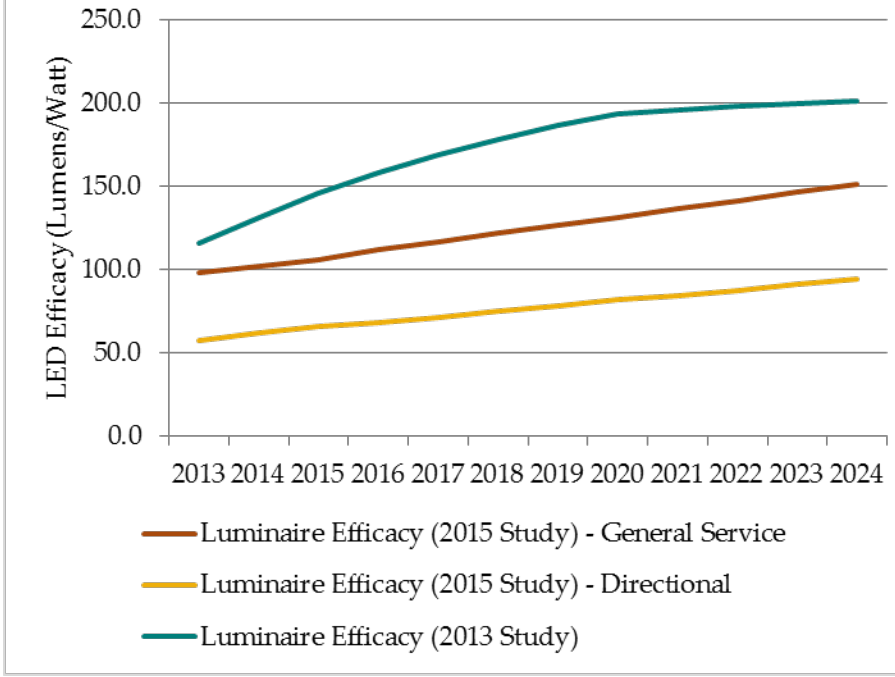
Source: 2010-2012 WO013 Residential Lighting Process Evaluation and Market Characterization
2010-2012 WO028 California Upstream and Residential Lighting Impact Evaluation

LED efficacies are updated to market averages and they have dropped compared to previous (2013) potential study.

LED Technology Improvements (Lamps)



LED Technology Improvements (Luminaires)



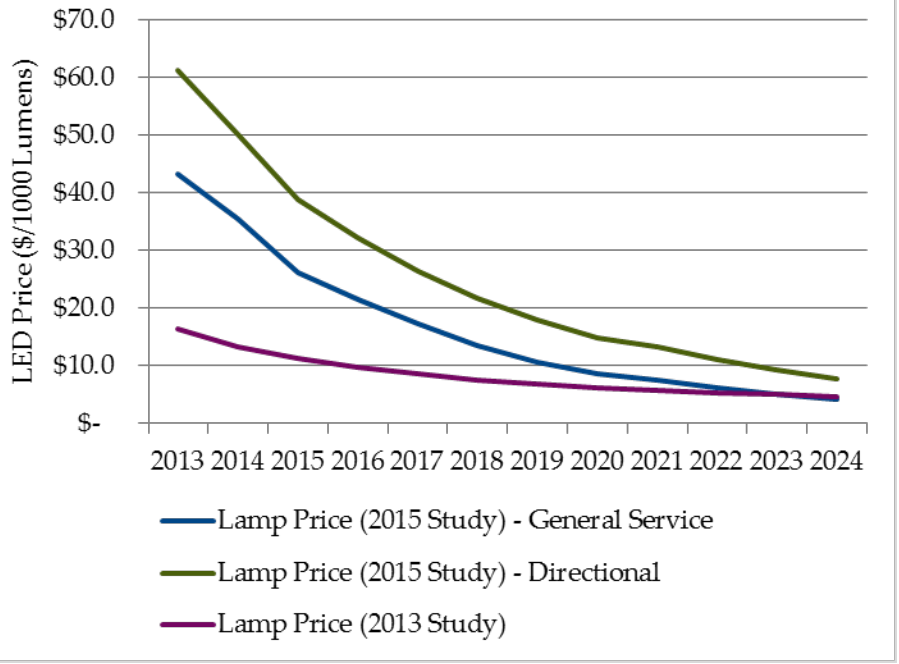
- Previous data (2013 Study) represented the "best performers" in the market which was based on U.S. DOE technology targets and did not represent the majority of products in the market.
- New data (2015 Study) represents the average performance and cost which is based on historical data for LEDs.
- New study uses efficacy and cost data specific to LED applications (i.e. General Service and Directional).

Source: Navigant. Energy Savings Potential of Solid-State Lighting in General Illumination Applications. Prepared for the U.S. Department of Energy, January 2012.
Navigant. Energy Savings Forecast of Solid-State Lighting in General Illumination Applications. Prepared for the U.S. Department of Energy, August 2014.

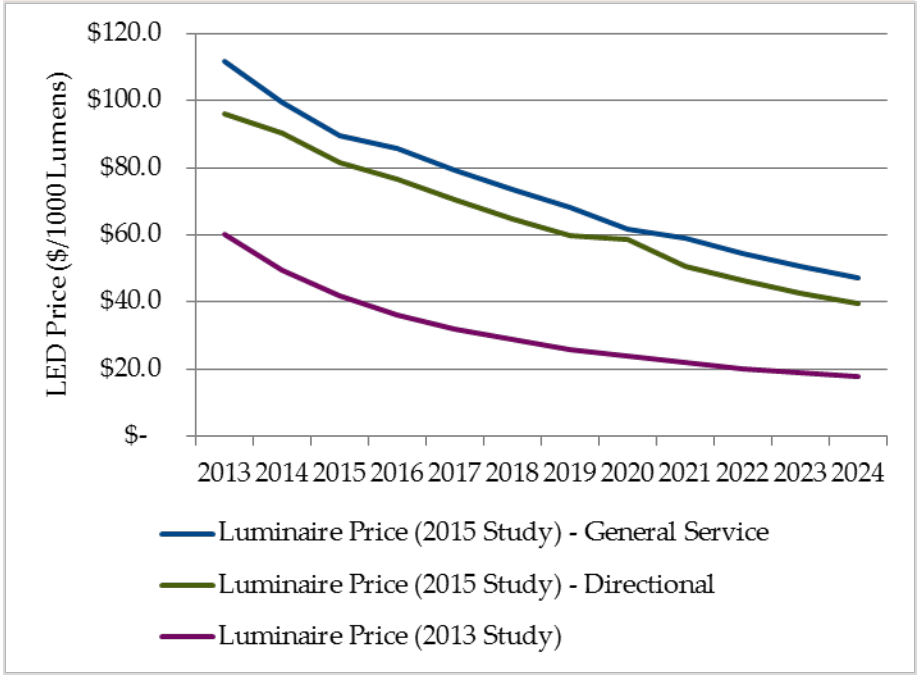
NAVIGANT ENERGY

LED costs are updated to market averages and adjusted to represent LEDs that meet the CEC's Voluntary Quality LED Lamp Specification.

LED Technology Improvements (Lamps)



LED Technology Improvements (Luminaires)



- Navigant has developed a web-scraped database of pricing and specifications for over 15,000 LED lighting products time-stamped between 2008 and 2014. Major data sources include Home Depot, Lowes, Target, Walmart, Grainger, BestBuy, CALiPER, Gateway, GSA Advantage, Platt, ACE Hardware, Amazon.com, and 1000bulbs.com.
- From this dataset Navigant analyzed the price premium associated with LEDs that meet the California Energy Commission's Voluntary Quality LED Lamp Specification. In particular the new standard requires LED lamps to have a minimum of 90 Color Rendering Index (CRI) in order to qualify for incentive programs and rebates and its manufacturers have argued that high CRI LED lamp products have higher manufacturing costs which then translates to a higher price point for consumers.

Source: Navigant. Energy Savings Potential of Solid-State Lighting in General Illumination Applications. Prepared for the U.S. Department of Energy, January 2012.

Navigant. Energy Savings Forecast of Solid-State Lighting in General Illumination Applications. Prepared for the U.S. Department of Energy, August 2014.

California Energy Commission, "Response to comment made at CEC Title 24 pre-workshop", November 3rd, 2014.
http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-11-03_workshop/comments/Philips_Lighting_Response_to_CEC_Title_24_Pre_Workshop_2014-11-13_TN-73977.pdf

NAVIGANT ENERGY

Table below illustrates the 2015 values used for LEDs in the two potential studies.

		LED Screw-In Indoor Lamp: 8W, 675 lumens	LED Screw-In Indoor Reflector Lamp: 12W, 850 lumens	LED Screw-In Indoor Specialty Lamp: 10W, 780 lumens	LED Screw-In Indoor Lamp: 16.5W, 1300 lumens
2015 Efficacy (Lumens/ Watt)	2013 Potential Study	112.5	112.5	112.5	112.5
	2015 Potential Study	80.9	71.7	80.9	71.7
2015 Price ($/unit)	2013 Potential Study	$7.62	$9.11	$8.97	$13.43
	2015 Potential Study	$17.73	$31.40	$20.85	$46.30

- 2015 Potential Study cost data is slightly higher than most common products seen in the market, however, these values are adjusted values specific to LEDs that meet the CEC's Voluntary Quality LED Lamp Specification.
  - On average prices are adjusted by 10-12% starting in 2014 with the percentage adjustment decreasing over time to almost 0% by 2020, assuming CA market average will catch up with the Quality Specification over time.
- 2015 Potential Study efficacy values are in line with the current products available in the market.

Source: Navigant. California Potential and Goals Study 2015

NAVIGANT ENERGY

Navigant assigned a risk factor to each ET to account for inherent uncertainty in the ability for ETs to produce reliable future savings.

» The model applies the ET risk factor to the savings of the ET measures and ensures that only willingness (via levelized measure cost) is affected by the ET risk factor, not actual savings.

» In general, risk factors are reduced, mainly because more data have become available and the technical and market uncertainties that are associated with each ET measures have been tested further in the last two years since the last potential study.

– Most of the LED risk factors dropped from 30% to 20%.

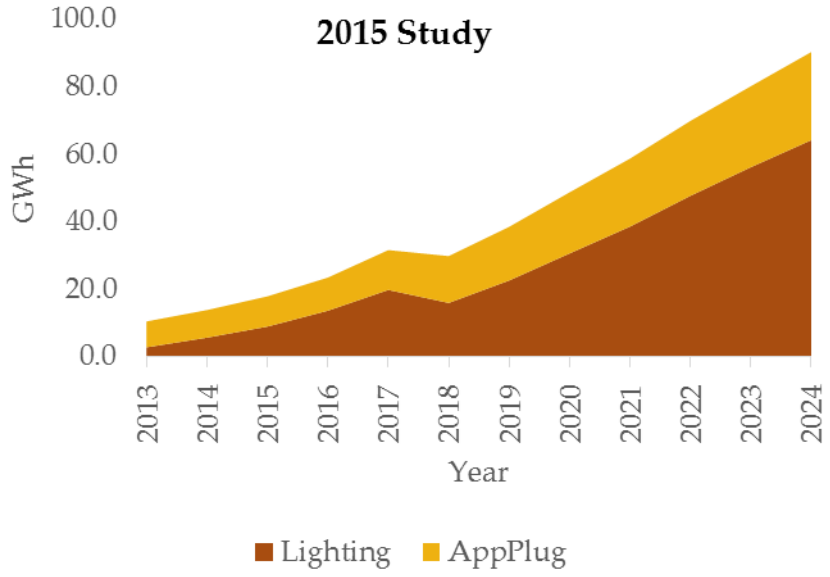
Risk Category	ET Risk Factor 90%	70%	50%	30%	10%
Market Risk (25% weighting)	High Risk: • Requires new/changed business model • Start-up, or small manufacturer • Significant changes to infrastructure • Requires training of contractors Consumer acceptance barriers exist.			Low Risk: • Trained contractors • Established business models • Already in U.S. Market • Manufacturer committed to commercialization	
Technical Risk (25% weighting)	**High Risk:** Prototype in first field tests	Low volume manufacturer. Limited experience	New product with broad commercial appeal	Proven technology in different application or different region	**Low Risk:** Proven technology in target application
Source Risk (50% weighting)	**High Risk:** Based only on manufacturer claims	Manufacturer case studies	Engineering assessment or lab test	Third party case study (real world installation)	**Low Risk:** Evaluation results or multiple third party case studies

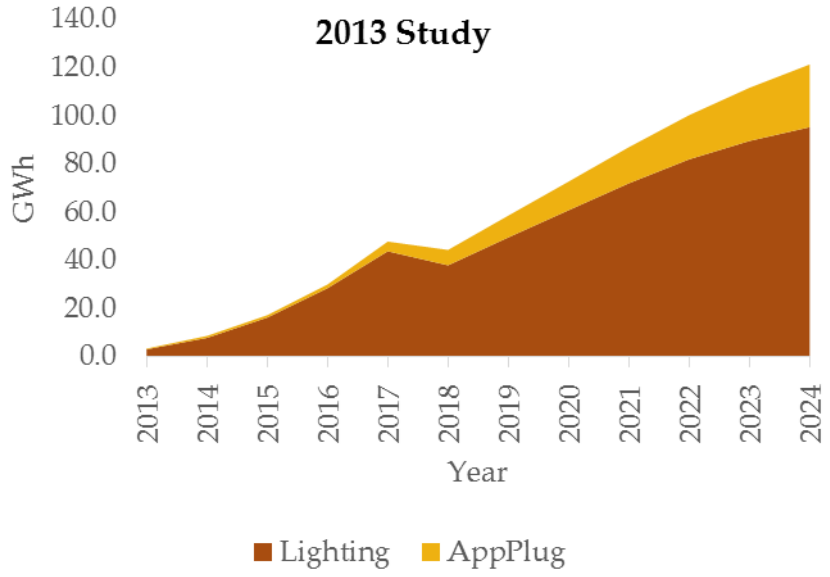
Source: Navigant Analysis

NAVIGANT ENERGY

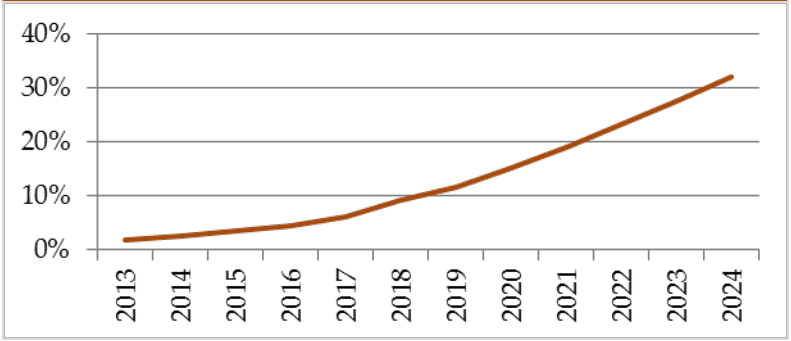
Many drivers in the Stage 1 update impacted the savings potential for ETs, and one of the key drivers is CFLs became more cost-effective while LEDs became less cost-effective, shifting the balance between the two competing measures.

Residential Incremental Market Potential for Emerging Technologies (GWh)





ET potential as a % of Total Res. Savings (GWh)



End Use	ET Measure
Lighting	LEDs
HVAC	SEER Rated Split System AC and HP
AppPlug	Self-Contained Refrigerator, Clothes Washer, Dishwasher, HP Clothes Dryer, Smart Strip

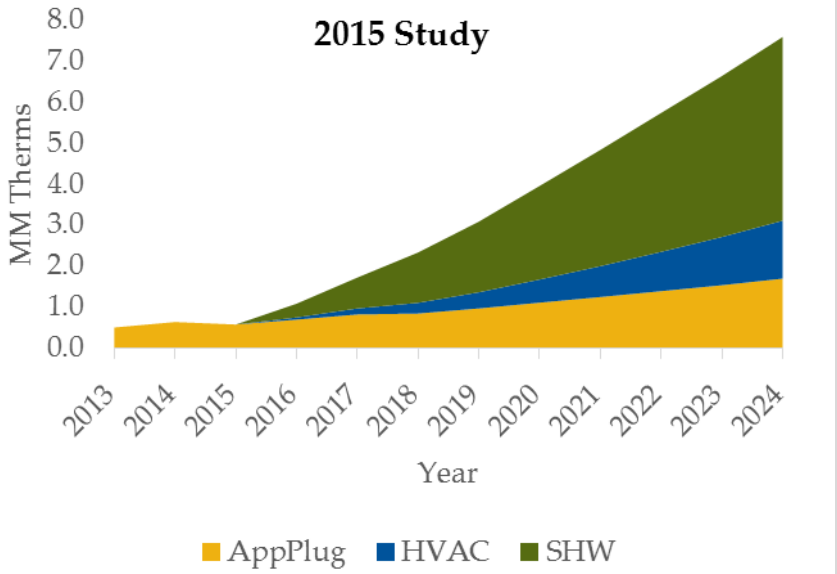
Source: Navigant. California Potential and Goals Study 2015

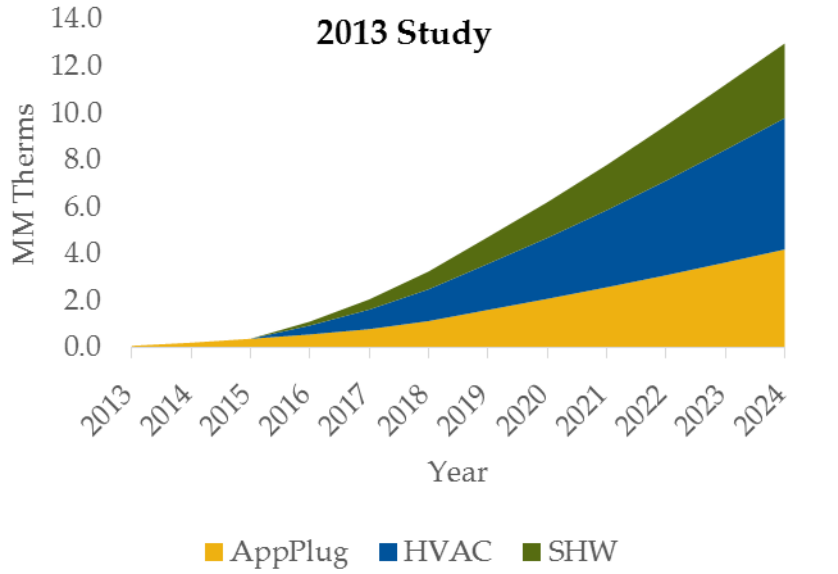
Note: Negative savings from measures due to interactive effects are excluded from the analysis.

NAVIGANT ENERGY

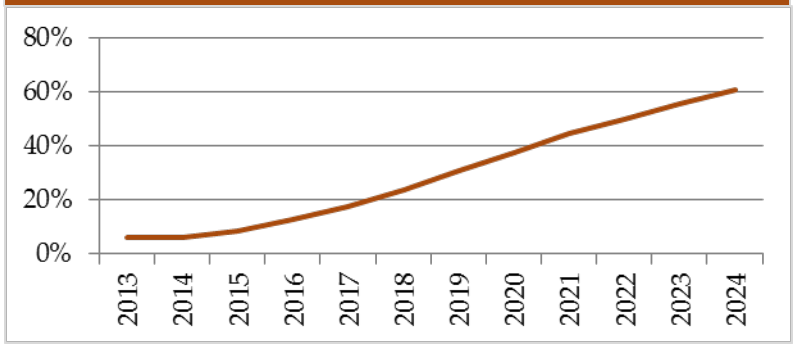
Storage Water Heaters with high efficiency represent significant share of the gas savings for residential sector in the future.

Residential Incremental Market Potential for Emerging Technologies (MM Therms)





ET potential as a % of Total Res. Savings (MM Therms)



End Use	ET Measure
AppPlug	Clothes Washer, Dishwasher
SHW	Storage Condensing Water Heater
HVAC	Gas Furnace

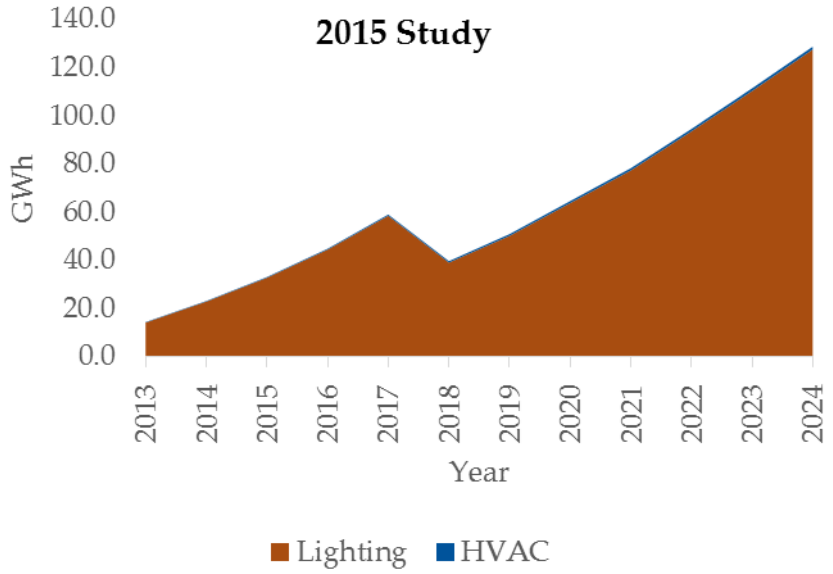
Source: Navigant. California Potential and Goals Study 2015

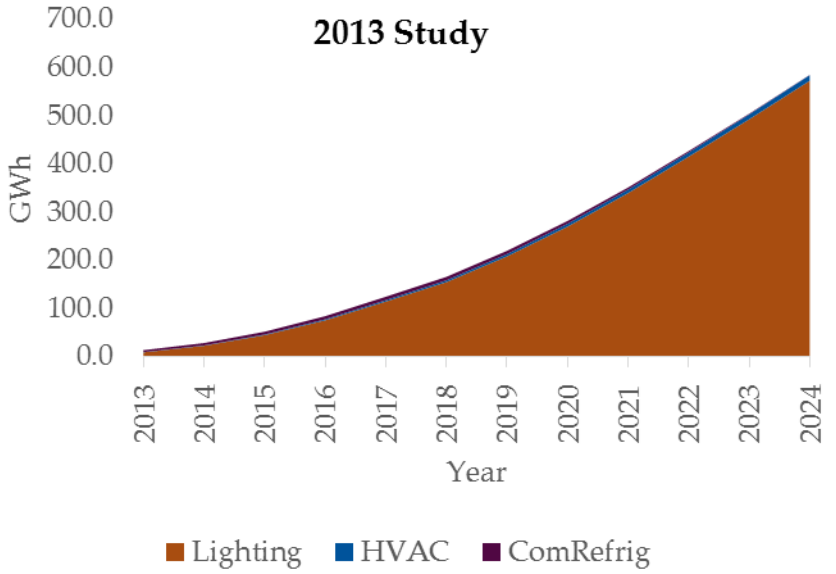
Note: Negative savings from measures due to interactive effects are excluded from the graphs.

NAVIGANT ENERGY

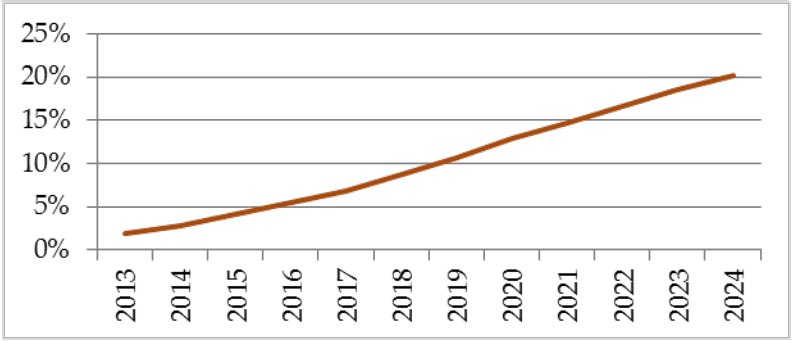
Many drivers in the Stage 1 update impacted the savings potential for ETs, and one of the key drivers is CFLs became more cost-effective while LEDs became less cost-effective, shifting the balance between the two competing measures.

Commercial Incremental Market Potential for Emerging Technologies (GWh)





ET potential as a % of Total Com. Savings (GWh)



End Use	ET Measure
Lighting	LEDs
HVAC	Energy Recovery Ventilation, Advanced Package Rooftop AC

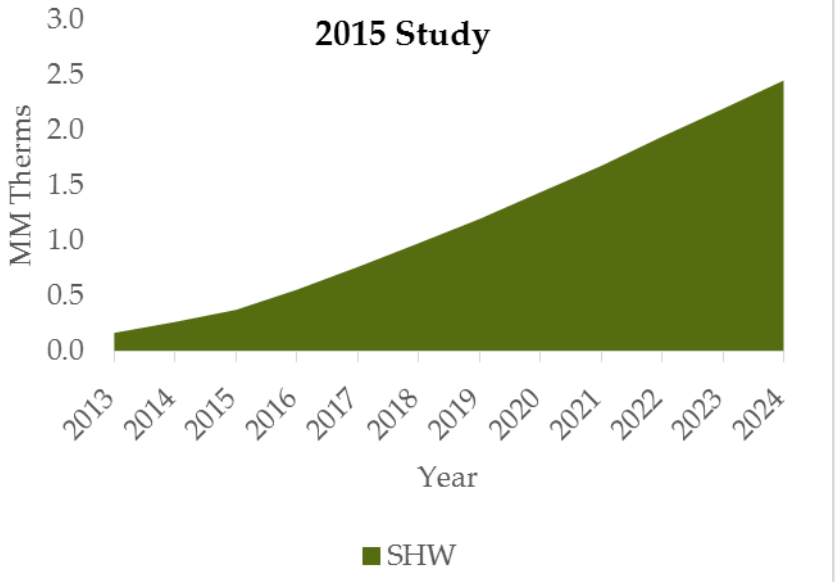
Source: Navigant. California Potential and Goals Study 2015

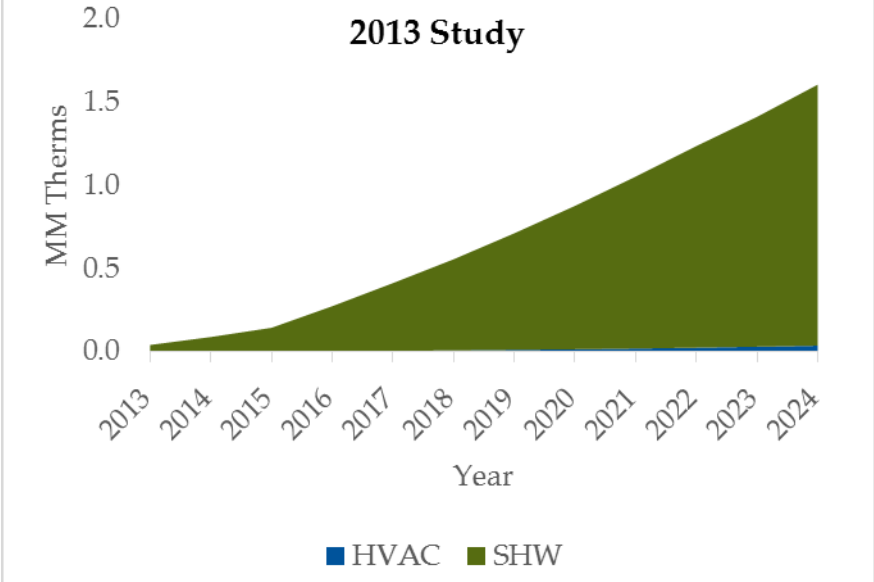
Note: Negative savings from measures due to interactive effects are excluded from the analysis.

NAVIGANT ENERGY

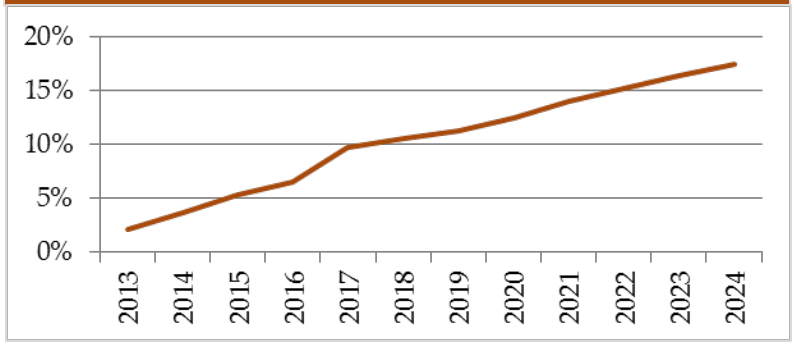
Even though Storage Water Heater data has not been updated, it shows higher potential compared to 2013 study due to other drivers.

Commercial Incremental Market Potential for Emerging Technologies (MM Therms)





ET potential as a % of Total Com. Savings (MM Therms)



End Use	ET Measure
SHW	Storage Condensing Water Heater

Source: Navigant. California Potential and Goals Study 2015

Note: Negative savings from measures due to interactive effects are excluded from the graphs.

NAVIGANT ENERGY

NAVIGANT ENERGY

Commercial and Residential whole building bundles were reviewed and updated where new data was available.

Whole-Building Bundle Name	Stage 1 Data Updates
Commercial New Construction Level 1	Same as the 2013 study
Commercial New Construction Level 2	Same as the 2013 study
Commercial New Construction Level 3	Same as the 2013 study
Commercial New Construction ZNE	Updated data
Commercial Renovation Level 1	Updated data
Commercial Renovation Level 2	Updated data
Residential New Construction Level 1	Same as the 2013 study
Residential New Construction Level 2	Same as the 2013 study
Residential New Construction Level 3	Same as the 2013 study
Residential New Construction ZNE	Updated data
Residential Renovation Energy Upgrade CA - Basic Path	Reviewed data
Residential Renovation Energy Upgrade CA - Flex Path	Updated data
Residential Renovation Energy Upgrade CA - Advanced Path	Updated data

NAVIGANT ENERGY

Commercial and Residential Bundle Updates

» Commercial and Residential New Construction Zero Net Energy

- **New Data Sources**
  - **Baseline construction costs updated:** Reed Construction Data Inc., RS Means Square Foot Estimator: http://www.rsmeansonline.com
  - **2013 Title 24 Residential Compliant Energy Use Updated:** Single and multifamily electricity, electric demand and natural gas consumption updated, California Energy Commission, CBECC-Res 2013 Std Design Results, January 2015.
  - Updated commercial vectors comparing ZNE savings relative to Title 24 (dynamic over time)

» Commercial Retrofit Bundles Levels 1-2

- Bundles represent a group of representative measures to be installed in a commercial retrofit
- Bundles were assembled using a selection of individual measures from MICS in 2013 study
- 2015 study updated individual measure data within the bundles

» Residential Retrofit Bundle Update: Energy Upgrade California (EUC)

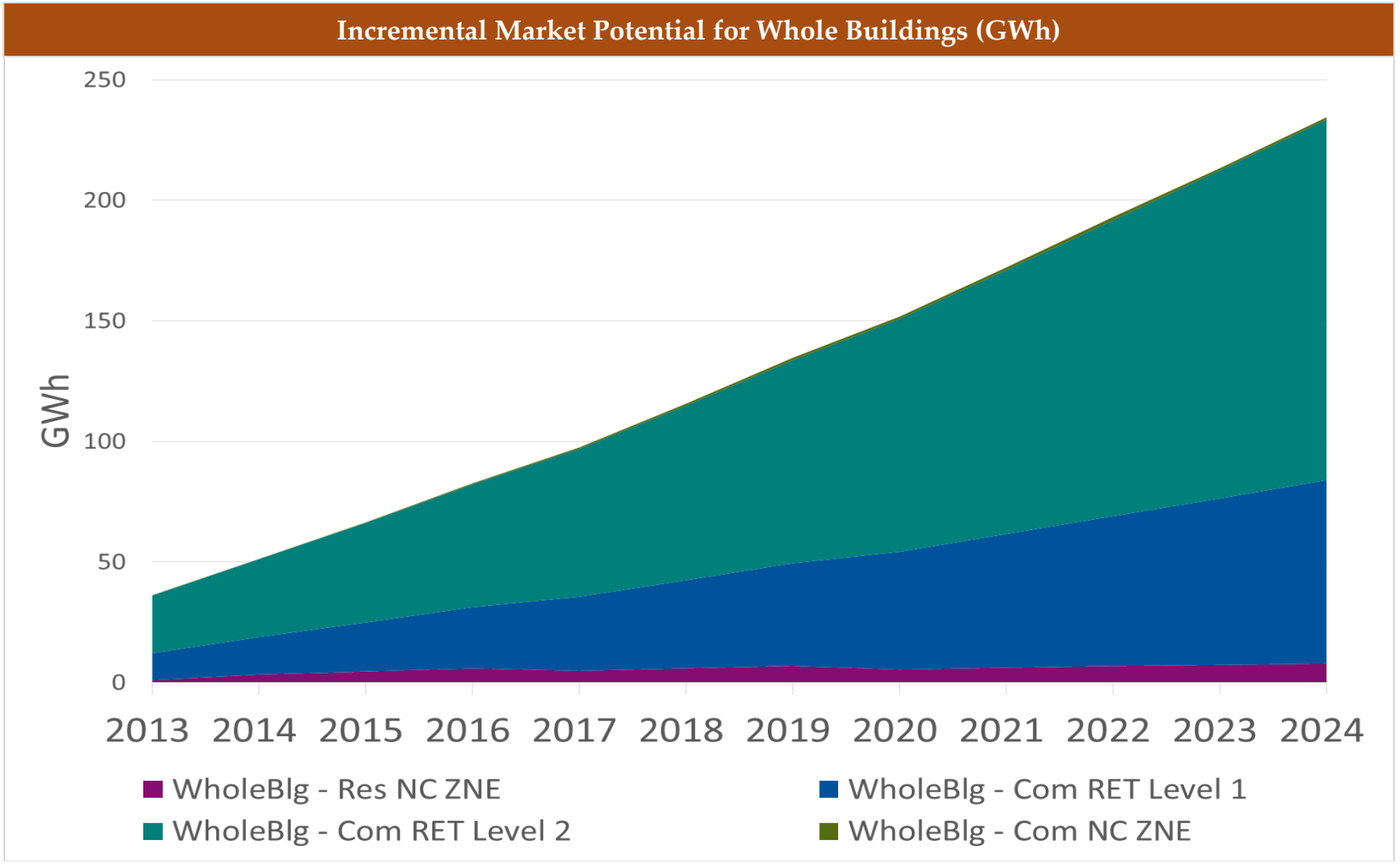
- Navigant worked with DNV GL on this update as DNV GL performed the 2010-2012 Whole House Retrofit Impact Evaluation (October, 2014)
- **New Data Sources**
  - Savings data for the model came from the DNV GL, *Whole House Retrofit Impact Evaluation*, October 2014, which includes data from 2010-2012 EUC program
  - CPUC 2013-2014 EUC program tracking data, EDCentralServer.com, alltracking1314q7_wroadmap.sas7bdat

Residential Retrofit Bundle Update: three tiers are considered in the study: Basic Path, Flex Path and Advanced Path

- **Advanced Path:** Unit energy savings sourced from 10-12 EM&V study
- **Basic Path:** Applies to multifamily homes only in the model. Impact Evaluation study did not include multifamily homes, so the data remained the same as the 2013 study
- **Flex Path:** 2010-2012 retrofits were either Advanced Path or Basic Path (single family). Flex Path data was not available. Flex Path savings were developed by assuming a weighted average of 2/3 Advanced and 1/3 Basic to determine Flex Path savings
  - Flex path options are similar to Advanced Path options, except that ex ante Flex Path savings are deemed for specific popular measure combinations, and Advanced Path options are calculated individually for each retrofit with the use of building simulation software.
  - In the 2010-2012 program, the software overestimated savings. Because evaluated savings were estimated for the program as a whole and not at the participant or the measure levels, it is not possible to develop estimates for Flex path from existing reports and documentation – this would require a detailed estimation effort. The choice of 2/3 Advanced and 1/3 Basic reflects DNV GL's "best available estimate" that Flex is more like Advanced than like Basic.

- Density (current saturation and remaining eligible population) determined based on RASS and EIA records used in the 2013 study, the EUC 2010-2012 participant numbers from the *Whole House Retrofit Impact Evaluation* and latest available CPUC tracking data for 2013-2014.
- Key comments on Energy Upgrade CA:
  - Unit energy savings decreased compared to 2013 study assumptions
  - Cost data is still suspect – does not represent true incremental costs
  - Model shows EUC is not cost effective (given existing data) and doesn't forecast savings

Whole building NC ZNE and Commercial Retrofit were the only measures with savings potential.



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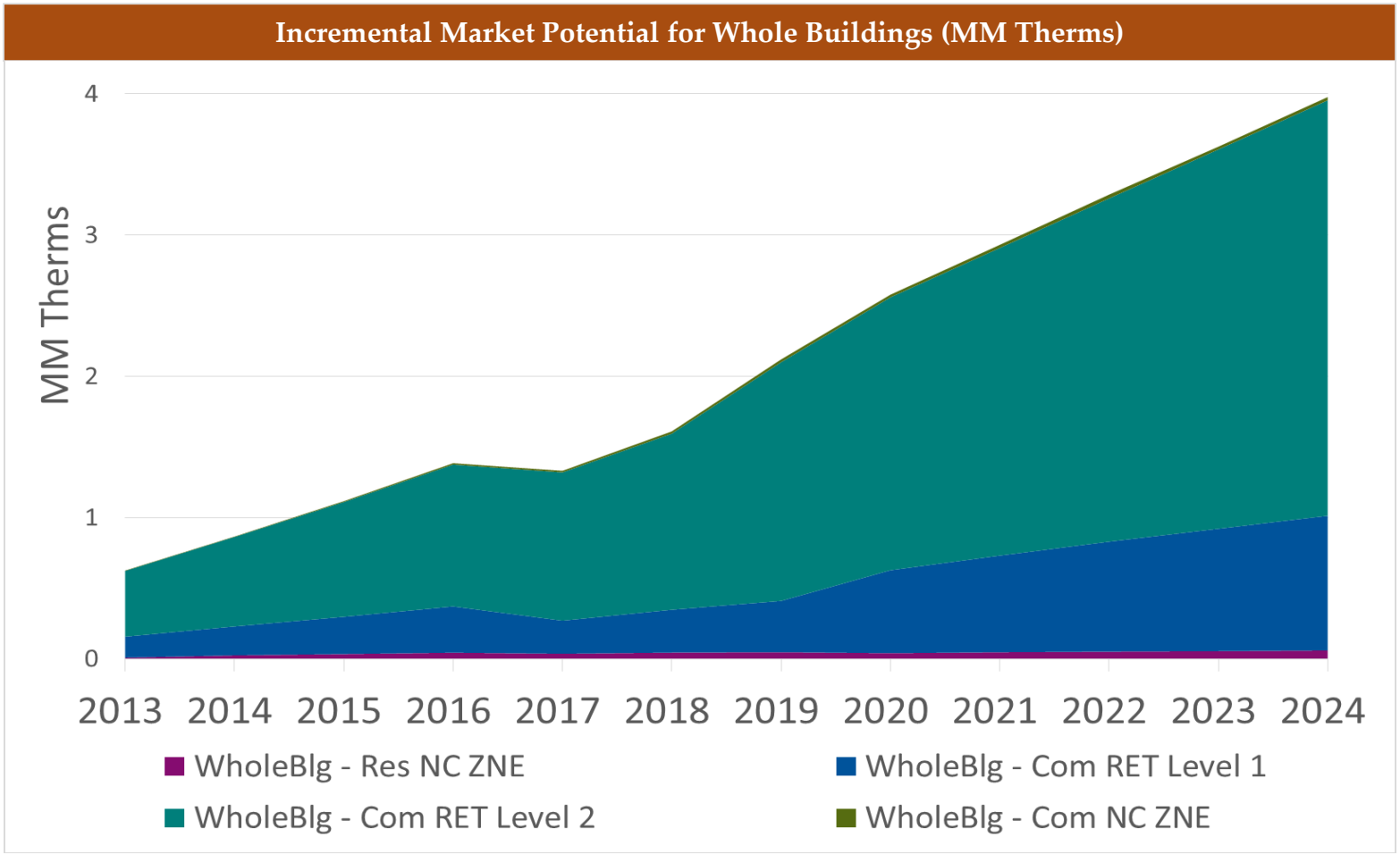

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The financing data update uses best available data including preliminary data from the IOU financing pilot evaluation studies.

» Financing applies to residential and commercial customers. Key data for forecasting the impact of financing are:

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Updated data is available for several financing inputs through recent research efforts.

» Changes in values increase projected market impact due to EE financing. The estimation in population eligibility has the greatest impact on the results.

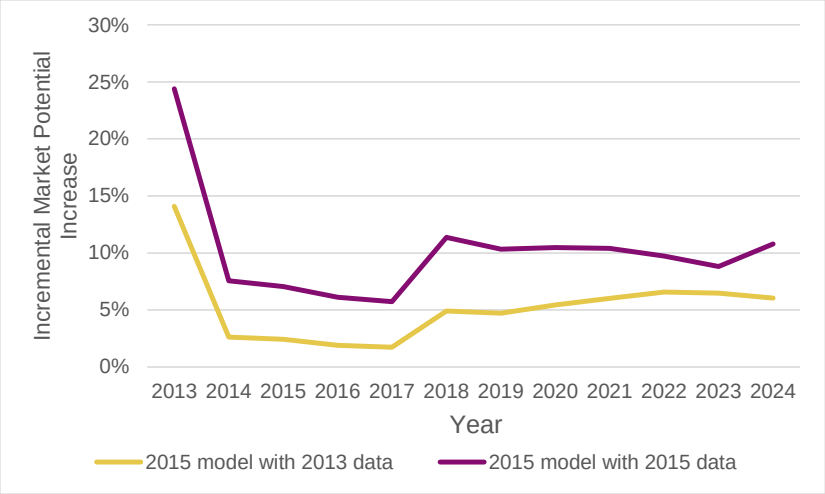
Input	2013 Study Value	2015 Study Value	2015 Study Source
Single Family Sector Interest Rate	9%	8%	Mystery Borrower Analysis, PY2013-2014 California Statewide Finance Baseline Residential Study under Work Order ED_O_FIN3
Single Family Eligible Population	63%	98%	Experian Consumer Credit Data, access date: Nov 19, 2014
Commercial Eligible Population	20%	77%	Experian Business Credit Data, access date: Mar 2, 2015
Single Family Sector Implied Discount Rate Reduction*	11%	14%	Residential Baseline Survey, PY2013-2014 California Statewide Finance Baseline Residential Study under Work Order ED_O_FIN3
Multi-Family Implied Discount Rate Reduction	13%	20%	Residential Baseline Survey, PY2013-2014 California Statewide Finance Baseline Residential Study under Work Order ED_O_FIN3

* No update to Commercial Sector Implied Discount Rate

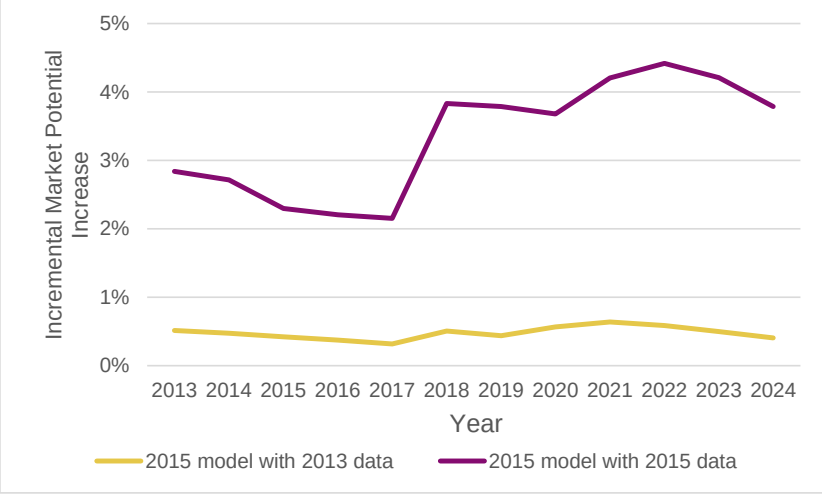
The 2015 data update increases incremental savings due to financing for both residential and commercial sectors.

» Financing increases incremental electric savings by an average of 10% for Residential Sector and 3% for Non-Residential Sector from 2013- 2024.

Residential Sector Incremental Electric Savings due to Financing



Commercial Sector Incremental Electric Savings due to Financing



To show the effects of the 2015 data update, we compare the model results using 2013 finance assumptions with the model results using 2015 finance assumptions.

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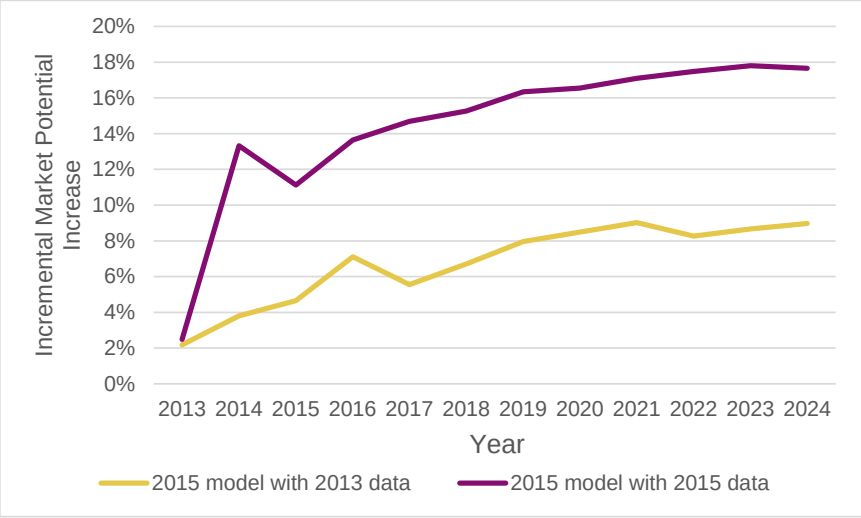
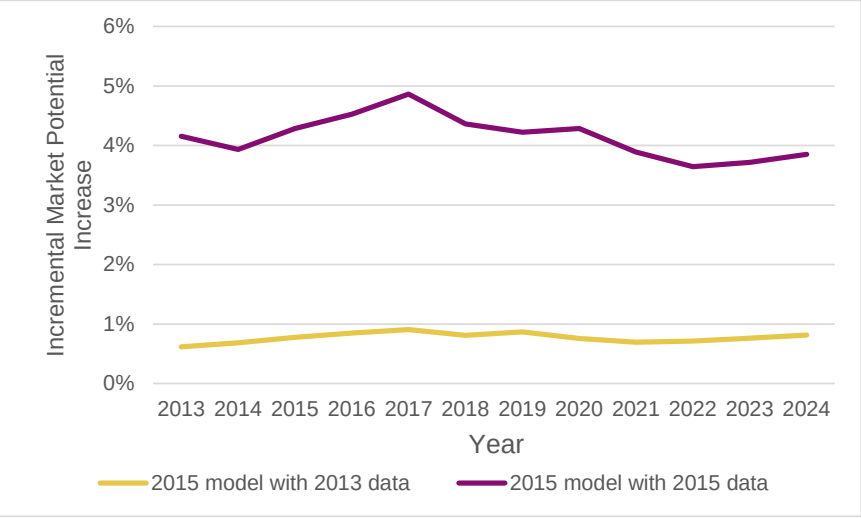
The 2015 data update increases incremental savings due to financing for both residential and commercial sectors.

» Financing increases incremental gas savings by an average of 14% for Residential Sector and 4% for Non-Residential Sector from 2013- 2024.

Residential Sector Incremental Gas Savings due to Financing



Commercial Sector Incremental Gas Savings due to Financing



To show the effects of the 2015 data update, we compare the model results using 2013 finance assumptions with the model results using 2015 finance assumptions.

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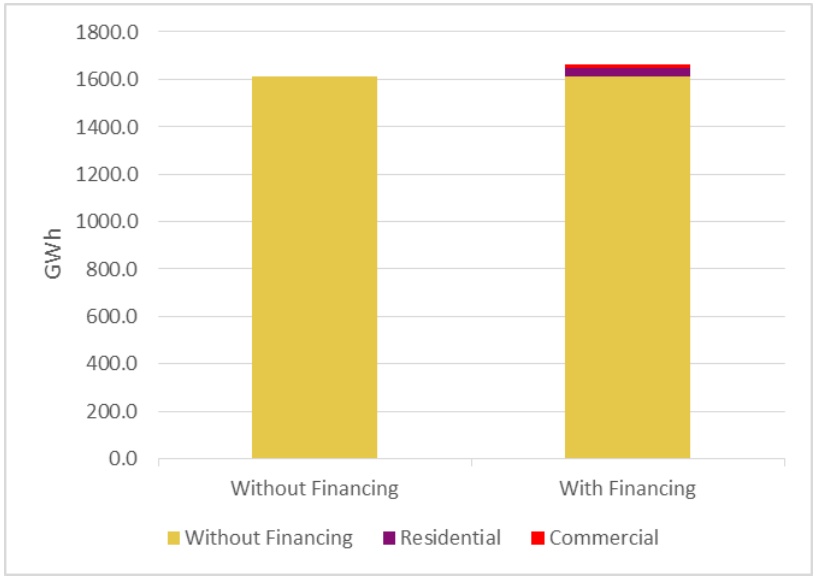
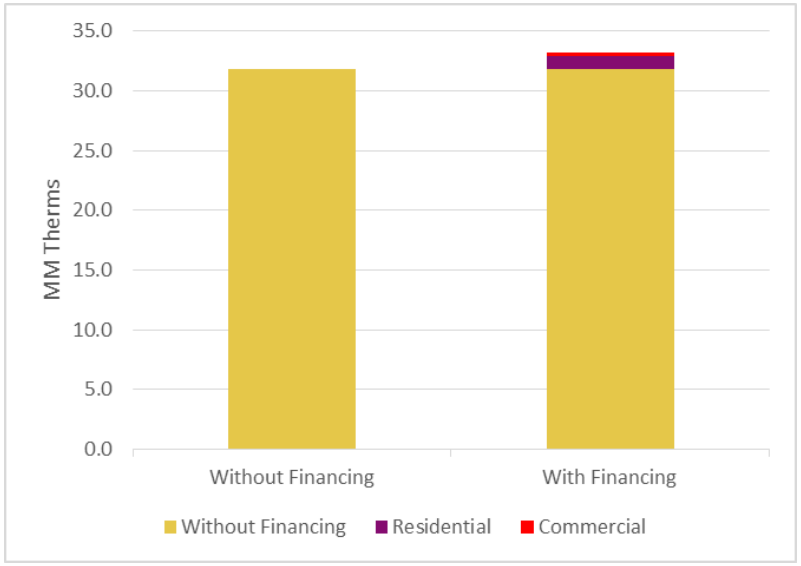
The impact of financing is more prominent in the residential sector than in the commercial sector.

» Financing increases the 2016 incremental electric savings potential by 3% while increasing the 2016 incremental gas savings potential by 5%.

2016 Incremental Electric Savings



2016 Incremental Gas Savings



Savings presented in the without financing scenario encompass residential, commercial, and AIMS 2016 incremental savings. The 2015 PG model estimates incremental impact due to financing in the residential and commercial sectors, excluding AIMS.

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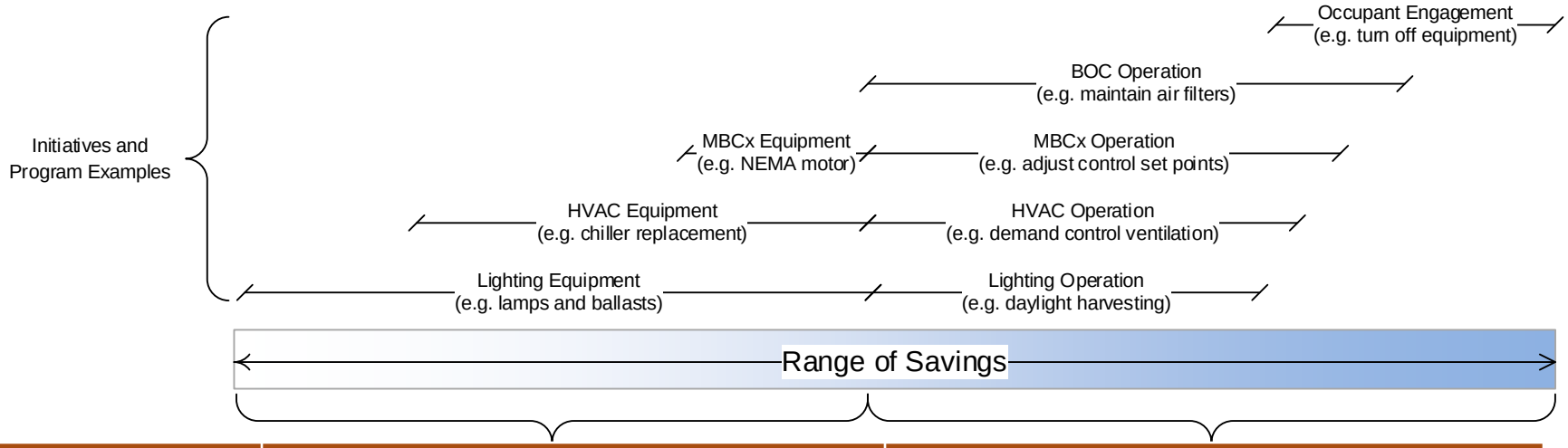
The behavior model update uses best available data for non-residential and residential behavioral programs and considers the difference between operational, or usage-based, and equipment savings.

- 2015 update uses the same methodology and parameters as the 2013 study
- The research team reviewed over 75 sources to inform the updates but relied on CA specific data where possible (see appendix)
- Updates incorporate stakeholder feedback where supported by sources

Non-Residential		Residential	
Parameter	**Key Source(s)**	**Parameter**	**Key Source(s)**
% of floor space impacted	Assessment of commercial building stock data	Participation rates	CPUC data on current and planned CA IOU participation rates (HER programs)
Usage-based savings per 1,000 square feet	Research Into Action and Energy Market Innovations, *Summary Of Building Operator Certification Program Evaluations*, November 2011; and others	Savings rates (kWh and therms) per household	Most recent available CA IOU HER program evaluations (except SCG)
		Portion of household savings from usage-based behavior	Review of 21 sources addressing the topic (nationwide)

Non-res model focuses on operational savings from BOC programs; Stage 2 will consider additional initiatives and programs.



	Equipment Savings	Operational Savings
Definitions	Most commonly defined as 'efficiency'	Most commonly defined with 'conservation'
Relationship to work	Saves energy by doing the same work for less energy	Saves energy by doing less work
Nature of fuel savings	Savings based on a delta watt	Savings based on changing device operation
Demand savings certainty	Demand savings a certain	Demand savings are uncertain
Load shape impacts	Keeps load shape, but shifts it 'down'	Changes load shape
Organizational decisions	Organizational decisions = purchasing decisions	Organizational decisions = ability to influence behavior
Key assumptions in forecasting EE potential	Potential is estimated primarily by modelling stock turnover and assuming consistent equipment operation	Potential is calculated primarily by estimating how information, controls, and modifying operator/occupant behavior can save energy by changing equipment operation.
Nature of measure costs	High percentage of projects require capital budget	Limited expense required (information and training)

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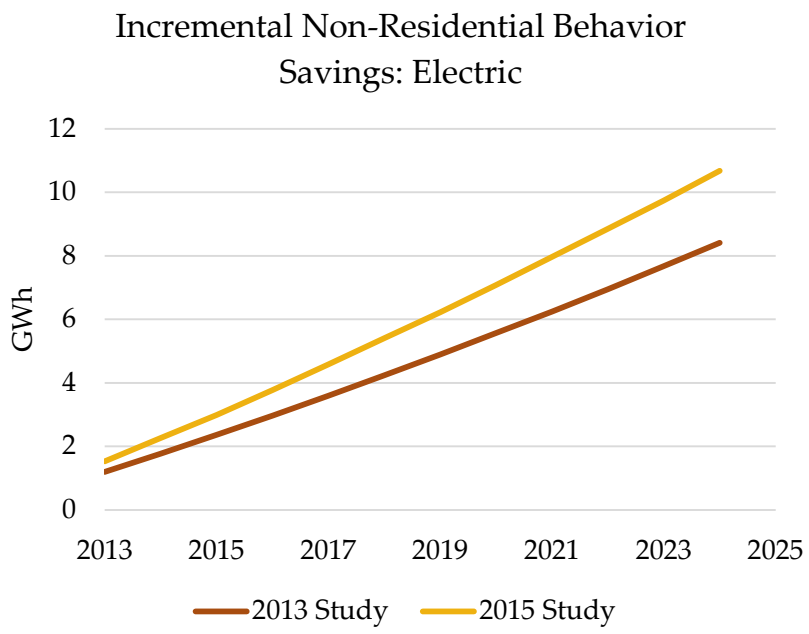
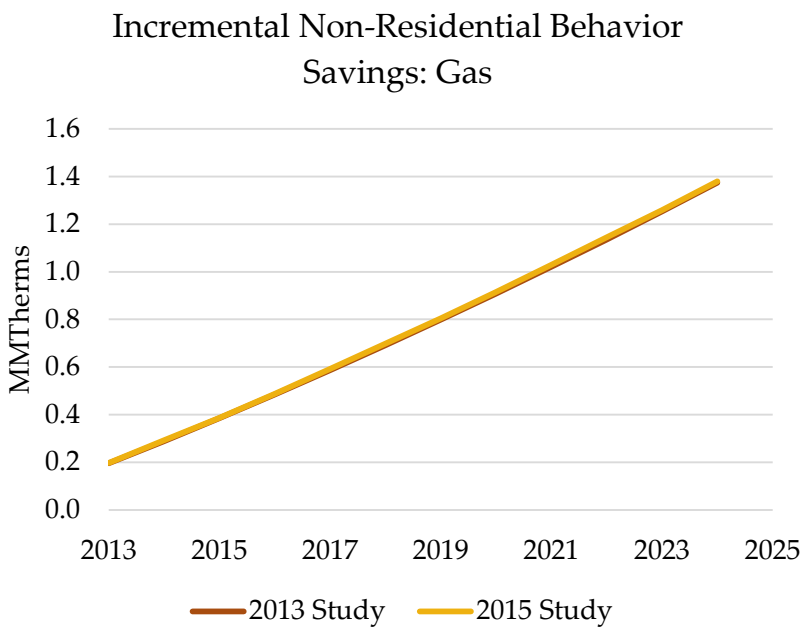
Summary of 2015 non-residential input values compared to 2013 values.

Non-Residential Inputs	2013 Model	2015 Model
Portion to usage-based behavior (kWh/1,000 sq. ft.)	41	58
Portion to usage-based behavior (therms/1,000 sq. ft.)	5.6	5.6
2015% of commercial floor space impacted	0.95%	1.00%
2026% of commercial floor space impacted	3.00%	3.45%





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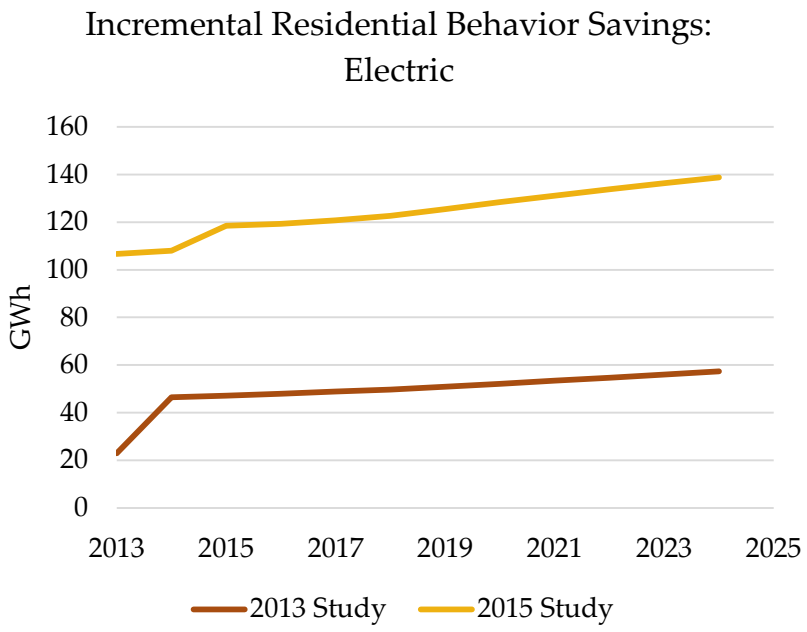
Stage 1 updates made to existing model using same parameters as 2013 model; Stage 2 updates will consider additional research and data.

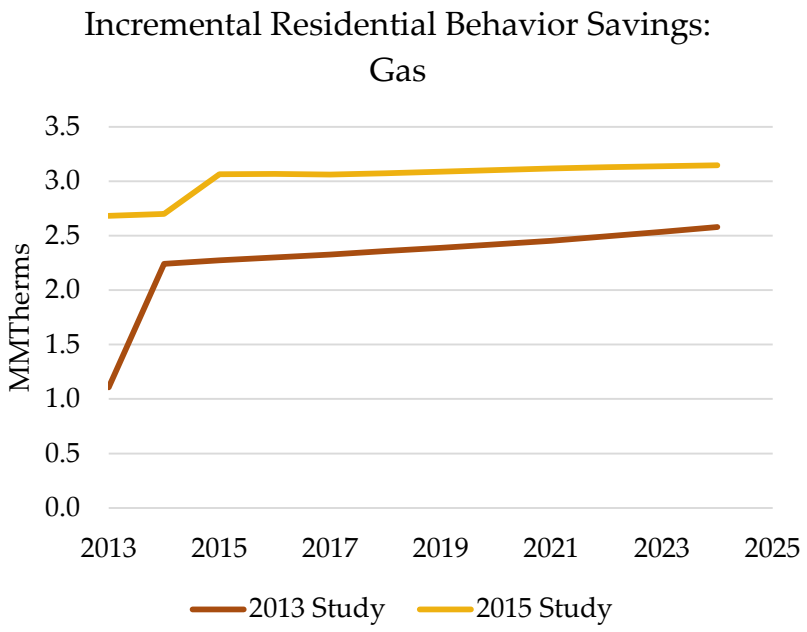
Stage 1 Residential Results	Considerations & Stage 2 Concepts
Results reflect market potential only	Incorporate technical and economic potential in Stage 2
Participation and savings inputs reflect actual 2014-2015 rates for evaluated California IOUs	Incorporate a broader array of behavior programs and explore various savings and participation rate scenarios that reflect utility program implementation plans in Stage 2
Model assumes constant participation and savings rates over time and maintains a one year measure life	
Incorporates findings from a review of all available CA IOU behavior program evaluations as well as close to 75 other sources (evaluations, white papers and conference presentations) covering behavior program impacts	
Adjusts usage-based assumption upwards 5% by removing savings "discount" that included upstream and downstream rebated equipment savings	Based on review of sources to ascertain if there was sufficient quantifiable evidence to support revising number (see list of sources)

Summary of 2015 residential parameter values compared to 2013 values.

Residential Inputs	PG&E	SCE	SCG	SDG&E
Participation Rates 2014-2026 -- % of Residential Population				
Assumes constant rates of participation, applied to shifting number of customers in each IOU territory by year.				
2013 Model	5.00%	5.00%	5.00%	5.00%
2015 Model	22.65%	23.23%	0.84%	5.72%
kWh Savings Rates 2014-2026 -- % per Household				
Assumes constant savings rates.				
2013 Model	1.80%	1.80%	n/a	1.50%
2015 Model	0.69%	1.40%	n/a	2.60%
Therm Savings Rates 2014-2026 -- % per Household				
Assumes constant savings rates.				
2013 Model	1.30%	n/a	1.30%	0.90%
2015 Model	0.71%	n/a	0.70%	2.00%
Behavior vs. Equipment				
2013 Model	67.00%	67.00%	67.00%	67.00%
2015 Model	72.00%	72.00%	72.00%	72.00%

Summary of 2015 Study residential results compared to 2013 Study.





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Questions?

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ISP Studies that inform Potential*

Industry Standard Practice Studies Used	Sector applied	Study Measure
Oil Pipeline Pump Motor VFDs	Mining	Pump Motor VFDs
Outdoor Steam Pipe Insulation for Oil-fields in California	Mining	Pipe Insulation
Artificial Lift Pump Control Technologies	Mining	Artificial Lift Pump Control
Oilfield Wastewater Pump Controls	Mining	Pump Controls
Juice Tank Insulation	Industrial	IAC ARC: Use economic thickness of insulation for low temperatures. [**Study results: Not ISP (only ISP for new construction)**]
Injection Molding Machine Industry Standard Practice Study	Industrial	IAC ARC: Replace hydraulic/pneumatic equipment with electric equipment.
Almond Drying Exhaust Air Recirculation Summary	Industrial	IAC ARC: Utilize outside air instead of conditioned air for drying.

ISP Studies not Used*

Industry Standard Practices Considered	Sector applied	Considerations (or why not)
CO Demand Control Ventilation for Enclosed Parking Structures - VFD Airflow Modulation	Commercial	Commercial related, parking structures that are not specifically targeted by the Industrial sector.
Cement Industry Standard Practice to Add a Percentage of Limestone During Grinding	Industrial	ISP is extremely specific and the measure inputs do not account for this specific application/measure.
Wastewater Treatment Plant Pumps VFD - v1	Utilities	Wastewater facility related, not specifically targeted by the Industrial sector.
Low-Rigor ISP Study on Thermal Oxidizers in Plastic Bag Industry	Industrial	ISP is extremely specific and the measure inputs do not account for this specific application/measure.

ISP Findings: *Studies and findings relate to very specific subsectors.*

*Studies being uploaded by CPUC at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Ex+Ante+Review+Custom+Process+Guidance+Documents.htm

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Stage 1 Sources

Source(s)	Sector	Comment
DOE. Industrial Assessment Center Database. Last accessed: March 2015 http://www.energy.gov/eere/amo/industrial-assessment-centers-iacs	Industrial Agriculture	Informs inputs. Recent updates vetted to determine impact on model outputs; investigation found negligible changes and therefore these inputs are unchanged from previous analysis.
EIA. Manufacturing Enduse Consumption Surveys. Last accessed: March 2015 http://www.eia.gov/consumption/manufacturing/	Industrial	Informs subsector enduse energy distributions.
CEC. Quarterly Fuel and Energy Report. January 2015	AIMS (all)	Informs subsector distributions; equipment stocks Updated with electric consumption data
IEPR Forecasts: CEC. IEPR. California Energy Demand 2015-2025 Final Forecast Mid-Case Final Baseline Demand Forecast Forms. Last accessed: March 2015. http://www.energy.ca.gov/2014_energypolicy/documents/demand_forecast_sf/Mid_Case/ CEC. 2015 Integrated Energy Policy Report. Last accessed: March 2015 http://www.energy.ca.gov/2015_energypolicy/	Industrial Agriculture	Consumption used as a basis for savings (savings as a % of consumption) Retail rates inform payback periods on energy efficiency
CPUC. Ex Ante Review Custom Process Guidance Documents. Last accessed: March 2015 http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Ex+Ante+Review+Custom+Process+Guidance+Documents.htm	Industrial Mining	Industry Standard Practices (ISPs). Approved ISPs by CPUC for consideration in these updates.
ASWB Engineering Expert Advice	Industrial Mining	Expert input augments existing data, including input from other experts. Including reviews for measure applicability to California markets and current program/policy constraints.
DEER. IOU Compliance Filings. Last accessed March 2015. ftp://ftp.deeresources.com/E3CostEffectivenessCalculators	Industrial Agriculture Mining	Provides the potential study results a point of comparison. These aid the QC process reviews of the preliminary release. These will be used for Stage 2 activities as well.
California Drought Data: USDA. California Drought 2014: Farms. Last accessed March 2015 http://ers.usda.gov/topics/in-the-news/california-drought-2014-farm-and-food-impacts/california-drought-2014-farms.aspx	Agriculture	Sector-wide consumption fluctuations result from drought conditions. Data informs adjustments to the Agriculture inputs to reflect normal operating conditions.
SCE. Oil Industry Major and Minor Company Guidance. Last accessed March 2015 http://www.caasupport.com/2013/09/oil-industry-major-minor-company-guidance/	Mining	Applying ISPs to the portion of the market that is considered “major.” Augmenting previous guidance from CPUC ED.

Stage 1 Sources, continued

Source(s)	Sector	Comment
Oil and Gas Extraction Statistics: CA Dept. of Conservation. 2012 Preliminary Report of California Oil and Gas Production Statistics. Last accessed: March 2015 ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2012/PR03_PreAnnual_2012.pdf CA Dept. of Conservation. 2009 Annual Report of the State Oil and Gas Supervisor. Last accessed: March 2015 ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2009/PR06_Annual_2009.pdf	Mining	Update of oil well inventories and oil production totals (barrels) for California (the latest reports available).
CEC. California Energy Consumption Database. Last accessed: March 2015 http://ecdms.energy.ca.gov/	Mining	ECDMS data informs the IOU breakouts for mining consumption.
IOUs. Street Lighting lamp inventories. Supplied to Navigant via email December 2014 to January 2015	Street Lighting	Informing equipment stocks and distinguishing customer-owned and IOU-owned lamps.
SDG&E Street Lighting retrofit activities: National Lighting Bureau. $16 Million San Diego Lighting Upgrade Uses Broad-Spectrum Induction Technology. Last accessed March 2015 http://www.nlb.org/index.cfm?cdid=10839&pid=10213 City of San Diego. Citywide Broad Spectrum Street Lighting Retrofits. Last accessed March 2015 http://www.sandiego.gov/environmental-services/energy/programsprojects/saving/broadspectrumretrofit.shtml City of San Diego. Retrofit Activities Summary. Last accessed March 2015 http://www.sandiego.gov/environmental-services/energy/pdf/energysavings.pdf	Street Lighting	To estimate the change in equipment stocks from 2013 to 2015 for SDGE.

- ***See the accompanying AIMS Preliminary Results Supporting Data spreadsheet***
  - Additional data sources that will inform Stage 2 (e.g., IOU customer consumption data)
  - Data details supporting Stage 1 updates

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Data Sources

Sector	Measure Name	Efficiency Measure	Savings Source	Cost Source	Density Source
COM	Lighting - LED Fixture (Replacing T8) - Emerging	LED fixture: 33W, 3500 lumens	Energy Savings Forecast of Solid-State Lighting in General Illumination Applications	Energy Savings Forecast of Solid-State Lighting in General Illumination Applications	Adoption of Light Emitting Diodes in Common Lighting Applications: Snapshot of 2013 Trends
COM	Lighting - LED Lamp (Basic High - Indoor) - Emerging	LED interior lamp: 24W, 1700 lumens			
RES	Lighting - LED Lamp (Basic High - Indoor) - Emerging	LED Screw-In Indoor Lamp: 16.5W, 1300 lumens			
RES	Lighting - LED Lamp (Basic High - Outdoor) - Emerging	LED Screw-In Outdoor Lamp: 16.5W, 1200 lumens			
COM	Lighting - LED Lamp (Basic Low - Indoor) - Emerging	LED interior lamp: 11W, 900 lumens			
RES	Lighting - LED Lamp (Basic Low - Indoor) - Emerging	LED Screw-In Indoor Lamp: 8W, 675 lumens			
RES	Lighting - LED Lamp (Basic Low - Outdoor) - Emerging	LED Screw-In Outdoor Lamp: 9W, 700 lumens			
RES	Lighting - LED Lamp (Reflector - Indoor) - Emerging	LED Screw-In Indoor Reflector Lamp: 12W, 850 lumens			
RES	Lighting - LED Lamp (Reflector - Outdoor) - Emerging	LED Screw-In Outdoor Reflector Lamp: 14W, 1000 lumens			
RES	Lighting - LED Lamp (Specialty - Indoor) - Emerging	LED Screw-In Indoor Specialty Lamp: 10W, 780 lumens			
RES	Lighting - LED Lamp (Specialty - Outdoor) - Emerging	LED Screw-In Outdoor Specialty Lamp: 11W, 870 lumens			
COM	Lighting - LED Plug-In Indoor Fixture - Emerging	LED interior fixture: 14W, 900 lumens			
RES	Lighting - LED Plug-In Indoor Fixture - Emerging	LED Indoor Fixture: 10W, 650 lumens			
RES	Lighting - LED Plug-In Outdoor Fixture - Emerging	LED Outdoor Fixture: 10W, 700 lumens			

Data Sources

Sector	Measure Name	Efficiency Measure	Savings Source	Cost Source	Density Source
RES	AppPlug - Clothes Washer (Electric) - Emerging	Clothes Washer All Sizes, Electric DHW, Electric or Gas Dryer - Average MEF = 2.87, Average Capacity = 2.93 Gallons	Workpaper - PGECOAPP114	2013 Study	Energy Star 2014 Qualified Products List
RES	AppPlug - Clothes Washer (Gas) - Emerging	Clothes Washer All Sizes, Gas DHW, Electric or Gas Dryer - Average MEF = 2.87, Average Capacity = 2.93 Gallons	Workpaper - PGECOAPP114	2013 Study	Energy Star 2014 Qualified Products List
RES	AppPlug - Dishwasher (Electric) - Emerging	Energy Star® Dish Washer - Standard Size w/Electric Water Heater - 160 Cycles per Year - EF = 1.0	2013 Study	2013 Study	Energy Star 2014 Qualified Products List
RES	AppPlug - Dishwasher (Gas) - Emerging	Energy Star® Dish Washer - Standard Size w/Electric Water Heater - 160 Cycles per Year - EF = 1.0	2013 Study	2013 Study	Energy Star 2014 Qualified Products List
RES	AppPlug - HP Clothes Dryer - Emerging	Heat Pump Electric Clothes Dryer	2013 Study	2013 Study	Navigant calculations
RES	AppPlug - Self-Contained Refrigerator - Emerging	Emerging Tech Refrigerator - 15% less energy than code	2013 Study	2013 Study	Energy Star 2014 Qualified Products List
RES	AppPlug - Smart Strip Home Office - Emerging	Home office - Smart Strip with one control outlet, four controlled outlets, and two constant outlets	Workpaper - SCE13CS002	Workpaper - SCE13CS002	Navigant calculations
RES	AppPlug - Smart Strip Home Theater - Emerging	Home theater - Smart Strip with one control outlet, four controlled outlets, and two contant outlets	Workpaper - SCE13CS002	Workpaper - SCE13CS002	Navigant calculations

Data Sources

Sector	Measure Name	Efficiency Measure	Savings Source	Cost Source	Density Source
COM	HVAC - Advanced Package Rooftop AC (> EER 12) - Emerging	Advanced Rooftop Unit AC, EER 12, COP 3.52, Advanced Economizer and Controls	2013 Study	2013 Study	2013 Study
COM	HVAC - Energy Recovery Ventilation - Emerging	Energy Recovery Ventilation system for commercial HVAC	2013 Study	2013 Study	2013 Study
RES	HVAC - Gas Furnace - Emerging	Furnace Upgrade to Efficienct Furnace - Average AFUE = 98	DEER 2015	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	Energy Star Unit Shipment and Market Penetration Report
RES	HVAC - SEER Rated Split System AC (SEER 22) - Emerging	22 SEER Split-System Air Conditioner	2013 Study	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	Navigant calculations
RES	HVAC - SEER Rated Split System HP (SEER 21) - Emerging	Split SEER-Rated Heat Pump - Average SEER = 21	2013 Study	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	Navigant calculations
COM	SHW - EF Rated Storage Water Heater (Gas) - Emerging	Condensing Small Gas Storage Water Heater with low Nox burner - Average Size = 51 Gal, Average EF = 0.77	2013 Study	2013 Study	2013 Study
RES	SHW - EF Rated Storage Water Heater (Gas) - Emerging	Small Gas Storage Water Heater - Average Size = 51 Gal, Average EF = 0.82	DEER 2015	2010-2012 WO017 Ex Ante Measure Cost Study Final Report	Energy Star Unit Shipment and Market Penetration Report
COM	SHW - ET Rated Storage Water Heater - Emerging	Condensing Large Gas Storage Water Heater - Average Et = 0.99	2013 Study	2013 Study	2013 Study

Description of the LED Lamp and Luminaire Groupings in Each Submarket

SUBMARKET	LIGHTING PRODUCT	DESCRIPTION
General Service	Lamps	All A-type lamp shapes with a medium-screw base.
Decorative	Lamps	All bullet, candle, flare, globe, and any other decorative lamp shapes.
Directional	Lamps and Luminaires	Includes reflector, BR, MR, and PAR lamps as well as recessed and surfaced mounted downlights and indoor accent, track, and spot light luminaires.
Linear Fixtures (General Service)	Lamps and Luminaires	All troffer, panel, suspended, and pendant luminaires, as well as, LED linear replacement lamps.
Low/High Bay	Luminaires	Includes LED low and high bay luminaires.
Parking	Lamps and Luminaires	Includes LED lamps and luminaires for attached and stand-alone parking garages, as well as parking lot applications. LED lamps are only considered viable in parking garage applications.
Streetlights/Roadway	Luminaires	Includes LED luminaires installed in street and roadway applications.
Building Exterior	Lamps and Luminaires	Includes all lamps fixtures installed in façade, spot, architectural, flood, wallpack, step/path applications.
Other	Lamps and Luminaires	Includes all other special use lighting applications such as tunnel, signage, wall-wash, and cove.

1 » AIMS Data Sources

2 » Emerging Tech Data Sources

3 » Behavior Analysis Data Sources

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The team reviewed close to a dozen sources to inform the non-residential behavior updates. The key sources are summarized below.

- Cadmus Group Inc., *Focus on Energy MEEA Training Program Evaluation*, January 2015, Public Service Commission of Wisconsin
- Opinion Dynamics Corporation, *Impact Evaluation Of The California Statewide Building Operator Certification Program*, February 2014, California Public Utilities Commission
- Research Into Action, *BOC-Expansion Initiative Market Progress Evaluation Report #1*, April 2014 , Northwest Energy Efficiency Alliance
- Navigant Consulting Inc., Opinion Dynamics Corporation, and Itron, *Program Year 3 DCEO Building Operator Certification (BOC) Program Evaluation, May* 2012, Illinois Department of Commerce and Economic Opportunity
- Research Into Action and Energy Market Innovations (EMI), *Summary Of Building Operator Certification Program Evaluations*, November 2011, Consumers Energy
- Navigant Consulting, Inc., *Long Term Monitoring and Tracking Report on 2011 Activities* , July 2012, Northwest Energy Efficiency Alliance
- Navigant Consulting, Inc., *Evaluation Of MN BOC Training*, March 2011, Midwest Energy Efficiency Alliance and Minnesota Office of Energy Security
- Navigant Consulting, Inc., *Long Term Monitoring and Tracking Report on 2010 Activities,* June 2011, Northwest Energy Efficiency Alliance
- Navigant Consulting, Inc., *Long Term Monitoring and Tracking Report on 2009 Activities,* October 2010, Northwest Energy Efficiency Alliance
- Opinion Dynamics Corporation, *Evaluation Of Kansas City Power and Light's Building Operator Certification Program,* September *2009,* Kansas City Power and Light
- RLW Analytics, *Impact and Process Evaluation Building Operator Training and Certification (BOC) Program, September* 2005, Northeast Energy Efficiency Partnerships

The team reviewed over 50 sources to inform the residential behavior updates. The key sources are summarized below.

- CPUC. *SW EA Monthly Metrics Report All IOUs Oct 2014_111314.xlsx.* January 2014
- CPUC. *Email from Valerie Richardson.* February 2014
- DNV-GL. *2013 PG&E Home Energy Reports Program Review and Validation of Impact Evaluation ED Res 3.1.* January 2015
- DNV-GL. *2013 SCE Home Energy Reports Program Review and Validation of Impact Evaluation ED Res 3.2.* December 2014
- Applied Energy Group. *SCE's Home Energy Report Program Savings Assessment: Ex Post Evaluation Results, Program Year 2013*. October 2014
- DNV-GL. *2013 SDG&E Home Energy Reports Program 2013 Impact Evaluation, ED Res 3.3.* October 2014
- KEMA, Inc. *SDG&E Home Energy Reports Program Savings Results.* August 2013
- DNV KEMA. *Review of PG&E Home Energy Reports Initiative Evaluation.* May 2013
- Freeman, Sullivan & Co. *Program, Evaluation of PG&E's Home Energy Report Initiative for 2010-2012.* April 2013
- 21 different evaluations and white papers addressing the equipment vs. behavior topic primarily through surveys and double counting analysis; one study explored AMI data

The team reviewed over 50 sources to inform the residential behavior updates.

- 2012 IPL Residential Peer Comparison EM&V Report July 11, 2013. Maria Larson. TecMarket Works, Opinion Dynamics, The Cadmus Group, Integral Analytics and Building Metrics. 2013.
- 2013 Home Energy Report Evaluation. Bobette Wilhelm. DNV GL. 2014.
- 2013 PG&E Home Energy Reports Program . n/a. DNV-GL. 2015.
- 2013 PG&E Home Energy Reports Program . n/a. NEXANT. 2015.
- 2013 SCE Home Energy Reports Program. n/a. DNV-GL. 2014.
- 2013 SDG&E Home Energy Reports Program . n/a. DNV-GL. 2014.
- Analysis of PSEs Pilot Energy Conservation Project: Home Energy Reports (2011). . LBNL. .
- C3-CUB Energy Saver Program EPY5 Evaluation Report. Bill Provencher, Carly McClure. Navigant. 2014.
- Energy Efficiency / Demand Response Plan: Plan Year 2 (6/1/2009-5/31/2010). Bill Provencher. Navigant.
- Energy Efficiency / Demand Response Plan: Plan Year 3 (6/1/2010-5/31/2011). Bethany Glinsman, Bill Provencher. Navigant.
- Energy Efficiency Nicor Gas Plan Year 1, Evaluation Report: Behavioral Energy Savings Pilot. Jenny Hampton. Navigant. 2013.
- Energy Efficiency/Demand Response Plan Year 3, 2011 Evaluation Report HER Program. Randy Gunn, Stu Slote, Bill Provencher, Bethany Glinsmann, Paul Wozniak. Navigant. 2012.
- Energy Efficiency/Demand Response Plan Year 4, Evaluation Report: Home Energy Reports. Randy Gunn, Bill Provencher, Bethany Glinsmann. Navigant. 2012.
- Energy Efficiency/Demand Response Plan Year 5, Evaluation Report: Home Energy Reports. Bill Provencher, Bethany Glinsmann. Navigant. 2014.
- Energy Efficiency/Demand Response Plan: Plan Year 4 (6/1/2011---5/31/2012). Bethany Glinsman, Bill Provencher. Navigant.
- Evaluation of 2013 DSM Portfolio. Adam Thomas, Steven Keates, P.E., Jeremey Offenstein, Ph.D., Julianna Mandler, Zephaniah Davis, Jay Blatchford, Don Dohrmann, Ph.D. ADM Associates, Inc. 2014.

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- Evaluation of Residential Incentive Program Portfolio (May - Dec 2012). . ADM Associates. .
- Evaluation of the Home Energy Report Program. Bethany Glinsmann, Bill Provencher. Navigant. 2012.
- Evaluation of the Year 2 CL&P Pilot Customer Behavior Program (R2). NMR Group, Inc. Tetra Tech, Oversight Evaluation Contractor:, Lisa Skumatz, Skumatz Economic Research Associates, Scott Dimetrosky, Apex Analytics, Lori Lewis, AEC. NMR Group, Tetra Tech, Skumatz, Apex. 2014.
- Evaluation of Year 1 of the CL&P Pilot Customer Behavior Program (Draft) . Hunt Allcott. NMR Group, Tetra Tech, Hunt Allcott. 2013.
- Evaluation Report: OPOWER SMUD Pilot Year2. Bill Provencher. Navigant.
- Home Energy Report Program. Sharon Noell. DNV GL. 2014.
- Home Energy Reports Program, Program Year 2012 Evaluation Report. Navigant. 2013.
- Home Energy Savings Program GPY2/EPY5 Evaluation Report, Nicor Gas. Miroslav Lysyuk, Ryan Powanda, Mark Thornsjo. Navigant. 2014.
- Impact & Persistence Evaluation Report Sacramento Municipal Utility District Home Energy Report Program. Mary Wu (Pete Jacobs and Patricia Thompson contributed). Integral Analytics. 2012.
- Impact and Process Evaluation Of 2011 (Py4) Ameren Illinois Company Behavioral Modification Program (Oct 2012). Olivia Patterson, Jeevika Galhotra. ODC/Navigant. 2012.
- Impact and Process Evaluation of 2011 (Py5) Ameren Illinois Company Behavioral Modification Program (Oct 2012). Olivia Patterson, Jeevika Galhotra. ODC/Navigant. 2014.
- Impact and Process Evaluation of 2011 (Py6) Ameren Illinois Company Behavioral Modification Program (Oct 2012). Olivia Patterson, Jeevika Galhotra. ODC/Navigant. 2015.

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- Massachusetts Cross-Cutting Behavioral Program Evaluation Integrated Report June 2013. Anne Dougherty. ODC/Navigant . 2013.
- MASSACHUSETTS CROSS-CUTTING BEHAVIORAL PROGRAM EVALUATION Volume II Final (June 2011). Anne Dougherty. ODC/Navigant. 2011.
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- Massachusetts Three Year Cross-Cutting Behavioral Program Evaluation Integrated Report July 2012. Anne Dougherty. ODC/Navigant . 2012.
- Measurement and Verification Report of Lake Country's Opower Energy Efficiency Pilot Program. . Power System Engineering. 2010.
- Measurement and Verification Report of OPower Energy Efficiency Pilot Program. . Power System Engineering. 2010.
- National Grid Residential Building Practices and Demonstration Program Evaluation Final Results. n/a. DNV KEMA . 2014.
- New Jersey Market Assessment, Opportunities for Energy Efficiency. EnerNOC. 2013.
- PECO Act 129 – Phase II Research Report: Program Year 5. Jenny Hampton . Navigant. 2013.
- Process Evaluation Report, EE&C Plan, Program Year Four. Anne West, Hope Lobkowicz. The Cadmus Group Inc.. 2013.
- Puget Sound Energy's Home Energy Reports 2012 Impact Evaluation (Mar 2013). n/a. KEMA. 2013.
- Puget Sound Energy's Home Energy Reports Program Three Year Impact, Behavioral and Process Evaluation (2012). n/a. KEMA. 2012.
- Puget Sound Energy's Home Energy Reports Program: 20 Month Impact Evaluation. n/a. KEMA. 2010.
- PWP Home Energy Report (HER) Evaluation Results, Memo. Bethany Glinsmann, Bill Provencher. Navigant. 2013.
- PY1 EM&V Report for the Residential Energy Efficiency Benchmarking Program. Stuart Schare, Bethany Glinsman, Jenny Hampton, Robert Russell. Navigant. 2012.

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- Readying Michigan to Make Good Energy Decisions: Energy Efficiency. Michigan Economic Development Corporation / GDS Associates. 2013.
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- SCE's Home Energy Report Program Savings Assessment. Patric Ignelzi. Applied Energy Group. 2014.
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- Smart Energy Manager Program 2013 Evaluation Report. Bethany Glinsmann, Bill Provencher, Brent Barkett. Navigant. 2014.
- Summit Blue Evaluation Report - SMUD. Bill Provencher . Navigant . .
- Update to the Colorado DSM Market Potential Assessment (Revised). KEMA. 2013
- Utah Home Energy Reporting Program. Bill Provencher, Bethany Glinsmann, Argene McDowell, Amanda Bond, Dave Basak. Navigant. 2014.
- Verification of Hawaii Energy 2011 Programs. n/a. Evergreen Economics. 2012.
- Washington Home Energy Reporting Program 18 month evaluation report. Bill Provencher, Bethany Glinsmann, Argene McDowell, Amanda Bond, Dave Basak. Navigant. 2014.

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