# Meeting State Carbon Emission Requirements through Industrial Energy Efficiency

The Southern California Gas Company's Industrial End User Program

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## I. Introduction

In 2005, the California Public Utilities Commission (CPUC), California Energy Commission (CEC), and California Power Authority developed a joint action plan to cut greenhouse gas (GHG) emissions and improve energy efficiency in the state. This was driven by the passage of Global Warming Solutions Act of 2006 (AB 32) which requires California to reduce its GHG emissions to the 1990 levels by 2020 and Executive Order S-3-05 which establishes a GHG emission target designed to bring GHG emissions down to 80 percent of the 1990 levels by 2050 in the state.[1] For part of its contribution, CPUC established a natural gas reduction target of 45.0 trillion Btu per year by 2013.[2] This goal meant that all investor-owned natural gas utilities in California were now tasked with reducing the energy consumption of their customers. The Southern California Gas Company (the Gas Company) responded by creating a multi-faceted initiative, the Industrial End User (IEU) program, to help its large industrial customers increase their energy efficiency and thus reduce their energy use and GHG emissions.

Founded in 2006 as a joint effort between the Gas Company, CEC, and the U.S. Department of Energy's (DOE) Industrial Technologies Program (ITP), IEU was initially designed to solely identify energy efficiency opportunities in large plants through energy assessments. Those performing the energy assessments would calculate potential incentives or rebates from the utility based on how much energy the proposed improvements would save. However, the scope of the program was later expanded to include other opportunities for improved industrial energy efficiency. For example, plants in the utility's service area are eligible to participate in plant or project verification assessments, receive custom incentives to help finance the purchase of energy-efficient equipment, learn how to use software tools to identify opportunities to improve energy efficiency, and participate in training and reduced GHG emissions.

## II. Background on California's GHG and Energy Situation

Manufacturing accounts for 33.2 percent of all natural gas consumption[3] and 19.4 percent of electricity consumption in California,[4] making it among the largest contributors to GHG emissions in the state in 2006. This sector is estimated to account for 20 percent of California's total carbon emissions.[5] In order for the state to achieve the emission targets established in AB 32 and Executive Order S-3-05 (Exhibit 1), California's manufacturing sector must commit to improving its energy efficiency.

DOE's Energy Information Administration (EIA) predicts that U.S. industrial energy consumption will increase a total of 0.3 percent between 2006 and 2030,[*] with a 4.3 percent overall increase in industrial natural gas consumption during that time.[6] As per EIA, the total energy consumption in California in 2005 was 8,359.8 trillion Btu, of which 2,001.3 trillion Btu was consumed at industrial facilities.[7] This represents 6.2 percent of total U.S. energy consumption. As industrial energy use grows, so will its associated GHG emissions unless industry implements energy efficiency and clean energy solutions. In order to meet AB 32 emission reduction targets, the industrial sector must decrease its total GHG emissions from 76.9 million metric tonnes of carbon dioxide equivalent ($MMTCO_2e$) to the state's 1990 level of 72.7

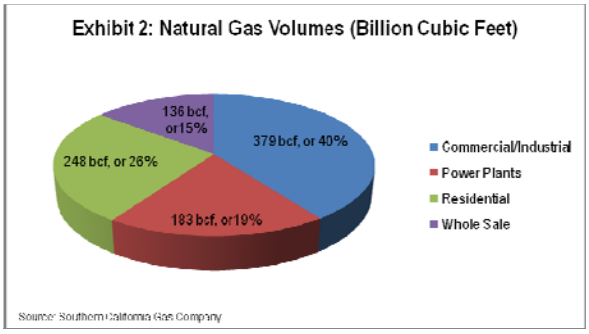
[*] EIA does not provide specific long-term energy consumption projections by state.

$MMTCO_2e$ by 2020. Further ambitious reductions are called for with Executive Order S-3-05 which targets the state's emissions to be 58.2 $MMTCO_2e$ by 2050, or to 20 percent below the 1990 levels.[8]

| Exhibit 1: GHG Actual Measures and Targets ($MMTCO_2e$)† | | |
|---|---|---|
| Year | AB 32 | S-3-05 |
| 1990 Baseline | 72.7 | 72.7 |
| 2000 | 71.5 | 71.5 |
| 2005 | 76.9 | 76.9 |
| 2020 | 72.7 | --- |
| 2050 | --- | 58.2 |
| Source: Energy Information Administration; California Air Resources Board | | |

## III. Meeting State and CPUC Goals through Industrial Energy Efficiency Programs

Approximately one-third of all manufacturing conducted in California happens in Los Angeles County, making the county one of the largest manufacturing centers in the U.S.[9] The Gas Company is in a unique position to meet the challenges of significantly reducing industrial energy consumption and contributing to the state's natural gas reduction target based on the importance of industry in the area. Though commercial /industrial setups comprised only 5 percent (about 418,000 customers)[10] of its customers, they together consume 40 percent of the fuel provided by the utility, or 379 billion cubic feet (Exhibit 2).[11]




The following table, Exhibit 3, displays a matrix of all that is offered under the IEU program. Columns denote whether or not a tool or other resource is applicable to a specific natural gas-based system. An "X" in the last column indicates that all industrial customers qualify for an IEU resource. More detailed descriptions of each item and additional success stories are provided in Appendix A.

† GHG emission entries from 1990, 2000, and 2005 are actual measures as reported by EIA, while emission entries for 2020 and 2050 are targets as mandated by AB 32 and S-3-05.

| Exhibit 3: Components of the Gas Company's Industrial End User Program | | | |
|---|---|---|---|
| | Process Heating | Steam System | Other |
| Energy Assessments | | | |
| Examine energy-intensive processes | X | X | X |
| Measure system performance | X | X | X |
| Identify ineffective energy use | X | X | X |
| Recommend ways to improve energy efficiency and reduce GHG emissions | X | X | X |
| Project Verification | | | |
| Verify projected energy savings | X | X | X |
| Custom Incentives | | | |
| Financial Incentives | X | X | X |
| Software Tools | | | |
| *DOE Suite* | | | |
| Process Heating Assessment and Survey Tool (PHAST) | X | | |
| Steam System Assessment Tool (SSAT) | | X | |
| *Business Energy Efficiency Program (BEEP) Tools* | | | |
| Load Balance | X | X | X |
| Score Card | X | X | X |
| Excess Air | X | | X |
| Furnaces and Ovens | X | | |
| Heat Recovery | X | | X |
| Like to Like | X | X | X |
| Thermal Oxidizer | X | | |
| Training – Energy Resource Center | | | |
| Technical Seminars | X | X | X |
| Qualified Specialist Training | X | X | X |
| Onsite Training | X | X | X |

## A. Energy Assessments

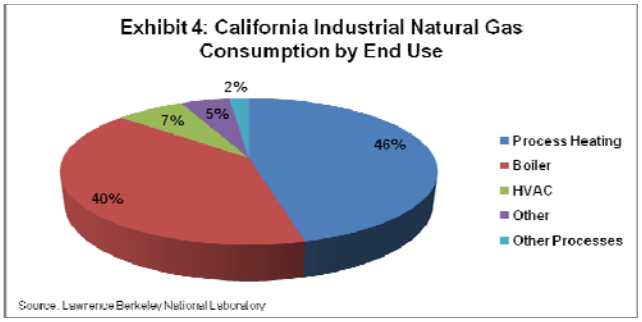
The utility offers no-cost natural gas assessments to its large industrial customers.[‡] IEU specialists (also known as account representatives) conducting the assessments measure system performance and identify practices and equipment in industrial facilities that use energy ineffectively. They also recommend ways to concurrently reduce natural gas consumption and carbon emissions. Recommendations from these specialists range from simple solutions such as powering down equipment when it is idle to more complex alternatives such as investing in a new energy-efficient technology (see Appendix A).

The "Energy Van" Team

*Each assessment is a team effort consisting of account representatives (IEU specialists), engineers, and service technicians. The IEU team takes the "Energy Van" to an industrial customer's facility to provide energy assessments, analysis, and training. The group is then able to discuss what they saw at the plant and confer over recommendations.*

[‡] Plants are not required to consume a minimum amount of energy to be eligible for an IEU assessment.

According to the Gas Company, approximately 80 percent of all requested energy audits are for process-specific assessments while the remaining 20 percent are plant-wide.[12] Process heating and steam assessments are requested the most because those systems account for 86 percent of all industrial natural gas consumption in California (Exhibit 6).[13] Process heating assessments typically analyze heating equipment such as furnaces, ovens, kilns or dryers while steam assessments primarily focus on boilers. During a plant-wide assessment, the IEU specialists will examine all energy-intensive processes, including compressed air systems, fans, motors, and pumps. In some instances, IEU specialists have even identified opportunities for electricity and water savings while conducting a natural gas assessment. All assessments, be it process-specific or plant-wide, end with each customer receiving an energy report and ITP tip sheets to help decide on purchasing energy-efficient equipment or changing a process. By making the customer aware of the gas and monetary saving opportunities that exist in their operations helps to contribute to the Gas Company's reduction goals and further contributes to the CPUC goal.




## B. Project Verification

The IEU program has received several requests from plants to verify the projected energy savings or GHG reductions identified by a manufacturer if the plant were to install its product. The IEU team will use software tools to project the energy savings for that equipment to either confirm or invalidate a manufacturer's projections. This is completed through the same process as a standard energy assessment. Project verification helps the IEU team achieve the program's goal by helping customers make cost-effective choices and validating if the equipment will help reduce overall energy intensity.

## C. Custom Incentives

It has been the experience of the utility that plant managers are most likely to approve the purchase of energy-efficient equipment if it has a payback period of less than three years. Based on opportunities identified during an assessment, the certified specialists will work with a plant to determine potential incentives to help finance energy efficiency improvements. For example, Vertis Communications participated in an IEU energy assessment in 2006. During that time, the specialist recommended that the plant install a regenerative thermal oxidizer. With incentives from the Gas Company, Vertis Communications was able to finance the purchase and is now saving approximately 30 billion Btu annually, contributing to the Gas Company's and CPUC total reduction goal.[14]

During the first quarter of 2007, the Gas Company's incentives cap was increased from $300,000 per project to $1 million per eligible customer per year.[15] This move enabled more plant

managers to approve and implement the natural gas efficiency improvements that were identified during the plant's energy assessment with the Gas Company. IEU specialists will also quantify a potential rebate or incentive for the plant if it chooses to install the energy-efficient equipment.

The Gas Company also identifies additional energy savings potential that are associated with electric and water costs during a natural gas assessment. For example, while performing assessments at a food processor and pharmaceutical in the utility's service area, the specialists identified ways for the plants to significantly reduce water consumption and waste. Working with the Metropolitan Water District of Southern California, the plants were then eligible for approximately $75,000 incentives from the water district to improve water efficiency in addition to natural gas efficiency incentives from the Gas Company.[16] By identifying these opportunities for its customers, the Gas Company is strengthening their relationship but also contributing to the overall state GHG initiatives.

## D. Software Tools

Software tools help the IEU team work toward CPUC's goals by identifying potential energy savings if a process is changed or energy-efficient equipment is installed. ITP offers a suite of software analytical tools through its BestPractices initiative to assist industrial plants in identifying and evaluating energy-saving opportunities. The first step toward using these tools is to first understand the process to which it will be applied. IEU staff train plant personnel on how to use ITP's software tools such as PHAST and SSAT. PHAST calculates available heat and projected savings if recommended improvements are implemented. SSAT can be used to calculate potential energy, cost, and carbon emission reductions that could be realized if certain energy efficiency improvements are made to a steam system.

The Gas Company took tool resources a step further and created several computational analysis tools based on ITP's software suite including PHAST and SSAT. Referred to as BEEP tools, the Gas Company staff uses these tools in conjunction with ITP's tools to quantify energy and cost savings. This ensures that readings and projections are accurate and defendable. In fact, all BEEP tools have proven accuracy within 5 percent.[17] Moreover, all tools are continuously updated as new information is released or pieces of energy-efficient equipment become commercially available. Appendix A provides specific information on these tools.

## E. Training – Energy Resource Center

One fundamental component of any industrial efficiency program is training. Training is the best way to ensure that a participant understands a product and knows how to use it. It also ensures that someone is qualified to perform a certain task or is knowledgeable of a certain process. The Gas Company's Energy Resource Center (ERC) provides several opportunities for industrial managers and plant personnel to enhance their systems' knowledge and learn how to identify opportunities for energy efficiency improvements. In 2007, approximately 14,900 people participated in ERC training, of which 6,800 attended technical seminars and 184 participated in IEU onsite sessions.[18] Training provides the Gas Company to reach a large number of plant personnel and facilities at a relatively low cost. By training plant personnel on energy efficiency, the Gas Company is contributing to its goal and the CPUC goal, by providing the skills for energy experts within each facility. More information on ERC training is provided in Appendix A.

## IV. Notable Results

The Gas Company has achieved significant progress toward achieving internal and CPUC goals. CPUC's natural gas reduction goal is significantly higher for the Gas Company (2.3 trillion Btu) than other California gas utilities because of its continued success with energy reduction.[19§]

Aside from helping the utility reach its energy efficiency goals for natural gas, helping the customers is also an attractive option for the Gas Company because it strengthens the economic viability of those key account customers and enables the utility to have additional gas available for other customers.

But perhaps the greatest measure of success for a utility is not so much the amount of energy saved or GHG emissions reduced from the identification of energy efficiency improvements, but rather the ability for the utility to further enhance its relationships with key industrial accounts. The customers benefit from this partnership because they have the potential to realize substantial energy and cost savings in addition to notable GHG emission reductions.

## V. Looking Forward

The Gas Company continues to expand its IEU program in order to provide its industrial customers with more options and tools for improving their energy efficiency. For example, after IEU engineers analyze a plant's process heating system, the engineers typically supply the plant manager with ITP tip sheets ranging on topics from reducing air leakage in furnaces to methods for waste heat recovery. The tip sheets assist with validating the recommendations made by the IEU specialists. The IEU team is now partnering with ITP to provide co-branded tip sheets to the Gas Company's industrial customers, bearing the utility's logo along with ITP's. The Gas Company is also examining the prospect of creating and co-branding carbon tip sheets with ITP.

Next, the Gas Company is developing more Web-based tools in partnership with CEC's Public Interest Energy Research program. These tools will allow more industrial customers to measure how efficiently a process is operating and to identify energy savings and GHG reduction opportunities. The tool portfolio will also be expanded to include new computational analysis tools that can be applied to different industrial processes.

Finally, the IEU team is in the process of adopting American National Standards Institute or (ANSI) standards for energy efficiency. Once adopted, the ANSI standards will be applied when an IEU specialist performs an energy assessment. These standards will also be incorporated into training.

## VI. Conclusion

The Gas Company is responding to CPUC's natural gas reduction goals through its Industrial End User program, which has led to improved energy efficiency at many industrial facilities in its southern California service area. The multi-faceted program serves as a model for other utilities, both natural gas and electric, consumer- and investor-owned, on how a utility can

§ Individual results of plants participating in an IEU energy assessment were not publicly available.

establish or strengthen a relationship with its key accounts by helping them save money through energy efficiency, reducing carbon emissions, and helping to guarantee their economic viability.

## VII. Contact Information

For more information about the Southern California Gas Company's Industrial End User program, please contact Christopher Goff at cgoff@semprautilities.com or Bryan Warren at bwarren@semprautilities.com. Please contact Sandy Glatt at sandy.glatt@go.doe.gov for more information on ITP software tools and training.

# Appendix A: Industrial End User Program in Detail

## A. Plant Assessment Recommendations

Typical recommendations include:

- **New Technology**: IEU specialists often recommend implementing new energy-efficient equipment during an assessment. For example, a common recommendation by the IEU team is for plants to install a recuperator for waste heat recovery in the furnace. Recuperators have been shown to more than double the energy efficiency of furnaces because they recycle heat back into the furnace that would otherwise be lost up the stack.[20] They also effectively destroy volatile organic compounds (VOCs). In addition, IEU staff members have recommended thermal oxidizers as another means of oxidizing VOCs prevalent in certain industrial waste streams.[**] For example, IEU performed an energy audit of Puritan Bakery in Carson, California. During that assessment, the energy specialist confirmed that the bakery would save 8.4 billion Btu annually if it added a thermal oxidizer to the incinerator.[21]

  The IEU team also encourages plants to participate in multiple assessments, especially if plant management installed recommended energy-efficient equipment. This allows the IEU team to monitor the equipment's performance and calculate real-time energy savings and GHG reductions. Additional assessments also give plants the opportunity to identify more energy efficiency opportunities.

- **Simple Fixes**: During an energy assessment, the certified specialist performing the audit will identify "low-hanging fruit" opportunities for energy efficiency improvements that a plant can implement in the near-term with little to no cost. These actions tend to be overlooked activities, such as powering down a motor when not in use, putting a door on the furnace, or replacing worn seals or insulation. These simple fixes have minimal implementation costs and immediate paybacks.

- **Process Changes**: IEU energy assessments focus more on processes than pieces of equipment. The assessments are tailored to locate where a plant is having process inefficiencies and where energy is being wasted. Examples of process improvements that result in cost savings and lower GHG emissions could include slightly lowering the temperature required to heat or melt a product or switching from an electric- to gas-based system.

- **Operations and Maintenance Changes**: The IEU team also makes recommendations for improving operations and maintenance (O&M) in plants. The program recognizes that performing routine maintenance will not only help ensure the long life of a piece of equipment, but will also ensure that the equipment operates efficiently. Potential O&M improvements could include maintaining a clean heat transfer surface or replacing equipment before it fails.

[**] Thermal oxidizers recommended by the Gas Company, when installed, decrease the total carbon equivalent from that process because they recover energy from VOCs.

## B. Software Tools

The Gas Company developed and provided the following BEEP tools that are incorporated into all energy assessments:

- **Load Balance Tool**: This tool quantifies how much natural gas is being consumed at a plant. The tool measures gas consumption in therms per year based on the plant's billing records. This tool is essential for every plant assessment since the actual amount of gas usage must be is established to quantify potential gas savings.

- **Score Card Tool**: This tool ranks energy efficiency opportunities and their feasibility in a plant. Results are presented in a dropdown list and in bar graph form.

The following BEEP tools determine energy savings associated with installing and implementing system-specific improvements:

- **Excess Air Tool**: This tool can be utilized to calculate energy savings for replacing a burner with a power burner, repairing furnace leaks for induced draft systems, or fixing furnace leaks for stack draft furnaces.

- **Furnaces and Ovens Tool**: This tool models and quantifies gas energy savings associated with improved furnace efficiency. It examines the following applications for savings: aluminum preheat, fixture weight, moisture reduction, oxygen enrichment, steel preheat, and wall loss.

- **Heat Recovery Tool**: This tool measures potential energy savings resulting from waste heat recovery. The tool covers combustion air preheat, flue gas to air, flue gas to water, and water to water opportunities.

- **Like to Like Tool**: Plants can use this tool to determine gas savings if a piece of equipment is replaced with a new, more energy-efficient model. Similar to the other tools, the Like to Like Tool is also updated when new pieces of equipment become commercially available.

- **Thermal Oxidizer Tool**: This tool compares scenarios with different thermal oxidizers depending on the equipment's intended use. It also helps to calculate savings associated with potential thermal oxidizers and quantifies VOCs.[22]

## C. Training – Energy Resource Center

ERC provides following forms of training:

- **Technical Seminars:** Industrial workers are invited to participate in no-cost technical seminars at ERC. Technical seminars can cover specific systems such as steam, process heat, compressed air or motors. These sessions typically discuss process operation, general opportunities for improved energy efficiency and cost savings, GHG reduction, and ITP software applications such as PHAST and SSAT. ERC also offers courses on

sustainability, combined heat and power applications, waste heat recovery, and renewable energy integration among other topics.

- **Qualified Specialist Training:** ERC offers training for industry experts in co-sponsorship with ITP. ITP Qualified Specialists assist industrial clients in finding ways to reduce energy consumption in specific areas, such as compressed air systems, fans, process heating systems, pumping systems, and steam systems. Training involves a two-day workshop and half-day written exam that demonstrates a candidate's ability to utilize a specific ITP tool and apply it toward an industrial system. Successful candidates will be recognized as Qualified Specialists by ITP and will be eligible to perform energy assessments with that designation.

  **Onsite Training:** ERC provides onsite training at an industrial facility. The experts conducting the training generally provide an overview of particular gas-based systems and software tools for measuring natural gas consumption and potential energy savings. For example, ERC provided onsite training at the White Wave Foods plant in the City of Industry and was able to identify approximately $100,000 annual energy savings if the plant were to increase condensate recovery, reduce boiler blowdown, and improve insulation, among other activities.[23]

In 2006 alone, there were seven Industrial End User Workshops conducted by ERC staff which resulted in the collective identification of 1.9 trillion Btu gas savings during the onsite training sessions. The identified gas savings exceeded the IEU program's energy saving goal set for the first year of the program.[24]

## Endnotes

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