

2019 AND BEYOND POTENTIAL STUDY

CUSTOM AND EMERGING TECHNOLOGY
METHODOLOGY FOR INDUSTRIAL AND
AGRICULTURAL SECTORS

FEBRUARY 2019



INTRODUCTION AND SCOPE

Scope of this discussion:

- Share with interested stakeholders the methodology used to develop the energy efficiency potential in the Agricultural and Industrial sectors for emerging technologies and generic custom technologies.
- Describe the characterization of the savings and the top down modeling methodology to calculate potential.
- Topics
 - Industrial and Agricultural Measure Categories
 - Approach to Generic Custom Measures
 - Approach to Emerging Technologies
 - Draft Example of Output Format

INDUSTRIAL AND AGRICULTURAL MEASURE CATEGORIES

The 2019 P&G study defines the Industrial and Agricultural markets with **four measures** categories

Characterized measures:

- Discrete measures that account for ~60% of sector savings. These measures have defined characteristics and are forecasted using a diffusion model.

Examples

Lighting, VSDs

Generic custom measures:

- Projects unique to various subsectors that cannot be readily defined at the measure level or forecasted using a diffusion model, such as measure labelled “Process – Other”. Generic custom also includes a large number of discrete measures that each contribute a small amount of savings and collectively account for less than ~10% of sector savings.

Process - Other

Emerging technology measures:

- A combination of measures that are entering the market in the short term. Limited measure characterization data and modeling approach using a top-down model

Micro-channel HX
Other process specific

SEM:

- SEM savings represent a mix of measures including SEM per ISO definition, advanced use of centralized controls / SCADA, RCX and continuous commissioning, and continuous improvement

Operational/SEM

INDUSTRIAL AND AGRICULTURAL MEASURE CATEGORIES

- Modelling Approach
 - Savings for each measure category will be forecasted separately and added together to form the sector forecast.

Measure Categories	2019 P&G Model Approach
Characterized Measures	Bottom-up bass diffusion approach
Generic Custom	Top-down approach
Emerging Technologies	Top-down approach
SEM	Top-down approach

INDUSTRIAL AND AGRICULTURAL MEASURE CATEGORIES

Measure savings estimates based on analysis of historic CEDARS and EEStats data for Industrial and Agriculture market sectors

2013 – 2017 Average Industrial Percent of Savings*

Impact Type	Gross GWh	Gross MMth
Characterized Measures	61%	48%
Generic Custom	22%	49%
SEM	17%	3%
Total	100%	100%

Source: Navigant analysis of EEStats and CEDARS

2016-2017 Agricultural Percent of Savings**

Impact Type	Gross GWh	Gross MMth
Characterized Measures	76%	58%
Generic Custom	17%	42%
SEM	7%	0%
Total	100%	100%

Source: Navigant analysis of EEStats and CEDARS

* Industrial and Ag Q3 and Q4 2017 EEStats data was extrapolated based on CEDARS

** Full AG data note available prior to 2016

INDUSTRIAL AND AGRICULTURAL MEASURE CATEGORIES

- 2019 P&G model redefined Ag sector measure to be consistent with IEPR forecast definition.
 - Included new measure category for CEC for water pumping NAICs.

NAICS Code	NAICS Code description	PG&E	SCE	SDG&E
221310	Water Supply and Irrigation Systems	71%	2%	93%
221311	Water pumping, municipal water supply	5%	96%	4%
221312	Water pumping, agriculture irrigation	24%	2%	3%

Source: CEC

- Comparison of Ag segment definition by model vintage

2017 P&G Forecast Ag Segments
Irrigated Agriculture
Post-Harvest Processing
Dairies
Refrigerated Warehouses
Wineries and Vineyards
Concentrated Animal Feeding Operation
Greenhouses

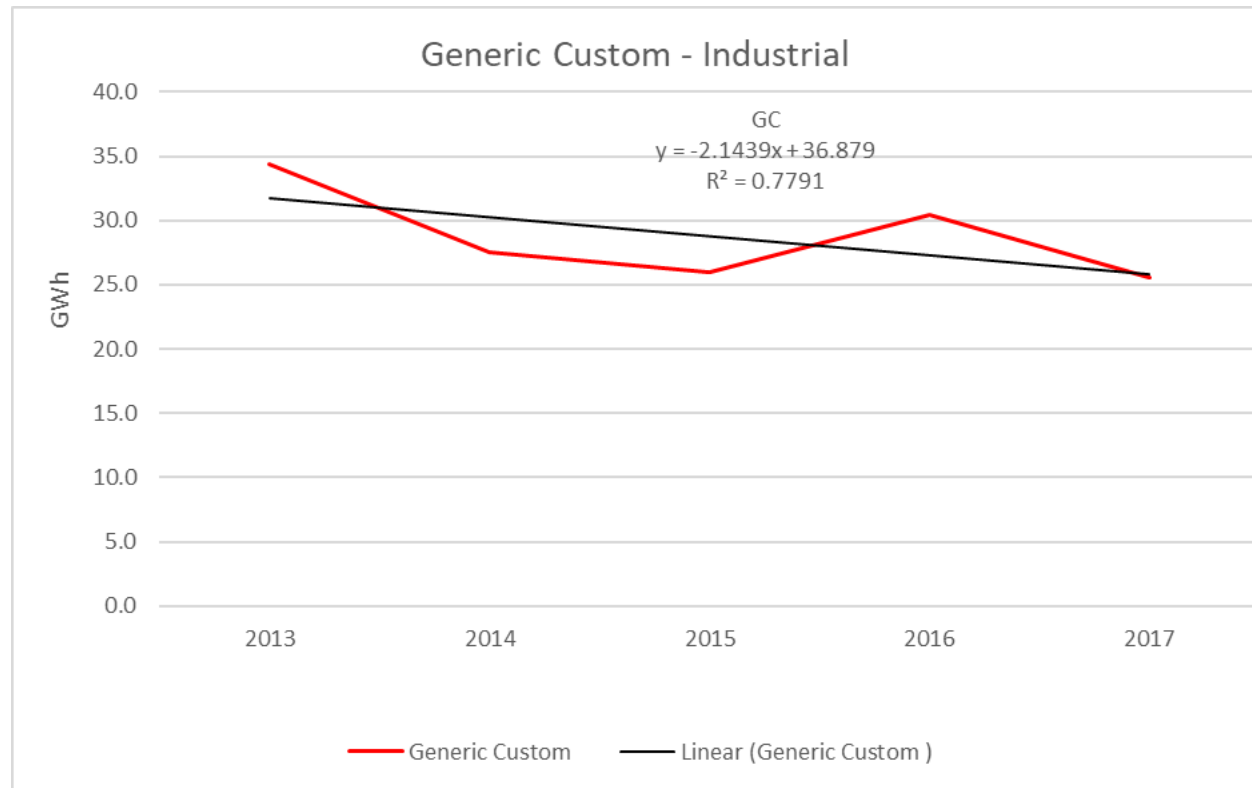
Source: Navigant

2019 P&G Forecast Ag Segments
Dairies, fishing, hunting
Irrigated Agriculture, vineyards, forestry and greenhouses
Water pumping

Source: Navigant

APPROACH TO GENERIC CUSTOM MEASURES

- Historic savings (net and gross) for generic custom measures are defined from CPUC reports, evaluations, and tracking data.
- Review of EEStats data indicates generic custom measure savings decreasing between 2013 and 2017



APPROACH TO GENERIC CUSTOM MEASURES

- General AIMS forecast equations:
 - Incremental Market Potential (kWh and Therms) =

$$\text{Annual Segment Consumption} \times \text{Applicability Factor} \times \text{Unit Energy Savings} \times \text{Participation Rate}$$
 - Incremental Market Potential (MW) = Market Potential (kWh) x Peak to Energy Ratio
 - Program Cost = Market Potential x Cost Factor
- Generic custom inputs and updates.

Factor	P&G Model Vintage	
	2017	2019
Unit energy savings		
kWh	0.16%	0.09%
Therm	0.17%	0.13%
Applicability Factor	100.0%	100.0%
Participation rate	Constant	Decreases at 2.1% per year
Peak to energy ratio	0.00020	0.00020
Effective Useful life	15	15
Reference case costs		
kWh	\$0.33	\$0.33
Therm	\$2.25	\$2.25

Source: Navigant

APPROACH TO EMERGING TECHNOLOGIES

- 2019 forecasting approach consistent with 2017 P&G ET methodology:
 1. Reviewed various sources to update list of ETs applicable to the AIMS sector, including:
 - Emerging Technologies Coordinating Council
 - California Energy Commission Publications Database
 - DOE Research and Development Projects
 - DOE Energy Efficiency & Renewable Energy Emerging Technologies Database
 - Broad web search which included independent research of topics and keywords that seemed of relevance based on initial web scrape results.
 2. Used emerging technology evaluation criteria to assess applicability and potential of new measures.

Technology Characteristic	Weight	1	2	3	4	5
Energy Technical Potential	3	Low	Low	Medium	High	High
Energy Market Potential	3	Low	Low	Medium	High	High
Market Risk	2	High Risk	High Risk	Medium Risk	Low Risk	Low Risk
Technical Risk	2	High Risk	High Risk	Medium Risk	Low Risk	Low Risk
Utility Ability to Impact Market	1	Private sector will succeed without utility involvement	Utility is unlikely to be critical to adoption	Utility is likely to accelerate adoption	Utility is very important in accelerating adoption	Utility is essential for catalyzing market
Non-Energy Benefits (NEBs)	1	Few or none NEBs	Some modest NEBs likely	Significant benefits; difficult to quantify / not understood	1 or 2 quantified, well-documented NEBs	Extensive, quantified, well-understood NEBs

Source: Navigant

APPROACH TO EMERGING TECHNOLOGIES

3. Used emerging technology evaluation criteria to assess approximately 1,140 ET's
4. The following formula was used to calculate a Unit Energy Savings (UES) multiplier for each emerging technology, applied to a specific market sector and end-use:

$$M_{e,i,j} = T_e \times E_{i,j} \times MT_j \times TW_j$$

Where:

e = subscript indicating the emerging technology

i = subscript indicating the end-use

j = subscript indicating the market sector

$M_{e,i,j}$ = multiplier for each emerging technology, e , applied to end-use, i , and sector, j

T_e = technology energy savings percentage for emerging technology, e

$E_{i,j}$ = percentage of sector j energy attributable to end-use, i

MT_j = market trajectory for sector j

TW_j = segment energy consumption trend weight for sector j

APPROACH TO EMERGING TECHNOLOGIES

5. General AIMS forecast equation used to define ET potential:

- Incremental Market Potential (kWh and Therms) =
Annual Segment Consumption x Applicability Factor x Unit Energy Savings x Participation Rate
- Incremental Market Potential (MW) = Market Potential (kWh) x Peak to Energy Ratio
- Program Cost = Market Potential x Cost

Emerging Technologies inputs and updates:

Factor	Model Vintage	
	2017	2019
Peak to energy ratio	0.00020	0.00020
Effective Useful life	15	15
Reference case costs		
kWh	\$0.42	\$0.42
Therm	\$2.83	\$2.83

Source: Navigant

APPROACH TO EMERGING TECHNOLOGIES

Emerging Technologies inputs and updates continued:

- Changed starting saturations, penetration forecast method, and compound annual growth rate (CAGR) to reflect ET's entering the market in 2019

Factor	Model Vintage	
	2017	2019
Starting Saturation	1.0%	0.1%
Reference CAGR	1.3%	3.3%
Aggressive CAGR	2.0%	4.3%

Source: Navigant

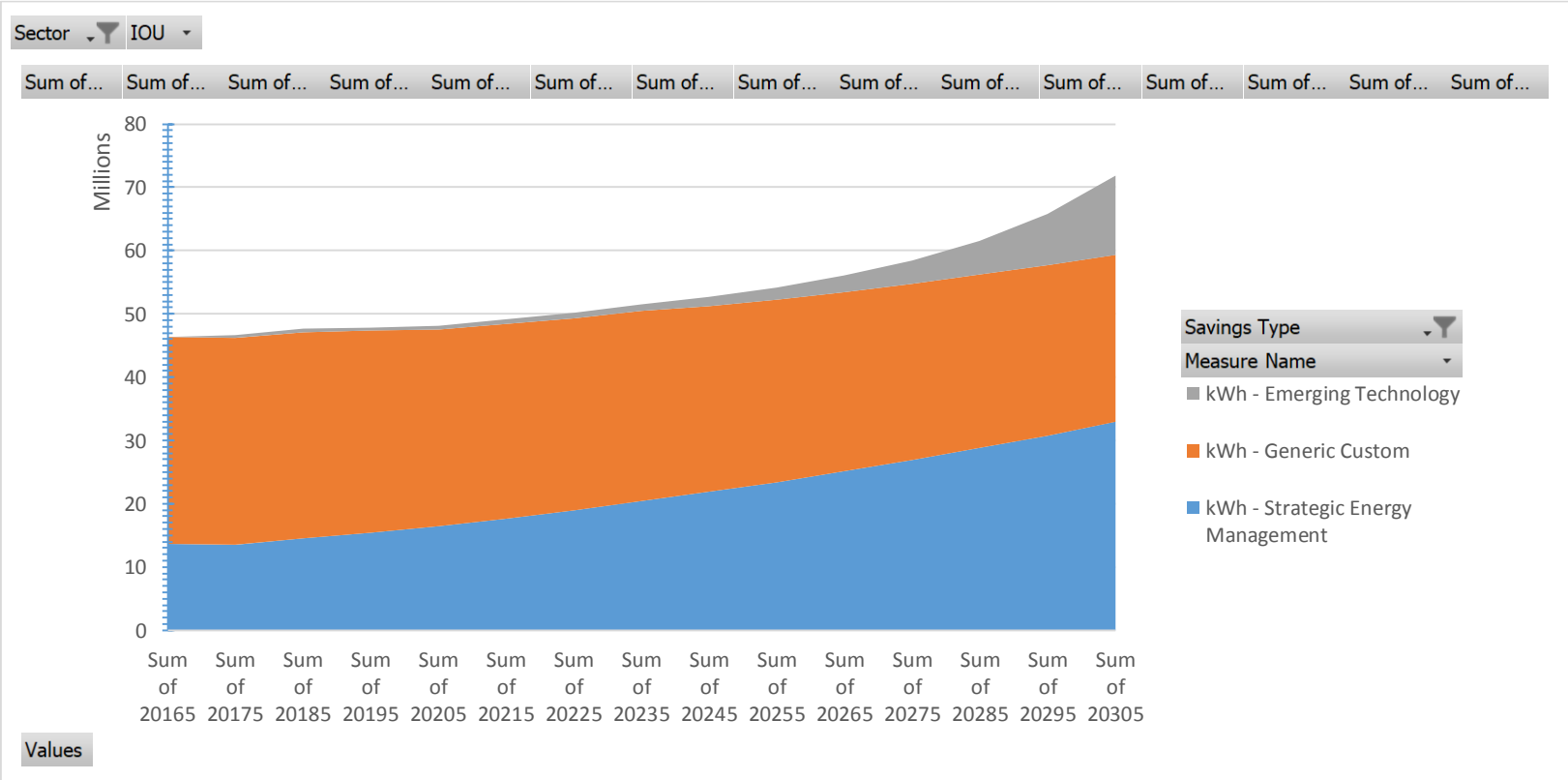
- Updated UES factors on select measures to reflect current research and address QA/QC issues with 2017 estimates.

Segment	Fuel	Model Vintage	
		2017	2019
Ind - Food	kWh	1.6%	1.7%
Ind - Electronics	kWh	2.4%	0.8%
Ind - Electronics	therms	4.1%	1.4%
Ind - Plastics	kWh	1.4%	0.9%
Ind - Plastics	therms	5.4%	3.6%
Ind - Fabricated Metals	kWh	1.5%	1.0%
Ind - Fabricated Metals	therms	14.2%	9.5%
Ind - Industrial Machinery	kWh	2.9%	1.9%
Ind - Industrial Machinery	therms	5.6%	3.7%
Ind - Transportation Equipment	kWh	1.2%	0.8%
Ind - Transportation Equipment	therms	1.9%	1.3%
Ind - Printing & Publishing	kWh	1.0%	1.0%
Ind - Printing & Publishing	therms	1.0%	1.0%
Ind - Textiles	kWh	1.4%	0.5%
Ind - Textiles	therms	2.9%	1.0%
Ind - Lumber & Furniture	kWh	1.3%	0.9%
Ind - Lumber & Furniture	therms	2.7%	1.8%
Ag - Irrigated Agriculture	kWh	9.6%	4.8%
Ag - Refrigerated Warehouses	therms	11.9%	0.0%
Ag - Greenhouses	kWh	4.2%	4.1%

Source: Navigant

DRAFT EXAMPLE OF AIMS OUTPUT FORMAT

- Example of AIMS forecast output format for generic custom, SEM, and emerging technologies



Source: Navigant

INFORMAL WRITTEN COMMENTS

- This presentation will be accessible at the Evaluation Studies Public Document Search website at <https://pda.energydataweb.com/#!/>
- The team welcomes informal, written comments
- Due date: February 11, 2019
- Comments can be submitted electronically via the PDA

CONTACTS

GREG WIKLER

Project Director

415.399.2109

greg.wikler@navigant.com

AMUL SATHE

Project Manager

415.399.2180

amul.sathe@navigant.com

KAREN MAOZ

AIMS Lead

415.399.2172

karen.maoz@navigant.com

FLOYD KENEIPP

Tierra Resource Consultants

AIMS Co-Lead

925.954.7363

floyd.keneipp@tierrarc.com

MATTHEW JOYCE

Tierra Resource Consultants

ET Lead

303-579-3344

mathew.joyce@tierrarc.com