Together, Building a Better California

DRAFT

Energy Efficiency Business Plan

Industrial Sector Chapter

Draft – October 18, 2016

PG&E Industrial Sector Business Plan - *Draft*

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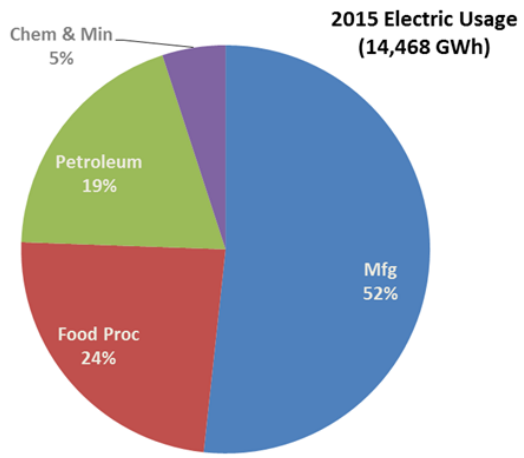
Industrial Sector Snapshot

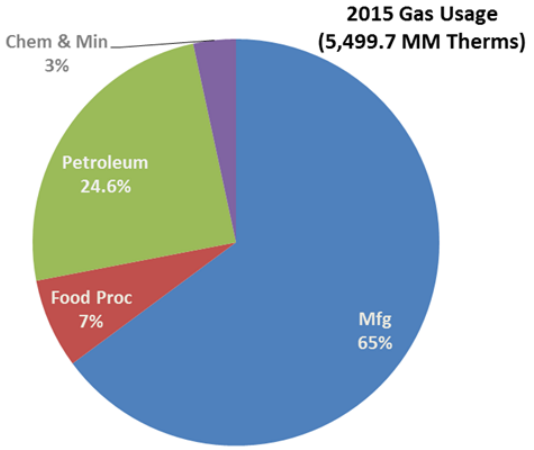
Customers by the Numbers[1]

	2011-2015 Average	Trend[a]	2015 Total
Customer Counts (Number of customers)[b]			
Electric	72,788		72,841
Gas	24,217		23,535
Total	86,414		85,894
Annual Sales (GWh, MM Therms)			
Electric	14,291.3		14,581.4
Gas	5,075.5		5,516.1
Energy Savings (GWh, MW, MM Therms)			
Electric	125.9		76.3
Demand	19.4		12.7
Gas	14.1		5.3
Program Participation (% of total)			
Electric	2.8%		2.0%
Demand	2.6%		1.9%
Gas	6.1%		4.4%
Segment Program Participation (% of segment)			
Electric (GWh) Savings participants			
Manufacturing	2.3%		1.7%
Food Processing	5.6%		4.6%
Petroleum	5.1%		3.5%
Chemicals & Minerals	3.6%		2.4%
Wastewater & Treatment	2.0%		0.8%
Gas (Therms) Savings participants			
Manufacturing	5.6%		3.8%
Food Processing	7.6%		7.3%
Petroleum	13.1%		7.0%
Chemicals & Minerals	6.0%		3.4%
Wastewater & Treatment	13.2%		3.6%

Notes: [a] Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively
[b] Customer count by unique combination of Account ID and Premise ID

Industry represented 25% of electric and 36% of overall gas usage for PG&E in 2015[2]





[1] PG&E program and customer data
[2] California Energy Commission; 2015 Integrated Energy Policy Report (IEPR); http://www.energy.ca.gov/2015_energypolicy/

A. PG&E's Industrial Sector Vision[3 4]

PG&E's vision for addressing energy efficiency in the industrial sector centers on enabling customers to better understand, manage, and eliminate unnecessary energy use in their operations.

Industrial customers are characterized by highly complex processes and operations that are often unique to individual facilities. They range, for instance, from highly capitalized corporations with in-house energy engineering expertise to smaller operations with little extraneous resources to invest in energy efficiency measures. Finding solutions that accommodate this varied customer landscape presents a challenge, as well as an opportunity to use PG&E's strengths in data capture and analysis, industrial energy engineering, as well as the broad perspective on energy grid infrastructure that a large utility is best suited to address. PG&E is committed to meeting customers on their energy journey with appropriate technical and financial energy efficiency resources.

At present, industrial producers in California face many of the challenges present throughout the country: high costs, tight regulations, increasing automation, and intense competition from abroad. Although most segments can easily relocate, others such as food processing and oil production cannot. It is in California's strategic interest to maintain a vibrant and profitable industrial sector. PG&E will play an integral role in supporting customer competitiveness through strong energy-management solutions, given that energy costs constitute a sizeable share of most industrial customers' expenditures.

It is worth noting that PG&E's 2011–2015 industrial sector trends, as depicted in the above snapshot, reflect declining participation and savings per customer, coupled with rising gas consumption. While this runs counter to PG&E's projected industrial energy efficiency gains, as outlined in Navigant's 2015 Potential Study,[5] Strategic Energy Management (SEM) and other efforts seek to aggressively reverse this trend.

SEM, in particular, will be a cornerstone of PG&E's new industrial strategy. Integrating this innovative conceptualization of energy usage into industrial operations will be crucial to maximizing long-term, deep savings, as well as opportunities from behavior, retrocommissioning, and operations and maintenance (BRO) measures as outlined in AB 802. Enhanced savings in industrial operations will also be a core contributor to realizing a doubling of energy efficiency by 2030, as mandated by SB 350.

PG&E's Industrial Customers in Brief

In 2016, California ranked as the sixth largest economy in the world, larger than France or Brazil. Manufacturing and other industrial production plays a major part in maintaining that economic success, contributing nearly 10% of the state's GDP and leading the nation in segments such as electronics and computer manufacturing. However, industry in California faces considerable challenges–rising labor costs, tightening regulations, and growing competition nationally and abroad are pushing many industrial firms to move out of state or internationally. PG&E's industrial energy efficiency programs work with firms to reduce the energy costs and environmental impact of their operations, and keep firms in compliance with and/or ahead of building codes and regulations.

PG&E works with industrial customers ranging from large, integrated factories employing hundreds to smaller, family-owned operations. While the largest customers generate the majority of energy efficiency program savings, PG&E is also committed to helping smaller companies save money and energy.

[3] "California Overtakes France to Become Sixth-Largest Economy"; Bloomberg; June 14, 2016: http://www.bloomberg.com/politics/articles/2016-06-14/california-overtakes-france-to-become-sixth-largest-economy

[4] "California's Economy: The 9 Industries Driving GDP Growth"; Investopedia; January 14, 2016: http://www.investopedia.com/articles/investing/011416/californias-economy-9-industries-driving-gdp-growth.asp

[5] "Energy Efficiency Potential and Goals Study for 2015 and Beyond: Stage 1 Final Report"; prepared by Navigant Consulting for the California Public Utilities Commission; September 25, 2015: http://www.cpuc.ca.gov/General.aspx?id=2013

PG&E's Industrial Sector Goals

PG&E has four overarching goals for the industrial sector.

- PG&E's industrial sector will save X GWh, X MW, and X MM Therms over the next ten-year-planning cycle (2018–2027),[6] with an emphasis on three key industrial segments (manufacturing, oil and gas production and refining, and food processing).
- Reach an increasing percentage industrial customers (increasing from about 2% in 2017 to xx% per year after the 10-year period) – with tracking by size and key segment.
- Increase industrial customers' ability to manage energy and integrate energy use into decision making by assisting X% of customers with long-term plans through SEM or similar program efforts.
- Integrate energy efficiency with other DER options within x% of industrial buildings. [7] [8]

Greater detail on the intervention strategies supporting these goals can be found in *Section G: PG&E's Approach to Achieving Goals*.

Over the forthcoming ten-year period, PG&E is proposing to spend X dollars to achieve savings of X GWh, X MW, and X MM Therms. Annual budgets and savings are depicted in Table 1 and Table 2, respectively.

B. PG&E's Industrial Sector Proposal Compared to Prior Program Cycles

For the past five years, PG&E's industrial programs have focused on overcoming the traditional market barriers to energy efficiency. Employing a full suite of energy-efficient tools, PG&E's industrial portfolio works to accelerate the adoption of energy efficiency measures. Key offerings included:

- Rebates and incentives for efficient equipment and systems
- Technical assistance such as facility audits and energy savings analysis
- Continuous Energy Improvement (CEI)

Some of these programs successfully targeted and enabled completion of projects in a wide range of facilities including oil production, printing plants, plastic-injection molding, component fabrication, lumber and paper mills, cement and quarries, metals processing, petroleum refineries, chemical plants, assembly plants, and water and wastewater treatment plants. In 2015, PG&E's statewide programs supported and processed over 170 industrial energy efficiency projects and delivered customer savings exceeding 2 MW, 16 GWh, and 4 MM Therms.

Third-party programs have been an integral part of PG&E's industrial offerings, as they bring the kind of specialized technical expertise often required for industrial facilities.[9] Additionally, PG&E has found the third-party performance payment model a good fit for long lead-time projects that often do not materialize. These programs

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[6] "Energy Efficiency Potential and Goals Study for 2015 and Beyond: Stage 1 Final Report;" prepared by Navigant Consulting for the California Public Utilities Commission; September 25, 2015: http://www.cpuc.ca.gov/General.aspx?id=2013

[7] *Barriers to Industrial Energy Efficiency*: A Study Pursuant to Section 7 of the American Energy Manufacturing Technical Corrections Act; U.S. Department of Energy; June 2015; p. 6. (Note that this report is referenced henceforth throughout this business plan chapter as "DOE Barriers study.")

[8] Regulatory Assistance Project. "U.S. Experience with Efficiency as a Transmission and Distribution System Resource." Chris Neme and Richard Sedano. February 14, 2012. https://www.raponline.org/wp-content/uploads/2016/05/rap-neme-efficiencyasatanddresource-2012-feb-14.pdf

[9] *Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector*; Industrial Energy Efficiency and Combined Heat and Power Working Group; SEE Action; March 2014; p. 30. (Note that this report was developed as a product of the State and Local Energy Efficiency Action Network (SEE Action), facilitated by the U.S. Department of Energy/U.S. Environmental Protection Agency. It is referenced henceforth throughout this business plan chapter as "DOE SEE Action study.")

deliver a large portion of energy savings for the segment. For example, in 2015, third-party programs specifically targeting oil fields, refineries, large manufacturing and mining, and food processors completed over 200 efficiency projects, contributing 75% of the sector's total electric savings and 29% of its gas savings.[10]

Going forward, however, California's changing economic and technological landscape calls for new strategies and techniques for addressing energy efficiency among industrial customers. Notably, EM&V impact evaluations that targeted industrial projects encountered challenges with many of PG&E's large industrial projects, including low gross realization rates (GRR) and high free-ridership, as determined by net-to-gross (NTG) ratios.[11] At the same time, the 2015 Potential and Goals study reflects ongoing potential for cost-effective energy efficiency in the industrial sector.[12] Indeed, the DOE notes that "Industrial energy efficiency programs are often more cost effective compared to residential and commercial energy efficiency programs. Industrial energy efficiency measures can be half the cost (measured in dollars per unit of energy saved) compared to energy efficiency measures implemented in homes or buildings."[13]

In an effort to rationalize conflicting market signals and capture sustainable, cost-effective energy savings in the industrial sector, PG&E has embraced the following seven strategic interventions:

- **Data Access and Awareness:** PG&E collects a vast amount of interval data on each customer's energy use, but has not historically used this data to its full potential. PG&E plans to employ sophisticated analytics to better target ideal programs to customers, as well as create a benchmarking platform.
    - PG&E is currently developing a process to identify individual customer's "Energy DNA"[14] to allow for finer segmentation and marketing focus.
    - Industrial customers are notoriously difficult to benchmark on account of the sector's diversity and a general reluctance among customers to share production data. When the data is available, PG&E can benchmark participating customers' energy use intensity against similar sites in the U.S. DOE's database.[15] Even with limited data, PG&E can benchmark customers based on more readily-available criteria such as program participation, energy savings, and progress toward full SEM– with the aim of motivating low-achieving customers and publicly recognizing high achievers.
    - The Environmental Protection Agency (EPA) ENERGY Star Industrial provides tools for industrial customers to benchmark facilities and share energy management best practices. PG&E will support its industrial customers' participation in EPA programs and others.[16]
- **Data Analytics:** Imperfect information about both energy efficiency programs and energy consumption patterns remains a persistent challenge to energy efficiency adoption across the industrial sector and beyond. Widespread lack of access to reliable energy savings measurements constitutes and additional hurdle. Data analytics seeks to bridge these gaps to strategically target high-opportunity projects and provide targeted value propositions.
- **Technical Assistance and Tools:** Industrial customers often require technical assistance to identify appropriate energy efficiency opportunities and articulate the value of energy efficiency investments.[17]

[10] Based on PG&E internal data.

[11] Itron 2014. 2010-12 WO033 Custom Impact Evaluation. Final Report; Itron 2015. 2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial; Itron 2016a. 2014 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial; Itron 2016b. 2014 Nonresidential Downstream Deemed ESPI Lighting Impact Evaluation Report; and Itron 2016c. 2014 Nonresidential Downstream Deemed ESPI Pipe Insulation Impact Evaluation Report.

[12] Navigant, 2015. Energy Efficiency Potential and Goals Study for 2015 and Beyond.

[13] DOE Barriers study, p. 37.

[14] Laurain, Anne-Lise; Bao, Tingwen. Zawadski, Pawel, et al. "Better Understanding Customers: Developing SMB DNA to Improve Customer Interactions and Catalyze Positive Behavior Changes." 2016 ACEEE Summer Study on Energy Efficiency in Buildings. http://aceee.org/files/proceedings/2016/data/papers/8_403.pdf

[15] https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/measure-track-and-benchmark/tools-tracking-and

[16] https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants

Technical assistance and energy efficiency measurement tools comprise critical benefits that PG&E has delivered to its customers. Facility audits− especially those conducted for smaller customers with less in-house energy efficiency expertise− have served to identify energy efficiency opportunities within a customer's operation. PG&E has built strong, long-term relationships with its industrial customers through its network of account representative and third-party implementers, which is critical for industrial customers.[18] PG&E will continue to use these relationships to develop energy savings analyses, project valuations that include non-energy benefits (NEBs)[19] to attract the attention of decision-makers to make the, business case, and other forms of assistance to spur increased energy efficiency investments. Overall, project identification and savings quantification capabilities in this realm (often executed by sending engineers to plants to actually improve process efficiency) add significant value.[20]

  - PG&E plans to expand the selection of tools and assistance currently available to include methods to incorporate BROs, improvements and updates in sub-metering of equipment, and using the growth of automation that are rendering the industrial sector more productive.

- **Financial Solutions:** Loans, rebates, and incentives have always been an integral component of PG&E's industrial energy efficiency programs. Moving forward, however, PG&E's application process will become increasingly holistic− by evaluating customers' needs more thoroughly, and appropriately packaging technical assistance, rebates, incentives, and loans. For example, some customers may only require rigorous technical analysis and financing options, instead of rebates. This process will also be integrated into an overarching SEM strategy, enabling customers to maximize their financing package.
- **New Models:** While PG&E has offered Continuous Energy Improvement (CEI) to customers since 2010, the program has been downsized from implementation of full-scale CEI protocols to small, cohort-type training courses for various customer segments. CEI faced program design flaws. For example, limited availability and completeness of data has consistently impeded reliable assessment of the program's impacts− namely calculations of cost-effectiveness and energy savings. As a result, PG&E has been looking instead to the Strategic Energy Management (SEM) framework to promote persistent operational, organizational, and behavioral changes that yield greater efficiency gains. SEM is a key strategy of the U.S. DOE's industrial energy efficiency strategy.[21] Overall, with support from the CPUC, California IOUs have opted to make substantial changes to CEI and transition to a resource-acquisition program adopting major design components and M&V protocols from successful programs implemented by Northwest utilities in the U.S. and Canada.
- **Strategic Partnerships:** PG&E has marketed and delivered its offerings through myriad channels, including presence at industry events, support for education and research activities, and close partnerships with engineering and installation firms. Going forward, integrating SEM into the marketplace will require additional interaction with these partners. Additionally, PG&E will build partnerships for other benefits, including research to contribute to customer targeting, knowledge sharing, and greater exposure for customers identified as leaders and "Energy Champions."
- **Upstream Initiatives:** PG&E will explore opportunities to partner with distributors to promote the most efficient products, components, and systems for the industrial sector, where entrenched repair practices make downstream prescriptive rebates challenging and costly on their own. Through further market research and testing, PG&E will evaluate pairing rebates across multiple market actors to ensure that incentives are aligned to adopt the most efficient option.

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[17] DOE SEE Action study, p. ES 8.
[18] DOE SEE Action study, p. 28.
[19] DOE Barriers study, p. 50.
[20] DOE SEE Action study, pp. 30-31.
[21] DOE SEE Action study, pp. 18-21.

These seven intervention strategies will be deployed in stages, over the near, mid, and long term. PG&E discusses the individual tactics for each of these strategies in greater detail in *Section G: PG&E's Approach to Achieving Goals.* Below is a brief summary:

- **In the near term (1-3 years)**, PG&E will conduct and analyze market research to help strengthen existing programs that meet customer needs and lay the groundwork for future solutions. PG&E will continue to enhance tools and services, providing engineering expertise and financial solutions in the most cost-effective manner.
- **In the mid term (4-7 years)**, PG&E will begin standing up solutions that not only integrate energy efficiency into customers' everyday decision making, but also create a framework for SEM. PG&E also plans to engage with partners to identify and promote "Energy Champions," raising the energy efficiency bar for industrial customers.
- **In the long term (8-10 years)**, PG&E envisions SEM as the lynchpin of its industrial offerings. PG&E will offer a variety of levels to meet customer needs, ranging from online management and periodic audits for smaller firms ("low-touch" SEM) to integrated expertise and data-management systems for large customers ("high-touch" SEM). Across the board, PG&E envisions customers weaving energy efficiency into production goals and making energy use reductions a key part of a company's bottom line. These solutions will also integrate Distributed Energy Resources (DERs) such as demand response solutions for a complete turnkey program that meets individual customers' energy needs.

Achieving these goals will involve not only new energy efficiency offerings from PG&E, but also close collaboration with partners like the U.S. DOE, national laboratories, U.S. EPA, third-party implementers, and industry trade organizations.

To achieve its vision, PG&E also anticipates allocating the following budget to meet the following energy savings goals, as depicted in Sections C–D.

EM&V Key Research Learnings of California's Industrial Sector and Energy Efficiency Programs

Almost all the energy used by industry and major opportunities for savings are in its production processes. Furthermore, energy use and savings are typically concentrated among a few, very large facilities and/or end-uses. This sector continues provided ¼ of the electricity and 36% of the gas portfolio savings in 2015. Key recent evaluation learnings include (see KEMA 2012a-h; Navigant Consulting 2015a-f; DOE SEE Action 2014, and others as indicated below):

- Industrial customers care most about production, maintaining competitiveness, and compliance with various regulations. Energy use and efficiency are less important than production-related inputs such as feedstock, labor, and compliance with safety, health, air and water quality regulations.

- Energy efficiency offerings should address industrial customers' concerns. For example, increased productivity and quality, reduced unplanned downtime, and being able to tout how "green" their production is, are typically more important benefits to highlight than saving energy and bill reductions.

- Industrial customers have different needs and concerns that affect their capability, interest, and ability to adopt more energy efficient practices and equipment. Programs need to address this diversity. Large customers may have energy teams, who although typically focused on minimizing energy procurement costs, are also very useful for incorporating mayor energy efficiency aspects to large production systems overhauls or new construction. Small and medium size enterprises are more limited in both human and capital capabilities and energy efficiency efforts focus more on lighting and HVAC, and less on deep process improvements.

- Industrial customers trust utilities with information on new, more energy-efficient technologies and practices.

- Industrial customers rely on utility energy efficiency programs for technical assistance, endorsement of vendor energy savings claims, and financial incentives to make the business case to upper management for energy efficiency capital investments.

- SEM can help industrial customers to improve their energy and water operations and management practices, and develop long-term plans to reduce the energy intensity of their products. To be cost effective, the SEM program offering should target small and medium sized customers via cohorts and/or trade associations, and use individual engagements with large customers (Cadmus 2012; CEE 2014; Energy 350 2014).

These key learnings have been incorporated into the industrial business plan intervention strategies. EM&V research will continue to focus on providing feedback to enhance the success of future programs.

C. Sector-Level Budget

Over the 10 year period, PG&E is proposing to spend X dollars to achieve savings of x GWh, x MW, and x MM Therms. Potential savings by year are shown in Table 2 and budgets by year are shown in Table 1.

Table 1: Annual Industrial Sector Budgets

Year	Budget	% of Portfolio
2018-2027	TBD	TBD

D. Annual Net Savings from Potential Study

The below table reflects savings values that are targets from the 2015 Potential Study.

Table 2: Annual Net Savings from Potential Study

Year	Annual Net Goals					
	GWh	% of Portfolio	MW	% of Portfolio	MM Therms	% of Portfolio
2018	41.5		4.0		4.3	
2019	40.6		3.9		4.2	
2020	39.9		3.8		4.2	
2021	39.2		3.7		4.1	
2022	38.7		3.6		4.1	
2023	38.2		3.6		4.0	
2024	37.8		3.6		3.9	
2025	TBD		TBD		TBD	
2026	TBD		TBD		TBD	
2027	TBD		TBD		TBD	

Source: Navigant Consulting 2015.

E. Sector Overview

Target Audience

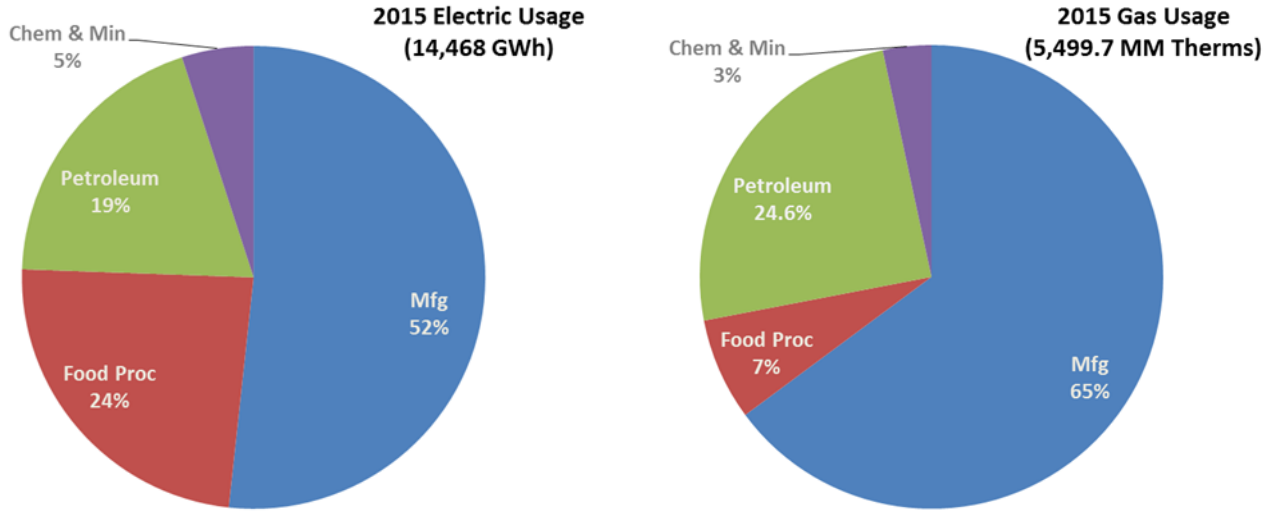
PG&E characterizes its industrial customers in terms of segment, size, energy efficiency program participation, and geography.

Segment Overview and Energy Usage: As shown in Figure 1, PG&E divides the market into segments based on fuel type and NAICS classification, with its core segments encompassing manufacturing, food processing, petroleum, and chemicals & minerals.

In 2015, over half of total electric usage was attributed to manufacturing, followed by food processing and petroleum with most of the remainder. Manufacturing was even more dominant in gas consumption, capturing 65% of total usage in 2015. Petroleum accounted for nearly another 25% of 2015 gas usage across the industrial sector.

California's recent EM&V research has focused on executing market characterizations and assessments to better understand how to tap savings in key industrial segments.[22] [23] Notably, PG&E has examined several key customer segments such as cement, plastics, ceramics, metalworking, paper, chemicals, motors, oil and gas extraction and produced water management and recycling, and food processing.[24]

Figure 1: Energy Usage by Industrial Customer Segment



Source: 2015 PG&E customer data as divided by NAICS code.

Size and Energy Efficiency Program Participation: PG&E further divides the industrial sector into small and large customers across the segments (with large customers using over 500 MWh and/or 250,000 Therms annually). The sector is dominated by a small portion of very large, high energy-consuming customers, coupled with prolific small-scale businesses. Capturing the energy efficiency savings opportunities requires that the programs target

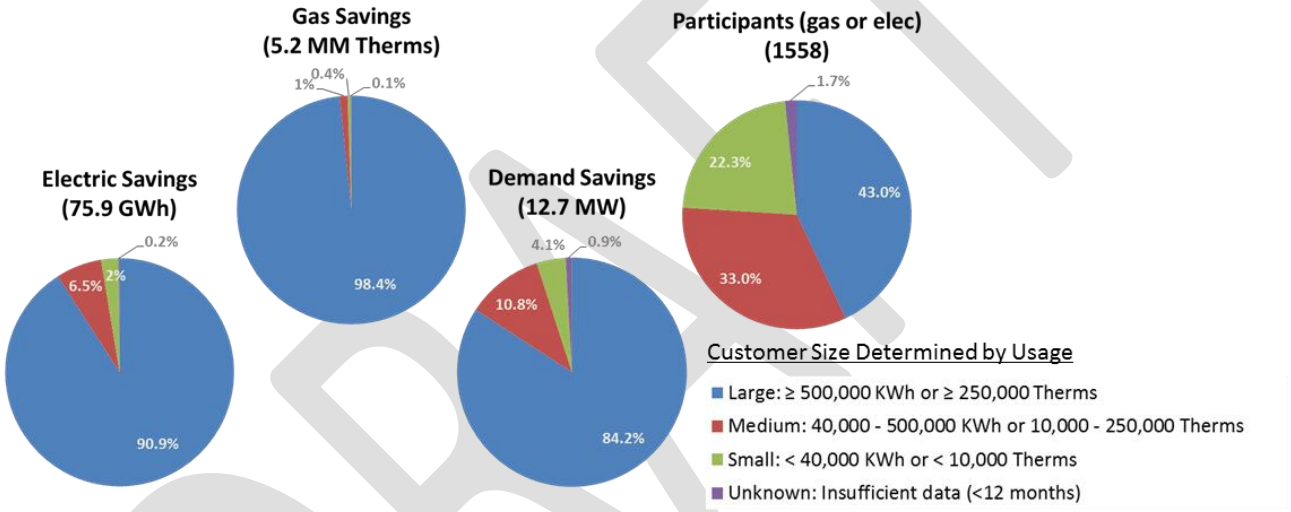
[22] KEMA. 2012 b - h. *Industrial Sectors Market Characterization: Chemicals Industry; Metalworking Industry;* Plastics Industry; Mineral Product Manufacturing Industry; Glass Industry; Water and Wastewater Industry; Paper Industry.

[23] Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI):* New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling*; Food Processing Industry;* Wastewater Treatment Facilities*;* Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries*;* Integrated Design for New Construction Buildings.

[24] See "*Measure, Application, Segment, Industry (MASI)"*studies in *Section N: Reference List*.

large customers differently from how small and medium customers' needs are addressed. Large customers have typically demonstrated greater energy efficiency sophistication, and are able to invest substantial amounts of capital and expertise. These large customers are frequently associated with national or multinational corporations and usually have a strategic energy plan that they are following. High quality, in-depth industry-specific technical assistance and incentives, with a long term involvement, enables the capture of the very large savings opportunities available with large customers that come up only every few decades. PG&E seeks to address the multiple decision-makers in industrial energy efficiency uptake and highlight impacts on their key decision drivers to complement the energy savings, which typically are of marginal importance.25 26 While small and medium-sized customers may have complex operations and energy efficiency potential as well, they are typically not of a sufficient size or level of sophistication to employ staff dedicated to energy management. For these smaller customers, given the size of savings opportunities and customer capital available per site, as well as program cost-effectiveness requirements, interventions focus on lighter, more actionable opportunities and resources dedicated to specific customer sites. The programs seek to capture large savings from these customers by expanding participation.[27 28 29]

Figure 2: Industrial Sector 2015 Energy Efficiency Program Participation and Savings by Size



Source: PG&E internal data

Geography: Industrial customers are dispersed throughout PG&E's service territory, with primary concentrations in the East Bay, South Bay, and Central Valley. Certain segments are clustered in specific areas – food processing in the Central Valley, upstream oil and gas services around Bakersfield, and computer-chip manufacturing in the South Bay. This clustering of segments presents an opportunity to maximize marketing and outreach spending when targeting programs.

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[25] Michael Sullivan. January 2009. "Behavioral Assumptions Underlying Energy Efficiency Programs for Businesses." Prepared for CIEE/CPUC. Available at: http://uc-ciee.org/library/1/nclked/exact/behavioral-assumptions-underlying-energy-efficiency-programs-for-businesses/a/1/desc

[26] Christopher Russell. 2008. "The Industrial Energy Harvest." www.energypathfinder.com

[27] Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI):* New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling*; Food Processing Industry;* Wastewater Treatment Facilities*;* Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries*;* Integrated Design for New Construction Buildings*.*

[28] PG&E Large Business Customer Journey Research Report; November 16, 2015; Greenberg.

[29] http://www.energy.wsu.edu/Documents/IN-BestBusinessPractices-Dec2011.pdf

Table 3: Industrial Customers by Climate Zone

	Customer By Climate Region[a]				Percent of Sector			
	Central Valley[b]	Coastal[c]	Mountain[d]	Total	Central Valley	Coastal	Mountain	Total
Customers								
Electric	34,753	36,332	981	**72,066**	48%	50%	1%	100%
Gas	10,724	12,646	81	**23,451**	46%	54%	0.3%	100%
Usage								
Electric (GWh)	8,999	5,369	101	**14,468**	62%	37%	1%	100%
Gas (MM Therms)	3,716	1,719	65	**5,500**	68%	31%	1%	100%
Participants								
Electric	700	771	9	**1,480**	47%	52%	1%	100%
Gas	449	568	8	**1,025**	44%	55%	1%	100%
Savings								
Electric (GWh)	57.0	17.2	1.7	**75.9**	75%	23%	2%	100%
Gas (MM Therms)	4.36	0.85	0.03	**5.2**	83%	16%	1%	100%

Notes: [a] Climate Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory.
[b] Central Valley includes: Z11 - Z13
[c] Coastal includes: Z01 - Z09
[d] Mountain includes: Z14 - Z16

Table 4: Industrial Electric Customers by Climate Region and Size

	Customer by Size[a] and Region[b]					Percent of Region			
	Large	Medium	Small	Unk[c]	Total	Large	Medium	Small	Total[d]
Usage (GWh)									
Central Valley	8,459.0	430.7	104.7	3.3E-04	8,994	94%	5%	1%	100%
Coastal	4,678.2	556.3	132.8	3.9E-04	5,367	87%	10%	2%	100%
Mountain	91.5	6.9	2.5	1.4E-05	101	91%	7%	2%	100%
Total	**13,229**	**994**	**240**	**7.3E-04**	**14,463**	**91%**	**7%**	**2%**	**100%**
Customers									
Central Valley	13,011	8,732	12,682	328	34,753	37%	25%	36%	100%
Coastal	10,093	9,695	16,154	390	36,332	28%	27%	44%	99%
Mountain	393	149	425	14	981	40%	15%	43%	99%
Total	**23,497**	**18,576**	**29,261**	**732**	**72,066**	**33%**	**26%**	**41%**	**99%**
Savings (GWh)									
Central Valley	53.4	2.5	1.1	0.1	57.0	94%	4%	2%	100%
Coastal	13.9	2.4	0.8	0.1	17.2	81%	14%	5%	100%
Mountain	1.7	0.05	0.003	-	1.7	97%	3%	0%	100%
Total	**69**	**4.9**	**1.9**	**0.13**	**76**	**91%**	**6%**	**2%**	**100%**
Participants									
Central Valley	312	210	172	6	700	45%	30%	25%	99%
Coastal	317	272	163	19	771	41%	35%	21%	98%
Mountain	1	7	1	-	9	11%	78%	11%	100%
Total	**630**	**489**	**336**	**25**	**1,480**	**43%**	**33%**	**23%**	**98%**

Notes [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory.
Central Valley includes: Z11 -Z13
Coastal includes: Z01 - Z09
Mountain includes Z14-Z16
[c] ''Unknown' size category included for completeness. Represents insufficient or partial-year data
[d] Column may not sum to 100% due to a small percentage of Unknowns not included

Table 5: Industrial Gas Customers by Climate Region and Size

	Customer by Size[a] and Region[b]					Percent of Region			
	Large	Medium	Small	Unk[c]	Total	Large	Medium	Small	Total[d]
Usage (MM Therms)									
Central Valley	3,696	16.9	2.9	0.04	3,716	99%	0.5%	0.1%	100%
Coastal	1,693	13.1	3	10.1	1,719	98%	1%	0.2%	99%
Mountain	65	0.02	0.02	-	65	100%	0.02%	0.03%	100%
Total	**5,454**	**30**	**5.9**	**10.2**	**5,500**	**99%**	**1%**	**0.1%**	**100%**
Customers									
Central Valley	2,369	2,779	5,433	143	10,724	22%	26%	51%	99%
Coastal	2,326	3,891	6,223	206	12,646	18%	31%	49%	98%
Mountain	27	3	51	-	81	33%	4%	63%	100%
Total	**4,722**	**6,673**	**11,707**	**349**	**23,451**	**20%**	**28%**	**50%**	**99%**
Savings (MM Therms)									
Central Valley	4.33	0.02	0.01	4.1E-04	4.36	99%	1%	0.2%	100%
Coastal	0.79	0.03	0.01	0.005	0.85	94%	4%	1%	99%
Mountain	0.03	-2.0E-04	2.4E-04	-	0.03	100%	-1%	1%	100%
Total	**5.16**	**0.06**	**0.02**	**0.005**	**5.24**	**98%**	**1%**	**0.4%**	**100%**
Participants									
Central Valley	147	161	137	4	449	33%	36%	31%	99%
Coastal	199	215	141	13	568	35%	38%	25%	98%
Mountain	1	6	1	-	8	13%	75%	13%	100%
Total	**347**	**382**	**279**	**17**	**1,025**	**34%**	**37%**	**27%**	**98%**

Notes [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)

[b] Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory.
Central Valley includes: Z11 -Z13
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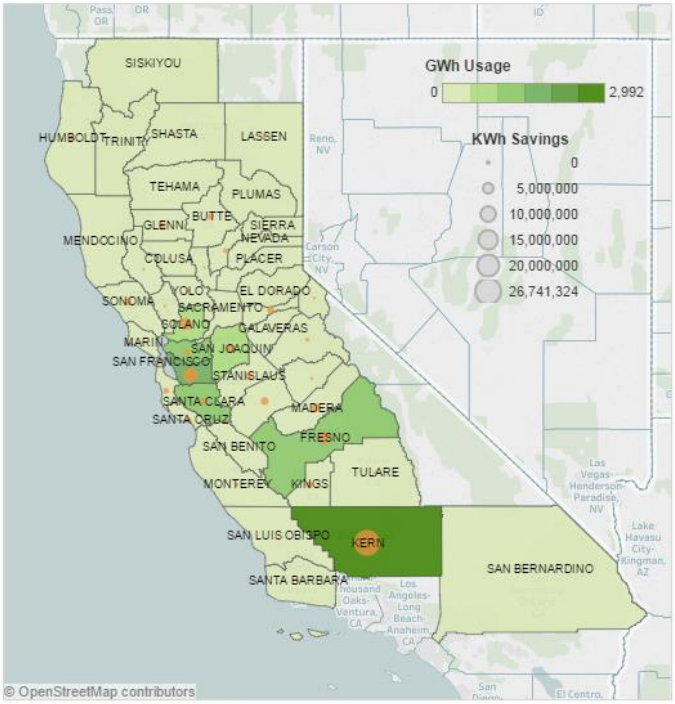
Mountain includes Z14-Z16

[c] ''Unknown' size category included for completeness. Represents insufficient or partial-year data

[d] Column may not sum to 100% due to a small percentage of Unknowns not included

Figure 3: 2015 Industrial Sector Electricity Consumption and Savings by County



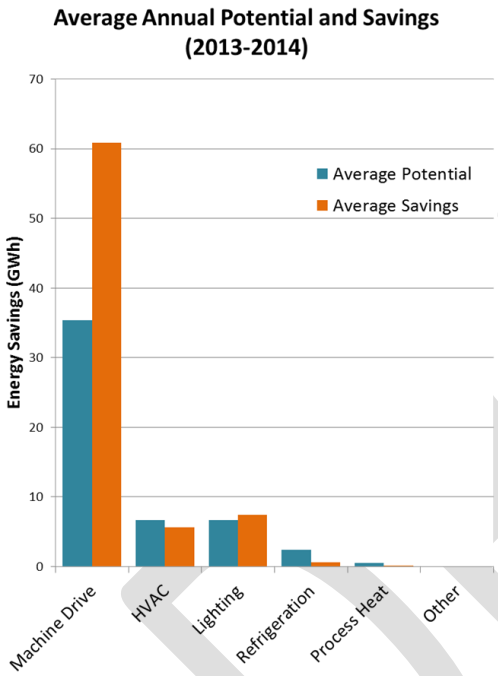
Source: PG&E internal data

Energy Efficiency Potential (i.e., opportunities)

The 2015 Potential and Goals Study[30] (Potential Study) is used to define utility energy savings goals, and the benefits of its findings vary widely across sectors. For instance, while it provides measure-level forecasts of savings for the residential and commercial sectors, the potential model has typically used supply cost curves to estimate savings by end use for the industrial and agricultural sectors. This generic assessment has limited the forecast model's usefulness in targeting savings. The upcoming 2018 and Beyond Energy Efficiency Potential and Goals Study will expand the model to include measure-level detail for all sectors including industrial. PG&E will incorporate the updated forecast as it becomes available.

Figure 3 depicts the Potential Study categories and 2013–2014 potential, compared with PG&E's industrial program savings within similar categories. PG&E notes that major categories of industrial program savings such as industrial systems and boilers and steam do not appear in the model. PG&E is advocating for a correction of this misalignment in forthcoming potential studies.

Figure 4: Energy Efficiency Potential and Past Program Savings[31]



Source: Navigant Consulting 2015; PG&E internal data.

Much like the agricultural sector, the 2015 Potential Study identified relatively limited market potential for industrial measures. However, as illustrated in Figure 4, PG&E achieved strong savings through several measures including machine drives (i.e., termed 'pumps and variable-frequency drives' (VFDs) at PG&E) and lighting. PG&E expects pump and VFD measures to remain prominent its industrial portfolio, but will strive to diversify its offerings. According to the U.S. DOE, energy savings opportunities may exist for motors, process equipment, and steam systems. Additionally, energy efficiency opportunities may exist for installations of energy management systems that optimize energy use.[32]

[30] "Energy Efficiency Potential and Goals Study for 2015 and Beyond: Stage 1 Final Report"; prepared by Navigant Consulting for the California Public Utilities Commission; September 25, 2015: http://www.cpuc.ca.gov/General.aspx?id=2013

[31] Note that an updated chart will be included in the final version.

[32] DOE Barriers study, p.35.

Overall, the Potential Study is only marginally useful in its current form− and no other recent study shows potential. PG&E is contemplating mining internal data to begin to address this significant information gap. The new industrial, agricultural, and large commercial energy efficiency evaluation research roadmap is also proposing research that will tap recent non-residential audits and other reports to identify major untapped energy efficiency opportunities in this customer segment. Better alignment between potential studies and industrial program segmentation would greatly benefit program design going forward. It is also worth noting that the Potential Study's determination that PG&E is actually saving more than the 'potential' essentially renders the findings un-actionable for planning purposes.

Lastly, PG&E notes that industrial facilities tend to be unique− even when producing similar products. Each facility has its own management structure, decision-making criteria, and equipment. Given that external factors can affect costs and expenditures at any moment, it is difficult to use the Potential Study results when addressing the expected energy efficiency savings opportunities in specific facilities.

F. Industrial Market Trends and Challenges

Trends

California industry faces significant challenges: competing effectively in a global market, managing increasingly scarce natural resources, and complying with increasingly strict regulations. Overall, the industrial sector must confront heightened public concerns about food safety, cleaner air and water, worker safety, as well as the long-term sustainability of scarce natural resources, ecosystems, and species.

Several studies delved into the fundamental disconnect between industrial customers' objectives and the ability to grow energy efficiency savings in this sector. These studies contested that key barriers to energy efficiency "include limited capital, production priorities, limited staff time, and severe cost-effectiveness criteria."[33] Namely, many industrial operations lack sufficient resources available to prioritize energy efficiency. This is substantiated by observations that "for most facility and plant managers, keeping equipment and systems operational while meeting quality requirements and avoiding production disruptions is the highest priority."[34] More specifically, with investment in production machinery often requiring capital funding, PG&E's large industrial customers have a tendency to maintain and repair older equipment for as long as possible, reducing the potential for energy efficiency-related additions.[35]

In light of these challenges, PG&E has identified four major market trends impacting its industrial customers.

1. **Increasing regulation and the high cost of doing business in California are placing more and more financial pressure on industrial customers.**
    - State agency regulation of industry is ever-increasing surrounding nitrogen oxide (NOx) and GHG emissions, use/handling/transport of specific chemicals key to production, water usage, and hazardous waste disposal. Facing intensifying emissions limits, PG&E's largest customers are looking to energy efficiency, as well as other distributed energy resources, to meet regulations.
    - According to a 2014 study by the California Foundation for Commerce & Education, the total cost of doing business in California is 19% higher than the national average, or $57,000 per employee.[36] The high cost of real estate and labor, coupled with declining shipping costs, is driving many industrial operations overseas.

[33] Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 3.
[34] Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 78.
[35] PG&E Large Business Customer Journey Research Report; November 16, 2015; Greenberg.
[36] "The Cost of Doing Business in California," p. 19. California Foundation for Commerce & Education (CFCE). Prepared by Andrew Chang & Company. August 12, 2014. http://www.calchamber.com/cfce/documents/cfce-cost-of-doing-business-in-california.pdf

2. **Many customers are turning to self-generation (often via co-generation, wind, and solar) to mitigate costs and pervasive business uncertainty.**
    - This trend can complicate opportunities to achieve predictable energy savings. At the same time, energy efficiency can help to offset some of these costs and meet demands for greener energy, while targeted customer outreach will play an important role in informing customers about how energy efficiency programs can do so.
3. **The industrial sector is consolidating, and manufacturing of high-tech, precision, high-margin equipment is becoming more prominent relative to other products.**
    - This trend is particularly relevant in the realms of biotech and pharmaceuticals– as quality control standards, higher shipping costs, and the research and development (R&D)-intensive component will continue to remain local. These elements contribute to a relatively predictable customer segment for PG&E to target- and also one that is already savvy about every usage. Overall, this raises bar for the means by which PG&E must influence them.[37]
4. **Industrial automation is on the rise as money and technology [i.e. automation, data analytics, and the internet of things (IoT)] are increasingly channeled into the sector.**
    - As automation renders equipment costs more and more prominent in industrial operations (relative to labor cost), this opens the door to energy efficiency savings opportunities. In this emerging high-tech landscape, PG&E seeks to harness advanced technology solutions to help its customers understand their energy usage and save energy.
    - Energy management information systems (EMIS) have enabled companies to gain visibility of the energy usage for these various automation systems, as well as link energy savings to the overall performance of an industrial operation. Automation, as well as general improvements in information technology, has enabled EMIS costs to drop and the desire for information and data-driven decision making to increase. This in turn has driven the price for metering to decline, and the amount of existing information technology within large industrial plants to increase.[38]

Challenges

The industrial sector is particularly challenging to target with energy efficiency programs due to the breadth of diversity, how decisions are made, and the level of technical expertise required at times. The most significant economic and financial challenges to be addressed in energy efficiency program design are as follows:

Capital constraints: Industrial customers often face internal competition for capital and frequently require very short payback periods (one to three years). Additionally, corporate tax structures, such as depreciation and energy bills, can deter industrial customers' interest in energy efficiency upgrades.[39]

Decision-making complexity: Industrial customers often split responsibilities for operations, energy management, and investment decisions across multiple lines of business, each of which may prioritize energy efficiency and energy use reductions differently. This lack of coordination can impede and delay energy efficiency upgrades.[40]

Energy efficiency project valuation: In many cases, project valuation ignores co-benefits such as reduced maintenance costs, grid reliability, employee satisfaction, and improved air quality. Valuing these "non-energy benefits" as part of energy efficiency project analysis can increase the internal rate of return and decrease the payback, making the energy efficiency investments more viable and attractive to decision makers.[41]

[37] Final business plan chapter to include proper citation.
[38] Rogers, E. 2013 and 2014.
[39] DOE Barriers study, p. 39.
[40] DOE barriers study, p. 43.
[41] DOE Barriers study, pp. 43-44.

Energy prices: Low natural gas prices can compromise interest in energy efficiency. Based on EIA data, PG&E expects natural gas prices to remain at relatively low levels in the midterm (rising from over $2.5/MMBtu to $4/MMBtu by 2020, and remaining at roughly $5/MMBtu to 2040),[42] which may temper industrial customers' motivation to pursue energy efficiency projects.[43]

IOU energy efficiency programs' ease of use: The complexity of IOU program rules and procedures can render energy efficiency uptake difficult and unattractive, particularly given the extended wait times that customers frequently endure before getting clear answers about their incentive(s) and opportunities. PG&E constantly seeks to identify ways to clarify rules and support customers to make program participation easier, while maintaining a focus on capturing incremental savings from what are often complex and difficult-to-analyze projects. Overall, while uncertainty in utility energy efficiency programs can make participation challenging,[44] the U.S. DOE concluded that "not having industrial customers participate in energy efficiency programs represents a significant missed opportunity," particularly in gas savings programs.[45]

PG&E's seven core intervention strategies seek to overcome these key barriers for the industrial sector, as shown in Table 6 and explained in greater detail in *Section G: PG&E's Approach to Achieving Goals*.

Table 6: Industrial Market Trends and Barriers to Energy Efficiency Program Participation

Key Barriers for the Industrial Sector	Industrial-Sector Interventions
• Decision-making complexity	• Data access and awareness
• Decision-making complexity	• Data analytics
• Decision-making complexity • Energy efficiency project valuation • Programs' ease of use	• Technical assistance and tools
• Capital constraints • Energy prices • Programs' ease of use	• Financial solutions
• Decision-making complexity • Energy efficiency project valuation • Programs' ease of use • Capital constraints	• New models
• Energy efficiency project valuation • Programs' ease of use	• Strategic partnerships
• Programs' ease of use • Capital constraints • Energy prices	• Upstream initiatives

[42] DOE. 2016. Annual Energy Outlook 2016. DOE/EIA -0383 (2016) August. See, for example, Figure ES-6.
[43] DOE Barriers study, p. 46.
[44] DOE Barriers study, p. 42. And M. Kelly and E. Rogers. 2016, pp. 7-8.
[45] DOE Barriers study p. 50

G. PG&E's Approach to Achieving Goals

Strategic Interventions Overview

PG&E has more than a 20 year track record of providing viable energy efficiency offerings to its industrial customer base, with critical support from field engineers, project managers, account representatives, relevant experts, vendors, and auditors that help to move projects forward. Building upon past experience, PG&E has identified seven core strategic interventions to address California's evolving energy efficiency technology and policy landscape in the industrial sector. These strategies are divided into two categories– those that focus directly on the customer, and those focusing on the larger market.

- **Data Access and Awareness** for strategically targeting high-opportunity projects and providing specialized value propositions to increase customer awareness of their energy use.
- **Data Analytics** to target customers and the most cost-effective energy efficiency solutions.
- **Technical Assistance and Tools** to facilitate access to benchmarking, energy management technologies, and ongoing monitoring.[46]
- **Financial Solutions** such as loans, rebates, and incentives to help customers overcome first-cost barriers to energy efficiency project implementation.[47]
- **New Models** such as Strategic Energy Management (SEM) to promote operational, organizational, and behavioral changes that yield ongoing efficiency gains to meet SB 350 goals and capture "stranded" energy savings.[48]
- **Strategic Partnerships** to maximize outreach efforts, share technical expertise, and use cross-agency resources to help scale efficiency and meet SB 350 goals.[49]
- **Upstream Initiatives** to support energy-efficient products, components, and systems.

The next section provides further detail on the selected intervention strategies and exploratory tactics. Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness.

Figure 5: PG&E's Approach and the Customer Energy Journey

(Placeholder for broader customer energy journey graphic)

[46] DOE SEE Action study, p. 14.
[47] DOE SEE Action, p. 15-16.
[48] DOE SEE Action Study, p. 18.
[49] DOE SEE Action Study, p. 35.

Intervention 1– Data Access and Awareness

Industrial customers need accurate and complete information to make informed decisions about energy efficiency investments.[50] Making customer energy consumption data accessible and useful is the first step in helping customers recognize opportunities for energy efficiency, and connecting them to technical assistance, incentives and rebates, SEM, and other resources. According to the DOE, lack of metering and energy consumption data can prevent identification and evaluation of energy efficiency opportunities.[51]

Most industrial customers have highly specialized operations and are risk averse when it comes to energy efficiency improvements. Enabling greater visibility into energy efficiency opportunities and more accountability around energy use can drive increased energy efficiency investments.[52] Going forward, PG&E seeks to ensure that all customers have access to their energy usage data and the ability to share this data with relevant third parties.

Table 7. Intervention 1: Data Access and Awareness

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Data access and awareness (to promote customer understanding and management of their energy consumption, and to target high-potential energy efficiency opportunities)	**Decision-making complexity**	Continue to use existing meters and tools through which industrial customers can view their data such as Green Button Connect.	E	N
		Evaluate benchmarking techniques for industrial customers. Gather data and analyze existing industrial benchmarking programs (e.g., EPA ENERGY Star for Industry) to evaluate the feasibility of various approaches.	N	N
		Select a promising industrial segment (such as food processing or manufacturing) to serve as the focus of an initial, limited benchmarking offering.	N	M
		Offer relevant and actionable comprehensive facility audits to identify energy efficiency, demand response, and distributed generation potential in customers' facilities. Large Integrated Audits (LIAs), for instance, have helped to increase awareness of energy efficiency and demand response for PG&E industrial customers.	E	N
Partners: Industry groups, government agencies, and research institutions involved in industrial benchmarking programs; research institutions [Electric Power Research Institute (EPRI), Lawrence Berkeley National Laboratory (LBNL), American Council for an Energy-Efficient Economy (ACEEE)] for assistance with market research				

[50] DOE Barrier study, p. 53.
[51] DOE Barriers study, p. 53.
[52] DOE Barriers study, p. 57.

Data Access: Almost all recent studies[53] [54] tout the importance of providing more visibility to energy use data and/or sharing energy audit results that identify opportunities, to get customers to save energy. Both information and energy audits have been key programs in the broader portfolio of programs to get customers to become more aware of their energy use and where opportunities exist to save. PG&E is proposing a variety of studies to 1) identify where the largest untapped energy savings opportunities exist in the IALC markets; 2) carry out in-depth market characterizations of the key markets where these opportunities exist to offer useful program design/implementation guidance; and, 3) carry out process evaluations of new interventions to provide early feedback that enables timely enhancements to programs.[55]

PG&E will continue to provide Large Integrated Audit (LIA) services via onsite energy assessments of qualifying customer sites to help industrial customers realize untapped opportunities in their facilities and gain better awareness of their potential for demand response. PG&E will focus on refining the qualifying process for LIAs versus other audit services, and on training account representatives, field engineers, and vendors on how to better develop and present audits to customers (using the data from audits to better target opportunities and customers, as well as increasing the conversion rates of measures identified through audits).

Benchmarking: Benchmarking has been a powerful tool used by residential and commercial customers to facilitate energy use awareness and drive greater energy savings potential. PG&E recognizes an opportunity to improve its industrial customers' benchmarking practices by ensuring that customers have access to disaggregated data, the ability for themselves and their partners to analyze this data and develop and refine facility energy management practices. The 2011 CSEEP set forth a goal to "build market value of and demand for energy efficiency through branding and certification," with one result being that "energy efficiency certification and benchmarking will become a standard industrial practice for businesses that are responsible for 80 percent of the sector energy usage by 2020."[56]

The ENERGY Star for Industry program[57] constitutes a viable model for PG&E's industrial customers to use as a starting point. The unique nature of industrial facilities makes it difficult to compare them against others or even procure data to do so on account of confidentiality issues. While researchers (e.g., national laboratories, international organizations such as International Energy Agency (IEA), and academia) publish energy intensities for specific segments, these studies are sporadic and non-comprehensive across industrial markets, and thus of limited use. Therefore, PG&E initially plans to evaluate what tools and best practices currently exist for industrial benchmarking to get better insight into effective methods in the market. PG&E will then use that research to develop services or possibly a stand-alone program centered on benchmarking for its industrial customers. PG&E believes using its in-house energy usage and program-participation data, as well as other customer-specific details, can inform an offering that ranks customers on both energy usage-intensity and less quantitative criteria, such as program participation, cumulative energy savings, and commitment to energy efficiency.

Intervention 2– Data Analytics

According to a 2013 report by ACEEE, "imperfect information may be the most widespread barrier to energy efficiency. The most significant drivers include the difficulty of measuring energy savings and [the] challenge of

[53] KEMA. 2012 b - h. *Industrial Sectors Market Characterization: Chemicals Industry; Metalworking Industry;* Plastics Industry; Mineral Product Manufacturing Industry; Glass Industry; Water and Wastewater Industry; Paper Industry.

[54] Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI):* New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling*; Food Processing Industry;* Wastewater Treatment Facilities*;* Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries*;* Integrated Design for New Construction Buildings*.*

[55] See the 2017 EE EM&V Roadmap, available at: http://www.energydataweb.com/cpuc/search.aspx?did=1644

[56] CSEEP 2011, p. 41.

[57] https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants

separating energy use from individual devices."[58] These challenges are particularly pronounced in the industrial sector on account of its diversified customer base and high energy-intensity consumption patterns (representing 25% of overall electric and 36% of gas usage across PG&E's service territory in 2015[59]).

Customer Targeting: PG&E will use insights from interval data to increase cost-effective savings by identifying customers with "stranded potential," allowing for targeted interventions tailored to industrial customers' specific needs.[60] Furthermore, PG&E will conduct market research to identify high-potential customers and market segments. The research will seek to expose high relative energy users, as well as segments with recent technological innovations. This will inform PG&E's delivery of appropriate and timely solutions to customers on their energy efficiency journey.

Table 8. Intervention 2: Data Analytics

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Data analytics (to target customers and cost-effective energy efficiency opportunities)	**Decision-making complexity**	Use available and/or new data to identify high-potential customers and market segments to enhance PG&E's delivery of appropriate and timely solutions to customers, and to target customers at the optimal time in their decision-making and budget cycles.[61]	M	N
Partners: Third-party vendors; EM&V research consultants				

PG&E will conduct in-house analyses of customer billing data, and complement these with a review of recent non-residential audits, tracking data on customers' adoption of energy efficiency, account representatives" knowledge of specific customers' conditions, and further in-depth market research.

Intervention 3– Technical Assistance and Tools

Many customers face technical barriers to identifying and/or completing energy efficiency projects. In particular, small- and medium-sized customers tend to lack on-site personnel with sufficient expertise to detect energy inefficiencies. In contrast, many larger customers may be aware of efficiency opportunities, but still unable to qualify for utility incentives. Limited time, expertise, and financial resources also frequently preclude customer implementation of energy efficiency projects.[62] In addition, little usable benchmarking data exists for industrial

[58] Vaidyanathan, Nadel, Amann, et al. "Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency," American Council for an Energy-Efficient Economy, p. vi. March 2013: http://kms.energyefficiencycentre.org/sites/default/files/e136.pdf
[59] California Energy Commission; 2015 Integrated Energy Policy Report (IEPR); http://www.energy.ca.gov/2015_energypolicy/
[60] *Analyzing Energy Efficiency Opportunities Across Building Portfolios*; ACEEE 2014 Summer Study; Ellen M. Franconi and Michael J. Bendewald, Rocky Mountain Institute; Caitlin E. Anderson, ME Engineers: http://www.rmi.org/Content/Files/ACEEE_2014-Analyzing_Building_Portfolios.pdf
[61] DOE SEE Action study, p. 32.
[62] Christopher Russell. 2008. "The Industrial Energy Harvest." www.energypathfinder.com

facilities at present. This may be a limiting factor to customer engagement with utility programs due to pervasive lack of customer understanding of energy usage and consequent confidence in energy-related choices.[63]

Overall, technical assistance helps to identify and quantify energy savings opportunities that large customers' energy managers may typically overlook (in their predominant focus on procurement) and small customers lack the resources to detect. It also provides an independent review of vendor claims (vis-à-vis the relative energy savings potential of a proposed technology), which can provide crucial endorsement value.

In continuing to provide relevant technical assistance, tools, and knowledge sharing, PG&E seeks to effectively integrate energy efficiency into day-to-day operations for an increasing percentage of customers.

Table 9. Intervention 3: Technical Assistance and Tools

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Technical assistance, tools, and knowledge sharing (to facilitate customer awareness and action)	**Decision-making complexity** **Energy efficiency project valuation** **Programs' ease of use**	Improve existing technical and project-management support to enable project identification and completion. Continue to offer on-site consultative engineering assistance through both statewide and targeted (third-party) offerings to guide customers toward efficient options, evaluate vendor proposals, and facilitate incentive submissions.	M	N
		Develop new calculation and measure-selection tools to fast-track custom project development and optimize cost effectiveness, much like the Modified Lighting Calculator.	N	N
		Create a delivery model to fast-track pre-install review for complex projects with basic underlying savings and cost calculations above a threshold of x dollars spent and/or x energy saved. The relative rigor of the review should align with the project scope (e.g., savings potential and proposed incentive amounts).	N	N
		Offer tools and services that identify BRO (behavior, RCx, O&M), as these require little capital investment and yield maximum energy efficiency savings within a customer's financial means.	M	M
		Develop case studies and other marketing materials to help risk-averse customers overcome their concerns. Use printed materials, as well as hosted trainings, industry trade publications, conferences,	M	N

[63] Michael Sullivan. January 2009. "Behavioral Assumptions Underlying Energy Efficiency Programs for Businesses." Prepared for CIEE/CPUC. Available at: http://uc-ciee.org/library/1/nclked/exact/behavioral-assumptions-underlying-energy-efficiency-programs-for-businesses/a/1/desc

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
		testimonial videos (of efficient manufacturing plants), and site tours.[64]		
		Improve and expand upon technical trainings offered to facility personnel. Recruit technical experts to deliver technology or industry-specific trainings (i.e., compressed air, biotech) on energy efficiency best practices. These can be at PG&E, or at customer or vendor sites.		
Partners: Third-party vendors; engineering consultants				

Technical Assistance: The expertise to identify energy efficiency opportunities is not omnipresent in existing industrial facility staff. In many cases, facility staff must also address higher priorities than energy efficiency, impeding the identification of cost-effective energy efficiency opportunities.[65] To overcome this barrier, PG&E will offer low-cost and no-cost technical assistance in the form of engineering services, project valuation, and energy and retrocommissioning audits to identify energy efficiency opportunities and help industrial customers clearly articulate the value of energy efficiency investments.[66]

The U.S. DOE suggests that including co-benefits, or non-energy benefits (NEBs), in the cost-benefit analysis of energy efficiency projects can reduce payback times for investments.[67] PG&E will provide project value propositions developed by technical experts and/or account representatives to quantify NEBs as part of the project-scoping process. Given that NEBs are typically more visible and attractive to customers relative to energy efficiency offerings, it is important for PG&E to maximize the visibility of NEBs in its projects to encourage customer implementation. PG&E will continue to work with Commission staff to demonstrate the importance of NEBs and the best approach for documenting NEBs during the project development process.

PG&E plans to introduce more effective and nuanced timing when approaching customers. Most large industrial customers have long planning cycles that require capital investments to be approved well before implementation. PG&E understands this, having built long-term relationships with its industrial customers, which is critical for successful energy efficiency.[68] PG&E plans to use its technical experts– IOU account representatives, as well as contracted experts– to provide high-quality technical advice and support on energy efficiency options specific to individual industrial segment needs. Technical experts with a solid foundation in specific industry segments can enable IOUs to address industrial customers' core needs, operating issues, and the environment in which the customers operate. In this way, IOUs can build trust among industrial customers, understanding their decision-making process, spurring energy efficiency uptake, and making the best use of customers' limited resources.[69]

[64] DOE SEE Action study, p. 34.
[65] DOE SEE Action study, pp. 24-25.
[66] DOE SEE Action study, pp. 26-27.
[67] DOE SEE Action study, pp. 25-27.
[68] DOE SEE Action study, p. 28.
[69] DOE SEE Action study, p. 30.

Knowledge Sharing: The CSEEP acknowledges that industrial customers require greater knowledge sharing and awareness to identify and develop energy efficiency projects.[70] Various 2012 market characterization studies exposed pervasive customer ignorance of energy efficiency programs and opportunities across the chemicals, minerals, metalworking, and glass industries. Notably, "knowledge gaps identified in program understanding appear to inhibit broader participation among customers interviewed"[71]:

- Chemicals industry "customers indicated that they did not feel like they were familiar with the utilities' program offerings."[72]
- "Most of the respondents [in the glass industry] expressed not being too familiar with the energy efficiency programs offered by their utility."[73]
- "In addition to not knowing about utility rebate programs, respondents of smaller firms [in the metalworking industry] had no idea what they should be looking for in terms of future energy efficiency projects."[74]

The 2012 market characterization study advises that "attaining a better understanding of the customer's world will assist [PG&E and SCE] in their design and implementation of industrial energy efficiency programs,"[75] suggesting the need for further market characterization studies.

PG&E plans to increase knowledge sharing among industrial customers as a means to increase investments in energy efficiency.[76] Ensuring that decision-makers are aware of PG&E's energy efficiency offerings, and providing customers with tools to improve their understanding of energy efficiency and share best practices can lead to increased participation.[77]

Intervention 4– Financial Solutions

Industrial customers have limited capital for equipment investments, process upgrades, and plant improvements– and energy efficiency must compete for this capital.[78] Furthermore, industrial facility decision-makers expect capital investments to have short payback periods of one-to-three years.[79] Such constraints preclude many industrial customers from considering energy efficiency upgrades. While many smaller customers may lack capital and have conflicting priorities, larger customers may have adequate capital but need a solid business justification to pursue energy efficiency. According to the U.S. DOE, for instance, industrial customers may view increasing production more favorably than producing a product with less energy.[80]

Although financing is an option for many customers, the extent to which it can impact industrial customers' credit rating[81] renders IOUs' loans, rebates, and incentives all the more important.

PG&E has been offering financial incentives for energy efficiency upgrades for decades, and in the near and mid term it plans to continue engage the industrial sector through deemed and custom incentives that improve the economics of customers' energy efficiency investments.[82] Deemed rebates constitute an effective way to move

[70] CSEEP 2011, p. 43.
[71] Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 4.
[72] Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 78.
[73] Industrial Sectors Market Characterization: Glass Industry; KEMA; January 2012; p. 58.
[74] Industrial Sectors Market Characterization: Metalworking Industry; KEMA; March 2012; p. 79.
[75] Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 6.
[76] DOE SEE Action study, p 34.
[77] DOE Barriers study, p. 54.
[78] DOE Barriers study, p. 39.
[79] DOE Barriers study, p. 39.
[80] DOE Barriers study, p. 40.
[81] DOE Barriers study, p. 41.
[82] DOE SEE Action study, p. 15.

targeted early/mid-stage technologies into more widespread adoption. At the same time, industrial custom incentive programs have historically delivered larger savings, driven better paybacks per project,[83] and proven highly cost effective.[84] Overall, a combination of deemed and custom options will best support diverse customer needs.[85]

Additionally, PG&E plans to expand the use of financing products to further improve energy efficiency project economics.

Because industrial customers vary so widely in terms of size and sophistication, PG&E must become much more precise in determining the type of financial assistance a customer may need to increase project completion and reduce free-ridership. PG&E and the CPUC have identified the inherent problems associated with large custom projects and associated poor project documentation. As identified in the recent 2010 to 2014 Industrial, Agricultural and Large Commercial (IALC) Impact Evaluations, the 2010-2012 and the 2013-2014 custom programs continued to exhibit high free-ridership levels of about 50%. PG&E has put in place processes to reduce free-ridership, and will continue to focus on efforts to maximize ratepayer dollars. At the same time, the U.S. DOE suggests that industrial customers in particular require a streamlined and expedited application process,[86] especially when industrial customers' operational cycles influence when energy efficiency investments are made.[87] Furthermore, DOE notes that identifying free-ridership is complicated, and ambiguity around measuring savings can inhibit project implementation. In some cases, "spillover-effect" can minimize and neutralize free-ridership, as the New York State Energy Research and Development Authority (NYSERDA) found.[88] Encouraging industrial customers' continued participation in energy efficiency is critical as industrial energy efficiency programs can provide valuable energy savings and societal benefits at lower costs than many other programs in other sectors. As noted by the DOE,[89] and as ACEEE stated, "Capturing energy efficiency savings through industrial programs is one of the best ways to keep energy prices low for all customers.[90]

In addition, PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.[91]

Going forward, the success of this intervention will be dictated by the extent to which energy-saving projects are prioritized such that savings from industrial projects increases.

Table 10. Intervention 4: Financial Solutions

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Financial solutions (such as loans, rebates, and	**Capital constraints**	Continue to offer custom incentives[92] tailored to individual customers or specific industrial facilities, and ensure sound project documentation.[93]	E	N

[83] DOE SEE Action study, p. 15.
[84] DOE SEE Action study, p. 5, and PG&E data.
[85] DOE SEE Action study, p. 31.
[86] DOE SEE Action study, p. 34.
[87] DOE SEE Action study, p. 25.
[88] DOE SEE Action study, pp. 39-40.
[89] "Implementation of cost-effective energy efficiency measures, if made within the context of ratepayer-funded energy efficiency programs, ultimately reduces the energy bills of all consumers." DOE SEE Action study, p. 7.
[90] ACEEE, "Industrial Energy Efficiency Programs Can Achieve Large Energy Savings at Low Cost."
[91] For more information, see "Senate Bill No. 1414," *California Legislative Information*, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414
[92] DOE SEE Action study, p. 14.

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
incentives to enable project completions)	**Energy prices** **Programs' ease of use**	Continue to offer deemed rebates[94] for eligible energy-saving technologies such as lighting, efficient boilers, and VFDs on process fans.	E	N
		Increase the use of financing products such as OBF and OBR as appropriate. "Alternative Path" OBF projects disconnected from incentive reviews and no-limit OBR loans will be particularly relevant for industrial customers.	E	N
		In partnership with CPUC staff, PG&E will explore the bundling of various forms of financial subsidies, technical assistance, and/or loans based on key project development criteria to better match individual customer needs.	M	M
		Develop a tiered incentive approach based on criteria such as past program participation, program influence, and lifecycle savings.[95]	M	M
Partners: Green banks; state/federal/local development funds and tax credits				

Various past evaluation studies have highlighted the value of financial offerings in enabling industrial customers to access more energy-efficient technologies for their often-complex operations.[96] Additionally, studies suggest changes to incentive designs to maximize net program impacts.[97]

Intervention 5– New Models

SEM[98] is a cornerstone of PG&E's long-term industrial strategy. Combining data access, technical assistance, tools, and knowledge sharing, and financial solutions PG&E envisions a comprehensive, customized approach to meet individual customers' energy efficiency needs – an especially important resource given the wide variety of equipment, operation sizes, and energy efficiency expertise that industrial customers possess.

Supporting SEM across PG&E customers will require integrating the various energy efficiency offerings, as well as incorporating PG&E's other demand-side management offerings. Some of these might include distributed generation and demand response.

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[93] Itron. 2014 Custom Impact Evaluation of Industrial, Agricultural, and Large Commercial; pp. 1-12 to 1-15.
[94] DOE SEE Action study, p.14.
[95] Itron. 2014. 2014. Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report. Submitted to CPUC. April 29, 2016. P. 6-15.
[96] See, for instance, *Industrial Sectors Market Characterization: Water and Wastewater Industry* (KEMA 2012g).
[97] tron. 2014. 2014. Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report. Submitted to CPUC. April 29, 2016. P. 6-15.
[98] Note that many program administrators offer SEM as a fundamental tool to increase savings in the industrial sector, including the Northwest Energy Efficiency Alliance (NEEA): http://neea.org/initiatives/industrial/commercial-and-industrial-sem-infrastructure

SEM offers a promising framework for future energy-efficiency interventions in the industrial sector and a means of integrating energy efficiency into day-to-day operations. Namely, SEM integrates strategy, metrics, and people and management systems into a process of continuous energy improvement (CEI– as it was previously termed). PG&E will provide the tools to help customers integrate this process into their operations, offering training to create an in-house energy manager if one does not yet exist, assisting in establishing an overall energy-management strategy, creating and collecting metrics, and developing energy-management systems that will be self-perpetuating within a customer's operations.[99]

SEM remains in the early planning stages, and participation and savings are expected to be minimal in the near term. The California IOUs have hired a consultant to develop SEM evaluation guidelines based on those developed for similar programs by the U.S. DOE, Energy Trust of Oregon, Bonneville Power Authority, and BC Hydro.

Having an SEM plan in place will better enable both customers and PG&E to plan ahead for specific project-financing needs, yielding greater business certainty. By pre-authorizing funding on a long-term timeline, PG&E can give customers clear visibility into the available financial assistance that can render energy efficiency projects more attractive than other investments.

Table 11. Intervention 5: New Models

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
New models (such as SEM to promote operational, organizational, and behavioral changes that result in greater efficiency gains on a continuing basis)[100]	**Decision-making complexity** **Energy efficiency project valuation** **Programs' ease of use**	Develop and broadly implement an SEM program that weaves energy efficiency into the operating mentality of participating customers. SEM will fold individual energy efficiency projects into the broader context of a customer's operations and ensure that energy efficiency becomes salient for all decision makers.	M	N
		Implement large-scale SEM offering with options for customers based on their available resources. Customers with limited interest/resources can enroll in an online SEM program, whereas those with greater awareness can connect via an in-person cohort model or high-touch individual approach.	M	M

[99] Bonneville Power Administration. MT&R Reference Guide 4: http://www.bpa.gov/Energy/N/pdf/MTR_Reference_Guide_Rev4_0.pdf;
ESI Energy Performance Tracking Team. 2015. MT&R Guidelines.Version 5 for BPA: https://www.bpa.gov/EE/Policy/IManual/Documents/MTR-Reference-Guide-Rev5.pdf;
Cadmus. 2013. Energy Management Pilot Impact Evaluation Report: https://www.bpa.gov/EE/Utility/research-archive/Documents/BPA_Energy_Management_Impact_Evaluation_Final_Report_with_Cover.pdf;
CEE Strategic Energy Management Minimum Elements: https://library.cee1.org/sites/default/files/library/11283/SEM_Minimum_Elements.pdf;
ETO. 2014. 2014 Energy Trust Workshops on Strategic Energy Management Impact Evaluation: Report on Key Outcomes: http://assets.energytrust.org/api/assets/reports/SEM_Evaluation_Workshop_Report.pdf;
EVO. International Performance Measurement and Verification Protocol (IPMVP), Option C.
USDOE. 2016. Uniform Methods Project. Steering Committee Meeting. Presentation on January 19, 2016: http://www.nrel.gov/extranet/ump/pdfs/20160119-meeting-presentation.pdf

[100] DOE SEE Action study, p. 18.

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
		As SEM becomes mainstream, evaluate the incorporation of enhanced incentive levels for SEM participants (an SEM "kicker") or implement cascading SEM incentives– equating to higher-than-average incentives in the first several years for program participants, followed by declining annual incentives until customers reach standard rates.	N	L
		Explore pay-for-performance models in target segment areas to help drive adoption where traditional incentive programs may be challenged or too costly.[101] [102]	N	M
Partners: CPUC; DOE; regional and national utilities; SEM software and service providers; third-party vendors				

SEM draws from the experience of the proof-of-concept pilot and non-resource, Continuous Energy Improvement (CEI) programs run by California IOUs over the past five years and the SEM program experience of Bonneville Power Authority, Energy Trust of Oregon, Northwest Energy Efficiency Alliance, BC Hydro (Canada), and Superior Energy Performance (SEP) of the U.S. DOE. To reduce confusion in the marketplace, California has decided to rename the CEI effort SEM. SEM seeks to execute similar activities to those in CEI, but will draw upon the experience of CEI and SEM from other realms− particularly with regard to evaluating savings and enhancing participation across the industrial customer base. The CPUC and IOUs are working collaboratively to develop a California-specific version of SEM that includes protocols and procedures for both program implementation and evaluation.

Net savings from SEM of 1.2% were demonstrated within a small study of 10 companies in the Northwest.[103] The Consortium for Energy Efficiency (CEE) characterized the SEM market as having few industrial end users investing in SEM, but providing about 5.4% of savings when implemented.[104] Despite the low uptake to date, CEE believes that "because SEM is a set of practices making up a management system and is not bound to any piece of equipment or process, it is scalable and applicable to a broad range of manufacturing facilities regardless of size or industry".[105] As depicted in Table 11 above, PG&E plans to implement various levels of SEM. Additionally, if SEM can save between 1.2% and 5.4% of use per year, this intervention alone could provide substantial savings to industrial programs (which on average saved roughly 0.9% of electricity per year[106]).

[101] CEC, 2015. "California's Existing Buildings Energy Efficiency Action Plan;" pp. 74-75.
[102] Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings." p.17
[103] Energy 350 2014, p. 4
[104] CEE 2014, pp. 8-9.
[105] CEE 2014, p. 8
[106] This calculation was derived by dividing the average GWh savings of 125.9 by the average use of 14,291 GWh; both values are included in the *Industrial Sector Snapshot* on page 2 of this business plan.

In addition to SEM, PG&E will evaluate other pay for performance models focused on verified performance of energy savings, and procuring energy efficiency as a capacity resource.[107] Pay for performance models have the potential to cost-effectively scale deeper energy efficiency retrofits, and ensure the persistency of energy savings. "Moving to widespread pay-for-performance, metered energy efficiency can unlock capital market investment and simply the retrofit process."[108]

Intervention 6 – Strategic Partnerships

By partnering with industry organizations, research institutions, federal, state and regional organizations, and others, PG&E can share technical expertise, program design and implementation guidance, and build capacity for customers to gain greater knowledge around energy efficiency. For example, the EPA Energy Star for Industry program provides guidance, tools, and recognition to drive improvements in industrial customers' energy efficiency performance.[109] Government organizations, industry groups, and trade organizations can help to identify and bring recognition to customers that are achieving energy efficiency success, as well as provide a new avenue to reach customers who are also members of these organizations. Partners can also play a role in creating case studies and other outreach materials tailored to their particular industry.

Overall, relative improvements in industrial customer energy efficiency knowledge will serve as a barometer for this intervention's success going forward.

Table 12. Intervention 6: Strategic Partnerships

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Strategic partnerships (to maximize outreach efforts, share technical expertise, and use cross-agency resources)[110]	**Energy efficiency project valuation** **Programs' ease of use**	Continue to use government partnerships to support program implementation and customer installation of energy efficiency measures. PG&E is partnering with LBNL, for instance, to explore best practices for SEM measurement and verification (M&V) protocols.	E	N
		Engage industry and trade organizations to procure additional customer data, supporting customer outreach.	N	M, L
		Work with industry and trade organizations to publicly recognize customers achieving high levels of energy savings from PG&E programs through peer-to-peer Industrial Energy Outreach Champion	N	M, L

[107] Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings." p.17
[108] Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings." p.21
[109] DOE SEE Action study, p. 35.
[110] DOE SEE Action study, p. 35.

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
		initiatives.		
Partners: Government agencies (e.g., CPUC, CEC); industry and trade organizations; midstream vendor groups (e.g., vendors of fans, drives, and other commonly-used industrial equipment)				

PG&E plans to facilitate a peer-to-peer Energy Champion Outreach initiative to drive continuous improvement in energy performance at industrial facilities. The DOE supports a successful Energy Champion program that trains facility energy leaders in energy management best practices and provides appropriate tools, methods, and support to ensure effective energy management expertise and employee engagement at the company's top energy-consuming facilities.[111] PG&E's peer-to-peer Energy Champion is modelled after this, and encourages dialogue amongst industrial customers focused on highlighting energy management best practices (much like the Southeast's Industrial Energy Efficiency Network.[112] [113] Energy Champions will provide data for case studies and other marketing materials, and serve as a resource for customers interested in energy efficiency programs. By elevating high-performing customers as models for their peer groups and industry networks such as California Manufacturers and Technology Association (CMTA) and California League of Food Processors (CLFP), PG&E can influence and promote the participation of other members of these organizations. Peer networks can drive companies to implement energy efficiency measures[114] and can be extremely effective in increasing awareness.[115] As such PG&E plans to unite industrial customers in a cross-sector, peer-to-peer group in which Energy Champions help to drive increased participation in energy efficiency programs, with a focus on continuous energy management improvement techniques.

Furthermore, many local, state, regional, and federal government organizations offer a venue to share energy efficiency best practices and lessons learned. These types of strategic partnerships are a feature of many industrial energy efficiency portfolios and a noted best practice.[116] Partnering with these organizations to share resources, technical expertise, training opportunities, and program implementation support capacity will extend the reach of PG&E's industrial energy efficiency initiatives.

Intervention 7– Upstream Initiatives

Upstream initiatives hold great potential to increase the market penetration of efficient technologies, at a significantly reduced unit-cost, enhancing sector and portfolio cost effectiveness as well as much greater energy savings. Furthermore, partnering with upstream vendors can facilitate delivery of specific energy-efficient technologies to customers.

[111] https://betterbuildingssolutioncenter.energy.gov/implementation-models/energy-champion-program
[112] Marsh and Taube "The Industrial Energy Efficiency Network supports energy efficiency through peer-to-peer dialogues among industrial manufacturers in the United States;" 2012; p. 5.
[113] DOE SEE Action study, p. 15.
[114] DOE SEE Action study, p. 14.
[115] Marsh and Taube, p. 6.
[116] ACEEE "Industrial Efficiency Programs Can Achieve Large Energy Savings at Low Costs;" p. 2. http://aceee.org/sites/default/files/low-cost-ieep.pdf

PG&E will explore opportunities to partner with distributors to stock and promote energy-efficient products, components, and systems (such as fans, motors and pumps) with the intention to increase cost-effective energy savings and promote increased participation in energy efficiency initiatives. Working with distributors provides economies of scale and the ability transform the marketplace.[117] The DOE notes the opportunity for market transformation in the industrial sector.[118]

PG&E envisions an upstream program complementing its downstream initiatives by making efficient equipment readily available to industrial customers, providing resources for distributors to stock and upsell these products. PG&E sees an opportunity for customers who have limited resources and those who are newer to energy efficiency.

Overall, upstream (and midstream) initiatives seek to increase the availability of energy efficiency measures and decrease the cost of these measures on a sustainable basis.

Table 13. Intervention 7: Upstream Initiatives

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Near, Mid, or Long-term
Upstream initiatives (to promote the most efficient products, components, and systems)	Programs' ease of use Capital constraints Energy prices	Investigate market transformation opportunities in the industrial sector.	N	M, L
Partners: Upstream vendor groups (i.e. vendors of fans, drives, and other commonly-used industrial equipment)				

PG&E plans to identify and assess the market transformation objectives, or "targeted market transformation initiatives" (TMTI), of an industrial upstream initiative prior to implementation.[119] As recommended in "Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives," PG&E will coordinate with CPUC staff, CEC staff, CAEECC stakeholders, and other stakeholders to act as a "sounding board" throughout the implementation plan (IP) development process.[120] While there was some momentum toward encouraging vendors to stock more energy-efficient motors in the past, industrial upstream/midstream efforts remain largely early-stage and limited to date.

See Appendix D for information on the phases PG&E suggests for developing, vetting, and launching this TMTI, along with its administrative structure.[121]

[117] Maureen Quaid and Howard Geller, 2014. "Upstream Utility Incentive Programs: Experience and Lessons Learned" p. 4.
[118] DOE SEE Action study, pp. 17-18.
[119] Cathy Fogel, 2016. "Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies;" p. 2.
[120] Keating, 2014. "Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives;" p. 15.
[121] As recommended by Cathy Fogel, Energy Division staff in "Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies." p. 3.

PG&E Industrial Programs/Incentives Targeted by Intervention Strategies

PG&E's seven industrial intervention strategies will translate into a set of existing, modified, and new programs, as illustrated below. Note that this table is illustrative, and does not represent the full suite of program offerings.

Intervention Strategy	Energy Advisor	Targeted Third-Party Programs	Calculated Incentives	Deemed Rebates	Strategic Energy Management (SEM)	Other New Programs
Customer: Data Access & Awareness	X	X	x	X	x	x
Customer: Data Analytics	x					
Customer: Technical Assistance & Tools		X	x		x	x
Customer: Financial Solutions		X	x	X	x	x
Customer: New Models		x			x	x
Market: Strategic Partnerships					x	x
Market: Upstream Initiatives		x		x		X

Within *Section G: PG&E's Approach to Achieving Goals*, PG&E describes new and innovative strategies and tactics, some of which will lead to pilot efforts at the program level. PG&E will describe any unique and innovative aspects of each program, as well as any pilots contemplated or underway, within its program-level implementation plans.

Additionally, PG&E will consider the appropriate workforce standard requirements, such as any required certifications, minimum performance standards, or pre-qualification process for specific programs in support of its energy efficiency portfolio. As applicable, PG&E will detail workforce standard requirements in each Implementation Plan (IPs).

H. Leveraging Cross-cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the industrial sector. Here PG&E provides a brief overview of how cross-cutting initiatives fit into its industrial strategy. For more detail on PG&E's cross-cutting programs, refer to Chapter X.

- **Finance:** Finance offerings will play a critical role in increasing energy efficiency opportunities for a broader customer base in the industrial sector– through a diversified mix of loans, rebates, and incentives. OBF and OBR will also become a larger part of the financing picture for industrial customers. See ***Intervention Strategy 4: Financial Solutions*** for a detailed description of how PG&E plans to expand financing offerings for its industrial customers.
- **Emerging Technologies (ET)**: ET support is essential in advancing the Technical Assistance and Tools intervention strategy, monitoring the evolving energy efficiency market, and responding to new technologies, trends, and practices. See ***Intervention Strategy 1: Data Access and Awareness***, and ***Intervention Strategy 3: Technical Assistance and Tools*** for a detailed description of how PG&E plans to explore emerging technology opportunities for its industrial customers.
- **Workforce Education and Training (WE&T):** As PG&E hones the necessary skills and knowledge to effectively implement energy efficiency projects, WE&T efforts are integral to educating partners and

customers on energy efficiency opportunities. For example, SEM training, and training for pay-for-performance may be critical to the success of these initiatives.[122] ***See Intervention Strategy 3: Technical Assistance and Tools***, and the ***Intervention Strategy 6: Strategic Partnerships*** for an overview of WE&T initiatives that PG&E plans to launch in support of its industrial customers.

- **Marketing:** Marketing will continue to play a major role in crafting and delivering appropriate messaging to customers and vendors to raise awareness of new energy efficiency tools and offerings, as well as building integration with Distributed Energy Resources. See I***ntervention Strategy 3: Technical Assistance and Tools***, and ***Intervention Strategy 6: Strategic Partnerships*** for an overview of how PG&E plans to integrate marketing into its portfolio in support of its industrial customers.

I. Integrated Demand-Side Management (DSM)

While energy efficiency may be the most cost-effective way to reduce energy consumption and greenhouse gas emissions, PG&E uses a range of other DSM strategies to support its industrial customers' energy management needs. These DSM strategies can provide comprehensive, actionable, and economically-viable solutions for PG&E's industrial community.

Industrial Facilities and Targeted Demand-Side Management (TDSM)

TDSM represents a stark contrast to standard energy efficiency offerings in its selective, targeted, 'whole-system' approach to moderating load.

Enhanced incentives currently provide a key 'carrot' for influencing customer behavior in TDSM. In 2016, PG&E incentivized non-residential projects using a $100/kW "kicker" for business customers that complete energy efficiency projects by the end of 2017. Whereas this has proven effective in influencing select small and medium-sized industrial customers, large customers are typically more difficult to engage and can require more customized, intimate outreach from PG&E on account of their capital-intensive operations and longer lead times to implement change. This represents an untapped opportunity in PG&E's industrial customer base.

Geographical targeting is another major consideration as energy efficiency is integrated into PG&E's larger TDSM initiative. PG&E is actively taking steps to incorporate the industrial sector into TDSM, particularly surrounding grid assets where industry plays a prominent role in overall load. At the Linden substation in East Stockton, for instance, PG&E has been targeting several particularly large industrial consumers− namely a food processor (of cherries, walnuts, and apples) and a fertilizer plant− in an effort to moderate their peak loads.

PG&E envisions broader opportunities to integrate TDSM going forward, particularly as energy usage data increasingly informs the way industrial customers manage their operations. Energy-intensive industrial customers such as cold storage plants, for instance, may be prime candidates for energy efficiency upgrades using multiple forms of financing and high touch assistance to mobilize them to take action.

Industrial Facilities and Distributed Energy Resources (DER)

As the prevalence of energy management systems and automation increases, so does the potential to integrate with demand response (DR) programs. Looking ahead, PG&E's industrial customers can work with aggregators to deliver load reduction capacity at market rates or for emergency events; most of this would occur directly on the CAISO market. Currently, PG&E provides comprehensive audits assessing energy efficiency, DR, and distributed generation potential− as well as targeted comprehensive incentives for constrained substation areas. PG&E will explore further integration of DR services in third-party programs as a natural progression from the integration achievements completed to date.

[122] Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings," p.20.

As industrial customers invest in distributed generation (DG) such as solar panels, SEM planning can help to integrate energy efficiency into the overall energy management of their operations. PG&E will strive to support customers as they move toward an integrated energy management process going forward.

Industrial Facilities and Time-of-Use (TOU)/Rate Design

While rate design is not intended to encourage energy efficiency and often requires energy efficiency products to complement changing rates, many industrial customers actually have the flexibility to use dynamic pricing to their advantage. This is particularly true for oil producers and refineries, manufacturers, and heavy industrial customers that typically operate around-the-clock.

In general, the proliferation of renewables and the associated 'duck-load curve' is driving changes in rates. The California Large Energy Consumers Association (CLECA)'s matinee pricing pilot[123]– designed to bolster demand during non-peak times– should serve the industrial sector particularly well, given that most customers can change their production and relative energy use during "swing shifts" and other times to minimize their total energy bills. Growth in self generation gives customers further control over their energy usage and related costs. All of these factors render PG&E's planned shift in non-residential mandatory TOU/peak periods (from noon-6pm through 2018 to 5pm-10pm from 2019 onward), less of a concern for most industrial customers.

At the same time, small and medium-sized industrial customers are generally less flexible and have less understanding of and control over their energy use, and may need support from energy efficiency products to help offset impacts of these rate changes.

Industrial Facilities and Carbon Credits Program

Given the increase in generation costs driven by PG&E's compliance with cap-and-trade under AB 32 (the *California Global Warming Solutions Act of 2006*),[124] [125] the Air Resources Board (ARB) annually allocates millions of allowances to PG&E free-of-charge with the mandate that PG&E sell them into auctions (and buy back a portion for compliance). Decision (D).12-12-033, D.14-12-037, and Resolution E-4716 further stipulate that PG&E must return GHG electric revenue to select market sectors to compensate for a portion of the GHG emission costs associated with the electricity they purchase.

Industrial facilities deemed "emissions-intensive and trade-exposed," or "EITE," entities are prioritized above all and eligible to receive California Industry Assistance from the state as an annual credit on their utility bill, regardless of the amount of emissions produced. This approach aims to incentivize these industries to manufacture products in California in the most GHG-efficient manner possible on a sustainable basis.[126]

Overall, this paradigm implicitly recognizes the industrial sector's strong economic value to the state, and effectively insulates key industrial customers from cap-and-trade-related revenue losses to encourage their ongoing presence in California.

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[123] "CLECA Proposal on Matinee Pricing;" Barbara R. Barkovich, Barkovich & Yap., Inc.; for California Large Energy Consumers Association; Matinee Pricing Workshop; February 24, 2016.

[124] *Assembly Bill No. 32; Chapter 488*; Approved by Governor on September 27, 2006. Filed with Secretary of State on September 27, 2006: http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf

[125] *Assembly Bill 32 Overview*; California Environmental Protection Agency, Air Resources Board: https://www.arb.ca.gov/cc/ab32/ab32.htm

[126] *GHG Cap-and-Trade– CA Industry Assistance*; CPUC: http://www.cpuc.ca.gov/industryassistance/

J. PG&E Helping to Meet State Policy Goals

Table 14: Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E's Policy Support
SB 350	• Doubling of energy efficiency savings by 2030	Establish strategic partnerships with industrial service providers to increase awareness of available energy efficiency programs and offerings Create targeted customer outreach approaches to increase customer awareness and engagement: • Conduct market research to identify high-potential market segments • Develop case studies and marketing materials • Research and offer meaningful benchmarking information to help motivate customers Offer SEM and pay-for-performance models to scale energy efficiency cost effectively
AB 802	• Benchmarking • Provide financial incentives ad assistance for high opportunity projects	• Offer technical assistance and tools to facilitate project completions and improve customer understanding of energy use • Use incentive-free OBF and other tools emerging from high opportunity projects to deliver savings to industrial customers • Use meter-based savings to measure energy savings and ensure persistency for SEM offerings and other new program models
California Energy Efficiency Strategic Plan (CEESP)	• Support California industry's adoption of energy efficiency by integrating energy efficiency savings with achievement of GHG goals and other resource-management objectives. • Build market value of and demand for energy efficiency through branding and certification. • Provide centralized technical and public policy guidance for resource efficiency and workforce training.	• Continue existing technical and project-management support • Scale SEM plan to integrate energy efficiency into customer consciousness • Create BRO (behavior, RCx, O&M) programs that require little capital • Continue with custom and deemed rebates to offset initial project costs • Increase use of OBF/OBR as appropriate • Move toward more of a grant-application approach • Publicly recognize customers to motivate further energy efficiency actions • Develop outreach champions to drive uptake

Policy Drivers	Guidance Given	PG&E's Policy Support
		• Use upstream market actors to decrease costs and/or increase number of projects • Explore opportunities for market transformation in the industrial sector
SB 1414	• Effective January 1, 2017, IOUs must collect proof of permit closure before paying rebates or incentives to customers or contractors for central air-conditioning or heat pumps and their related fans.	PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.

K. PG&E's Partners and Commitment to Coordination

PG&E's success in the industrial sector will rely on a broad range of program administrators, regulators, government agencies, universities, and other educational entities, market actors, and stakeholders.

As discussed in *Section G PG&E's Approach to Achieving Goals*, PG&E's emphasis on strategic partnerships is a key component to its vision for the industrial sector.

Program Administrators

PG&E will collaborate with program administrators and publicly-owned utilities (POUs) to share best practices and lessons learned, ensure consistent messaging and program delivery, minimize gaps and program overlap, and coordinate implementation of statewide and local offerings that cut across multiple service territories. For example, customers in overlapping counties should have access to the same program offerings.

California Public Utilities Commission (CPUC)

PG&E will work with CPUC staff to assess business plan performance and identify opportunities for continuous improvement. Additionally, PG&E will identify and perform market research studies to confirm that the business plans metrics are effectively evaluated. As it modifies existing industrial programs and develops new programs, PG&E will work in close concert with CPUC staff to ensure that these programs are "EM&V-ready" and meet CEESP and other state policy directives. In particular, PG&E will work with CPUC staff to assess opportunities for a streamlined custom review process, tiered incentives, SEM program development, and upstream program initiatives.

Government Agencies

PG&E will maintain and/or develop new partnerships with government agencies to advance collective interests in the industrial sector. PG&E will work closely with these agencies to develop, refine, and implement, where applicable, key intervention strategies and programmatic activities. Agencies include:

- U.S. DOE: PG&E will work with industrial customers to encourage participation in the DOE's Better Plants Program[127]
- U.S. EPA: PG&E will work with industrial customers to encourage participation in the ENERGY STAR Challenge for Industry– a global call-to-action for industrial sites to reduce their energy intensity by 10 percent within five years.[128]

Universities and Other Educational and Research Entities

- PG&E will continue to work with entities such as Lawrence Berkeley National Laboratory (LBNL) to build expertise and tools to realize SEM program models.
- PG&E will continue to look to universities and other research institutions such as the Electric Power Research Institute (EPRI) to gain understanding of new technologies that may be entering the market to meet industrial customers' needs.

Third-Party Implementers and Market Actors

- Third-party program implementers have been, and will continue to be, an important delivery channel for PG&E. PG&E plans to expand its network of third-party vendors in the coming years. PG&E will work with market actors such as contractors, financial institutions, and other vendors such as manufacturers and distributors to bring new products and services to its industrial customers, while also providing enhanced training and technical support for key areas of focus for industrial customers.

Stakeholders

PG&E will continue to engage with experts through participation in the California Energy Efficiency Coordinating Committee (CAEECC), and the industrial subcommittee. PG&E will solicit stakeholder feedback input throughout the life of its business plan, and in the development, refinement, and modification of intervention strategies and programmatic activities for Implementation Plans.

L. Statewide Administration and Transition Timeline

TBD

M. Solicitation Strategies

TBD

[127] http://energy.gov/eere/amo/better-plants
[128] https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/earn_recognition/energy_star_challenge_industry2

N. Metrics and EM&V Considerations

PG&E and the other PAs understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. PG&E also recognizes that listed metrics can have powerful and unintended effects.[129]

Below PG&E proposes draft metrics as of October 2016. PG&E expects that these metrics will change before the final draft as the company attempts to compute and thoroughly document the baseline values. Where the metrics may not make sense, PG&E intends to revise accordingly to better capture what will be valuable to the CPUC, program administrators, or other stakeholders.

Ultimately, all of the metrics proposed for the final business plan draft will be consistent with the agreed-upon statewide guiding principles for metrics that were shared with the Energy Division on Aug 16, 2016 (see Table 15 below).

Table 15: Guiding Principles for Metrics

Metrics should…
Be used and useful by PAs to manage portfolio
Inform on the progress to achieving desired market effect(s) and strategy effectiveness
Rely on data collected during program implementation and/or data reporting to CPUC
Simple to understand and clear of any subjectivity
Outcome metrics preferred, but output metrics have high benefit to cost ratio
Not all metrics have a readily interpretable meaning, context is needed
Not a replacement for EM&V

The primary metrics that PG&E is proposing comprise PG&E's energy-savings metrics. PG&E is also proposing additional secondary metrics, such as participation, to meet the expectations (and requests) of the CPUC; however, PG&E notes that there are times when participation may actually need to decrease in order to focus resources to reach savings goals. As such, more participation does not always track to more savings. Moreover, although PG&E anticipates that participation will increase in the long term as it ushers in new scalable models, it will not be possible to track participation at the customer level as programs start to move to mid- or upstream program models.

[129] Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he descripted varying interpretation of the "same" term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. (Perrin, Burt. 1998. *Effective Use and Misuse of Performance Measurement. American Journal of Evaluation 1998:19;367.)*

The draft metrics proposed are aligned with the overall program goals. Specifically, within the next-10-year period, PG&E's primary goal for the industrial sector is to:

- Save xx GWh, xx MW, and xx MM Therms with an emphasis on three key industrial segments (manufacturing, oil and gas production and refining, and food processing). This is the key priority.

Secondary goals that PG&E intends to track include:

- Reach an increasing percentage industrial customers (increasing from 2.8% to xx% per year after the 10-year period)– with tracking by size and key segment.
- Increase industrial customers' ability to manage energy and integrate energy use into decision making by assisting X customers with energy-savings commitments through SEM or similar program efforts.
- Integrate energy efficiency with other utility DER options within x% of industrial customers.

Direct Effects from PG&E Efforts

PG&E's proposed sector-level metrics that can be tracked and monitored with some frequency (i.e., monthly, quarterly, or annually) are presented in Table 16.

Table 16: PG&E-Specific Industrial Sector Effects and Metrics

PG&E Goals	Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-7 years)	Long-Term Targets (8-10+ years)
Save xx GWh, xx MW, and xx MM Therms	All	Electricity saved	Average of approximately 126 GWh/year across 2011-2015	Annual ex ante net savings from program tracking database	XX GWh	XX GWh	XX GWh
		Demand saved	Average of 19.4 MW/year across 2011-2015		XX MW	XX MW	XX MW
		MM Therms saved	Average of 14.1 MM Therms/year across 2011-2015		XX MM Therms	XX MM Therms	XX MM Therms
Reach an increasing percentage of customers per year (increasing	Data Analytics Technical Assistance and Tools	Annual proportion of all customers participating in energy efficiency programs with tracking by size and key segment	2.8% per year	Program tracking databases	X% per year	X% per year	X% per year

PG&E Goals	Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-7 years)	Long-Term Targets (8-10+ years)
from 2.8% per year to XX% over the 10-year period)		Cumulative participating in energy efficiency programs (unique customers) with tracking by size and key segment (manufacturing, petroleum, and food processing)	XX% between 2011 and 2015	Program tracking databases	XX% cumulative across time frame	XX% cumulative across time frame	XX% cumulative across time frame
		Notes on this metric: Participation may go up or down based on the type of program design. Over time, PG&E expects to touch a larger percentage of customers with its programs, but these will not be able to be tracked if most programs move to mid- and upstream program models. PG&E will revisit this metric and revise based on the final program models. PG&E expects that the denominator for the population will need to stay constant over some period of time.					
Increase customers' ability to manage energy	Data Analytics Data Access Technical Assistance and Tools Financial Solutions	Number of long-term commitments (2 or more years) between customer and PG&E to save energy	X	Program tracking database	X commitments over the time frame	X commitments over the time frame	X commitments over the time frame
		Notes on this metric: "Commitments" will need to be defined.					
Integrate energy efficiency with other utility DER options within x% of industrial customers	Technical Assistance and Tools Financial Solutions	Percent of industrial customers with energy efficiency and at least one other utility DER (such as DR participation, DG, or storage)	Need baseline from IDSM report	Tracking databases for EE, DR, DG, PG&E's other DER efforts	% of customers over time frame	% of customers over time frame	% of customers over time frame
		Note on this metric: PG&E is not currently considering savings from DER since DER-enabled does not always lead directly to savings (e.g., if DR events are not called).					

Overall Statewide Market Effects within the Sector

The California Energy Efficiency Strategic Plan (CEESP) envisions that energy efficiency will support the long-term economic success of California industry. Within this realm, the CEESP aims to guide the state toward achieving significant increases in the efficiency of electricity and natural gas use in the industrial sector. Recent legislation such as AB 802 further supports this goal in striving to make energy consumption data more accessible to customers to inform more sustainable energy choices in their daily operations. Rendering energy usage information more visible should help to "elevat[e] energy as a business priority," which is depicted as a key challenge in the CEESP.

Beyond these direct effects, though, PG&E plans to influence the larger market by working with industry and trade organizations to bring market attention to customers achieving high levels of energy efficiency and potentially engaging mid-stream market actors to promote energy efficient equipment.

Table 17: Statewide Market-Level Industrial Sector Metrics

Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-7 years)	Long-Term Targets (8-10+ years)
All	Industrial energy efficiency potential	Current Potential Study values	Future Potential Studies	No study expected, so no change	1% reduction per year from baseline to year of potential study	10% reduction in energy efficiency potential
Data Access and Activities to Increase Awareness Midstream Energy Efficiency Equipment Activity	Awareness of specific opportunities for energy savings in small and medium-sized customers' industries	TBD with a study in the short term	Population Survey	No appreciable change expected due to planned activities		

O. EM&V Research Needs and Considerations

Market Research Requirements

PG&E plans to carry out a new series of market studies to supplement previous work (see Navigant's "MASI" and KEMA's "Industrial Market Characterization" studies in *Section O References List*), to:

1. Identify major untapped energy savings opportunities by market segment
2. Further our understanding of these market segments to clarify how to best capture these untapped energy savings opportunities
3. Provide timely feedback on any new interventions carried out to tap these energy savings.

Ultimately, the research for this sector will be contingent upon the needs of the portfolio as a whole and the annual research budget for this sector.[130] However, PG&E believes that the following studies should be considered in the EM&V Research Plan to support both market metrics and PG&E program metrics:

Studies to Support Overall Market Metrics:

- **Updated potential study (forthcoming):** As previously discussed, current (and prior) potential studies have underestimated the energy savings potential of this sector. Moreover, the industrial sector data used in the potential study is limited. The current potential study includes only two measure-level categories (machine drives and process refrigeration), and thus requires additional detail. The forthcoming Energy Division-led potential study plans to include more detail on the industrial sector (e.g., lighting, HVAC, process loads, whole building). This update will be integral in determining optimal longer-term goals and targets for this sector.
- **Additional market assessments to understand measure-specific use in sector (needed):** While the updated potential study will start to shed more light on the industrial sector, PG&E anticipates that this potential study, in conjunction with internal data analysis, and possibly a statewide study mining past data (e.g., non-residential audits and impact evaluations), will identify the energy use of various measures, processes, and systems within the industrial sector and large remaining savings opportunities. This work will be supplemented with an effort to understand the key drivers and decision-makers and decision making processes to tap the identified savings opportunities. Any data collected for this effort could also inform the development of a "knowledge base of efficiency solutions" as described in the CEESP if the information is shared through a transparent industrial database that does not specifically identify users. Ideally, this effort would be representative of PG&E's industrial sector, but coordinated statewide.
- **Periodic tracking studies for specific measures:** PG&E's industrial sector business plan calls for detailed studies within the following two distinct realms:
    - The potential study provides a market baseline for specific industrial equipment. Tracking the uptake of more efficient equipment requires additional data collection and

[130] While PG&E provides several studies in this section, the current budgets are relatively small. The 2016 budgets in the most recent EM&V plan show approximately $4 million for Energy Division-led impact studies and $125,000 for IOU-led process studies. These budgets cover the large commercial and industrial programs, as well as agricultural programs. The CPUC, PAs, and other stakeholders will need to discuss EM&V priorities and determine the relative availability of budget to cover any of the studies. The IALC Roadmap 2017 (Industrial/Agriculture/Large Commercial, Non-residential New Construction) EM&V research plan contemplates roughly $1 million in spending on IALC research on the IOU side over the next 2-3 years, drawing upon 2013 to 2017 funding for EM&V.

analysis as mentioned above. The information on the industrial sector should be updated preferably every five years.

- PG&E programs will focus on making energy data more 'visible' to its customers. To track this effort, PG&E will consider performing at least three, quick and limited survey efforts throughout the next 10 years to assess the perceived 'visibility' of customer energy use. Results from the first survey will establish the baseline and be available by the end of year two. Results from the second survey will be available at the end of year five, with the third survey available at the end of year eight. In addition to these surveys, specific information on the number of customers using any data access tools will support visibility.

Studies to Support PG&E Programs:

- **Studies to understand and optimize metrics for the industrial sector:** Given the variability of energy use across the sector, energy use per product (energy intensity) may be a better indicator of success. If appropriate, additional studies, in collaboration with statewide partners, are needed to better understand the best metrics for future market realities.
- **Studies of available and future energy information and management tools to determine optimal resources for industrial customers:** PG&E recommends conducting a study to elucidate which EMIS and EMS systems customers are using, if any, to understand the specific energy use within their organization. This effort should be coupled with a market-level investigation of the EMS and EMIS tools available to industrial customers that provide access to energy use data and improve process optimization and control. PG&E will coordinate this study with research conducted by the statewide Emerging Technologies (ET) program or parties such as ACEEE and the U.S. DOE.
- **Studies on estimating savings from new programs such as SEM**. The SEM program is currently being developed; including work on its scope and evaluation. PG&E is collaborating with the CPUC and others to develop the most cost-effective evaluation framework and protocols for the SEM program. This may require further research.
- **Study of data access and technical assistance pilots:** PG&E will be piloting new data access tools and broader technical assistance, and will perform at least one process evaluation of a potential pilot executed (assuming available funding).

EM&V 'Preparedness'

PG&E recognizes the importance of EM&V 'preparedness,' identifying specific data collection strategies early on to support internal performance analysis and program evaluations. As sector-specific programs and energy efficiency measures are developed to support PG&E's industrial business plan, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate evaluation. Details on data collection and reporting will be provided in as much detail as possible in PG&E's Implementation Plans (IPs). EM&V 2.0 strategies will be used wherever PG&E and CPUC evaluation teams believe these offer more accurate and cost-effective data collection and impact evaluation capabilities. More traditional tracking data (e.g., contact information, project development and technical descriptions, savings calculations) will also be available to support evaluation efforts.

PG&E will regularly track and report the following industrial sector data to apprise the CPUC and stakeholders of its progress, starting with monitoring efforts:

- **Monitoring and embedded evaluation efforts:** These efforts will focus on sector-level spending, sector-level savings, participation among large and small/medium customers, participation of three targeted segments, participation in constrained areas, average energy use among participants (not adjusted)

The variability across this sector e.g., size and site equipment, management, and operating characteristics), exceed that of many other sectors. This variability can significantly change the criteria for success. This sector historically had few prescriptive options other than lighting and HVAC in their buildings while processes and contextual singularities at each individual facility affect energy savings differently. For this reason, it is important to monitor and report on current conditions to provide the right context for any achievements. Business plan-level targets may also need to shift over time. Because of this variability, implementation-level metrics may be even more important for the industrial sector than other sectors so that stakeholders can better understand progress towards PG&E's goals. As such, PG&E describes the potential metrics for the programs in this section.

In support of the implementation plans, industrial programs will track and report implementation plan-level metrics that will demonstrate achievements by intervention strategy. While precise detail on these metrics will only be provided in forthcoming implementation plans, PG&E broadly anticipates tracking the following implementation plan metrics.

- **Implementation Plan metrics** (subject to change based on implementation plan content)**:**
    - Data access
        - Percentage of customers with access to data overall, as well as broken down by size, three key segments, and targeted constrained areas
    - Technical assistance
        - Percentage of customers receiving technical assistance overall, as well as broken down by size, three key segments, and targeted constrained areas
        - Savings for same participant groups after using tool or being provided technical assistance (pre/post)
    - Financial incentives
        - Percentage of customers with projects overall by each type of financial offering, as well as broken down by size, three key segments, and targeted constrained areas
        - Savings for same customer groups, by offering
        - Percentage of new and repeat customers with completed projects
    - Strategic partnerships
        - Number and type/description of each strategic partnership, including potential reach and type of information shared

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Q. Appendices

Appendix A: Stakeholder Feedback[132]

Relevant Committee or Subcommittee	Topic	Source/Issue/ Numbered Feedback	Page #
Industrial	Chapter Drafts (Voluntary)	CPUC/ Kay Hardy/ #1: "Proposal compared to prior cycles" – using AMI data to target customers does not seem like a substantial comparison, especially when it seems that programs will still focus on specific technologies, etc. Recommend: Assess what worked and didn't, taking into account prior evaluation results, and address other differences in current extended cycle.	pp. 4-8
Industrial	Chapter Drafts (Voluntary)	CPUC/ Kay Hardy/ #4: "Recent market assessments" provide specific technologies with EE potential – (1) there is no list of measures anywhere in this chapter and it would be most helpful, and especially here; (2) if these are the MASI studies CPUC management instructed the IOUs not to use them for determining potential as they were very small in scope, were not peer reviewed and conclusions questioned by CPUC; troubling to see them referred to as the "focus" of program offerings (if reference is to MASI, as there is no citation). Recommendation: do not rely on MASI studies for potential.	pp. 9-15
Industrial	Chapter Drafts (Voluntary)	TURN/ general comment/ #5: Customer sector goals and program savings, budgets, and cost effectiveness are forward looking. The BPs are intended to be integral to California moving the current generally flat or stagnant needle on energy efficiency. Some quantitative context to the current portfolios and programs would be very helpful. We recommend that all data on projected customer sector goals and program savings, budgets, and cost effectiveness be given some context relative to ongoing customer sector activities and accomplishments. There needs to be some demonstration as to how the BP will advance savings and improve cost effectiveness.	pp. 2, 9

[132] Note that stakeholder feedback was sourced from the CAEECC website (http://www.caeecc.org/tracking-documents) and sorted by sector (i.e. industrial), topic (i.e. intervention strategies & metrics; voluntary chapter drafts), issue (i.e. stakeholder concern), date entered, and status (i.e. issue closed vs. open). The above table omits all content specific to other IOUs, other business plan drafts, and/or other non-relevant items.

Appendix B: Industrial Sector Business Plan Checklist

	PG&E Industrial Sector	
BP Page #	**Business Plan Guidance (Market Sector)**	**PG&E Notes**
TBD	A. **Summary Table for cost effectiveness w/TRC,PAC, Emissions, Savings as well as budget and metrics/Portfolio and sector level metrics for regulatory oversight (GWh, MW, Therms, cost effectiveness, and other parameters where applicable),** including performance metrics for non-resource programs.(also p.47 D.15-10-028)/ Portfolio and sector-level budgets that meet portfolio savings and cost effectiveness requirements (p.48 D.15-10-028)	TBD - will be provided as cost-effectiveness analysis is developed
Section B, pp. 4-8	**B. Compare/contrast this proposal with past program cycles**	
Section B, pp. 4-8	C. **How this proposal addresses performance issues within the sector** Narrative description of changes from existing portfolio, including (1) budget changes; (2) program/intervention strategy changes; (3) justifications for the above. (from D.15-10-028, Appendix 3; included here to be consistent with 7/5/16 discussion with ED, but is not in the sector description of the Appendix)	Budget changes and justifications to be included in future drafts
Section E, pp. 9-15	**D. Market Characterization (Overview and market/gap & other analysis)**	
Section E, pp. 9-15	1. Electricity/natural gas consumption, GHG emissions, costs, etc.	GHG emissions to be included in future drafts
Section I, pp. 35-36	2. State goals, strategies and objectives e.g. strategic plan, SB 350, AB 758, etc. and other Commission policy guidance a. Descriptions of overarching goals, strategies, and approaches for each sector, as well as near-, mid-, and long-term strategic initiatives and sector-specific intervention strategies.	Goals and strategies also included in Sections A, G, and L
Section B, p. 7-8; Section G, pp. 18-33	4. Include any EM&V recommendations and how they are being addressed/Historical sector performance and evaluation takeaways/ Analysis of PA and CPUC evaluation reports for this sector within context of this proposal	EM&V recommendations included throughout document; see footnotes and reference lists
Section E, pp. 9-15	5. Customer landscape	
Section F, pp. 15-16	6. Major future trends in the above that are key for the PA and its customers	
Section F, pp. 16-17	7. Barriers to EE and other challenges to heightened EE (i.e. regulatory, market, data)	Barriers also included in Section G
Section G, pp. 18-33	**E. PA's approach to achieve goals in this sector**	
Section G, pp. 18-33	1. Products and services, and customer service activities/Resource Program Strategies; Non-Resource Program Strategies; Pilot Program Strategies/develop new strategies to achieve the state's energy efficiency goals in the future/	PG&E has structured its business plans around intervention strategies, and has provided examples of programs in each intervention strategy.
Section G, pp. 18-33; Section N, pp. 42-44	a. How does it advance goals discussed above	

Section M, pp. 38-41	b. One metric or more as appropriate for each intervention strategy/PAs will still need to set more granular metrics than just sector-level metrics, but they will do so in implementation plans, not business plans. (p. 53, D.15-10-028) Performance Metrics (Non-resource programs); Near-term (year one) strategic initiatives and expected outcomes; mid-term (years 2-3) strategic initiatives and expected outcomes; long-term (years 4-5+) strategic initiatives and expected outcomes/ Commission clearly states that program administrators "must establish up-front expectations for their activities" and that "business plans shall contain sector-level metrics".	PG&E has developed metrics that tract to each of its goals.
Section G, pp. 18-33	c. Projected savings/(resource programs) Near-term (year one) strategic initiatives and expected outcomes; mid-term (years 2-3) strategic initiatives and expected outcomes; long-term (years 4-5+) strategic initiatives and expected outcomes	
Section G, pp. 18-33	2. Description of PA's local marketing and integration with SWMEO if applicable/ Marketing and Outreach: Strategies, approaches and outcomes	Marketing tactics can be found throughout the intervention strategies.
Section B, p. 7; Section G, pp. 18-33	3. Whether items are near-, mid-, long-term strategic initiatives/Near-term (year one) strategic initiatives and expected outcomes; mid-term (years 2-3) strategic initiatives and expected outcomes; long-term (years 4-5+) strategic initiatives and expected outcomes	Timeframes can be found in each of the intervention charts.
Section I, pp. 35-36	4. Description of how each sector approach advances the goals, strategies, and objectives of the strategic plan (p. 46, D.15-10-028)	
Section G, pp. 18-33	5. Workforce Development, Education and Training: Strategies, approaches and outcomes 6. A description of any pilots contemplated or underway for each sector./ A description of any pilots contemplated or underway for the sector (p.46 D15-10-028)/ Describe any unique or innovative aspects of program not previously discussed, and describe any pilots contemplated or underway for the sector. (Appendix 3, D.15-10-028)	WE&T tactics can be found throughout the intervention strategies.
Section J, p. 32	**F. Key partners (committed and/or potential)**	
Section J, pp. 36-37; Section K, p. 37	**G. Program/PA Coordination:** Description of which and how strategies are coordinated regionally among PAs and/or other demand- side options. (IOU/REN programs; statewide programs; coordination with other state/local government activities.)/ Coordination with other state agencies and initiatives/Description of which and how strategies are coordinated statewide and regionally among PAs and/or with other demand-side options; (p.46 and Appendix 3 D.15-10-028)	
Section G, p. 32	**H. Cross-Cutting Coordination:** Description of how cross cutting activities are addressed in customer sector strategies/ Statewide Coordination and cross-cutting efforts/Description of how cross-cutting "sectors" are addressed. (p.46 D.15-10-028)/Cross-Sector Coordination: Description of how cross cutting activities are addressed in customer sectors strategies. Include as applicable: i) Emerging Technologies program ii) Codes and Standards program iii) WE&T efforts iv) Program-specific marketing and outreach efforts (provide budget) – Appendix 3, D.15-10-028	Cross-cutting strategies and tactics can be found throughout the intervention strategies.
Section B, pp. 7-8; Section M, pp. 38-41; Section N, pp. 42-44	**I. EM&V Considerations**: Statement of evaluation needs "preparedness" (i.e., data collection strategies and internal performance analysis)/Anticipated study needs/Internal performance analysis/feed-through during program deployment/(p.47-48 and Appendix 3 of D.15-10-028) J. Demand Response	
N/A	**K. Residential Rate Reform**	N/A
Section H, pp. 33-34	**L. Integrated Demand-Side Resources**	

N/A	**M. Zero-Emission Vehicles (EVs)**	N/A
N/A	**N. Energy Savings Assistance (Multi-family Focused)**	N/A

Appendix C: Customer Data

Table 18: 2015 Electric Customers: Snapshot of Usage and Average Usage by Customer Size

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total[d]
Electricity Usage (GWh)													
Manufacturing	6,512.0	751.5	213.7	5.0	7,482.1	87.0%	10.0%	2.9%	100%	45.0%	5.2%	1.5%	51.7%
Food Processing	3,253.3	176.1	19.9	0.3	3,449.5	94.3%	5.1%	0.6%	100%	22.5%	1.2%	0.1%	23.8%
Petroleum	2,769.8	38.2	3.8	0.3	2,812.1	98.5%	1.4%	0.1%	100%	19.1%	0.3%	0.0%	19.4%
Chemicals & Minerals	693.7	28.1	2.6	0.1	724.4	95.8%	3.9%	0.4%	100%	4.8%	0.2%	0.0%	5.0%
Total	**13,228.7**	**993.9**	**239.9**	**5.64**	**14,468.2**	**91%**	**7%**	**2%**	**100%**	**91.4%**	**6.9%**	**1.7%**	**100.0%**
Customers (Number of customers)													
Manufacturing	17,522	14,881	26,999	599	60,001	29.2%	24.8%	45.0%	99%	24.3%	20.6%	37.5%	82.4%
Food Processing	3,452	2,522	1,585	81	7,640	45.2%	33.0%	20.7%	99%	4.8%	3.5%	2.2%	10.5%
Petroleum	1,683	662	379	18	2,742	61.4%	24.1%	13.8%	99%	2.3%	0.9%	0.5%	3.8%
Chemicals & Minerals	840	511	298	34	1,683	49.9%	30.4%	17.7%	98%	1.2%	0.7%	0.4%	2.3%
Total	**23,497**	**18,576**	**29,261**	**732**	**72,066**	**33%**	**26%**	**41%**	**99%**	**32.6%**	**25.8%**	**40.6%**	**99.0%**
Average Usage (kWh per customer)													
Manufacturing	371,648	50,502	7,914	8,265	124,700								
Food Processing	942,428	69,818	12,557	3,377	451,508								
Petroleum	1,645,736	57,729	10,043	15,830	1,025,559								
Chemicals & Minerals	825,774	54,946	8,628	3,699	430,437								
Average	**562,995**	**53,504**	**8,200**	**7,698**	**200,763**								

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers

Table 19: 2015 Electric Savings and Participants: Snapshot of Savings and Average Savings by Customer Size

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total[d]
Electricity Savings (MWh)													
Manufacturing	29,462.7	3,514.5	1,563.6	108.1	34,648.9	85.0%	10.1%	4.5%	100%	38.8%	4.6%	2.1%	45.5%
Food Processing	18,219.8	1,229.0	265.3	21.5	19,735.6	92.3%	6.2%	1.3%	100%	24.0%	1.6%	0.3%	26.0%
Petroleum	16,006.2	133.0	10.4	-	16,149.5	99.1%	0.8%	0.1%	100%	21.1%	0.2%	0.0%	21.3%
Chemicals & Minerals	5,322.7	32.2	17.2	-	5,372.0	99.1%	0.6%	0.3%	100%	7.0%	0.0%	0.0%	7.1%
Total	**69,011.3**	**4,908.7**	**1,856.4**	**129.63**	**75,906.1**	**91%**	**6%**	**2%**	**100%**	**90.9%**	**6.5%**	**2.4%**	**99.8%**
Participants (Number of Participants)													
Manufacturing	351	322	297	22	992	35.4%	32.5%	29.9%	98%	23.7%	21.8%	20.1%	65.5%
Food Processing	177	138	34	3	352	50.3%	39.2%	9.7%	99%	12.0%	9.3%	2.3%	23.6%
Petroleum	71	21	3	-	95	74.7%	22.1%	3.2%	100%	4.8%	1.4%	0.2%	6.4%
Chemicals & Minerals	31	8	2	-	41	75.6%	19.5%	4.9%	100%	2.1%	0.5%	0.1%	2.8%
Total	**630**	**489**	**336**	**25**	**1,480**	**43%**	**33%**	**23%**	**98%**	**42.6%**	**33.0%**	**22.7%**	**98.3%**
Average Savings (kWh per Participant)													
Manufacturing	83,939	10,915	5,265	4,913	34,928								
Food Processing	102,937	8,906	7,802	7,182	56,067								
Petroleum	225,439	6,334	3,455	-	169,995								
Chemicals & Minerals	171,699	4,024	8,581	-	131,025								
Average	**109,542**	**10,038**	**5,525**	**5,185**	**51,288**								
Participation Rates (% Participants per Cust.)													
Manufacturing	2.0%	2.2%	1.1%	3.7%	1.7%								
Food Processing	5.1%	5.5%	2.1%	3.7%	4.6%								
Petroleum	4.2%	3.2%	0.8%	0.0%	3.5%								
Chemicals & Minerals	3.7%	1.6%	0.7%	0.0%	2.4%								
Average	**2.7%**	**2.6%**	**1.1%**	**3.4%**	**2.1%**								

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers

Table 20: 2015 Gas Customers: Snapshot of Usage and Average Usage by Customer Size

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total[d]
Gas Usage (MM Therms)													
Manufacturing	3,533.2	18.7	4.5	10.2	3,566.6	99%	0.5%	0.1%	100%	64.2%	0.3%	0.1%	64.7%
Food Processing	380.3	10.5	1.3	0.0	392.1	97%	2.7%	0.3%	100%	6.9%	0.2%	0.0%	7.1%
Petroleum	1,354.7	0.2	0.0	0.0	1,354.9	100%	0.0%	0.0%	100%	24.6%	0.0%	0.0%	24.6%
Chemicals & Minerals	185.5	0.6	0.1	0.0	186.2	100%	0.3%	0.0%	100%	3.4%	0.0%	0.0%	3.4%
Total	**5,453.7**	**30.0**	**5.9**	**10.16**	**5,499.7**	**99%**	**1%**	**0%**	**100%**	**99.2%**	**0.5%**	**0.1%**	**99.8%**
Customers (Number of customers)													
Manufacturing	2,797	5,156	10,612	294	18,859	14.8%	27.3%	56.3%	98%	11.9%	22.0%	45.3%	79.2%
Food Processing	1,226	1,234	915	46	3,421	35.8%	36.1%	26.7%	99%	5.2%	5.3%	3.9%	14.4%
Petroleum	187	103	67	2	359	52.1%	28.7%	18.7%	99%	0.8%	0.4%	0.3%	1.5%
Chemicals & Minerals	512	180	113	7	812	63.1%	22.2%	13.9%	99%	2.2%	0.8%	0.5%	3.4%
Total	**4,722**	**6,673**	**11,707**	**349**	**23,451**	**20%**	**28%**	**50%**	**99%**	**20.1%**	**28.5%**	**49.9%**	**98.5%**
Average Usage (Therms per customer)													
Manufacturing	1,263,218	3,635	425	34,524	189,121								
Food Processing	310,192	8,491	1,402	149	114,605								
Petroleum	7,244,183	1,779	610	20	3,774,057								
Chemicals & Minerals	362,331	3,184	637	672	229,265								
Average	**1,154,954**	**4,492**	**505**	**29,117**	**234,520**								

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers

Table 21: 2015 Gas Savings and Participants: Snapshot of Savings and Average Savings by Customer Size

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total[d]
Gas Savings (Therms)													
Manufacturing	699,221	26,873	16,694	5,161	747,949	93.5%	3.6%	2.2%	99%	13.3%	0.5%	0.3%	14.2%
Food Processing	1,185,996	28,200	5,647	(56)	1,219,787	97.2%	2.3%	0.5%	100%	22.6%	0.5%	0.1%	23.3%
Petroleum	2,274,372	39	241	-	2,274,652	100.0%	0.0%	0.0%	100%	43.4%	0.0%	0.0%	43.4%
Chemicals & Minerals	996,279	2,552	(98)	-	998,733	99.8%	0.3%	0.0%	100%	19.0%	0.0%	0.0%	19.1%
Total	**5,155,869**	**57,664**	**22,484**	**5,105**	**5,241,121**	**98%**	**1%**	**0%**	**100%**	**98.4%**	**1.1%**	**0.4%**	**99.9%**
Participants (Number of Participants)													
Manufacturing	203	255	247	16	721	28.2%	35.4%	34.3%	98%	19.8%	24.9%	24.1%	68.8%
Food Processing	109	112	29	1	251	43.4%	44.6%	11.6%	100%	10.6%	10.9%	2.8%	24.4%
Petroleum	18	6	1	-	25	72.0%	24.0%	4.0%	100%	1.8%	0.6%	0.1%	2.4%
Chemicals & Minerals	17	9	2	-	28	60.7%	32.1%	7.1%	100%	1.7%	0.9%	0.2%	2.7%
Total	**347**	**382**	**279**	**17**	**1,025**	**34%**	**37%**	**27%**	**98%**	**33.9%**	**37.3%**	**27.2%**	**98.3%**
Average Savings (Therms per Participant)													
Manufacturing	3,444	105	68	323	1,037								
Food Processing	10,881	252	195	(56)	4,860								
Petroleum	126,354	6	241	-	90,986								
Chemicals & Minerals	58,605	284	(49)	-	35,669								
Average	**14,858**	**151**	**81**	**300**	**5,113**								
Participation Rates (% Participants per Cust.)													
Manufacturing	7.3%	4.9%	2.3%	5.4%	3.8%								
Food Processing	8.9%	9.1%	3.2%	2.2%	7.3%								
Petroleum	9.6%	5.8%	1.5%	0.0%	7.0%								
Chemicals & Minerals	3.3%	5.0%	1.8%	0.0%	3.4%								
Average	**7.3%**	**5.7%**	**2.4%**	**4.9%**	**4.4%**								

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers

Segment-Specific Electric Performance across the Industrial Sector

Table 22: Manufacturing Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Manufacturing													
Electricity Usage (GWh)	6,512.0	751.5	213.7	5.0	7,482.1	87.0%	10.0%	2.9%	100%	45.0%	5.2%	1.5%	52%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	17,522	14,881	26,999	599	60,001	29.2%	24.8%	45.0%	99%	24.3%	20.6%	37.5%	82%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	371,648	50,502	7,914	8,265	124,700								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	29,463	3,515	1,564	108	34,648.9	85.0%	10.1%	4.5%	100%	38.8%	4.6%	2.1%	46%
Savings Trends (2011-2015)													
Participants (Number of Participants)	351	322	297	22	992	35.4%	32.5%	29.9%	98%	23.7%	21.8%	20.1%	66%
Participant (2011-2015)													
Average Savings (kWh per Participant)	83,939	10,915	5,265	4,913	34,928								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	2.0%	2.2%	1.1%	3.7%	1.7%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 23: Food Processing Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Food Processing													
Electricity Usage (GWh)	3,253.3	176.1	19.9	0.3	3,449.5	94.3%	5.1%	0.6%	100%	22.5%	1.2%	0.1%	24%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	3,452	2,522	1,585	81	7,640	45.2%	33.0%	20.7%	99%	4.8%	3.5%	2.2%	10%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	942,428	69,818	12,557	3,377	451,508								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	18,220	1,229	265	22	19,735.6	92.3%	6.2%	1.3%	100%	24.0%	1.6%	0.3%	26%
Savings Trends (2011-2015)													
Participants (Number of Participants)	177	138	34	3	352	50.3%	39.2%	9.7%	99%	12.0%	9.3%	2.3%	24%
Participant (2011-2015)													
Average Savings (kWh per Participant)	102,937	8,906	7,802	7,182	56,067								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	5.1%	5.5%	2.1%	3.7%	4.6%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 24: Petroleum Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Petroleum													
Electricity Usage (GWh)	2,769.8	38.2	3.8	0.3	2,812.1	98.5%	1.4%	0.1%	100%	19.1%	0.3%	0.0%	19%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	1,683	662	379	18	2,742	61.4%	24.1%	13.8%	99%	2.3%	0.9%	0.5%	4%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	1,645,736	57,729	10,043	15,830	1,025,559								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	16,006	133	10	-	16,149.5	99.1%	0.8%	0.1%	100%	21.1%	0.2%	0.0%	21%
Savings Trends (2011-2015)													
Participants (Number of Participants)	71	21	3	-	95	74.7%	22.1%	3.2%	100%	4.8%	1.4%	0.2%	6%
Participant (2011-2015)													
Average Savings (kWh per Participant)	225,439	6,334	3,455	-	169,995								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.2%	3.2%	0.8%	0.0%	3.5%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 25: Chemicals & Minerals Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Chemicals & Minerals													
Electricity Usage (GWh)	693.7	28.1	2.6	0.1	724.4	95.8%	3.9%	0.4%	100%	4.8%	0.2%	0.0%	5%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	840	511	298	34	1,683	49.9%	30.4%	17.7%	98%	1.2%	0.7%	0.4%	2%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	825,774	54,946	8,628	3,699	430,437								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	5,323	32	17	-	5,372.0	99.1%	0.6%	0.3%	100%	7.0%	0.0%	0.0%	7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	31	8	2	-	41	75.6%	19.5%	4.9%	100%	2.1%	0.5%	0.1%	3%
Participant (2011-2015)													
Average Savings (kWh per Participant)	171,699	4,024	8,581	-	131,025								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	3.7%	1.6%	0.7%	0.0%	2.4%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Segment-Specific Gas Performance across the Industrial Sector

Table 26: Manufacturing Details: 2015 Gas Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Manufacturing													
Gas Usage (MM Therms)	3,533.2	18.7	4.5	10.2	3,566.6	99%	0.5%	0.1%	100%	64.2%	0.3%	0.1%	65%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	2,797	5,156	10,612	294	18,859	14.8%	27.3%	56.3%	98%	11.9%	22.0%	45.3%	79%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	1,263,218	3,635	425	34,524	189,121								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	699,221	26,873	16,694	5,161.2	747,949	93%	3.6%	2.2%	99%	13.3%	0.5%	0.3%	14%
Savings Trends (2011-2015)													
Participants (Number of Participants)	203	255	247	16	721	28.2%	35.4%	34.3%	98%	19.8%	24.9%	24.1%	69%
Participant (2011-2015)													
Average Savings (Therms per Participant)	3,444.4	105.4	67.6	322.6	1,037.4								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	7.3%	4.9%	2.3%	5.4%	3.8%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 27: Food Processing Details: 2015 Gas Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Food Processing													
Gas Usage (MM Therms)	380.3	10.5	1.3	0.0	392.1	97%	2.7%	0.3%	100%	6.9%	0.2%	0.0%	7%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	1,226	1,234	915	46	3,421	35.8%	36.1%	26.7%	99%	5.2%	5.3%	3.9%	14%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	310,192	8,491	1,402	149	114,605								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	1,185,996	28,200	5,647	(56.1)	1,219,787	97%	2.3%	0.5%	100%	22.6%	0.5%	0.1%	23%
Savings Trends (2011-2015)													
Participants (Number of Participants)	109	112	29	1	251	43.4%	44.6%	11.6%	100%	10.6%	10.9%	2.8%	24%
Participant (2011-2015)													
Average Savings (Therms per Participant)	10,880.7	251.8	194.7	(56.1)	4,859.7								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	8.9%	9.1%	3.2%	2.2%	7.3%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 28: Petroleum Details: 2015 Gas Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Petroleum													
Gas Usage (MM Therms)	1,354.7	0.2	0.0	0.0	1,354.9	100%	0.0%	0.0%	100%	24.6%	0.0%	0.0%	25%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	187	103	67	2	359	52.1%	28.7%	18.7%	99%	0.8%	0.4%	0.3%	2%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	7,244,183	1,779	610	20	3,774,057								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	2,274,372	39	241	-	2,274,652	100%	0.0%	0.0%	100%	43.4%	0.0%	0.0%	43%
Savings Trends (2011-2015)													
Participants (Number of Participants)	18	6	1	-	25	72.0%	24.0%	4.0%	100%	1.8%	0.6%	0.1%	2%
Participant (2011-2015)													
Average Savings (Therms per Participant)	126,354.0	6.5	240.8	-	90,986.1								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	9.6%	5.8%	1.5%	0.0%	7.0%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
Unknown: Insufficient data (<12 months)
[b] 'Unknown' size category included for completeness. Represents insufficient or partial-year data
[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Table 29: Chemicals & Minerals Details: 2015 Gas Usage and Savings with 2011–2015 Trends

	Customer By Size[a]					Percent of Segment[c]				Percent of Sector[c]			
	Large	Med	Small	Unk[b]	Total	Large	Med	Small	Total[d]	Large	Med	Small	Total
Chemicals & Minerals													
Gas Usage (MM Therms)	185.5	0.6	0.1	0.0	186.2	100%	0.3%	0.0%	100%	3.4%	0.0%	0.0%	3%
Usage Trends (2011-2015)[e]													
Customers (Number of customers)	512	180	113	7	812	63.1%	22.2%	13.9%	99%	2.2%	0.8%	0.5%	3%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	362,331	3,184	637	672	229,265								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	996,279	2,552	(98)	-	998,733	100%	0.3%	0.0%	100%	19.0%	0.0%	0.0%	19%
Savings Trends (2011-2015)													
Participants (Number of Participants)	17	9	2	-	28	60.7%	32.1%	7.1%	100%	1.7%	0.9%	0.2%	3%
Participant (2011-2015)													
Average Savings (Therms per Participant)	58,604.7	283.5	(49.0)	-	35,669.0								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	3.3%	5.0%	1.8%	0.0%	3.4%								
Participation Rate Trends (2011-2015)													

Notes: [a] Large: ≥ 500,000 KWh or ≥ 250,000 Therms
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms
Small: < 40,000 KWh or < 10,000 Therms
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[c] Not evaluating 'Unknown' size customers due to incompleteness of this data
[d] May not sum to 100% due to excluding 'Unknown' size category customers
[e] Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Appendix D: Upstream Targeted Market Transformation Initiative (TMTI)

As discussed in Market Intervention 2: Upstream Initiatives, PG&E plans to pursue opportunities for market transformation in the industrial sector to promote the most efficient products, components, and systems. PG&E sees an opportunity to partner with distributors to stock and promote energy-efficient products, components, and systems such as fans, motors, and pumps, with the intention of increasing cost-effective energy savings and participation in energy efficiency initiatives.

Phase and Activity	Timeline
Phase 1: Scan and identify target markets • Evaluate technologies • Characterize markets • Collect data for baseline estimations and intervention adoption curves • Develop market model, program theory and logic model • Establish interim and long term indicators of success • Develop draft program plan	TBD
Phase 2: Stakeholder Feedback and Approval • Establish Advisory Committee • Solicit stakeholder feedback via CAEECC • Revise implementation plan and/or program details based on CAEECC feedback • Develop ex ante savings estimates • Submit program plan via Advice Letter for CPUC approval	TBD
Phase 3: Implementation and Continuous Evaluation • Develop implementation plan, in coordination with CAEECC and other stakeholders • Establish market evaluations for data collection • Coordinate with downstream activities • Periodic review by Advisory Committee and/or CAEECC	TBD