PROCESS EVALUATION OF PACIFIC GAS & ELECTRIC COMPANY'S 2006 – 2008 HIGH-TECH PROGRAM

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EXECUTIVE SUMMARY

This report summarizes research and presents results of the Process Evaluation of the Pacific Gas & Electric Company's (PG&E's) 2006 – 2008 High-Tech Program. The research, conducted by Energy Market Innovations (EMI), is the first process evaluation of this energy efficiency initiative targeting PG&E's high-technology customer base. Given that this program was new to PG&E's nonresidential program portfolio in the 2006 – 2008 program cycle, this process evaluation represents an important opportunity to inform improvements for the 2009 – 2011 funding cycle.

The High-Tech Program addresses an important and rather prominent customer segment within PG&E's service area. That is, the headquarters of a significant portion of the national and international leaders in the high-tech sector (particularly data processing and storage) are located in Silicon Valley in the heart of PG&E's service territory. The high-tech market segment is represented by unique businesses – including electronics manufacturing, biotechnology, and data centers and server farms – that have disproportionately high energy requirements. Thus, a rich opportunity exists for energy efficiency improvements within this sector. Moreover, growth in this industry is significant and increasing at a faster rate than nearly any other commercial market segment. The EPA estimated that, in 2005, data centers were responsible for 1.5% of all power use in the United States, more than double that used in 2000 (U.S. EPA, 2007). At current growth rates, this percentage is expected to double again by 2011. This growth translates to an increase in new stand-alone data centers, as well as an increase in the number of servers and larger spaces to house server farms in existing commercial buildings. Reducing and managing power and energy requirements of such facilities is of critical importance to this highly competitive and fast growing sector.

The overarching objectives of this process evaluation research were to (1) characterize program delivery and operations and make recommendations for process improvements, and (2) conduct market research and review the program's target market and make recommendations for a strategic marketing and outreach plan. Underlying both of these objectives was to assess the *scalability* of the current program model and to provide input to PG&E to support its 2009 – 2011 program planning efforts. While the program proposals for the 2009 – 2011 cycle were not yet final or approved at the time this report was prepared, the expectation is that the High-Tech Program goals will increase significantly (perhaps triple). PG&E's Program infrastructure must be scalable to withstand a significant ramp-up in activity without sacrificing quality of service or customer satisfaction.

EMI acknowledges that the Program's delivery mechanisms and infrastructure are not static. That is, it was clearly evident throughout our research that PG&E was already undertaking or at least considering various changes – specific to the High-Tech Program, and through the energy efficiency organization. These changes pertained to a variety of aspects of program administration and delivery. Thus, this research represents a snapshot of the program at a

specific point in time. Second, some of the changes being planned or implemented that were specific to the High-Tech Program are actually related to some of the recommendations for improvements summarized below. As the evaluation team periodically debriefed the Program Manager on the interim research findings, the team learned that at least some of our findings and recommendations were not new or a surprise to the program staff, but rather confirmed or reinforced their own internal assessments.

The overarching key findings of this evaluation are four-fold:

Overall, the current program model and delivery appears to be successful. Even though the evaluation team detected some lost opportunities, such cases were the exception rather than the norm. One commonly used metric of success is customer satisfaction, and satisfaction with the Program and PG&E staff is high among interviewed program participants. PG&E was also successful in establishing itself as an active industry leader and participant in national and regional initiatives relating to improving the performance of data centers and other high-tech facilities. Such involvement has been very beneficial to PG&E for not only staying abreast of industry developments but also for contributing to and participating in the development of industry guidelines and standards.

The current program is not scalable to meet increased goals of the 2009 – 2011 program cycle. Despite the success of the 2006-2008 initiative, EMI concludes that the program infrastructure in its current form will not support a large-scale effort. There are several factors leading to this conclusion, most of which relate to PG&E's internal organizational structure and alignment, rather than a flawed program theory or implementation plan. For example, the evaluation found that many components of program infrastructure are not integrated in a way that supports information transfer (on a consistent basis) between the various departments involved in marketing, outreach, project development, and application review and processing. The Program's data tracking system is one core component of this infrastructure that is not optimized for program integration and scalability. Furthermore, Account Managers (Service & Sales staff) are widely recognized to be the keystone to successful program delivery, yet there does not appear to be a process in place for providing ongoing training to Account Managers to learn how to identify energy efficiency opportunities that should be referred to the targeted High-Tech Program. Additionally, the current 2006-2008 Program relied heavily on a very small number of individuals (Project Managers as well as Account Managers) who have the level of expertise needed to establish credibility with this fast-pasted, highly competitive, risk-averse customer base. EMI detected that these staff are already strained to take on additional workload, and will not be able to absorb the substantial activity that will be required to meet future program goals. Finally, the current mode of direct customer outreach by Program staff and coordination with Service & Sales Account Managers relies on one-on-one, personal relationships of only a few Project Managers on the Program team. While this method was successful in identifying customers with energy efficiency opportunities, it is not likely to support the number of projects needed to meet the future increased goals.

The Integrated Audits were not used strategically to identify customers with high-tech facilities in need of efficiency improvement. Perhaps one of the most notable findings of this process evaluation was that the Program is not using the Integrated Audits as a means for

identifying energy efficient improvement opportunities of high-tech facilities. The Integrated Audits are not designed to specifically address data centers and server facilities, nor do the audit contractors have the expertise to conduct an on-site evaluation of such buildings. Even if the audits were customized to include high-tech facilities, substantial improvements are necessary to facilitate information and data transfer so that Program staff can easily access the audit report and recommendations in a timely manner.

The Program only partially implemented various training and education services specified in the PIP. While the Program successfully implemented outreach, such outreach was primarily aimed at influencing developers of IT and high-tech facility equipment. Outreach efforts include participation and attendance at industry conferences, coordination with key federal and regional government and non-government organizations, and collaboration with key trade allies and stakeholders to develop consistent standards and guidelines regarding high-tech facility design and performance. Customer education and training, on the other hand, were only partially implemented. The High-Tech Program has published best practices design guidelines and has completed some retro-commissioning pilots and technology demonstrations. Further demonstrations, case studies, and other types of customer education and training are important ancillary services that will help educate customers and help the Program identify efficiency opportunities.

Results and recommendations specific to various aspects of the program are summarized below.

Program Theory and Logic Model. Given the anticipated significant increase in the size of this program for the 2009 – 2011 cycle and changes to program target market and delivery, EMI recommends a detailed review of the program theory and development of a logic model to support the development of performance metrics (discussed below). Articulating an documenting the program theory and logic and sharing these documents with key Program staff will help to ensure the theory is well-founded and that critical paths to success are identified and accounted for in the program marketing and delivery strategy.

Performance Metrics. Performance metrics relate to any or all aspects of program delivery, and should reflect both program evolution and PG&E's relative priorities. Performance metrics are often defined as a result of the development or period review of a program logic model that establishes linkages between the defined program activities and the assumed short and long-term program outcomes. Metrics of success are typically tied to these linkages, as well as specific program milestones.

Following the update of the program theory and logic model, EMI recommends that the Program establish performance metrics against which progress with respect to marketing and outreach and process improvements can be measured. Specific recommendations include the following:

- **Establish program goals and performance indicators associated with program outreach and marketing, and define how progress toward goals will be measured.** Performance indicators should be identified as a result of creating an updated program theory and logic model. Goals and performance indicators should be aligned with roles

and responsibilities of the various staff and departments involved in program delivery, but should also all contribute to the overall program goals of producing energy savings and peak demand reduction. Goals and performance indicators should be transparent and well documented.

- **Achievement toward goal attainment should be measured and performance indicators should be tracked frequently to provide staff and management with real-time feedback on progress.** Progress should be monitored on an ongoing basis so the Program Manager and other PG&E senior management can celebrate success and be alerted to changes that are not producing desired outcomes within the expected timeframe. Real-time feedback mechanisms provide programs with information needed to make mid-course changes that will eventually contribute to meeting energy and demand impact goals. Ideally, PG&E should develop management reports that can be generated from a Program tracking system that include data and graphics relating to the established performance metrics, though additional data collection and reporting independent of Program tracking might need to be established.

Marketing & Outreach. Since the onset of this process evaluation research, EMI has been aware that the High-Tech Program does not have a deliberate, scalable marketing strategy. Clearly the Program will need to develop efficient strategies for identifying customers with existing data centers, server rooms, and other environments that require specific, controlled environmental conditions. Given the wide range of commercial customers that are likely to have or need such facilities, the Program will need to be almost "surgical" to be efficient and effective in targeting its marketing and outreach efforts. Additionally, PG&E will need to create processes that will enable staff (Account Managers and Audit Contractors, for example) that are already working with these customers to identify projects that should be referred to the High-Tech Program. Select recommendations with respect to marketing and outreach are provided below.

- **Develop methods to systematically identify customers with high-tech facilities.** This research found the target market to be too ambiguous for an effective communication and marketing strategy. One of the challenges faced by the Program is how to identify customers that have data centers and server farms (particularly the "hidden" facilities). Perhaps one of the most effective strategies for identifying these customers is to leverage relationships PG&E already has with its customer base through Sales & Services. The Program should also consider an intense market research effort that will characterize PG&E's customer base with respect to existing data center/server farm facilities, data center construction, adoption of virtualization software, etc., that will provide a framework for identifying customers that are likely to be eligible for this targeted program.
- **Develop strategic partnerships with the engineering and design community that serves the data center and critical facility market.** Designers such as architects and engineers, as well as vendors and manufacturers, are critical sources of information for customers and can be very influential in facility retrofit design and equipment

specification. There is a great opportunity to utilize this relationship to increase program awareness and participation.

- **Integrate the Program with the Integrated Audit Program.** Even though the ultimate objective of providing energy audits at no cost to customers is to help customers identify and prioritize cost-effective energy efficiency improvement projects, this evaluation found that the High-Tech Program is not able to effectively leverage the Integrated Audits as a means for enrolling participants in the High-Tech Program. EMI recommends that managers of both the High-Tech and the Integrated Audit programs continue to strive toward more effective program collaboration.

Internal Organization and Program Delivery Processes. This research identified several opportunities to improve coordination efforts between departments, including more frequent training to Account Managers, Sales Engineers, and Auditors on the Program, improved communication and coordination between the Program and other departments that support the energy efficiency programs, and improved tracking and information transfer between departments that support program delivery. Select recommendations are summarized below.

- **Provide more frequent training to Account Managers/Sales & Services Staff on Program opportunities.** Account Managers play a critical role in developing customer interest in the program and providing customer feedback to the High-Tech Project Manager during the project development. In order for the Account Manager to "sell" energy efficiency to their customers, they need to be fluent in PG&E's efficiency program offerings. EMI recommends that PG&E develop formal program training so that Account Managers can learn about efficiency programs that are specific and unique to customers with high-tech facilities.
- **Clearly define roles and responsibilities of High-Tech staff and other departments.** According to the process maps, many different people and departments are involved in the High-Tech program, including High-Tech Program staff, Account Managers (Sales & Services), technical reviewers, and many others who are involved in energy analysis, application review, and general marketing. Clearly defining roles and responsibilities of these departments in the project development process will help PG&E and the Program identify overlaps, avoid duplication of efforts, and streamline coordination.

Program Tracking and Information Management. Underlying many of the above recommendations is the need for improved data tracking and information management that will be necessary to facilitate and support more effective coordination within PG&E's energy efficiency organization. The recommendations EMI presents below are high-level, because we found little to no systematic tracking outside of PG&E's master tracking system (MDSS). Recommendations for improved program tracking and information management include the following:

- **Establish a formal system for tracking marketing and outreach efforts that allow the program manager and staff to monitor progress in achieving the recommended goals and performance indicators.** It appears that individual staff members have developed their own means to track outreach and project developments. However, the program clearly lacks a formal tracking tool to coordinate program outreach efforts by the entire team (including non-High Tech staff working on High Tech projects). An opportunity and need exists for the Program to develop a user-friendly tracking system that can coordinate activities during the Business Development and Project Development Phases.
- **Continue to develop a centralized repository for program references and key documentation.** A program resource library will facilitate the transfer of critical information among PG&E staff, reducing unnecessary delays in project development. This resource should include all program collateral and training materials developed to educate PG&E staff and contractors about High-Tech program offerings and incentives. All staff that require such information should have access to this repository.

1. INTRODUCTION AND OVERVIEW

This report summarizes research and presents results of the Process Evaluation of the Pacific Gas & Electric Company's (PG&E's) 2006 – 2008 High-Tech Program. The research, conducted by Energy Market Innovations (EMI), is the first process evaluation of this energy efficiency initiative targeting PG&E's high-technology customer base. Given that this program was new to PG&E's nonresidential program portfolio in the 2006 – 2008 program cycle, this process evaluation represents an important opportunity to inform improvements for the 2009 – 2011 funding cycle.

The high-tech market segment is represented by unique businesses – including electronics manufacturing, biotechnology, and data centers and server farms – that have disproportionately high-energy requirements. Thus, a rich opportunity exists for energy efficiency improvements within this sector. The three-year goals for this program were to reduce summer peak demand by 3.6 MW and annual energy use by 24.125 MWh. The approved budget for this program was $4,788,988. While these program goals and budget account for less than 2% of PG&E's nonresidential program portfolio, this program addresses an important and rather prominent customer segment within PG&E's service area. That is, the headquarters of a significant portion of the national and international leaders in the high-tech sector (particularly data processing and storage) are located in Silicon Valley in the heart of PG&E's service territory. Moreover, growth in this industry is significant and increasing at a faster rate than nearly any other commercial market segment. The EPA estimated that, in 2005, data centers were responsible for 1.5% of all power use in the United States, more than double that used in 2000 (U.S. EPA, 2007). At current growth rates, this percentage is expected to double again by 2011. This growth translates to an increase in new stand-alone data centers, as well as an increase in the number of servers and larger spaces to house server farms in existing commercial buildings. Reducing and managing power and energy requirements of such facilities is of critical importance to this highly competitive and fast growing sector.

To achieve the energy efficiency and demand reduction goals, this program provided financial incentives for the installation of recommended measures for both retrofit and new construction projects. Among others, eligible measures included variable frequency drives (VFDs) for cooling, virtualization software, HVAC system upgrades and replacements, both water and outside air economizers, and air-flow management improvements. Additionally, PG&E has worked to become a leader in the high-tech industry by collaborating with both federal and regional initiatives to establish high performance standards for new data centers and servers. PG&E staff also participated in numerous industry conferences and seminars, sharing information with other utilities, and collaborating with IT representatives, manufacturers, and vendors.

In the 2006-2008 program cycle, PG&E's targeted sector approach established sector-specific program outreach and delivery that is integrated into the existing mass market, nonresidential retrofit, and new construction application review and approval processes developed in prior program cycles. Therefore, this process evaluation provides important feedback for gauging the

effectiveness of the new targeted-sector delivery approach and the operational efficiency of program delivery in conjunction with the existing application review infrastructure.

1.1. Process Evaluation Objectives and Overview

1.1.1 Evaluation Objectives

The overarching objectives of this process evaluation were twofold. First, this research serves to document the implementation of PG&E's High-Tech Program, particularly with respect to the objectives and delivery strategy outlined in the approved Program Implementation Plan (PIP) (PG&E, 2005). Second, EMI was tasked with evaluating program outreach and delivery and conducting a cursory market assessment to inform the development of the 2009 – 2011 implementation strategy.

Prior to finalizing the evaluation plan for this project, EMI conducted an initial program review so that the evaluation approach could be focused in a way that would provide maximum value to the program. This initial program review included an assessment of the program design and documentation, and initial in-depth interviews with PG&E program staff and contractors. Based on the initial assessment, EMI identified the following as priority outcomes for this evaluation:

- **Identify Specific Process Improvements.** After nearly three years of implementation, the High-Tech Program has grown to a point where it will benefit from a top-down examination of its operations and delivery mechanisms, with an emphasis on improving overall efficiency and effectiveness. EMI recommended that the evaluation focus on working with staff to review the existing processes in detail and identify areas for potential enhancement moving into the 2009 – 2011 program cycle. EMI examined program delivery and processes specifically with respect to *scalability* to meet the increased goals for this program in the 2009 – 2011 period.
- **Develop Strategic Marketing Recommendations.** The program is presently operating without a systematic and focused strategy for identifying and targeting potential customers that have a high likelihood of participation. While the program has been successful thus far in meeting its goals, the scalability of this program with its present strategy will be challenging. The development of a detailed market understanding and a focused marketing strategy will enable program staff to leverage their efforts more effectively and provide a sustainable program into the future. EMI recommended that the evaluation focus on developing and synthesizing strategic marketing information, and at a minimum, developing the framework for such a marketing plan moving forward.
- **Recommend Improved Approaches for Working with Third Party Implementers and Local Government Partnerships**. The program has had mixed experiences thus far in interacting with third party contractors. It is likely, however, that future efforts in this area will rely (at least in part) upon the involvement of such entities. EMI recommended that the evaluation be used as an opportunity to learn from the experiences (positive and negative) of working with third parties through this program. Such knowledge will help

identify concrete recommendations for working successfully in strategic partnerships with these types of entities in the future. It is important that any evaluation effort distinguishes between the Third Party Implementers and Local Government Partnerships, which, by definition, have different roles and relationships with PG&E in program implementation. This type of research is important in order to provide PG&E with a better understanding of the potential synergies and opportunities for leveraging resources with both types of organizations.

After the initial program review and the identification of priority outcomes for the evaluation, follow-up discussions with PG&E further prioritized the process evaluation efforts. The research effort was narrowed to address the following four priorities:

1. **Focus on Data Centers.** The customer research focused almost solely on customers within PG&E's service area that are likely to house data centers or large server farms in one or more of their facilities. Thus, biotechnology, pharmaceutical, and electronics manufacturing customers were effectively excluded from the customer research. The reasons for this shift are twofold: (1) electronics manufacturing has largely moved overseas, with very little manufacturing facilities remaining in PG&E's service area, and (2) the program was particularly interested in insight from customers who house "hidden" data centers and that have server rooms and server farms in existing facilities. While the program recognizes the highest potential in new construction data center activity, identifying customers with existing (and expanding) needs remains an important element of the program.
2. **Focus on Delivery and Operations Prior to Application Submittal.** The process evaluation reviewed program delivery and operations leading up to but stopping at the application submittal review. That is, this evaluation specifically covered the targeted sector initiative and did not examine processes associated with the mass market, nonresidential retrofit, or new construction application review and approval processes.
3. **Focus on the Core High-Tech Program.** The process evaluation research de-emphasized the third party and local government partnership research effort, because of uncertainty regarding the extent of coordination with these organizations in the future. EMI conducted in-depth interviews with representatives of third party programs and local government partnerships with which the High-Tech program coordinated with during the 2006 – 2008 cycle; these interviews did help to frame issues associated with the strategic relationships between IOUs and non-IOU implementers. However, PG&E and the evaluation team agreed that addressing other research objectives was a higher priority, given limited evaluation resources.
4. **Review the Program's Tracking System and Information Management Processes.** An additional research task focused on evaluating the Program's data tracking system. Early in the project, the evaluation team encountered challenges in linking Program databases, which led to challenges in fully tracking program accomplishments and/or shortfalls. This also presented difficulties from an evaluation perspective, as information regarding Program participants and

nonparticipants is needed in order to conduct evaluation research. Thus, reviewing the Program's tracking and information management systems was a priority for this process evaluation effort. Improving the manner in which Program data is tracked and shared will allow the program to operate in a systematic manner and continue to meet future goals.

1.1.2 Overview of Research Methods

This evaluation sought to gain an initial in-depth understanding of the program operational efficiency and to gain an understanding of the high-tech market segment. Thus, research methods were developed to produce "rich," qualitative understanding of the customer experience and market opportunities. The goal of this evaluation was not to undertake large-scale data collection efforts and produce quantitative results of statistical significance. As will be described in more detail in Section 3 of this report, the evaluation research included the following four components:

- **Customer Research.** The objectives of the customer research task of this evaluation were to examine customer experiences with the program and understand the decision process and influences surrounding the selection of energy efficient equipment. EMI conducted in-depth interviews with program participants and nonparticipants to learn about customer experiences with the Program and to gain insight into the decision processes and opportunities and barriers of energy efficiency in high-tech facilities.
- **Process Mapping.** The ultimate objectives of the process mapping were to characterize the delivery of the High-Tech Program and develop recommendations for optimizing internal resources and processes. EMI facilitated a process-mapping workshop to gain an in-depth understanding of the means by which PG&E conducted outreach and marketing and the processes through which energy efficiency projects were identified and developed. The process mapping session characterized program processes, staff roles and responsibilities, and data and information needs.
- **Market Assessment Research.** EMI conducted both primary and secondary market research to gain a basic understanding of the high-tech sector and to characterize PG&E's target market with respect to interactions among various market participants, and to develop recommendations for developing a strategic marketing plan.
- **Third-Party Research.** The original intent of the third-party research was to conduct in-depth interviews with Quest and SVLG staff in order to identify key lessons learned, which could be applied to future third party collaborations. However, as discussed previously, this part of our evaluation was significantly reduced, because of the uncertainty regarding the program's involvement with third parties, and to maximize the value of other research tasks described above.

All research activities described herein were conducted by EMI staff between June and December of 2008.

1.2. Organization of the Report

The next section of this report provides a description of PG&E's High-Tech Program, which is largely drawn from the approved PIP. Section 3 describes the research methods EMI implemented to carry out this process evaluation. Section 4 summarizes research findings with respect to the delivery and operations of the High-Tech Program. This section describes the organizational processes and workflow of program implementation, and compares the program services and their delivery to the PIP. This section also summarizes the integration of the nonresidential audit into the targeted program, as well as customer feedback regarding satisfaction with the High-Tech Program, in general. Section 5 takes a step back from the program delivery and provides results of the high-tech market research, which is largely derived from in-depth interviews with customers and data center engineer and design firms. Section 6 reviews the High-Tech Program's data tracking efforts. The final section of this report summarizes key findings and offers a set of specific and actionable recommendations for program improvements.

Two appendices are provided with this evaluation report. Appendix A lists key references cited in the text, and Appendix B includes the in-depth interview guides for the customer and market research data collection efforts.

2. PROGRAM OVERVIEW

This section begins with a high-level overview of recent trends in the industry, which provides context about energy use in high-tech facilities, particularly data center energy efficiency. It then summarizes the design of PG&E's High-Tech Program, as depicted in the approved PIP. The PIP is the primary source of documentation referenced by the evaluation team to characterize the program services and the means by which those services were intended to be delivered to eligible customers. The section concludes with a summary of the status of the program, in terms of reported expenditures and reported *ex ante* energy and demand impacts that were recorded at the time this research was conducted.

2.1. Recent Trends in Data Center Energy Efficiency

In recent years, much of communication, information storage, and web commerce have shifted online, and because of this, more data and web storage space has become necessary. The U.S. Environmental Protection Agency (EPA) estimated that in 2005 data centers were responsible for 1.5% of all power use in the United States, more than double that used in 2000 (U.S. EPA, 2007). The EPA estimated that, at current growth rates, this percentage is expected to double again by 2011. High-energy use is due, in part, to Information Technology (IT) equipment within a data center, as well as the heating, ventilation, and air conditioning (HVAC) equipment used to ventilate and cool the facility.

Over the last few years, many influential reports and research supporting standards developing in data center energy efficiency have emerged. For example, the Lawrence Berkeley National Laboratory (LBNL) distributed a report of best practices for energy efficiency in data centers (Tschudi, Mills, Greenberg, & Rumsey, 2006). In mid-2007, the Consortium for Energy Efficiency (CEE) established a new Data Centers and Servers Initiative and formed a Committee to support work in this area. A best practices guide (European Commission, 2008, April 21) and code of conduct (European Commission, 2008, April 8) for energy efficiency in data centers are currently being drafted in the European Union. A group called the Standard Performance Evaluation Corporation (SPEC, 2008) has worked to establish a set of benchmarks and performance standards for servers, while EPA's ENERGY STAR Program is currently in the process of developing an ENERGY STAR rating for servers and data centers (U.S. EPA, 2008). Finally, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has developed thermal guidelines for data processing environments, and ASHRAE has developed a partnership with Green Grid[1] to develop data center energy efficient design and operation guidelines.

The confluence of activity in data center energy efficiency means that more facilities and IT managers as well as senior management of prominent companies in the industry are becoming aware of energy efficiency in their IT equipment selection, HVAC equipment and system design,

[1] See www.thegreengrid.org.

and overall facility design. New groups such as the Green Grid and Climate Savers Computing[2] engage member businesses to improve the efficiency of their computing equipment. The Green Grid has developed metrics to compare how much energy, additional to the power used for IT equipment, is consumed by data center facilities (2007). Other tools are also being developed to raise awareness of data center energy efficiency by the U.S. Department of Energy's (DOE) Energy Efficiency and Renewable Energy division (EERE). EERE's software program, DC Pro Tools, enables one to assess how the efficiency of a particular data center might be improved (U.S. DOE, 2008). Websites such as greenercomputing.com also place a significant focus on energy efficiency in data centers.

2.2. PG&E's Core High-Tech Program

Facing this growing need for energy efficiency at data centers, PG&E developed a targeted energy efficiency initiative to increase the adoption of energy efficient measures at High-Tech facilities. Because much of the efficiency measures at data centers are HVAC measures, PG&E grouped data centers with other high-tech facilities requiring intensive and unique HVAC requirements. In 2006, PG&E initiated the High-Tech Program, providing energy efficiency services to the following high-tech industries: biotechnology, pharmaceutical, electronics manufacturing, cleanrooms, data centers, and telecommunications, as defined in PG&E's PIP (PG&E, 2005, p.2).

This program provided deemed and custom incentives for the installation of qualified measures for both retrofit and new construction projects. PG&E contracted with a limited number of qualified engineering firms on an as-needed basis to conduct energy analysis for interested customers. These studies provided recommendations for customized energy efficiency measures, for which PG&E can provide incentives.

In addition to energy savings and peak demand reduction, desired outcomes of this program designated in the PIP include the following:

- **Benchmarking**. Standardize the process of high-technology energy use benchmarking.
- **Commissioning**. Emphasize the need for commissioning (ensuring design and construction of systems are energy efficient) and provide tools and assistance for doing so.
- **Retro-commissioning.** Provide tools and assistance for retro commissioning (involves building operations and operating staff).
- **System measure templates.** Develop high-technology templates for analyzing energy efficiency measures.

[2] See www/climatesaverscomputing.org.

- **Codes and standards**. Influence building and appliance energy codes to include energy efficient technologies and practices relevant to the high-tech market.
- **High-technology energy efficiency infrastructure**. Facilitate the integration of energy efficiency practitioners for high technology, especially in HVAC.

To achieve these desired outcomes, the PIP describes a wide range of products and services to meet the unique needs of their High-Tech customers:

- **Education and training services.** Education and training services to be offered through the Program include energy audits, benchmarking, commissioning and retro-commissioning, technology demonstrations, a one-stop web- and phone-based clearinghouse to deliver Program information, and best practices design guidelines.
- **Deemed incentives.** Although most savings attributable to the Program were expected to be custom-calculated, the Program also intended to deliver deemed savings to High-Tech customers as appropriate.
- **Calculated Incentives.** Calculated incentives for customized projects, both retrofit and new construction, were the focus of the program. Design assistance was offered in conjunction with calculated incentives. Among others, measures included variable frequency drives (VFDs) for cooling, virtualization software, HVAC upgrades and replacements, water and outside air-economizers, and air-flow management improvements.
- **Demand Response and Distributed Generation.** The High-Tech Program intended to coordinate with Demand Response and Distributed Generation to provide comprehensive program offerings to customers.

2.3. Current Status of the High-Tech Core Program

According to PG&E's 2008 Fourth Quarterly Report (PG&E, 2008a), the program has spent more than four times the three-year program budget of $4,788,988. The breakdown of total expenditures thus far, totaling more than $21 million, is summarized in Table 2-1. Expenditures have largely gone toward direct program implementation costs and incentive payments.

Table 2-1: Summary of Reported Program Expenditures (as of Q4 2008, revised 5/01/2009)

Budget Category	Expenditures	Percent of Total Expenditures
Administrative	$3,177,973.69	15%
Marketing and Outreach	$1,678,977.46	8%
Direct Implementation	$16,536,598.67	77%
Total	**$21,393,549.82**	**100%**

Throughout the three-year program cycle, PG&E reported that the program has met or exceeded savings and peak demand reduction targets.[3] Although these impacts have not been independently verified, as of December 2008, the program reportedly installed over four times the kWh forecast and almost three times the kW forecast. Although the program did not have natural gas efficiency targets, PG&E also reported 756,639 therm savings.

Table 2-2: Summary of Reported Ex Ante Energy Savings and Demand Reduction (through 2008, revised 5/01/2009)

	Energy Savings (kWh)	Peak Demand Reduction (kW)	Therms
Target Net Savings (02/2006)	24,124,980	3,619	-
Reported Ex Ante Impacts	98,412,488	9,818	756,639
Percent of Target	408%	271%	-

2.4. Third Party Programs

High-tech sector initiatives in PG&E's service area also included two additional programs, summarized below. EMI acknowledges the importance of these programs to the overall success of increased energy efficiency and demand reduction in this sector in PG&E's service area, but as we explain above, the process evaluation research focused almost solely on PG&E's Core program.

- **Silicon Valley Leadership Group Local Government Partnership.** PG&E has partnered with the Silicon Valley Leadership Group (SVLG) to assist with implementation of its High-Tech Core Program. The SVLG is a consortium of high-technology businesses in the Silicon Valley, and is responsible for marketing the High-Tech Program, demonstrating proposed measures, and installing measures for member businesses. Fieldwork for the program is conducted through Quantum Energy Services Technologies (QuEST), a third party implementer, and verified by EMCOR Energy Services (EES). PG&E coordinates all program activity and focuses on process applications and incentive payments. The program focuses on larger SVLG customers and primarily works with retro-commissioning projects. High-efficiency HVAC systems and lighting are commonly installed measures. While the program covers data centers and high-tech facilities, it does not do any specific work with high-tech equipment or energy efficiency measures, such as new servers or virtualization. At this time, PG&E does not anticipate continuing this partnership in its current format for the 2009 – 2011 cycle. However, PG&E is discussing ways to keep a limited relationship with SVLG, as PG&E recognizes the immense value that connections with major Silicon Valley businesses can have for its Core program.

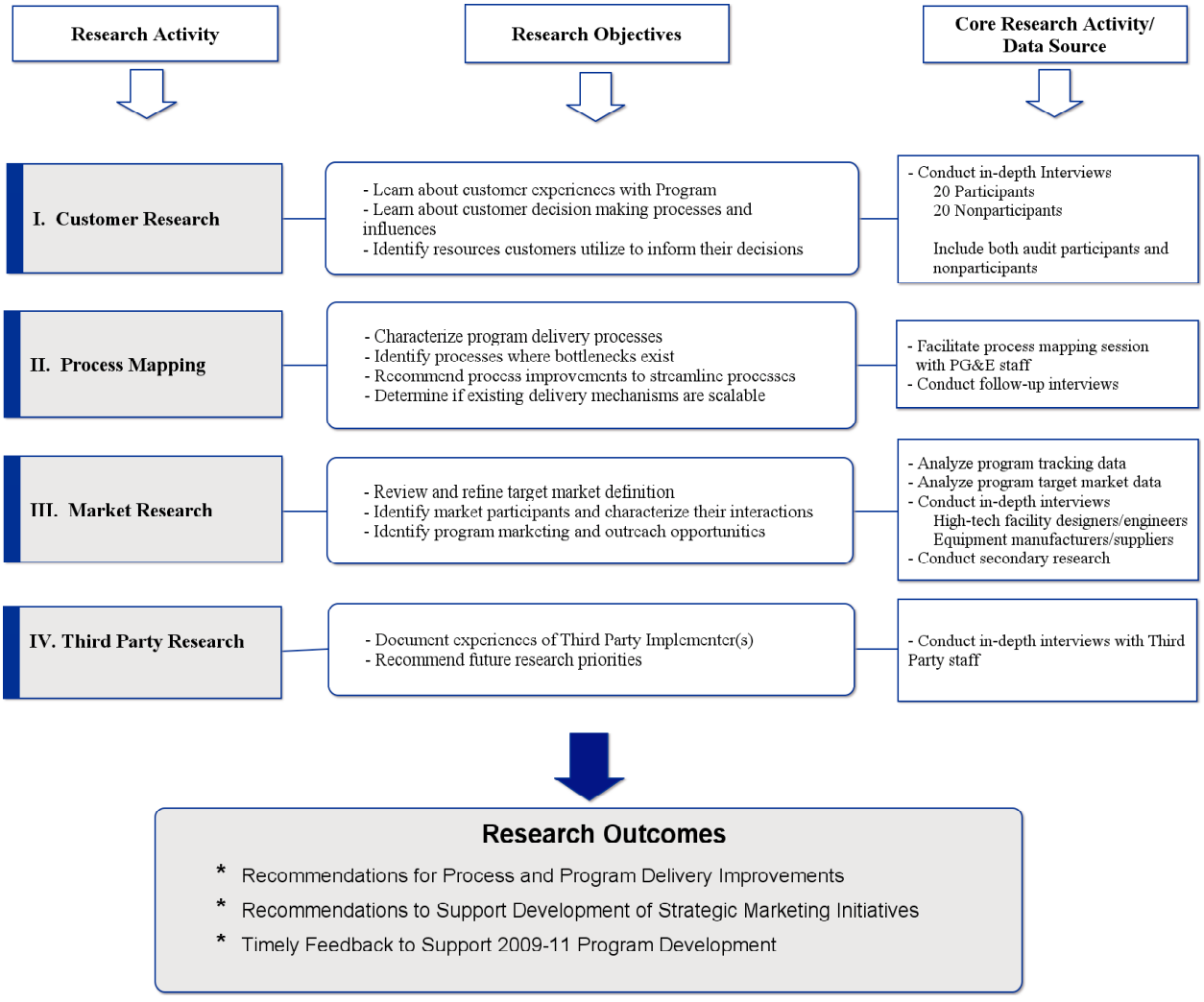
[3] The California Public Utilities Commission (CPUC) set goals at the portfolio level. PG&E allocated these portfolio goals across various target market sectors. Because these are not CPUC goals, the term "target" is used.

- **QuEST Data Center Cooling Controls Program**. QuEST is a third-party implementer responsible for the DCCCP (Data Center Cooling Controls Program). This third party initiative provides audits and incentives for installing wireless temperature control systems for HVAC within data centers and server farm facilities. This Program was slow to get started, as a contract between QuEST and PG&E was not signed until July 2006 for the 2006-2008 cycle, and the first engineering reports were not submitted until spring of 2007. The DCCP has been slow to achieve energy savings, and PG&E believes that DCCCP accomplishments have largely benefitted from work done through the Core Program. Thus, PG&E has decided not to renew their partnership with QuEST for the 2009-2011 program cycle.

3. PROCESS EVALUATION RESEARCH METHODS

Figure 3-1 provides an overview of the process evaluation research methods and objectives. As shown, this process evaluation involved four primary research activities: customer research, process mapping, market assessment research, and third-party research. The customer research included participant and nonparticipant interviews. Both a process-mapping exercise, which was conducted onsite at PG&E, and follow-up telephone interviews with program staff, were conducted to characterize program delivery and inform process improvements. Market research included in-depth interviews with market participants (i.e., data center designers and equipment manufacturers and suppliers), as well as an analysis of PG&E's program data and ancillary secondary research. Finally, third party research included in-depth interviews with third-party program staff.

Figure 3-1: Process Evaluation Overview



The remainder of this section describes each of the four research activities in more detail.

3.1. Customer Research

As shown in Figure 3-1, the primary objectives of customer research were to collect feedback that can be used to optimize the program implementation process and inform a strategic marketing strategy. An important first step to conducting customer research was to develop specific classifications of customers who fell within the program target market and who received varying degrees of energy efficiency services from PG&E. For the purposes of this evaluation, EMI classified customers as follows:

- **High-Tech Program Participants**. High-tech Program Participants are customers who implemented an energy efficiency improvement project for which they received a customized or calculated financial incentive from PG&E during the 2006 – 2008 program cycle. Some of these customers may have also participated in PG&E's nonresidential audit (NRA) program.
- **Nonparticipants.** Nonparticipants include customers who did not receive customized or calculated incentives from PG&E during the 2006 – 2008 program cycle. EMI further classifies nonparticipants as either "true" or "mass market" participants.

  True Nonparticipants. A true nonparticipant is high-tech customer who has not received any incentives or rebates from PG&E during the 2006 – 2008 program cycle. Some of these customers, however, may have also participated in PG&E's NRA program.

  Mass-Market Participants. Mass-market participants are those high-tech customers who received a rebate from PG&E for purchasing and installing one or more *deemed* measures, but did not receive customized or calculated incentives through the High-Tech Program. Some of these customers, however, may have also participated in PG&E's NRA program.

As shown in Figure 3-1, the customer research component of this evaluation included in-depth interviews with both participants and nonparticipants. All in-depth interviews were conducted over the telephone by EMI staff and were loosely structured to focus attention to issues that were particularly salient to individual interviewees. Interview questions were structured to provide both numeric responses that could be aggregated across customers, as well as more open-ended responses that provide important qualitative information. This enabled the researchers to explore important issues while maintaining a common format across customers.

Interview guides were constructed to identify ways to improve the participation process and to identify successful marketing tactics. Participants were asked about their experience with the program and whether they had suggestions for improving the process. To identify successful marketing tactics, participants were also asked how they found out about the program and what influenced their decision to participate. Nonparticipants (both true nonparticipants and mass-

market participants) were asked why they did not participate in the High-Tech Program. Those customers who had participated in the NRA Program were asked questions to discern the influence of audits on participation in the High-Tech Program and to inform program improvement recommendations to improve the integration of the NRA with the High-Tech Program. To understand the target market and examine additional marketing opportunities, both participants and nonparticipants were asked questions to identify customers' sources of information and decision-making processes regarding facilities design and equipment selection. The in-depth interview guide is included in Appendix B, for reference.

For participants, EMI sought to interview individuals responsible for their company's decision to participate in the program. These interviews lasted approximately 45 minutes to one hour. The interviews with nonparticipants targeted those individuals who were responsible for facility maintenance or improvements. Nonparticipant interviews lasted approximately 30 to 45 minutes.

EMI gathered rich customer insights from a variety of perspectives. As shown in Table 3-1, EMI interviewed 20 participants and 20 nonparticipants. Of the 20 participants, eight had received an energy audit and 12 had not received an energy audit. Of nonparticipants, five had participated in the Mass-Market Program, meaning they had received rebates for installing deemed measures that are not considered part of the High-Tech program. The remaining 15 had received neither Mass-Market rebates nor High-Tech Program incentives. Four nonparticipants participated in the NRA Program during the period covered by this study.

It is important to note that the in-depth interviews were primarily intended to provide qualitative information. Although results include some quantitative descriptive summary statistics, the small sample size does not allow for adequate statistical power to make conclusive comparisons and should not be considered representative of the population. Any differences between groups should be regarded as trends only.

Table 3-1: Customer In-Depth Interview Summary

	High-Tech Participants	Nonparticipants	
		True Nonparticipants	Mass-Market Participants
NRA Participant	8	2	2
NRA Nonparticipant	12	13	3
Total	**20**	**15**	**5**

Table 3-2 shows the primary business activity of customers interviewed for this research. The business activity mentioned most frequently was telecommunications, which included satellite communications, television broadcasting, cellular telephone signal transmission, and manufacturers of communications equipment. Other primary business activities include Internet service providers or data centers, software development or research firms, and property management or real estate companies. Such real estate companies were pertinent to this research because they lease property to high-tech businesses.

EMI interviewed a variety of individuals serving different functions within their companies, including Facilities Managers, Building Engineers, and Energy Managers. The various job categories of those interviewed are shown in Table 3-3. The majority were engineers and/or facilities managers, although we also spoke with other individuals, such as IT and real estate professionals.

Table 3-2: Primary Business Activity of Interview Respondents

Business Description	Number of Respondents
Telecommunications	10
ISP/Colocation or Data Center	5
Software Development/Research	5
Property Management/Real Estate	5
Electronics Manufacturing	4
Government	3
Other Manufacturing	2
Pharmaceuticals	2
Healthcare	1
Financial	1
Retail	1
Television Station	1
Total	**40**

Of the 20 program participants interviewed for this study, all indicated the presence of a data center or server room in their company building. Seventeen participants reported that the measures installed using Program incentives affected either the "entire building" or the data center in particular. One participant said the measures affected the office only, and one customer said the measures affected manufacturing facilities and office buildings. Information regarding specific areas of the building affected by installed measures was not available for one participant.

Table 3-3: Job Descriptions and Titles of Interview Respondents

Job Description/Title	Number of Respondents
Engineer/ Facilities Manager (Operations Systems Engineer, Senior Facilities Engineer, Assistant Chief Building Engineer, Chief Engineer, Chief Operating Engineer, Director of Engineering, Chief Engineer for Facilities, Senior Specialist, Facilities Services Director, Maintenance and Operations Manager, Lab Manager, Senior Facilities Engineer, Director of Facilities and Purchasing, Field Operations, General Manager of Facilities, Director of Site Operations)	26
Energy Manager (Global Energy Manager, Site Energy Coordinator, Energy Manager)	4
IT Professionals (Senior Administrator in IT Dept, Director of IT, Network Administrator)	3
President or Vice President (President of one-officer company, President of DC, Senior Vice President - manages DC new construction)	3
Real-Estate Professionals (Landlord, Building Manager)	2
HVAC Contractor	1
Director of Public Works	1
Total	**40**

3.2. Market Assessment Research

The objective of the market assessment research was to collect information that could inform the development of a deliberate marketing strategy for the program. To do this, EMI completed interviews with market participants and performed ancillary secondary research.

3.2.1 Market Participant Interviews

EMI conducted in-depth telephone interviews with influential market participants in the data center services industry. The market participants targeted by this effort were primarily data center designers and equipment manufacturers and vendors. The purpose of these interviews was to identify opportunities for marketing, identify industry trends regarding energy efficient equipment, and better understand the data center facility design and decision-making process.

As with customer interviews, market participant interviews were loosely structured. All questions were open-ended to allow for the exploration of particular issues that arose with each respondent. The evaluation team constructed two interview guides for market participants. One

guide was intended for use with designers (i.e. architects and engineers) with experience in data center design. Data center designers were queried about data center design process, opportunities for marketing/education/training, and sources for information and equipment. The second guide was intended for manufacturers and vendors whose products are relevant to energy efficiency in data centers. Vendors and manufacturers were asked questions regarding awareness of PG&E's High-Tech Program, opportunities for Program influence, industry trends, market barriers, and recommendations for Program improvements. Conversations with market participants lasted approximately 30 to 45 minutes each. The range of questions and duration of conversations make these interviews a particularly rich source of information. The in-depth interview guides are included in Appendix B, for reference.

EMI interviewed 16 market participants, including designers, engineers, software vendors, and equipment manufacturers. Nearly all respondents had at least 15 years of experience in their respective fields. Many had been involved in the high-tech, mission-critical or data center market sector for 20 years or longer. Examples of the background and qualifications of the respondents are noted below:

- EPA ENERGY STAR program group lead
- Virtualization software program manager
- Designer for mechanical, electrical, and plumbing contractor in data center design
- LEED certified professional engineers and designers for data centers
- Construction project manager with experience in data center construction
- Data center disaster recovery/contamination professionals
- Registered, licensed architect with experience in data center facilities
- Mechanical engineer, computational fluid dynamics modeler for data center facilities
- Mechanical engineering Ph.D., certified energy manager

3.2.2 Secondary Research

The purpose of the secondary research was to provide background information regarding data center energy efficiency that could help inform the development of the interview guides. Secondary research also allowed the evaluation team to identify important issues for customers and market participants to understand the context of their responses. Furthermore, secondary research allowed us to identify potential sample frame for the market participant interviews.

The secondary research began with Internet searches used to identify trade organizations, publications, and websites devoted to energy efficiency in data centers and cleanroom facilities. Members of the evaluation team also attended two conferences concerning energy efficiency in data centers: the Silicon Valley Leadership Group (SVLG) Data Center Energy Summit in June 2008, and the National Data Center Energy Efficiency Strategy Workshop hosted by Microsoft

in July 2008. These events provided a solid background on the industry and current efforts being undertaken to improve high-tech facility energy efficiency. These events summarized reports integral to the industry, benchmarking studies, energy efficient equipment used in data centers, misconceptions/barriers in the industry, and addressed the need for/development of metrics for energy efficiency of servers. Citations for secondary sources are provided within the text of this report; full references are provided in Appendix A.

3.3. Process Mapping

Process mapping is a research tool used to understand program processes and workflow while enabling EMI to identify opportunities to improve the efficiency and effectiveness of program delivery. In particular, creating a map of program processes provides the evaluation team with an in-depth understanding of program operations and internal processes that are otherwise difficult to obtain. Perhaps most importantly, however, EMI has found that the exercise of developing a process map provides an invaluable opportunity to facilitate dialogue with program managers and staff about how well various aspects of the program function. Process mapping sessions provide an interactive opportunity for staff to think openly about how the program actually works and how it could be improved. Looking at reporting points, information/data transfer, bottlenecks, etc. in a structured and methodical fashion provides us with a basis for identifying recommendations for process improvements, and allows us to communicate the relative priority of such recommendations. This approach also provided the evaluation team with a hands-on way of involving program staff in the evaluation process.

As shown in Figure 3-1, the primary objectives of the process mapping with respect to this particular study were to characterize key program delivery processes, review staff implementation experiences, and identify optimization opportunities. The results from the process-mapping exercise were used in conjunction with feedback from customers and stakeholders to develop a comprehensive understanding of program processes and identify key recommendations for program improvement. EMI staff, the High-Tech Program Manager, and the Project Evaluation Manager, collectively determined that the primary objectives of the process-mapping exercise were to (1) define marketing, outreach, and program delivery processes; and (2) identify opportunities for process improvements. The scope was limited to processes leading up to the application submittal, review, and approval.[4]

EMI facilitated a half-day process-mapping workshop on September 23, 2008. Attendees included eight PG&E staff including: the Program Manager, three Project Managers, one Account Manager, two Technical Product Support Service Group staff, and one technical support staff. (The Evaluation Manager also attended but did not participate.) Participants were first debriefed on the objectives of the workshop and were asked to actively participate in defining program processes and opportunities for improvement.

[4] Subsequent application review and approval processes were not in the scope of this evaluation because the nonresidential retrofit and new construction application processes being reviewed under a different evaluation effort.

Participants were first asked to define the high-level program delivery phases. Once the group reached consensus on the major program phases, EMI then facilitated a discussion to identify and describe program outreach and marketing efforts and steps required to develop an energy efficiency project and prepare the incentive application. In addition to characterizing these program processes, EMI sought to understand who was involved in each step and the interactions among all staff (and contractors). EMI closed the workshop by asking each participant to identify the data and information that they felt was most critical for them to be successful in fulfilling their own responsibilities, and when and from whom they obtained such data and information.

EMI facilitated the discussion and constructed the process steps in real time. The process maps depicted process steps, decision points, triggers to the start or end of a process, and process improvement desires. Once the maps were finalized, EMI staff conducted follow-up interviews with the Manager of PG&E's NRA Program, High Tech program staff, and the Technical Review team. These interviews provided additional insight into program processes identified as requiring further examination during the workshop. In general, these interviews included questions regarding how their jobs functioned and barriers they experienced when implementing the program.

3.4. Third-Party Research

While this study focuses almost solely on PG&E's Core High-Tech Program, the California Public Utilities Commission (CPUC) approved two other energy efficiency initiatives for the 2006 – 2008 funding cycle. As is the case with other IOU and non-IOU programs, it is important for program administrators and implementers to coordinate their initiatives with overlapping target markets to avoid duplication of effort, minimize customer confusion, and optimize overall effectiveness of public goods charge (PGC) funds.

EMI conducted in-depth telephone interviews with third-party staff early in this research, including two individuals with QuEST and one with SVLG. Initially, the objectives of these interviews were to identify aspects of coordination that were functioning well and areas that needed improvement.

As previously noted, after these initial interviews were conducted, it was determined that the process evaluation efforts would be most valuable if were focused solely on the Core program. (EMI strongly recommends, however, that future evaluation efforts continue to explore opportunities for maximizing the effectiveness of the relationships between IOUs and third-party initiatives.)

4. CHARACTERIZATION OF HIGH-TECH PROGRAM IMPLEMENTATION

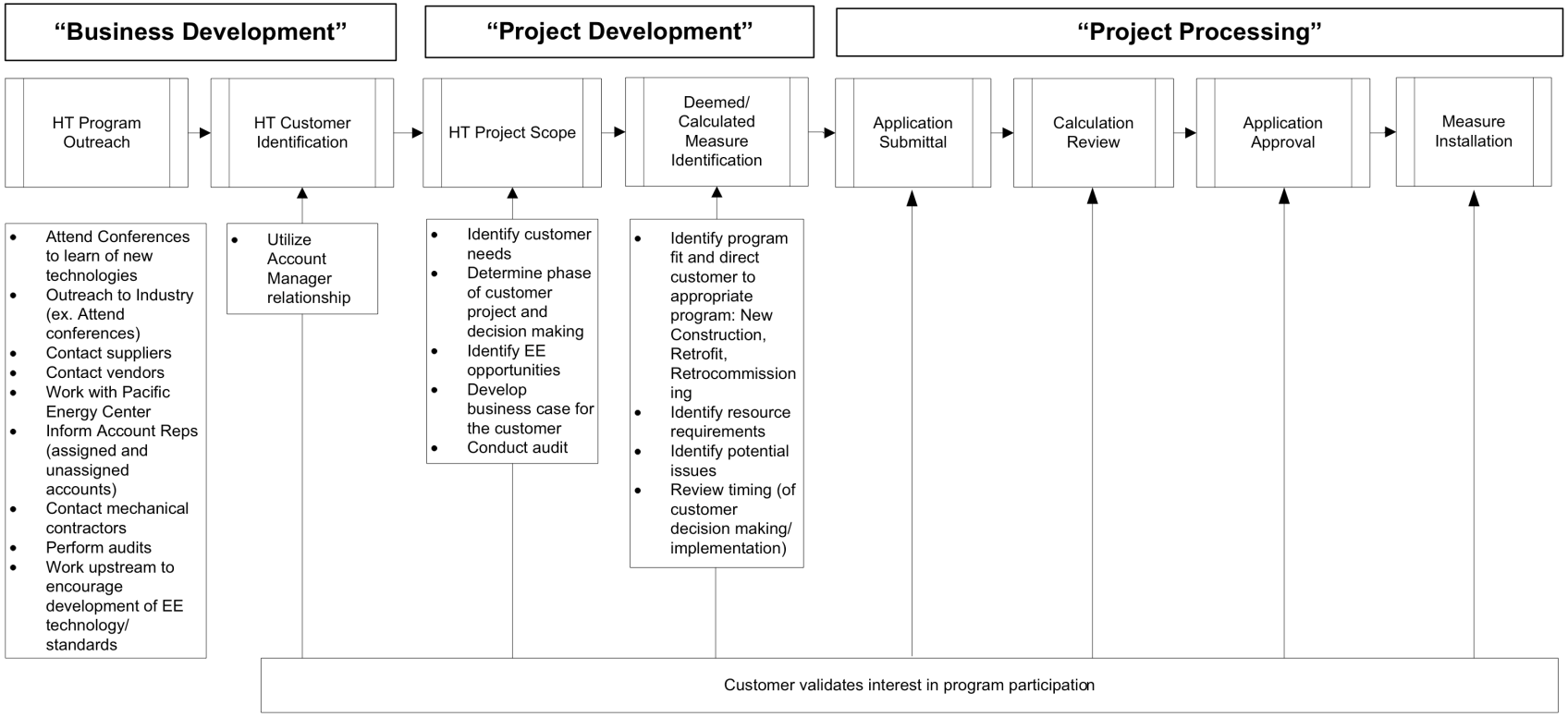
This section provides a detailed summary of the means by which program services were delivered to PG&E's high-tech sector customers during the implementation period covered by this research. EMI largely developed the characterization of the program delivery processes – from initial marketing and outreach through energy efficiency project development – as a result of the process-mapping session and follow-up interviews with PG&E staff that were described in Section 3 (and illustrated in Figure 3-1). The exercise of developing the process maps provided an invaluable interactive opportunity for program staff to think openly about current program delivery and operations and areas and functions needing improvement. This characterization was also informed with information provided by PG&E customers during in-depth interviews. In addition to characterizing program delivery, this section summarizes the influence of the integrated energy audits on Program participation, as well as overall customer satisfaction with the High-Tech Program.

4.1. Primary Phases of Program Delivery

There are three primary phases of program delivery, illustrated in Figure 4-1 that were identified during the process-mapping workshop:

1. **Business Development.** During the Business Development phase, PG&E staff (including High-Tech Program staff, Account Managers, and Nonresidential Audit program staff) conduct marketing and outreach activities to generate customer interest in energy efficiency measures.
2. **Project Development.** Once a customer expresses interest in pursuing an energy efficiency project, the Project Development phase involves the development of project scope and analyses to develop estimates of energy savings required for the incentive application.
3. **Project Processing.** This final phase includes the application submittal and project verification processes.

Figure 4-1: Primary Program Delivery Phases



4.1.1 Business Development

During the process-mapping session, the EMI workshop facilitator asked program staff to describe each step of the business development process, including start/end points and key decision junctions. The process map was created in real time, allowing for participants to revise the activities and interactions of all involved staff to best represent how the program was implemented.

Figure 4-2 provides the process map developed to represent the Business Development Phase of program delivery, which includes all activities undertaken to generate customer interest in an energy efficiency improvement project. In this figure, an oval denotes the beginning and end points of each distinct process. Each separate step of the process is represented by a rectangle, a diamond shape marks a key decision point, and a pentagon links the Business Development Map with the Project Development Map (shown in Figure 4-3).

Throughout the process mapping workshop, program staff were encouraged to contribute "wishes," or descriptions of specific processes that are either lacking or could use improvement so that they personally could perform their responsibilities more effectively, or that the program, in general, would be more effective in identifying projects and enrolling participants. Staff participated in the process by writing their "wish" on the appropriate shape paper and adding it to the illustration. All wishes submitted during the session are denoted by hexagons in Figure 4-2.

As shown in Figure 4-2 the Business Development Phase involves (1) industry outreach to raise energy efficiency awareness in the High-Tech industry and (2) direct outreach and marketing to customers in the target market. Each of these activities is summarized below.

4.1.1.1 Industry Outreach

The ultimate objective of industry outreach efforts is to establish PG&E as national leader supporting energy efficiency and sustainability in the High-Tech industry. The intent of industry outreach is to influence developers of IT and high-tech facility equipment so that future generations of IT equipment are more energy efficient. Industry outreach also aims to push the high-tech facility management field towards energy efficiency, ultimately creating a long-term, sustainable, and more energy conscious sector within PG&E's territory. Shown as items A, B, C, and D in Figure 4-2, industry outreach is conducted both locally and nationally and includes participation and attendance at industry conferences, coordination with key federal and regional government and non-government organizations, and collaboration with key trade allies and stakeholders to develop consistent standards and guidelines regarding high-tech facility design and performance.

The evaluation team attended two of these outreach efforts. One event was a meeting, organized by EPA's ENERGY STAR program, which brought together industry leaders, including PG&E, to discuss developments in an ENERGY STAR specification for servers. The other event was a utility coalition meeting, organized by PG&E, to coordinate utility developments in energy efficiency programs directed at data center facilities. Other examples of program outreach include those listed on PG&E's High-Tech program website (2008c):

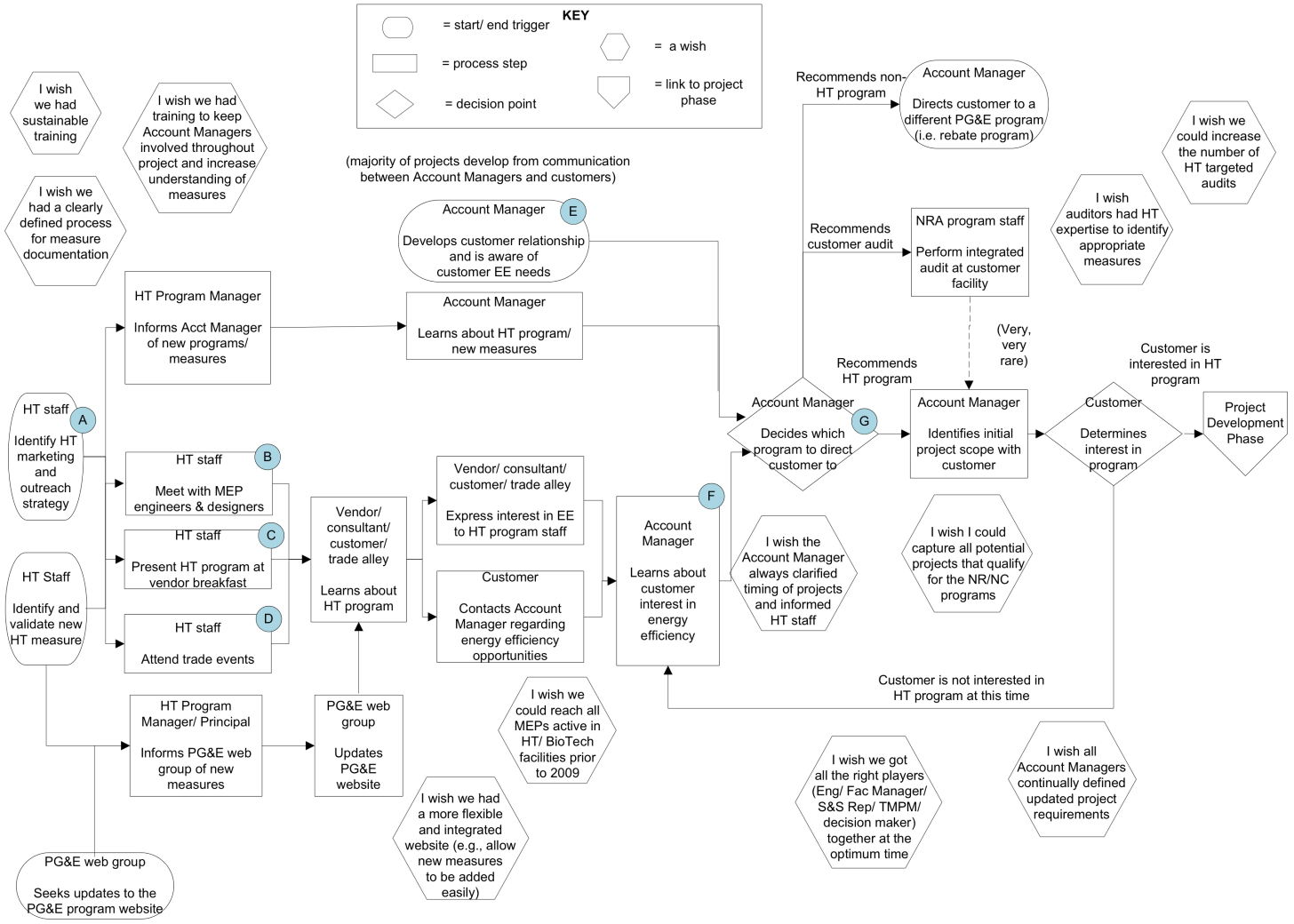
- Western Blue: Going Green Seminar
- University of California IT Leadership Team
- Green Grid Technical Forum
- ePlus Vendor Briefing
- North American Network Operators Group Conference
- SMUD Energy Efficiency for Business Technology Seminar
- Panduit Conference
- Cisco Systems Green Research Symposium
- AEE Globalcon 2008
- IDC Enterprise Data Center Forum West
- IDC Virtualization Forum West
- Association of Energy Service Professionals Spring Conference
- 7x24 Exchange Conference
- IDC Green IT Forum West
- Data Center Dynamics
- Northern California Computer Measurement Group

The High-Tech Program staff also conducted a variety of outreach activities directed to industry leaders specifically within PG&E's service territory. The intent of these outreach efforts is to generate specific customer interest in energy efficiency improvement projects. Types of these local outreach efforts include (but are not limited to) the following:

- Presentations at local high-tech conferences
- Presentations at local industry events
- Attendance at local trade meetings
- Participation on industry network boards
- Presentations at PG&E seminars, hosted by Account Managers,
- Seminars on specific High-Tech technologies
- Development of the PG&E High Tech website [5]
- Direct outreach to individual trade allies, who can in turn talk to their customers about energy efficiency opportunities

[5] See www.pge.com/hightech/.

Figure 4-2: Business Development Phase



4.1.1.2 Direct Customer Outreach

In contrast to the industry outreach efforts described above, the objective of direct customer outreach and targeted marketing was to identify specific energy efficiency improvement opportunities and enroll projects in the High-Tech Program. Direct customer outreach efforts were primarily conducted by Account Managers, who serve as PG&E's "sales and services" assigned to large customers (see items E, F, and G of Figure 4-2). High-Tech Program staff also worked with customers on a one-on-one basis and are also responsible for outreach efforts that targeted customers that are:

- Mid-sized, and therefore not assigned to a PG&E Account Manager;
- New, who would not yet be assigned an Account Manager; or
- Large, who are not informed about the High-Tech program through their Account Manager

Once a customer became interested in energy efficiency, PG&E staff typically referred them to their assigned Account Manager, who discussed all potential efficiency opportunities and program services with the customer (shown as item F of Figure 4-2). As shown, all of the outreach efforts discussed thus far involved the Account Manager who decided which PG&E program aligns with a customer's interest or need.

The importance of Account Managers as the primary conduit between the Program and customers is explicitly expressed in the PIP, which states, *"The Account Representative network is a cornerstone of the Program delivery structure for high technology"* (PG&E, 2005, p. 6).

The process-mapping workshop identified the role of Account Managers as central to the development of energy efficiency projects. Account Managers were involved throughout the Business Development and Project Development phases of the High-Tech program. They played a critical role in developing customer interest in the program and providing customer feedback to the High-Tech Project Manager during the Project Development Phase.

Because Account Managers develop direct relationships with customers, they were able to generate customer interest in energy efficiency and learn about customer's efficiency needs. However, in order for the Account Manager to act on a customer's request for energy efficiency information, they needed to be fluent in PG&E's efficiency programs. This placed a large burden on the Account Managers to recognize High-Tech customers, identify and communicate efficiency opportunities, and to coordinate project development with Auditors and High-Tech staff.

Because Account Managers were often a primary source of information about the program, it was important for Account Managers to be knowledgeable about High-Tech Program offerings and have the tools and communication channels to involve the appropriate program manager or other PG&E staff to proceed with project development and review. At minimum, Account Managers needed to systematically screen their customers to determine if a data center facility exists, and if so, inform them of the benefits of the High-Tech Program.

If the Account Manager successfully directed a customer to the High-Tech Program, the Account Manager, with assistance from Auditors and Sales Engineers[6], developed an initial project scope. If an Account Manager does not direct the customer to the High-Tech Program, however, it is likely that the customer either did not receive support from the High-Tech Program or the customer received support following some delay. This is because the customer may have been directed to implement mass-market efficiency measures or directed to conduct an integrated audit, neither of which provided custom services for the unique needs of high-tech facilities.

Workshop participants identified a need to develop formal program training so that Account Managers can learn about the targeted sector program offerings and periodic updates. Insofar as an in-depth review of the interactions between the Sales and Services department with the High-Tech Program was not in the scope of this study, EMI recommends a more in-depth review of the roles and responsibilities of Account Managers, the training they receive, and the information management systems required to support their important role in PG&E's energy efficiency initiatives.

4.1.1.3 Target Market

Any discussion regarding program outreach needs to include a summary and review of the target market. According to the PIP, PG&E defined its high-tech target market to include the following facility types: biotechnology facilities, pharmaceutical facilities, electronics manufacturing and support, cleanrooms and mini-environments, data centers (including server farms), and telecommunications facilities (PG&E, 2005, p. 2). However, the customer database used to identify high-tech customers to market the program used the 2002 North American Industry Classification System (NAICS) codes[7], which traditionally defines customers by *business type*. To help get around this issue, PG&E tracks two NAICS codes for each business; NAICS1 denotes the primary activity of the business as a whole, and NAICS2 denotes the primary activity at each customer site. EMI examined NAICS2 codes, because these classifications are more likely to describe the types of facilities in the High-Tech Program's target market database.

Based upon the customer database PG&E provided to EMI for this research, the high-tech target market in PG&E's service area included businesses with a NAICS2 classification presented in Table 4-1. As shown, the target market for the High-Tech Program consisted of 38,651 customer sites, the majority of which (31,899) are associated with the telecommunications industry. While these sites may house data centers, they may simply indicate a cellular transmission site or retail storefront. Note that other industries that require data centers (e.g., financial institutions, large law firms, government) are largely absent from the database. One possible reason for this is because outside of the high-tech industry, server rooms and server farms may be "hidden" in existing facilities, and it may be more challenging to identify such facilities. According to the PIP, customer sites that contain laboratories, cleanrooms, and data centers represent approximately 18,000 customer accounts (PG&E, 2005, p.12).

[6] Sales Engineers work for the Service & Sales Group and provide engineering support to the Account Managers.
[7] See www.census.gov/eos/www/naics/.

Table 4-1: Business Classifications of PG&E's High-Tech Market [a]

NAICS2	Description	# of PG&E Customer Sites [b]
325400 - 325414	Pharmaceutical and Medicine Mfg	388
334000 - 334119	Computer and Electronic Product Mfg	716
334200 - 334290	Communications Equipment Mfg	380
334310	Audio and Video Equipment Mfg	85
334400 - 334413	Semiconductor and Other Electronic Component Mfg	1,028
334612 - 334613	Mfg and Reproducing Magnetic and Optical Media	22
515100 - 515120	Radio and Television Broadcasting	828
516110	Internet Publishing and Broadcasting	6
517000 - 517910	Telecom (Wired & Wireless Carriers, Paging, Resellers, Satellite, and Cable)	31,899
518000 - 518210	ISPs, Web Search Portals, Data Processing Services	769
541500 - 541519	Computer Systems Design and Related Services	843
541700 - 541710	Scientific R&D Services (Physical, Engineering, and Life Sciences)	1,687
TOTAL		**38,651**

a. Data provided by PG&E.
b. Each observation represents a unique service agreement for a specific building.

While NAICS2 classification provides a "first-cut" at identifying customers with high-tech facilities, it falls short of providing the program with a useful database for strategic and targeted outreach and marketing. One challenge in defining this particular target market is whether the program should target high-tech *businesses* or high-tech *facilities*. With the former, many customer sites of high-tech businesses may not contain any high-tech equipment or facilities (e.g., it could be a transmission tower, or simply an office building). With the latter, the scope of the target market must be increased to include other types of businesses that require high-tech facilities (e.g., financial institutions, large commercial office spaces that house data centers and large server farms), even though the businesses themselves are not classified as "high-tech."

EMI found that this program's target market is defined by facility type (data centers and cleanrooms) and business type (telecommunications data centers, electronics manufacturers, and biotech/pharmaceuticals companies). While such a definition might appear straightforward on paper, the evaluation team received some feedback through our interviews and discussions with PG&E staff that this target market specification is difficult for program staff and account managers to operationalize. Because of the ambiguity, some customers with high-tech facilities are not targeted by current program outreach efforts, and some customers seeking to develop an energy efficiency improvement strategy might not be referred to the High-Tech Program to address high-tech facility needs because their business type is not easily associated with what one might consider to be "high tech." A clear target market and associated strategic marketing plan will minimize the occurrence of such lost opportunities and contribute to the scalability of this program.

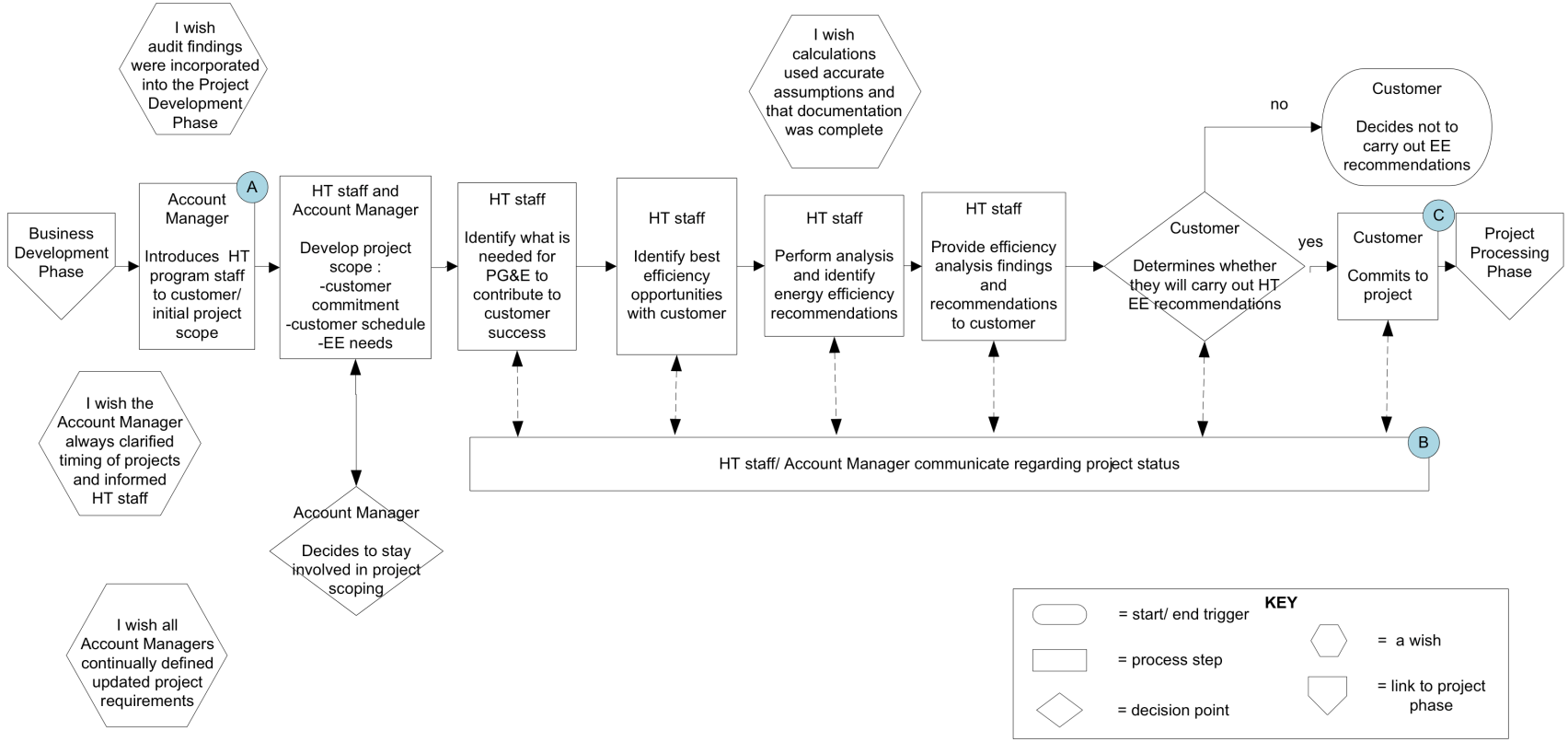
4.1.2 Energy Efficiency Project Development

Once the processes represented in the Business Development phase have succeeded and a customer is interested in developing a High-Tech project, the specific project details need to be defined. This is accomplished during the Project Development Phase, depicted in Figure 4-3. Once an initial project scope was identified, the Account Manager introduced the customer and their project to a High-Tech Project Manager. There may be some instances when a customer could begin defining a project with a High-Tech staff person and then circle back to the Account Manager to inform them of the project. This would have happened, for example, if the customer approached High-Tech Program representative at an industry event and wanted to begin developing specifications for an energy efficiency improvement project.

As denoted by item A of Figure 4-3, the High-Tech program staff worked with the customer and Account Manager to develop the scope of work and identify specific energy efficiency measures. Once finalized, the High-Tech staff, or contract engineer, conducted a customized energy analysis to identify cost-effective energy efficiency opportunities and talk to the customer about their findings.

Figure 4-3 illustrates that the High-Tech staff and the Account Manager were continually communicating with each other regarding the customer's schedule and the project status, shown as item B. This communication was critical to making sure that a project was aligned with the customer's needs. If the customer decided to implement the recommendations, the application and energy analysis were submitted for review (item C). Once this happens, the Project Processing Phase began, whereby a customer's application was reviewed and approved or rejected, and the customer received an incentive payment after successful project completion.

Figure 4-3: Project Development Phase



4.2. PG&E Staff Involved in the High-Tech Program

The process-mapping session showed that PG&E staff outside of the High-Tech Program were key to successful marketing and processing of High-Tech efficiency projects. Staff involved in the Business Development Phase of the High-Tech Program were particularly important because they helped generate customer interest in the program. Other PG&E staff involved in the Business Development Phase of the High-Tech Program were associated with PG&E's Emerging Technology Program, the website department, marketing department, the on-site auditors (including third party audit contractors), Sales Engineers, and most importantly the Account Managers. As shown on the process map (item G of Figure 4-2), all projects are channeled through Account Managers, who played a critical role in identifying efficiency opportunities and understanding the customer's schedule and capital improvement plans

EMI identified several circumstances where roles for the aforementioned staff in the delivery of the High-Tech Program were not well defined. This results in multiple staff performing similar activities. For example, Sales Engineers and High-Tech Program staff both conducted savings analysis to support development of the application package. High-Tech staff were also involved in tracking the status of rebates once an application was submitted, which was one responsibility of the Integrated Processing Center (IPC) performs as well.

EMI also found evidence of misaligned goals and performance objectives across the variety of staff involved in the High-Tech Program implementation. For example, High-Tech program staff have reporting and production responsibilities, while other departments (such as marketing) do not appear to have similar requirements associated with the High Tech program, specifically. While it is not logical to develop identical performance metrics that are identical across PG&E's organization, it is prudent to establish performance metrics for each department involved in program outreach, marketing, and project development so that are aligned with the same program outcomes.

Conversations during the process-mapping workshop and follow-up interviews identified the following opportunities to improve coordination efforts between departments.

- Provide training to Account Managers, Sales Engineers, and Auditors to improve their knowledge of HT Program measures.
- Increase communication and project tracking between departments.
- Share resource documents such as measure documentation, engineering calculations, and audit findings between staff.
- Prior to the Project Development Phase, conduct a meeting with the customer, engineers, sales staff, application review team, and project managers.

The need for increased coordination between departments was also discussed during interviews with market participants, who suggested that Account Managers with specific technical

knowledge of data centers would be better able to engage clients in the PG&E program for high-tech facilities. Specific knowledge that would be beneficial includes:

- Server Specifications (i.e. ENERGY STAR specification, virtualization and multi-core processor technology)
- Knowledge of power and cooling requirements for data centers, as opposed to typical commercial facilities (hot/cold aisle, constant demand, mission critical nature, etc.)
- Enter/participate early in the design process so that custom/calculated measures can be suggested along with other appropriate incentives.
- Market the program and benefits to owners, designers, and engineers.
- Make sure owners, designers, and engineers are familiar with PG&E program offerings.
- Anticipate a wall between Facilities Managers and IT Managers.
- Showcase models of efficient data centers, making use of best practices.

Given the above, consideration should be given to a team approach, whereby the Account Manager has access to experts (internal or contracted) who have the specialized knowledge and can take them on customer calls, when appropriate, to discuss data center/high-tech facility energy efficiency opportunities. A number of the market participants interviewed for this evaluation indicated that the program would benefit from early project involvement by PG&E representatives to promote the calculated or custom program incentives for the High Tech market.

4.3. Comparison of Program Delivery with Program Implementation Plan

One overarching objective of this process evaluation was to determine the extent to which the program was implemented as intended, according to the approved PIP. This subsection summarizes the program activities defined in the PIP (described in Section 2), with how the program was actually implemented, (as described in Section 4.1). Any discrepancies between the two could mean that (1) the program theory was appropriate but implementation was not aligned with the theory, leading to lost opportunities, or (2) the program theory was flawed in some way and what was initially planned may need to be revised. One explanation for any discrepancies between program implementation and program theory could be that there are some organizational/institutional barriers that prevent the current theory from being realized.

Table 4-2 compares the program activities specified in the PIP with actual program implementation. EMI's analysis of program implementation showed that the High-Tech Program was able to provide deemed and calculated incentive services to interested customers, which allowed the program to achieve it's primary outcome – to induce energy savings and peak demand reduction. PG&E also succeeded in it's industry outreach efforts and is, in fact, considered to be an active participant and leader in facilitating energy efficiency research in the

high-tech sector. The program was somewhat effective at establishing effective education and training services and was considerably less effective at integrating with other programs external to the energy efficiency portfolio.

Table 4-2: Comparison of PIP and Program Implementation

Program Element	Fully Executed	Partially Executed	Not Executed
Education and training to customers:			
Best practices design guidelines	X		
Perform audits		X	
Commissioning and retro-commissioning		X	
Technology demonstrations		X	
Benchmarking			X
Develop a clearinghouse for program information			X
Deemed incentive offerings	X		
Calculated incentive offerings	X		
Coordination with Demand Response Program			X
Coordination with Distributed Generation Program			X

"Not Executed" means that evaluators found no evidence that the activity was occurring. It is possible that such activity was implemented but not discussed with evaluators.

In general, program activities were delivered when staff was able to develop efficiency projects with interested High-Tech customers, and when staff were able to independently attend industry events to build efficiency awareness throughout the industry. The Program also succeeded at publishing best practices design guidelines for energy efficient data centers (PG&E, 2006). Program objectives that were partially implemented include technology demonstrations and commissioning/retro-commissioning. Although technology demonstrations were completed, they were conducted through the Emerging Technology Program, not the High-Tech Program (Ecos & EPRI, 2008; Ganguly, Shehabi, Tschudi, & Gadgil, 2009; Shehabi, Tschudi, & Gadgil, 2007). While the Emerging Technology Program demonstrations are useful, fully implemented technology demonstrations would include case studies at customer sites that could then be used to market the program to new customers.[8] Commissioning/retro-commissioning was also partially implemented. Although four retro-commissioning pilots have been completed, these projects were all implemented with one single customer, and thus do not represent program processes in general. Once commissioning and retro commissioning become standard procedure or at least more frequent aspects of the High-Tech Program, then this aspect of the program can be considered fully implemented.

Staff were least able to implement program activities when they had to rely on coordinating efforts with non-program staff. Institutional barriers, such as limited project tracking capabilities and informal coordination efforts, made it difficult for staff to work with other teams to identify opportunities (new customers and/or new projects) and to develop outreach materials.

[8] Silicon Valley Power, the municipal utility serving the City Of Santa Clara, in the heart of Silicon Valley, has developed a successful "live" demonstration through its Data Center Optimization Program. See: http://www.siliconvalleypower.com/bus/?sub=rebatedata or http://www.quest-world.com/datacenters-svp/

Additionally, as noted previously, because the program lacks a strategic marketing plan and the target market is not clearly identified, some customers with high-tech facilities were not being targeted with current High Tech outreach efforts.

Because some of these activities are not being delivered, there is potential for lost opportunity to develop new projects. As described in the PIP, because the high-tech market is large and varied, diversified program activities are required to meet the various needs of the market. Removing institutional barriers so that multiple departments within PG&E's organization can work together efficiently and have access to the same information could enable more effective program delivery. A strategic approach to program outreach and project development will better enable the program to sustain its success and meet increasing goals.

4.4. Summary of Critical Pathways and Information Needs

At the end of the process-mapping workshop, participants were asked to identify the most critical information and processes that they required to successfully perform their job responsibilities. Collectively, the group's responses helped the evaluation team identify critical pathways and information needed to optimize internal processes for effective program delivery.
As shown in Table 4-3, critical milestones include developing new measures, performing outreach, developing customer interest, scoping the project in light of customer's needs, and customer decision points. Each critical process step is dependent on a number of different PG&E staff, including High-Tech and non-High-Tech staff and resources. Without successful coordination and information management (tracking and information transfer), some of these critical steps cannot be completed successfully (or efficiently).

EMI found that program implementation is effective and efficient when involved staff have access to the critical information they need in a timely fashion. Unfortunately, the process can easily break down when the critical data or information is not produced when needed. EMI found evidence of some lost opportunities – generally when the preparation of project documentation (including energy analysis) was delayed, and the customer could not delay their project schedule. While these successful individuals should be commended, the program, as it is currently operating, is dependent on specific individuals. It is important to establish an infrastructure involving the proper documentation and effective access to and transfer of information, so that the program can move beyond depending on specific individuals and instead foster a strong foundation and program delivery network that is not only scalable but that also enables more effective internal alignment and integration.

Table 4-3: Critical Information and Process Points

Critical Process Step	Involved PG&E Staff	Critical Information & Data	Rationale
Develop new measure specifications & incentives.	High-Tech staff, Acct Mgrs, Sales Engineers, Auditors, Website Mgrs, Technical Reviewers	New measure documentation	When new measures are developed, Program staff rely on documentation to support marketing efforts and engineering calculations.
Develop customer interest in the program through support from the customer service group.	Website Mgrs & Acct Mgrs	Training documentation (policies, procedures, tools; a system that allows for measurable and track-able outreach data)	Outreach efforts are critical to developing new projects. Staff rely on program documentation to stay informed on current program offerings.
Establish project scope.	High-Tech staff, Acct Mgrs, Auditors, Sales Engineers	Customer and project requirements	PG&E staff, who rely on key customer information to determine their needs, initially scopes projects out.
Affirm customer interest in a particular High-Tech project.	High-Tech staff, Acct Mgrs, Auditors, Sales Engineers	Customer schedule and PG&E application review timeline	When a customer shows interest in developing an energy efficiency project, PG&E staff need to align the project development and application submittal with the customer's project timeline.
Confirm customer participation in the High-Tech program.	High-Tech staff, Acct Mgrs	Project calculations and report (must be available at the appropriate timeline in the customer's decision making process)	A key step in the process is when the customer decides to participate in the program. This decision is only possible once a customer has reviewed the energy analysis findings and recommendations.
Customer submits the incentive application.	High-Tech staff, Acct Mgrs	Application & documentation from the energy analysis	Customer participation is not final until PG&E receives an application from the customer. To complete an application, the customer or customer representative needs

4.5. Integration with the Nonresidential Audit Program

As stated in the PIP, the High-Tech Program sought to offer energy audits as part of its education and training services. Interestingly, the PIP did not explicitly state that energy audits would be used as a stepping-stone for identifying customers with cost-effective efficiency improvement opportunities. In other words, energy audits were not specified as a strategic marketing tool to increase program enrollment, despite the fact that customers with high-tech facilities that participate in the Nonresidential Audit Program (NRA) should be considered *prime candidates* for the High-Tech Program (or any other incentive program, for that matter). EMI paid particular attention to the extent that the Program coordinated with the NRA Program – and the Integrated Audits, specifically – to identify opportunities, the extent to which audits increased participation in the High-Tech Program, and the overall quality and usefulness of the audits to customers who participated in the Program.

Of particular interest in this research is the means by which NRA participants were referred to the High-Tech Program, if in fact the audit identified an energy efficiency improvement project that would be covered by the High-Tech Program. Results of the process-mapping workshop revealed that sometimes Account Managers referred high-tech customers to the NRA Program (for an Integrated Audit, specifically). In such cases, it was very rare, if ever, that the integrated audits identified efficiency opportunities in high-tech facilities. Instead, audit participants were traditionally directed to other efficiency programs with more "standard" efficiency measures (such as the Mass Market prescriptive program). EMI considers this a lost opportunity when High-Tech efficiency opportunities exist. At the time this report was developed, PG&E was in the process of developing a plan to better coordinate the NRA Audit program with the High-Tech Program to identify facilities that should be directed into the High-Tech Program.

Again, EMI focused a substantial portion of our customer interview guide on customers' experiences with the NRA Program's Integrated Audits. Customer feedback regarding the audits can be used to inform audits that can be targeted to high-tech facilities. An energy audit of high-tech facilities can serve a crucial role for the High-Tech Program by identifying energy efficiency opportunities that are specific to the high-tech sector. Customer perceptions on the usefulness of the energy audit and its usefulness are summarized below.

High-Tech Participants' Receptiveness to Energy Audits. Eight High-Tech Program participants who had not had an audit conducted were asked whether an audit would have been helpful to them. Participants were split as to whether an audit would have been helpful: three said an audit would have been helpful, three said it would not have been helpful, and two were not sure. Of those who said an audit would have been helpful, there was still hesitation. One respondent said that he would *"need to have a compelling case to undergo an audit. I would need to balance it with my immediate needs."* Another said, *"I've had audits performed in the past, but they don't include the server rooms. It would be helpful to have someone come in and discuss efficiency options for the server rooms."* Finally, another participant said, *"It would have been helpful to identify other efficiency opportunities throughout the building because we have a green policy. Any help is welcome."* Clearly, participants are receptive to energy audits that will help them identify real solutions that are specific to the data center.

Nonparticipants' Likelihood of Having an Audit. Nonparticipants who had neither participated in the High-Tech Program nor received an audit were asked how likely they would be to have an audit performed at their facility within the next two years. Seven of the twelve respondents were either somewhat or very likely to request an audit. Four customers said they were not at all likely to have an audit conducted at their facility, and one was not sure. Three out of the four customers who said they were very likely to have an audit in the next two years were unaware of this service before the interview. As one customer explained, *"I wasn't aware of these services, but if it's free, I would absolutely be interested in an audit. I would probably like to do this at the large data center and then, if successful, do the same at the hub sites."* Another notable response came from a customer who indicated they were somewhat likely to have an energy audit: *"I would participate if PG&E had something to offer data centers."* The customers interviewed for this study are quite open to the idea of energy audits, but they are

either entirely unaware that audits are available through PG&E, or they do not believe the audit will be relevant for the specific needs of data centers or server rooms.

Table 4-4: Nonparticipant Likelihood of Participating in Nonresidential Audit Program

Likelihood of Participating in Audit within Two Years	Frequency of Response
Not at all likely	4
Somewhat likely	3
Very likely	4
Not sure	1

Audit Comprehensiveness. Twelve of the customers we spoke with had received energy audits. When asked about the comprehensiveness of the audit, most customers said the audit was quite comprehensive, covering all aspects of the facility including data center and/or cleanroom space. Some customers chose to focus the auditors' attention on specific areas of the building. For example, one customer said that his company had already focused on energy efficiency in the cleanrooms, so they did not have the auditors walk through those spaces. One customer mentioned that the audit of the data center *"covered power usage, not on a granular level, but on a high level; they didn't actually go through the systems components and efficiency of mechanical systems, but had a more high-level view."* In this case, the auditors did not identify measures such as more efficient servers or virtualization software.

Usefulness of Audit Reports. Of the 12 customers who had received an energy audit, 10 indicated they received an audit report. The evaluation team asked these customers how useful the audit report was for them. Five participants said the audit report was useful, informative, or helpful. One customer, however, explained that the auditor did not quite understand everything about their business (CD manufacturing), and there were some errors in calculations due to this inexperience. Although this was the only report of incorrect calculations, another customer mentioned that the audit did not have relevance for their business (television station), suggesting that the audit process might need to be examined and fine-tuned for each specific type of high-tech industry. Another participant did not find the audit report helpful because they were already aware of all the recommendations prior to the audit, and the audit results did not provide them with any new information. Even though the audit report may not tell customers information they did not already know, there was the sense that for at least two customers, the audit reports helped them prioritize their energy efficiency projects.

Influence of the Audit on Program Participation. During the in-depth interviews, the evaluation staff queried High-Tech Program participants who also had received an energy audit regarding how influential the audit was on their decision to implement a project and apply for incentives from PG&E. Four of the seven respondents explained that the audit had influenced them to apply for incentives. These participants mentioned that the audit allowed them to get a budget approved and that it helped identify energy savings they had not considered. Three participants said it did not influence their participation; participants would have replaced the equipment without incentives, or the audit did not give them any new information.

Audit participants were asked what suggestions they had for improving the energy audits provided through the program. Two customers suggested that PG&E provide better program support, such as information on area vendors and contacts to implement the audit recommendations. This may be especially useful for decision-makers who are outside of PG&E's service territory who may not be aware of local vendors. One customer suggested offering a temporary discount on the electric rate (until payback period is achieved) in exchange for implementing audit suggestions. In other words, the customer would pay for the project cost up-front, and then receive discounted electric bills to result in quicker payback. Although the customer was not asked about on-bill financing, presumably, such an option may also influence the implementation of audit recommendations. Alternatively, the same customer suggested simply increasing the incentive level to make recommendations more achievable. Two other customers did not offer any suggestions for improvement, explaining that the audit and report were thorough, comprehensive, and well written.

In summary, the energy audits seem useful for influencing participation in the program. However, audits must be made worthwhile for high-tech customers, and be specific to their facility to be successful in increasing program participation.

4.6. Overall Participant Satisfaction with the High-Tech Program

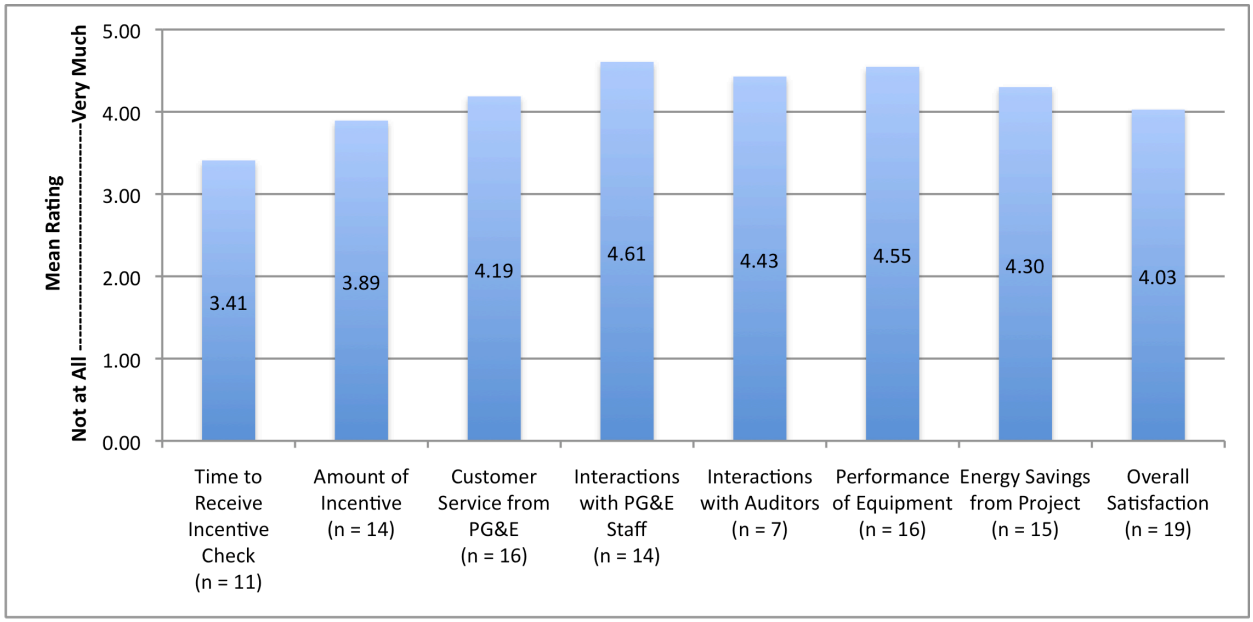
Although the process-mapping workshop provided information regarding room for improvement, staff feedback is only one part of the picture. It is also important to get customer feedback regarding program delivery. Thus, during customer interviews, EMI staff asked participants were asked to report their satisfaction with various aspects of the program. For each aspect, participants rated their satisfaction from 1 ("not at all satisfied") to 5 ("very satisfied"). Average satisfaction ratings for various aspects of the program are shown in Figure 4-4.

In general, participants were quite satisfied with the program. They were most satisfied with their interaction with PG&E staff. One respondent said he was *"happy with the way they follow up, make their presence known without being too pushy or annoying. It helps that they follow up if they haven't heard from you in a while."* Another respondent mentioned he had a good relationship with the PG&E account representative, who was *"always helpful."*

This was echoed when participants were asked to rate their overall satisfaction with the program. When asked to explain their rating, five participants spontaneously gave praise for their account representative, mentioning their attention to detail, diligence, and level of support. One participant went so far as to say, *"I just can't say enough about the relationship established with my rep. I don't think I've ever brought anything to PG&E's attention that I didn't get a positive response."* The account representative-customer relationship was a key to satisfaction for several participants.

In general, participants were least satisfied with the time it took to receive their incentive check. One participant said it took *"about one year to receive the funds."* Another mentioned that he had to *"go back and forth twice with PG&E"* because he *"forgot to sign on a certain line."* Another said the process of receiving incentives is *"always slow"* and that it is *"very rare that it turns around very fast."*

Figure 4-4: Average Participant Satisfaction Ratings



While customer interviews did reveal room for improvement, responses to the program were generally very positive. Customers are appreciative of PG&E staff and they are generally satisfied with the equipment and resulting energy savings. If anything, PG&E should focus on improving the consistency of these aspects of program delivery. Improvements in inter- and intra- departmental coordination and information tracking will make great strides toward improving the consistency of program delivery.

5. MARKET SUMMARY

This section presents the results of customer and market research activities described in Section 3. While Section 4 focused primarily on the internal program delivery, this section provides an assessment of the High-Tech Program from the perspectives of customers and other market participants involved in the industry. The research activities that EMI conducted in support of this effort included in-depth interviews with PG&E customers, PG&E staff, and key market participants who influence high-tech facility design and operations. This section begins with an overview of data center market interactions, and follows with a characterization of key influences of high-tech customers' decisions regarding equipment specification. This section concludes with insight from key market participants involved in high-tech facility design and operations (data centers, in particular).

5.1. Data Center Market Interactions

To explore potential program marketing channels, the evaluation team gathered information regarding data center market interactions and decision processes. This information is important for locating points of contact that can be used to market the program. In particular, insight obtained through the in-depth interviews with customers and market participants helped the evaluation team construct a network diagram to illustrate interactions among high-tech industry businesses, contractors, designers, and other stakeholders. Figure 5-1 illustrates the flow of information and influences among those involved specifically in the specification and design of HVAC equipment in data centers. This figure is not meant to be exhaustive, but rather provides a general overview of PG&E's relationship, or potential relationship, with various types of professionals involved in data center equipment and decisions that ultimately affect facility energy use.

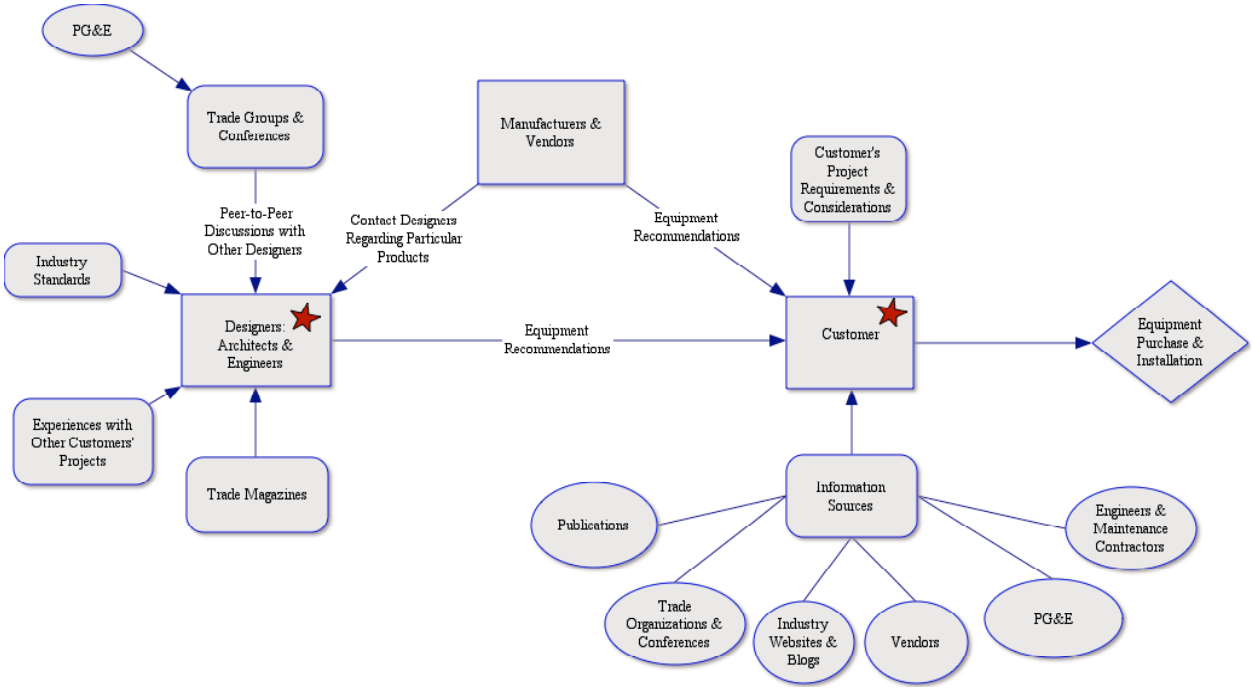
A major influence on equipment and design decisions comes from engineers and architects who are able to make equipment recommendations directly to the customer during the project design and development phases. These designers in turn get their information from a variety of sources, including vendors, trade magazines, industry standards published by ASHRAE and Leadership in Energy and Environmental Design (LEED), various professional organizations, as well as prior experience with other projects. Vendors are also able to influence customers directly, both prior to starting a project, and once equipment selection is underway. These findings are not unlike those of more detailed market characterizations of other markets conducted over the years.[9] Engineering and other design contractors play a prominent role in project design and specification development, and they are sometimes the sole decision maker (on behalf of the customer). As such, they have the unique opportunity not only to inform customers about the

[9] See CALMAC's publications database at www.calmac.org for examples.

availability and benefits of energy efficient equipment, but also to inform unaware customers about services and financial incentives available through PG&E programs.

Customers also base their decisions on project requirements and considerations that may be unique to high-tech customers (discussed below in Section 5.2), and they may consult various sources of information (shown in Figure 5-1: D, in no particular order) such as trade journals, industry-specific websites, and PG&E. Some of the unique considerations for high-tech customers can be barriers to energy efficiency improvements (also discussed below).

Figure 5-1: Data Center Market Interactions



5.2. Decision Influences

A sizeable portion of this research effort focused on characterizing high-tech customers' decision influences regarding the selection and installation of energy efficient equipment. The purpose of this effort was to identify both marketing opportunities and barriers. Understanding how energy efficient equipment gets from the manufacturer to the customer is valuable for identifying points of influence where marketing strategies may be especially useful. Understanding barriers to energy efficiency in this market segment will enable PG&E to strategize regarding how to leverage marketing strategies to address such barriers. Much of the recent literature regarding data center efficiency describes barriers to energy efficiency faced by this industry. The in-depth interviews conducted for this research confirm these findings.

5.2.1 Project Requirements

Customers were asked to report the top project requirements to consider when their organization was planning a major renovation, replacing equipment, or building a new facility. Table 5-1 lists the requirements that were mentioned, and the number of respondents who vocalized each one. Notably, 16 of the 27 respondents indicated that energy or energy efficiency was in their top four or five project requirements. (We acknowledge the likely presence of "social desirability" response bias due to the focus of the interview.) Ten of these respondents reported that energy or energy efficiency was either their first or second project requirement or consideration. Six respondents indicated that reliability was one of their top requirements, with half of these respondents indicating that reliability was their number one concern. Six customers said that payback or cost effectiveness was in their top four or five project requirements, with two indicating that this was their top priority.

Table 5-1: Priorities of Equipment Selection and Facility Design Decisions

Requirement or Consideration	**Mentioned as One Decision Factor** (n=27)	**Mentioned as *the* Top Priority** (n=27)
Energy or Energy Efficiency	16	4
Reliability	6	3
Payback or Cost Effectiveness	6	2
Initial Cost	5	2
Lifecycle Cost	5	1
Flexibility, Expandability, or Allowance for Growth	5	2
Performance of Equipment	4	3
Security	4	1
Redundancy or Backup	3	1
Timeline	3	1
Uptime	2	2

Understanding customers' project requirements is important for assisting with the development of marketing messages and program delivery. These responses suggest that messages should not only include information about energy efficiency and cost, but be designed to specifically address customer concerns and uncertainty regarding the reliability and flexibility of equipment.

5.2.2 Facility Design and Equipment Specification Decision Process

Through the in-depth interviews, EMI examined influences on decision-making for energy-intensive equipment and systems design. This included determining the types of individuals within the company and under contract who are responsible for such decision-making.

Involvement of Facilities and IT Staff in Decision-Making. Another notable result of this research is the range of individuals who are responsible for and involved in the process of selecting energy-intensive equipment for data centers or cleanrooms. As shown in Table 5-2, it

was common for different individuals to be responsible for the data center and for the remainder of the building; this was the case for 19 of the 36 data center respondents. For example, facilities managers were often responsible for maintaining HVAC equipment, while network administrators or datacenter operations staff were responsible for selecting equipment in the datacenter. Another situation in which different individuals would be responsible for HVAC and IT equipment is the case of colocation providers and real estate or property managers. Colocation providers and property managers are responsible for HVAC system decisions, while colocation customers and tenants are generally responsible for selecting their own IT equipment. The same person was responsible for both HVAC and IT equipment (e.g., a colocation provider that maintains servers for their customers) more frequently when the data center was the core of their business (as would be the case for a stand-alone data center, for example). The facilities manager and facilities operations and maintenance team is not necessarily solely responsible for making equipment-related decisions, as is often the case for a typical commercial office building. Often, IT managers or Chief Information Officers are the decision makers for equipment used in the data center or server room. This is an important distinction and should be taken into consideration in the program marketing strategy, as different messages will resonate with those responsible for facilities operations and maintenance compared to those responsible for information technology.

Table 5-2: Decision-making for HVAC and IT Equipment

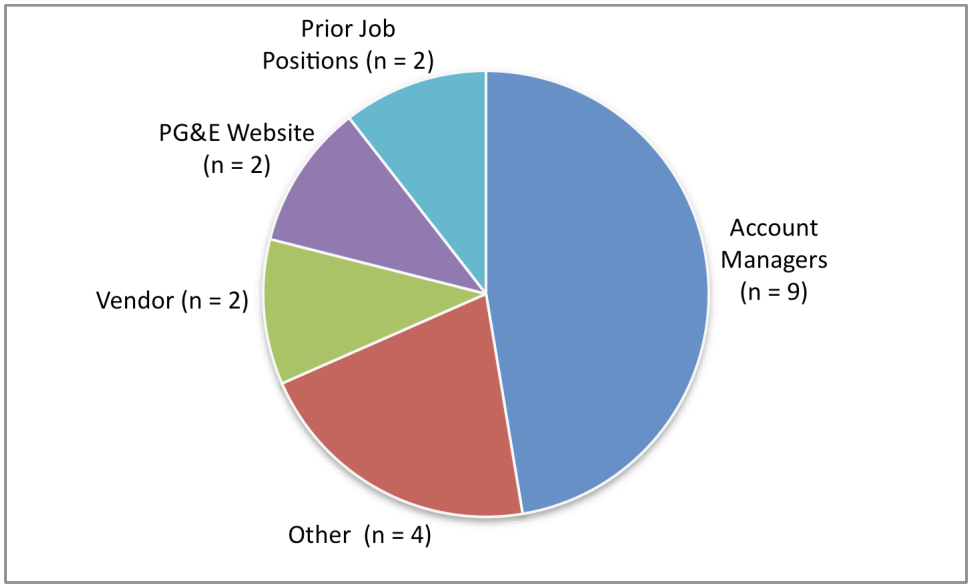
Decision Makers	Number of Interviewees
Separate Decision Makers for Facilities and IT Equipment	19
One Person Makes All Equipment Decisions:	
Facilities Manager or Engineer	11
Network Administrator, Lab Manager, or other IT Staff	3
Energy Manager	2
President or Vice President of Company	2
Corporate Office	1

Influence of Designers, Vendors, and Contractors. EMI asked customers who outside the company influenced the decision process. In an unprompted response, 10 customers explained that outside consultants and contractors influence equipment selection to some degree. One customer explained that they usually work with mechanical and electrical engineering companies and states that they *"leave it up to them [engineering contractors] to suggest equipment that supports their requirements and is energy efficient."* Another customer explained that *"contractors and engineers are the ones looking at new products – they recommend which products I should buy."* Additionally, six customers stated that vendors or manufacturers influence their decision-making when selecting or installing equipment. Clearly, engineers and architects are in a unique position to advise customers regarding energy efficient products and equipment. Furthermore, contractors, and to some extent, vendors, may be in a position to inform customers about opportunities for participating in the High-Tech Program.

5.2.3 Information Sources

To investigate which sources customers rely on for information regarding their facility's energy use and energy efficiency opportunities, EMI queried customers about how they first learned about energy incentives for businesses available from PG&E. As shown in Figure 5-2, about half of participants learned of the program through their PG&E Account Managers, staff that manage large C&I customer accounts. (Other ways of learning about the program included prior job positions held by the customers, the PG&E website, and vendors.)

Figure 5-2: Sources of Program Information

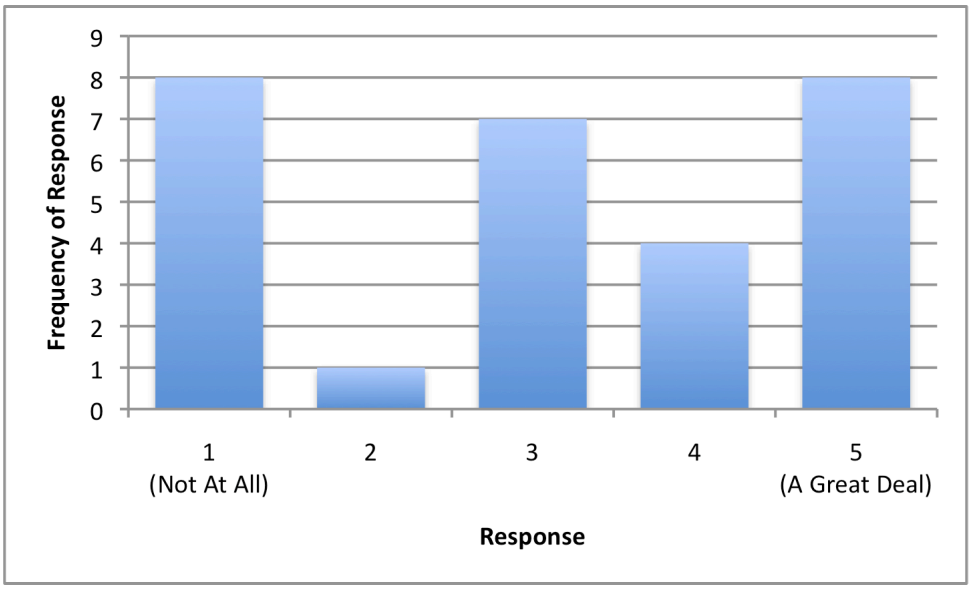


Out of 35 responses, 30 customers reported that they had a PG&E Account Manager assigned to their business. Four interviewees were unsure, and one said the their business did not have an Account Manager. When asked whether he had an assigned Account Manager, one respondent replied, *"In theory, but the person changes every time I talk to them."* Given the importance of the Account Manager-customer relationship, this issue of revolving Account Managers should be further investigated.

Customers were also asked how much they rely on their Account Managers for information regarding energy efficiency. On a scale of 1 (not at all) to 5 (a great deal), the average response was 3.2. As shown in Figure 5-3, responses covered the entire range, with many participants providing a rating of either "1" or "5." One customer said, *"[I] call them throughout the year to learn about changes in our rate, and we always talk about energy efficiency as a means to lower our rate."* On the other hand, another customer said, *"I do not talk to [my Account Manager] about energy efficiency. I don't need to; I can get all updated rebate info from the [PG&E]*

website." In general, High-Tech participants tended to rely on their Account Manager somewhat more than nonparticipants.[10]

Figure 5-3: Customer Reliance on Their Account Manager for Energy Efficiency Information



During the in-depth interviews, customers were also asked to describe the information sources that they regularly consult, read, or subscribe to in order to stay informed of events, issues, or new products relating to their profession. As shown in Table 5-3, industry publications, organizations, and conferences were mentioned by over half of the respondents. Interestingly, PG&E was mentioned on only 9 of the 38 mentions. This result indicates that PG&E should consider more deliberate marketing and outreach through trade publications and industry organizations to increase (and maintain) awareness of the program. The most common resources for each type of information source are listed in Table 5-4.

[10] The reader is reminded that statistical significance tests were not conducted due to small sample sizes. Differences discussed should be regarded as trends only.

Table 5-3: Primary Information Sources

Source	Number of Mentions
Publications	23
Trade Organizations, Conferences	21
Websites, Blogs	12
Vendors	9
PG&E	9
Engineers & Maintenance Contractors	6
Internal Communications	3
Other	2

Multiple responses accepted.

Table 5-4: Common Resources for Information

Publications
Broadcast Engineering Magazine
International Facility Management Association (IFMA) Magazine
TV Technology Magazine
Building Operating Management Magazine
The BOMA Magazine (Building Owners and Managers Association)
Trade Organizations, Conferences
Building Owners and Managers Association) (BOMA)
Critical Facilities Roundtable
Data Center Dynamics
International Facility Management Association
National Association of Broadcasters
AFCOM
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
Uptime Institute

Table 5-5 summarizes the sources of information participants received prior to participation. The most common sources of information about the Program were PG&E staff and the PG&E website.

Table 5-5: Source of Energy Efficiency Information Received Prior to Participation

Source of Information Received Prior to Program Participation	Frequency of Response
PG&E Account Manager or Program staff.	6
PG&E website	4
Don't know	2
Brochures	1
LBNL report	1
PG&E training classes	1
PG&E publications	1

Those who received information about the Program prior to participation were asked how relevant the information was for their business. Eleven participants rated the relevance of information they received on a scale of 1 (not at all) to 5 (very relevant), and the average rating was 4.1. Most Participants thought that the information they received was relevant. As one participant said, *"Any way to save money is relevant."* Another said, *"There is a wealth of information [on the PG&E website] so that you can understand what programs there are."* Still another participant, who gave a rating of "4," said, *"We are in [computing] labs, so we don't have all the same issues as datacenters."* This participant explained they had received information about the Program via a LBNL report, and also through PG&E at trade conferences. Another participant said, *"I haven't seen any marketing materials."*
Finally, participants were asked how they would improve the information or materials that they received. Some notable responses are provided below:

> *"It was fine the way it was. We did what we could do with things that applied to us; we made modifications where we saw fit."*
>
> *"Include more examples of current projects that have happened [to] convey… that it would work."*
>
> *"Always include the numbers/models and efficiency comparisons."*
>
> *"A less complicated process for smaller projects would be helpful."*
>
> *"There could be an input field [on the website or online tool] to say what project you are working on, [and] it could return what programs exist."*
>
> *"Target our industry (pharmaceuticals) more clearly, [and give] examples of savings and rebates."*

Customers interviewed for this study indicated they would benefit from "real world" examples of success stories, and that energy efficiency information would be more effective if it was tailored to their business. Case studies are considered to be a successful marketing tool, particularly for niche markets and large commercial or industrial customers that face significant barriers or have specific energy use requirements. Case studies are also a successful tool for illustrating high performance design of new construction projects. Interestingly, discussions with PG&E staff

during the process-mapping session and follow-up interviews revealed (real or perceived) institutional barriers (primarily associated with the time involved in obtaining legal rights) to publishing such case studies.

EMI asked nonparticipants what the best way was for PG&E to inform them of program opportunities. As summarized in Table 5-6, the most common response was that customers would like to receive information regarding program offerings through the postal mail or bill inserts. One customer noted, however, *"The PG&E mail goes to headquarters, which is not located at this facility. The mail would have to be sent to me."* Email and direct contact with the Account Manager (in person, telephone) were also common responses. One respondent explained that they preferred to be contacted by staff other than the Account Manager, stating, *"I would love to have a technical person from PG&E talk to me about energy efficiency opportunities."*

Table 5-6: Preferred Contact Methods for Receiving Program Information

Information Channel	Frequency of Response
Mail (including bill inserts)	5
Email	4
Account Manager	4
Phone	3
PG&E Technical Staff	1

Responses were received from 10 nonparticipants. Multiple responses from each customer were provided.

5.3. Summary of Barriers to Energy Efficiency

Understanding customer barriers to energy efficiency is a crucial element to crafting effective communications and messages about energy efficiency and program opportunities that target the high-tech sector. EMI investigated barriers to energy efficiency through the interviews with architects and engineers involved in data center design, and to a lesser degree through interviews with customers and secondary research.

The unique equipment requirements of data centers and server farms are largely due to the fact that they are *critical facilities*. By "critical facilities," we mean those that are essential to the functioning of a business or organization. Data centers are considered critical facilities because their failure could result in harm to businesses that count on them for data storage and communication. The very nature of critical facilities appears to be the most significant barrier to energy efficiency improvements. Interview respondents explained that critical facility upgrades require specific project requirements and considerations that are different from those of other a standard commercial office building, for example. In particular, projects involving the construction or retrofit of a data center or server farm place high importance on the following:

- Reliability,
- Redundancy,
- Uptime,
- Security, and
- Flexibility for expansion.

The interview respondents emphasized that those involved in identifying and developing energy efficiency improvement projects must be well versed in these special requirements for two reasons. First, a high knowledge level helps gain trust and adoption on the part of customers whose main priorities are not likely to be energy efficiency. Second, designers who are aware of potential issues and complications that certain types of equipment may present in the data center will allow for customers who do proceed with energy efficient measures to maintain that trust once it is gained. In other words, a designer who is not aware of unique data center requirements may inadvertently recommend procedures or equipment that will ultimately reinforce the original hesitations or fears on the part of the customer.

Market participants interviewed for this study gave specific examples of unique considerations for equipment specification in high-tech facilities. These specifications require detailed knowledge, experience, and finesse when working with data centers. Examples of special considerations for data centers include (but are certainly not limited to):

- Some cooling systems have the potential to negatively impact the advanced fire suppression systems found in data centers.
- Without a thorough understanding of the system as a whole, the use of free cooling/air side economizers in conjunction with more standard HVAC or CRAC (computer room air conditioning) systems may present adverse effects on efficiency.
- While servers may operate well at higher temperatures, network switches and cabling may have lower operating ranges. Additionally, as mentioned above, a potential concern is the impact of a cooling system failure on sensitive IT equipment running near the top end of the temperature range.

Because of these unique considerations, high-tech customers may have other priorities or misconceptions that present as barriers to selecting energy efficient equipment. Interestingly, while the high-tech industry is interested in new developments, customers do not tend to be early adopters because of the potential risk (or perceived risk) that the servers housed in the data center or server farm will overheat or fail. As one market participant described, *"No IT people get fired for not saving money, but they can get fired if their systems go down."*

Barriers to adoption of energy efficient equipment among high-tech customers include:

- Because of the importance placed on uptime, reliability, and redundancy, IT staff may be particularly likely to discount trends in efficiency.

- In turn, IT personnel are likely to be "change averse" with regard to cooling the data center.
- Initial costs for installing efficient equipment in data centers may be unusually high.
- Power requirements change rapidly, making equipment specification especially challenging.
- Given the amount of market expansion and demand, there can be long timelines for procuring data center HVAC equipment.[11]
- Communication between facilities and IT departments is often lacking (also see Brown, 2008).

High satisfaction ratings of those who have participated in the program suggest that high-tech businesses are receptive to energy efficiency in data centers; the key is to first gain customer trust by demonstrating awareness of their primary concerns and project requirements.

[11] This was the case as of August/September, 2008 when the market participant interviews were conducted. It is unknown whether the economic downturn has since shortened these timelines, or whether this industry is resilient to the recession.

6. REVIEW OF PROGRAM TRACKING AND INFORMATION MANAGEMENT

This section summarizes the tracking and information management needs assessment of the High-Tech Program. In the context of this effort, "program tracking and information management" refers to the *creation, maintenance, availability, and use of data and information that enables successful and efficient management and implementation* of the High-Tech Program. The overall intent of this assessment was to summarize EMI's review of data and information that EMI obtained from PG&E to support the process evaluation research. This review is intended to provide feedback regarding the Program's data tracking efforts in order to improve the Program's marketing, outreach, and implementation activities. EMI approached this assessment from program management and implementation perspectives. That is, from a process perspective, we examined the information and data that are needed for PG&E staff to effectively identify and enroll participants. This review did not assess tracking of project and program level energy savings and demand reduction, which would be more appropriately addressed by the impact evaluation.

This section first outlines the task objectives, followed by a description of the program databases EMI obtained for the process evaluation study and a summary of some of the challenges associated with those files. Finally, we outline our assessment of data and information management needs, focusing on the program delivery processes that occur prior to the submittal of an incentive application. (The submittal of an incentive application triggers project tracking through PG&E's Marketing Decision Support System (MDSS), which is not covered by this assessment). Also included is EMI's assessment of current practices in comparison to the identified needs. The final section offers conclusions and recommendations.

6.1. Task Objectives

The objectives of this research task were to:

- Identify program-tracking data and information needs, with respect to effective marketing, outreach, and delivery of program services, and
- Assess the program's current data tracking and information management processes; and
- Develop recommendations or improvements in data tracking and information management.

This review of the High-Tech Program's data tracking and information management is based upon data EMI received specifically for the High-Tech Program process evaluation and thus should not be considered a comprehensive, exhaustive review of all data and tracking systems associated with PG&E's energy efficiency programs. Again, we focused our efforts on assessing the needs and current practices associated with program delivery processes prior to the application submittal and tracking through MDSS.

6.2. Program Databases and Other Information Sources

To support the process evaluation of PG&E's High-Tech Program, EMI requested the following program and customer data from PG&E:

1. A database of all completed projects and measures installed,
2. A database of completed integrated audits, and
3. A database of customers in PG&E's High-Tech target market.

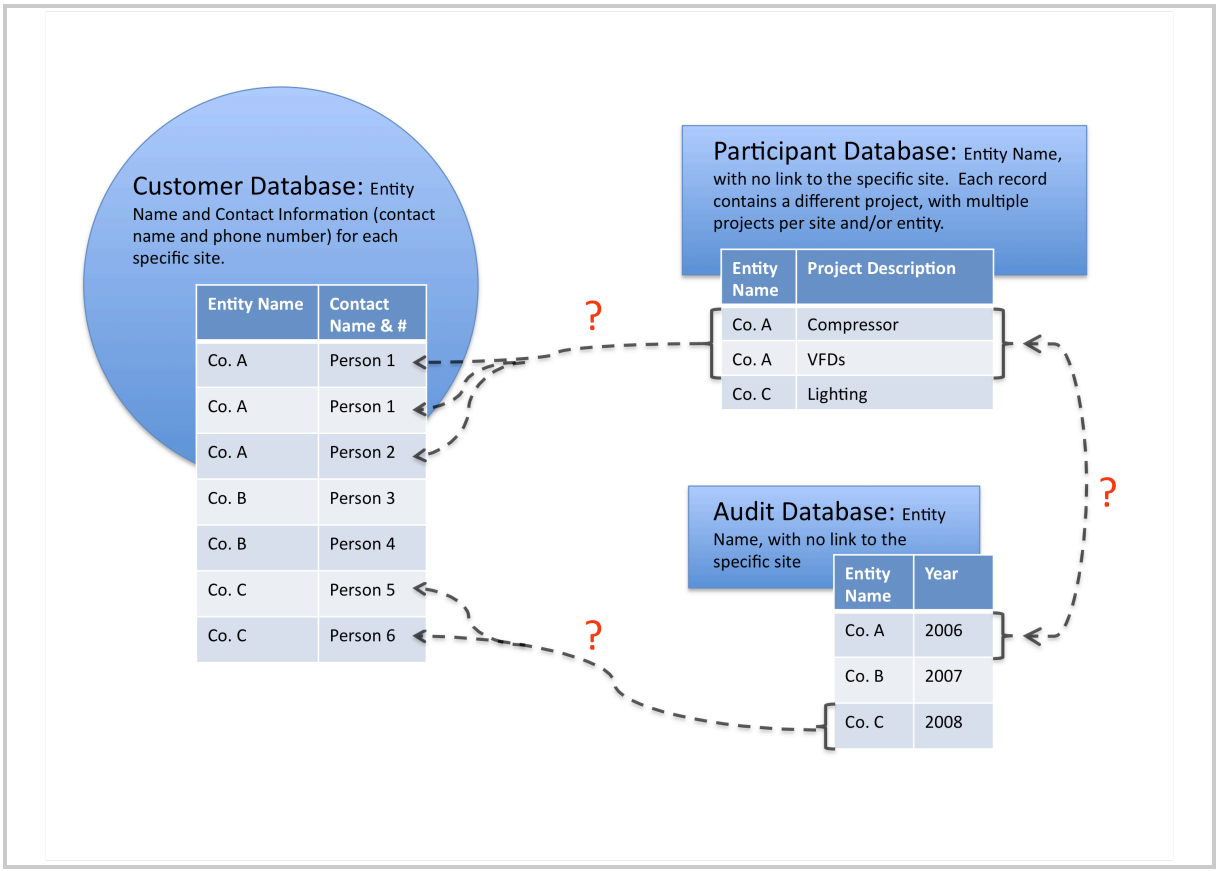
The requested data was needed specifically to characterize program participation and to determine the extent of integration between the High-Tech and Integrated Audit programs. The data was also needed to develop sample frames for the customer interviews and surveys. Although EMI received a response to our initial data request within seven business days, numerous iterations were necessary for EMI to obtain all of the data and information needed for the process evaluation. The three databases EMI received are summarized below:

- **High-Tech Customer Database.** This database contains those PG&E customer sites that are in the high-tech market sector, based on the 2002 NAICS codes. There are 38,651 observations in the database, with each observation representing a different customer site. Data fields include information about the company name and address, business activity description and NAICS codes, last rebate participation year, PG&E account representatives and relationship managers, names and contact information for the service agreement, figures for electric and gas sales, revenue, and demand, as well as three associated ID numbers: service agreement ID (for a specific building), account ID (representing unique buildings), and person ID (representing unique businesses).
- **Audit Database.** Each of the 111 observations in this database represents a high-tech customer site where an energy audit was performed. There are multiple observations for customer sites that received multiple audits. The number of observations also reflects businesses that had audits conducted at different facility sites within their business (i.e., a company that had audits conducted at two different sites would be represented by two observations in the database). The database contains three fields of data, providing limited information about the audit participants: the program year (2003 through 2008), the business site name, and the relevant sector (in this case, all High-Tech). There are also links to PDFs within the business site field, which provide access to the individual audit reports. While these PDFs are valuable for information about a specific project, they do not provide a high-level picture of audit activities.
- **Participant Database.** This database represents High-Tech customers who participated in the High-Tech Program (i.e., those that received incentives for custom projects). EMI received two separate files for paid projects: one for projects completed in 2008, and one for projects completed in 2006-2007. There were a total of 89 paid projects, representing

89 different customer sites. Data fields in the 2008 file included the business name, facility square footage, a brief project description, program name (nonresidential retrofit or new construction), a five-digit project code and 10-digit alphanumeric code, accept dates and check issue dates, rebate amounts, energy savings, and incremental costs. The 2006 – 2007 file included the same information, with a few exceptions. The 2006 – 2007 file includes the completion date, information regarding the last accomplished milestone, committed figures for energy savings, and rebate amount (in addition to paid figures). The 2006 – 2007 file excluded the information on incremental costs that was provided in the 2008 file.

Challenges faced by EMI as we attempted to link the three databases to develop sample frames for the process evaluation data collection are illustrated in Figure 6-1. Overall, the usefulness of these databases is limited because they are not easily integrated (they were not designed to communicate with each other) and they contain incomplete or incorrect information. For example, it took considerable effort for EMI to develop a database of high-tech program participants with complete contact information, indicators of participation in the audit program, and other general firmographic characteristics needed for sampling. The figure illustrates that multiple records for a single unique entity are not easily matched to the same site in the other data sources because one single unique site identifier was not available in all three databases.

Figure 6-1: Linkages between Customer, Participant, and Integrated Audit Databases



Additional information management and program tracking processes were identified during the process-mapping session and follow-up interviews with PG&E staff. EMI obtained information regarding methods the High-Tech Program utilizes to collect, store, and share information and data relevant to program marketing, outreach, and delivery.

6.3. Program Tracking and Information Needs

The process mapping session and follow-up interviews with PG&E staff revealed that the High-Tech Program, as a whole, has limited program-tracking capabilities. It appears that while each staff member has developed their own means to keep track of outreach and project developments, a formal tracking system to coordinate program marketing, outreach, and project development efforts across the entire team does not exist. Currently, the only comprehensive and integrated tracking system is PG&E's (MDSS). MDSS, however, does not track any activities prior to a submitted application, nor does it track progress through specific milestones during the application process. Staff stated that this system, particularly the tracking of retrofit projects, is very complex, in that Program staff are not able to update information in the database, and requests to personnel who update the database can sometimes take months before changes are implemented. Furthermore, aside from the forecasts set for energy savings and demand reduction, the Program does not have specific measureable goals regarding marketing and outreach activities.

In this section, EMI categorizes data and information needs by the following three primary phases of program delivery identified in Section 4 that are covered by this research: Business Development, Project Development, and Project Processing. Our assessment focused on the Business Development and Project Processing phases.

Table 6-1 summarizes EMI's assessment of program-tracking and information needs for each of these three phases. Descriptions of the various information needs are listed in the left column of this table. These needs were gleaned from the process-mapping session, staff interviews, and EMI's experiences working with program databases during the process evaluation. The program delivery phase(s) during which the needed data/information needs to be utilized are indicated in the next four columns. The user(s) of such data and information are listed in the "User" column. Finally, the right most column of Table 6-1 provides EMI's the current state assessment, indicating whether the program currently has a method for tracking or managing the needed information, or whether this need remains unmet.

Additional discussion follows this table.

Table 6-1: Program Tracking and Information Needs & Current State Assessment

	Identified Need	Program Delivery Phase				User	Current State Assessment
		Business Development		Project Develop.	Project Processing		
		Industry Awareness	Customer Outreach				
1	Supporting program references and documentation (detailed technical documents for HT measures, engineering calculations, marketing collateral, audit reports, incentive applications, and the Program business plan/operations manual)	X	X	X	X	Various. (HT Program staff, Service & Sales group, Website team, Sales Engineers, NRA staff, Tech Review staff, IPC & Project Mgmt staff)	Availability and accessibility varies. No central depository yet (but a High-Tech SharePoint site is in development)
2	Outreach events, including indication of attendance by HT Program staff (incl. staff role & participation in each event)	X				HT Program staff	Nothing formal; ad hoc communication among staff; tracking through individual calendars. PG&E website lists calendar of events.
3	Outreach event attendees who expressed interest in the program, including contact information	X	X			HT Program staff	Nothing formal; HT staff may make "mental notes"
4	List and descriptions of HT Program specific marketing initiatives (direct mail, email blast, blog, print advertisement, change in website, etc.) including date, description, and indication of businesses/market segment/customers that received messages or were targeted.		X			HT Program staff, Service & Sales group, website manager, marketing staff	Program does not currently track marketing initiatives.
5	Customers in HT Program target market, ideally with contact information for facility mgmt & IT equip mgmt staff and key firmographic characteristics		X			HT Program staff, Service & Sales group	Customer billing frame data; but firmographic data not populated (i.e., NAICS2 or SIC); program does not appear to utilize or have the ability to utilize this data for marketing/outreach purposes.

Table 6-1: Program Tracking and Information Needs & Current State Assessment, cont.

	Identified Need	Program Delivery Phase				User	Current State Assessment
		Business Development		Project Develop.	Project Processing		
		Industry Awareness	Customer Outreach				
6	Customers with high-tech facilities (e.g., data centers or large server rooms) that are not in HT Program target market, including contact information, ideally with contact information for facility mgmt & IT equip mgmt staff and key firmographic characteristics		X			HT Program staff, Service & Sales group	Customer billing frame data; but firmographic data not populated (i.e., NAICS2 or SIC); program does not appear to utilize or have the ability to utilize this data for marketing/outreach purposes.
7	Integrated audit participation - customers that are interested and/or participate in the audit program that are in the HT Program target market.		X	X		HT Program staff, Service & Sales group, NRA staff and project mgmt staff, Technical Review staff	Audit participation (including audit reports) is maintained separately and thus not useful as a resource for HT Program targeted marketing & outreach. Audit reports and recommendations are available but not easily accessible.
8	Customers directly contacted about the program (including contact information, date, and note of result and next steps)		X	X		HT Program staff, Service & Sales group, NRA staff	None. (HT Program staff track direct outreach on an ad hoc basis)
9	Customers who submitted an application for incentives (including contact information and key variables)				X	HT Program staff, Service & Sales group, IPC and project mgmt staff, Technical Review staff	Application data entered into MDSS; PG&E staff have difficulty accessing and using MDSS especially for the NRR projects.
10	Project description, list of measures and other meaningful project descriptors on incentive application			X	X	HT Program staff, Service & Sales group, IPC and project mgmt staff, Technical Review staff	Application data entered in MDSS; project descriptions for most HT Program projects are classified as "other" and thus not useful for mgmt reporting and analysis
11	Project milestone dates (outreach, project development, application for incentives, application approval, installation complete, verification, payment)				X	HT Program staff, Service & Sales group, IPC and project mgmt staff, Technical Review staff	Project milestones entered in MDSS.

6.3.1 Program References and Documentation

The first row of Table 6-1 denotes "supporting program references and documentation" needed throughout all program delivery phases. Examples of program references and documentation include the following:

- Detailed measure analyses, including engineering calculations and algorithms for estimating energy and demand impacts, to be referenced by project managers, sales engineers, and others who are involved in project development and application review. The program has developed "measure binders" that contain detailed technical information, though engineering analyses may or may not be available. Measure binders are not yet available for all measures, though they were in development at the time of this research.
- "Quick reference" measure description(s) and reference(s) will enable program staff and others involved in interfacing with customers to speak fluently on program offerings, enhancing the effectiveness of industry awareness and customer outreach. These quick-reference documents will also be useful to post to the program website, so that they can easily be accessed as a resource for interested customers. At the time of this research, such "quick references" were not available.
- Program collateral and other marketing materials should be available to Account Managers and program staff for to facilitate general industry awareness and for customer-direct marketing. In addition to being accessible internally, these materials should be easily accessed by the public via the program website. This will enable interested customers to access an easily digestible description of the program's offerings and benefits. At the time of this evaluation, program collateral and marketing materials were not available for review. It is EMI's understanding that such materials may not exist, but will likely be developed in the future as part of a larger strategic marketing initiative.

As noted, at the time of this research, the Program Manager explained that efforts were underway to develop reference materials and create in internal library, a High-Tech Program SharePoint site that would be accessible by all staff that requires the information.

6.3.2 Business Development Phase

Overall, effective program tracking and information management associated with the Business Development phase will enable the program to successfully (and efficiently) identify customers who are likely to develop and implement an energy efficiency improvement project. Additionally, setting goals for marketing and outreach activities, and then tracking and maintaining meaningful data and information on these initiatives, will enable the program to assess the effectiveness of such efforts. The program can then adjust its marketing and outreach efforts to focus on those initiatives that are determined to be most effective. Key information and program tracking needs identified for the Business Development phase relate to tracking participation and attendance at industry events, tracking marketing and outreach initiatives targeting specific customers, and maintaining a customer relations database(s).

EMI includes information and data associated with participation in the NRA program in the Business Development phase, because audits themselves are a way of engaging customers in energy efficiency and may influence them to pursue a retrofit project. Program staff suggested that, at times, Account Managers offer energy audits to customers as a last resort to appease customers who complain about their bill. However, customer interviews showed that, especially when audits include the data center/server room, customers find the audits valuable and they can influence customers to pursue the recommended measures and incentives. Thus, NRA participants should be considered to be prime candidates for the incentive program, and follow-up with these customers should be prioritized. Moreover, the audit documentation contains detailed energy analyses that will be needed to develop the project specifications and application package. Tracking customers interested in the Integrated Audits, along with their contact information, is useful for two purposes: ensuring adequate follow-up is conducted for interested customers, and for redirecting customers with high-tech facilities into the High-Tech Program to minimize "lost opportunities." Furthermore, setting goals regarding the proportion of audit participants who go on to participate in the Program will allow the Program to track the success of the audits as a business development strategy.

EMI's overall assessment of the High-Tech Program tracking and information management is that it is best described as "ad hoc," and in its current state, it will not support a formal, larger scale marketing and outreach platform. PG&E currently does not track industry outreach or customer-directed marketing efforts and there is no formal tracking of outreach events and attendees that is accessible to all staff. Information regarding outreach events and those attended by High-Tech staff is communicated informally among program staff, and events are tracked only on individual staff calendars. Attendees at various industry events are not tracked, though PG&E staff may make a mental note of prominent attendees or those who expressed interest in the program. As noted in Table 1, direct customer outreach is tracked on an ad hoc basis with individual program staff rather than a centralized system that provides universal access to information. EMI found no evidence of a formal customer relations management (CRM) system to track and share information about specific customer interest and participation in PG&E's program(s). (Such systems are common in the private sector.)

Customers who are interested in the Integrated Audit are currently not tracked, and the Audit Database itself, received by EMI, contained very little information. This deficiency limits the Program's ability to use the audits as a marketing tool to recruit participants in the High-Tech Program. Contact information for many of the audit participants was contained in the Customer Database; however, unique links with the High-Tech Customer Database were not contained in the Audit Database preventing EMI from merging the two together to develop a useful sample frame and contact database. In fact, the Program Manager had to extract the customer site IDs (i.e., SA_ID) from the audit reports by hand. This was a labor-intensive endeavor, and the wait time until EMI received this information was nine weeks. After receiving the unique identifiers for the Audit customers, and linking their NRA data with the Customer Database, we found that contact information was not available for many Audit participants. (Roughly 50% of customers in the Customer Database do not have associated contact information.) For audit participants, EMI began with a database of 111 customer sites where audits had been completed. When EMI selected those with customer contact telephone numbers, only 21 cases remained. In addition to incomplete and missing customer information, the Audit Database did not contain specific or

meaningful information about the audit results or recommendations. While the audit reports presumably include this information, it is not possible to develop a "management summary report" of audit activity and recommendations that Program staff can use for business development.

6.3.3 Project Development Phase

Program tracking and information needs during the Project Development phase are focused on individual customers and projects with the goal of maintaining the relationship with the customer and ensuring key project milestones are met. At this stage, the objectives are to minimize customer withdrawal from the program, maximize customer satisfaction, and to identify additional opportunities. Setting performance indicators, such as customer retention goals, will allow the Program to better track Customer and project information should be easily accessible to all who are involved in working with the customer to develop the project specifications and timeline, conduct the energy analyses, and prepare the incentive application package.

Similar to the Business Development phase, EMI found program tracking and information management in the Project Development phase to be inconsistent and lacking a central repository to increase accessibility (although as noted, a SharePoint site was in development at the time this research was conducted). In addition to the reference documents described above, key documents and information for project development include energy analyses and measure savings calculations (or algorithms), Audit reports and recommendations, project specification and schedules, etc.

6.4. Summary of Program Tracking and Information Management Review

EMI's assessment of program tracking and information management is summarized by the following key findings:

1. Overall, the Program's tracking and information management current practices are not adequate to support a larger scale program. Current practices are ad hoc and rely primarily on efforts developed by individuals rather than a "system" through which information is accessible to all staff.
2. The program does not utilize a centralized CRM system[12] and again, relies on efforts of specific individuals. Lack of more formal system for tracking outreach and marketing efforts increases the risk for lost opportunities and makes the transfer of information between staff difficult.

[12] EMI has since learned that PG&E's Service & Sales staff have access to a program called the Customer Management Tool (CMT), which serves as a type of CRM tool. However, this tool was not mentioned during staff interviews or process mapping, and the extent to which this program is used and its functionality is not known.

3. Various sources of customer and program participation data are not easily integrated, rendering it inadequate for effective customer profiling, market segmentation, strategic marketing, and overall program management and reporting.
4. The program does not appear to have established milestones or metrics of success, with the exception of the overall energy saving and demand reduction goals. Without having performance indicators and an effective means for tracking achievements, the program is not able to pinpoint areas in need of improvement or make mid-course corrections if program enrollment falls short of expectations.

7. SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

The overarching objectives of this process evaluation research were to (1) characterize program delivery and operations and make recommendations for process improvements, and (2) conduct market research and review the program's target market and make recommendations for a strategic marketing and outreach plan. Underlying both of these objectives was to assess the *scalability* of the current program model and to provide input to PG&E to support its 2009 – 2011 program planning efforts. While the program proposals for the 2009 – 2011 cycle were not yet final or approved at the time this report was prepared, the expectation is that the High-Tech Program goals will increase significantly (perhaps triple). PG&E's Program infrastructure must be scalable to withstand a significant ramp-up in activity without sacrificing quality of service or customer satisfaction.

Before summarizing key research findings and recommendations, it is important to note two important observations. First, EMI acknowledges that the Program's delivery mechanisms and infrastructure are not static. That is, it was clearly evident throughout our research that PG&E was already undertaking or at least considering various changes – specific to the High-Tech Program, and through the energy efficiency organization. These changes pertained to a variety of aspects of program administration and delivery. Thus, this research represents a snapshot of the program at a specific point in time. Second, some of the changes being planned or implemented that were specific to the High-Tech Program are actually related to some of the recommendations for improvements summarized below. As the evaluation team periodically debriefed the Program Manager on the interim research findings, the team learned that at least some of our findings and recommendations were not new or a surprise to the program staff, but rather confirmed or reinforced their own internal assessments.

The overarching key findings of this evaluation are four-fold:

Overall, the current program model and delivery appears to be successful. Even though the evaluation team detected some lost opportunities, such cases were the exception rather than the norm. One commonly used metric of success is customer satisfaction, and satisfaction with the Program and PG&E staff is high among interviewed program participants. PG&E was also successful in establishing itself as an active industry leader and participant in national and regional initiatives relating to improving the performance of data centers and other high-tech facilities. Such involvement has been very beneficial to PG&E for not only staying abreast of industry developments but also for contributing to and participating in the development of industry guidelines and standards.

The current program is not scalable to meet increased goals of the 2009 – 2011 program cycle. Despite the success of the 2006-2008 initiative, EMI concludes that the program infrastructure in its current form will not support a large-scale effort. There are several factors leading to this conclusion, most of which relate to PG&E's internal organizational structure and alignment, rather than a flawed program theory or implementation plan. For example, the evaluation found that many components of program infrastructure are not integrated in a way that supports information transfer (on a consistent basis) between the

various departments involved in marketing, outreach, project development, and application review and processing. The Program's data tracking system is one core component of this infrastructure that is not optimized for program integration and scalability. Furthermore, Account Managers (Service & Sales staff) are widely recognized to be the keystone to successful program delivery, yet there does not appear to be a process in place for providing ongoing training to Account Managers to learn how to identify energy efficiency opportunities that should be referred to the targeted High-Tech Program. Additionally, the current 2006-2008 Program relied heavily on a very small number of individuals (Project Managers as well as Account Managers) who have the level of expertise needed to establish credibility with this fast-pasted, highly competitive, risk-averse customer base. EMI detected that these staff are already strained to take on additional workload, and will not be able to absorb the substantial activity that will be required to meet future program goals. Finally, the current mode of direct customer outreach by Program staff and coordination with Service & Sales Account Managers relies on one-on-one, personal relationships of only a few Project Managers on the Program team. While this method was successful in identifying customers with energy efficiency opportunities, it is not likely to support the number of projects needed to meet the future increased goals.

The Integrated Audits were not used strategically to identify customers with high-tech facilities in need of efficiency improvement. Perhaps one of the most notable findings of this process evaluation was that the Program is not using the Integrated Audits as a means for identifying energy efficient improvement opportunities of high-tech facilities. The Integrated Audits are not designed to specifically address data centers and server facilities, nor do the audit contractors have the expertise to conduct an on-site evaluation of such buildings. Even if the audits were customized to include high-tech facilities, substantial improvements are necessary to facilitate information and data transfer so that Program staff can easily access the audit report and recommendations in a timely manner.

The Program only partially implemented various training and education services specified in the PIP. While the Program successfully implemented outreach, such outreach was primarily aimed at influencing developers of IT and high-tech facility equipment. Outreach efforts include participation and attendance at industry conferences, coordination with key federal and regional government and non-government organizations, and collaboration with key trade allies and stakeholders to develop consistent standards and guidelines regarding high-tech facility design and performance. Customer education and training, on the other hand, were only partially implemented. The High-Tech Program has published best practices design guidelines and has completed some retro-commissioning pilots and technology demonstrations. Further demonstrations, case studies, and other types of customer education and training are important ancillary services that will help educate customers and help the Program identify efficiency opportunities.

The remainder of this section offers a set of recommendations for program improvements that are presented in the following categories:

- Program theory and logic model,
- Performance metrics,
- Marketing and outreach,

- Internal organization and program delivery processes, and
- Program tracking and information management.

7.1. Program Theory and Logic Model

Logic models define the steps that must occur if programs are to deliver the energy expected saving. Defining these steps and disentangling the effects of various program activities (as well as the influence of other efficiency program offerings and other external market considerations) requires a comprehensive understanding of the underlying program theory prior to any data collection. Articulation of the program theory and developing a logic model will identify all of the important linkages between program activities and outcomes. While logic models are standard tools for guiding process evaluation research, they can be valuable references for program managers to identify critical pathways for success and key performance metrics. EMI has found the exercise of developing a program logic model, *itself*, can be a valuable exercise for program staff. That is, the act of vocalizing and documenting the rationale for each program activity can shed light on program elements that "sound good" but are not well-founded.

Given the anticipated significant increase in the size of this program for the 2009 – 2011 cycle and changes to program target market and delivery, EMI recommends a detailed review of the program theory and development of a logic model to support the development of performance metrics (discussed below). Articulating an documenting the program theory and logic and sharing these documents with key Program staff will help to ensure the theory is well-founded and that critical paths to success are identified and accounted for in the program marketing and delivery strategy.

7.2. Performance Metrics

Performance metrics relate to any or all aspects of program delivery, and should reflect both program evolution and PG&E's relative priorities. Performance metrics are often defined as a result of the development or period review of a program logic model that establishes linkages between the defined program activities and the assumed short and long-term program outcomes. Metrics of success are typically tied to these linkages, as well as specific program milestones.[13]

Following the update of the program theory and logic model, EMI recommends that the Program establish performance metrics against which progress with respect to marketing and outreach and process improvements can be measured. Moreover, establishing and tracking key performance indicators can help reduce uncertainties with respect to Program performance. As the Program expands for the 2009 – 2011 program cycle, there are a variety of indicators that should be monitored to assure PG&E that its program delivery mechanisms are effective and efficient, particularly with respect to budget expenditures, allocation of staff resources, program

[13] There are no "industry standard" performance metrics for energy efficiency programs; they should be unique to the program and should cover a wide variety of program functions and goals. Examples include customer awareness, customer satisfaction, $/kW reduced, application processing time, number of audits that resulted in program enrollment, market penetration, etc.

production, and cost-effectiveness. It is important to recognize that such indicators and the frequency at which they are monitored is an effort independent of the monthly and quarterly program reports uploaded to the CPUC. That is, EMI is referring to the *business* aspect of program delivery rather than regulatory compliance.

Specific recommendations include the following:

- **Establish program goals and performance indicators associated with program outreach and marketing, and define how progress toward goals will be measured.** As noted above, performance indicators should be identified as a result of creating an updated program theory and logic model. Goals and performance indicators should be aligned with roles and responsibilities of the various staff and departments involved in program delivery, but should also all contribute to the overall program goals of producing energy savings and peak demand reduction. Goals and performance indicators should be transparent and well documented.
- **Achievement toward goal attainment should be measured and performance indicators should be tracked frequently to provide staff and management with real-time feedback on progress.** Progress should be monitored on an ongoing basis so the Program Manager and other PG&E senior management can celebrate success and be alerted to changes that are not producing desired outcomes within the expected timeframe. Real-time feedback mechanisms provide programs with information needed to make mid-course changes that will eventually contribute to meeting energy and demand impact goals. Ideally, PG&E should develop management reports that can be generated from a Program tracking system that include data and graphics relating to the established performance metrics, though additional data collection and reporting independent of Program tracking might need to be established (especially if improvements to MDSS and other program tracking mechanisms are not made). Recommendations relating to Program tracking and information management are discussed below.

7.3. Marketing and Outreach

Since the onset of this process evaluation research, EMI has been aware that the High-Tech Program does not have a deliberate, scalable marketing strategy. Clearly the Program will need to develop efficient strategies for identifying customers with existing data centers, server rooms, and other environments that require specific, controlled environmental conditions. Given the wide range of commercial customers that are likely to have or need such facilities, the Program will need to be almost "surgical" to be efficient and effective in targeting its marketing and outreach efforts. Additionally, PG&E will need to create processes that will enable staff (Account Managers and Audit Contractors, for example) that are already working with these customers to identify projects that should be referred to the High-Tech Program. EMI offers the following recommendations for PG&E to consider relating to marketing and outreach efforts.

- **Develop methods for systematically identifying customers with high-tech facilities.** This research found the target market to be too ambiguous for an effective and targeted communication and marketing strategy. One of the challenges faced by the Program is how to identify buildings that have data centers and server farms (particularly the "hidden" facilities). Perhaps one of the most effective strategies for identifying these customers is to leverage relationships PG&E already has with its customer base through Sales & Services. That is, Account Managers are already working with many of these customers, but need to be trained to readily identify eligible High-Tech program customers and funnel potential projects to the program. The Program should also consider an intense market research effort that will characterize PG&E's customer base with respect to existing data center/server farm facilities, data center construction, adoption of virtualization software, etc., that will provide a framework for identifying customers that are likely to be eligible for this targeted program.
- **Develop strategic partnerships with the engineering and design community that serves the data center and critical facility market.** Designers such as architects and engineers, as well as vendors and manufacturers, are critical sources of information for customers and can be very influential in facility retrofit design and equipment specification. There is a great opportunity to utilize this relationship to increase program awareness and participation. EMI recommends that the Program develop strategic partnerships with these important market participants to identify customers who are beginning the design phase of a new data center or planning an existing facility upgrade. There are several partnership models or options to explore, such as contractor training and contractor referrals, as well as providing basic program "training" about so contractors have information to provide customers with information about the Program when opportunities arise.

  Is important to note here that EMI found that the engineering and design professionals that specialize in the high-tech facility design are in short supply. Thus, EMI also recommends that PG&E consider including program activity that facilitates training and certification of these professionals to have the expertise to address the needs of this fast growing market.
- **Integrate the Program with the Integrated Audit Program.** Even though the ultimate objective of providing energy audits at no cost to customers is to help customers identify and prioritize cost-effective energy efficiency improvement projects, this evaluation found that the High-Tech Program is not able to effectively leverage the Integrated Audits. First, the integrated audits are not designed to address the facilities targeted by the High-Tech program. Second, as noted above, process improvements are necessary to enable to the effective and timely transfer of customer and audit information to Program staff. Even though Program staff indicated that they could access information they need for a specific customer/audit, the current process for doing so, again, is not scalable and has inherent risks for lost opportunities. EMI recommends that the Integrated Audit differentiate between customers with specialized facilities to ensure such facilities (such as server rooms and data centers) can be included in the audit. This could mean, for example, that the Integrated Audit have a data center "module" or that a different audit be developed specifically for data centers and other critical facilities.

- **Market the Program via trusted information channels.** The Facilities Managers and IT professionals EMI interviewed for this research consult a number of sources to become aware of current technologies and trends in their field. PG&E should consider these sources as a means for increasing awareness and participation in the program. Industry publications, trade organizations, and relevant websites can be used to inform customers about the program through channels that they consult on a regular basis. In this way, PG&E can reach out to customers in the places they already frequent (and trust) to find new information.
- **Develop marketing messages specifically directed at IT professionals.** Nonresidential energy efficiency programs traditionally target facility and operations staff with program information and collateral, but facility professionals are not the only decision makers regarding critical facility construction or improvements. Because the IT professionals are a completely different audience from the facility operations and management staff, the Program should consider developing different messages and marketing platforms that will resonate with the IT community. Utilizing trusted information channels would be a particularly important element of the Program's marketing strategy for reaching out to IT professionals. Recognizing this, the Program should consider marketing the program through IT industry information sources, some of which were noted in this report.
- **Develop case studies and demonstration projects to showcase project success.** Case studies are often used to showcase project success and can be an effective program-marketing tool, particularly for niche markets and large commercial or industrial customers that face significant barriers or have unique needs. Although technology demonstrations were conducted via the Emerging Technology Program, these demonstrations have not been used to market the High-Tech Program. For the High-Tech Program, published case studies and "live" demonstration projects will provide assurance to this risk-averse, yet highly competitive customer base that HVAC system efficiency upgrades will not compromise their IT equipment performance or reliability, while at the same time illustrate potential for energy use and energy cost savings.[14]

7.4. Internal Organization and Program Delivery Processes

The process mapping session revealed that staff outside of the High-Tech Program are key to successful marketing and processing of High-Tech energy efficiency improvements. Staff involved in the Business Development Phase of the High Tech Program is especially important because they help generate customer interest in the program. Non-High Tech staff involved in the Business Development Phase include PG&E's Emerging Technology Program, website department, marketing department, Auditors, Sales Engineers, and most importantly Account Managers. As shown on the process map, all projects are channeled through Account Managers and thus they play a critical role in identifying customer efficiency opportunities and understanding their schedule and capital improvement plans. As a result of this research, EMI identified several opportunities to improve coordination efforts between departments, including more frequent training for Account Managers, Sales Engineers, and Auditors on the Program,

[14] We refer the reader again to Silicon Valley Power's Data Center Optimization program.

improved communication and coordination between the Program and other departments that support the energy efficiency programs, and improved tracking and information transfer between departments that support program delivery.

- **Provide more frequent training to Account Managers/Sales & Services Staff on Program opportunities.** Account Managers play a critical role in developing customer interest in the program and providing customer feedback to the High-Tech Project Manager during the project development, and roughly half of the Program participants we spoke with learned of the Program via their Account Manager. Many customers interviewed expressed high satisfaction about their relationship with their Account Manager. In order for the Account Manager to "sell" energy efficiency to their customers, they need to be fluent in PG&E's efficiency program offerings. This is especially important for a program that specializes in high-tech facilities that exist across a wide variety of business types. This places a large burden on the Account Managers to recognize High-Tech customers, identify and communicate efficiency opportunities, and coordinate project development with Auditors and High-Tech Program staff. There is a need to develop formal program training so that Account Managers can learn about efficiency programs as well as updates to the programs.
- **Develop and expand internal expertise in critical facility design, energy use characteristics, and energy efficiency opportunities.** While the Project Managers on the High-Tech Program staff are indeed experts in the high-tech industry, this research found that staff outside of the Program who are in contact with customers need to also have some expertise to have credibility with customers. Engineers whom Account Managers rely on for support, such as Auditors or Sales Engineers, also need to have some familiarity with the unique project requirements and energy use characteristics of data centers, server rooms, and other critical facilities. The improved training and availability of information discussed elsewhere should provide a foundation for developing this expertise.
- **Clearly define roles and responsibilities of High-Tech staff and other departments.** According to the process maps, many different people and departments are involved in the High-Tech program, including:
  - High-Tech Program staff
  - Account Managers (Sales & Services)
  - Sales Engineers
  - Website Managers
  - Auditors
  - Integrated Processing Center staff
  - Technical Reviewers

  Clearly defining roles and responsibilities of these departments in the project development process will help PG&E and the Program identify overlaps, avoid duplication of efforts, and streamline coordination.

7.5. Program Tracking and Information Management

Underlying many of the above recommendations is the need for improved data tracking and information management that will be necessary to facilitate and support more effective coordination within PG&E's energy efficiency organization. While one could develop numerous recommendations about specific data fields and information that should be tracked and accessible, the recommendations EMI presents below are high-level, because we found little to no systematic tracking outside of MDSS. We acknowledge that developing a customer relations management system could be a complex process and large undertaking. Should PG&E move forward to establishing a more formal CRM system, the design phase of that project will surely identify specific data and information to be tracked within the system.

- **Establish a formal system for tracking marketing and outreach efforts that allow the program manager and staff to monitor progress in achieving the recommended goals and performance indicators.** It appears that individual staff members have developed their own means to track outreach and project developments. However, the program clearly lacks a formal tracking tool to coordinate program outreach efforts by the entire team (including non-High Tech staff working on High Tech projects). An opportunity and need exists for the Program to develop a user-friendly tracking system that can coordinate activities during the Business Development and Project Development Phases. The system should necessarily include a marketing database that designates specific customers that are considered to be in the program target market. Key firmographic characteristics (NAICS/SIC codes, square footage, facility type, ownership, climate zone location, etc.) – to the extent they are available or can be created – should be included in this system to enable segmentation and profiling of customers and program participants. The system should be linked to MDSS in a way that enables program staff to learn about customer participation history that will be valuable in project development and review. Ideally, such a customer relations system should also interface with the customer billing frame system, which will enable the utility to pull energy and demand use characteristics into the customer profile. Finally, the system should be linked to the audit participation database to enable reporting and tracking of customers that participate in the audit program that are in the High-Tech Program target market. An effective customer-relations management (CRM) system[15] could address implementation needs by tracking customer contacts and coordinating efforts of High-Tech staff, Sales Engineers, Account Managers, Auditors, and Technical Reviewers.

- **Continue to develop a centralized repository for program references and key documentation.** A program resource library, such as the Programs SharePoint site that was in development at the time this report was produced, will facilitate the transfer of critical information among PG&E staff, reducing unnecessary delays in project development. This resource should include all program collateral and training materials developed to educate PG&E staff and contractors about High-Tech program offerings and incentives. All staff that requires such information should have access to this repository.

[15] An example of a CRM system can be found at salesforce.com.

- **Refine and regularly update project-level and measure-level information and data tracked in MDSS and the audit-tracking database.** To provide meaningful input to a systematic and strategic marketing efforts and management-level feedback on program achievements, data, and information that is tracked needs to be more specific and updated regularly. Developing internal processes through which accurate information is maintained will help to streamline some of the inefficiencies identified during the process-mapping workshop and will alleviate some of the "bottlenecks" that arose due to staff not having the right information at the right time.

7.6. Recommendations for Future Research and Analysis

Given that this program was new to PG&E's nonresidential program portfolio in the 2006 – 2008 program cycle, one of the key objectives of this process evaluation was to inform improvements for the 2009 – 2011 funding cycle. As discussed previously, the overarching finding of this research is that the program in its current state is not scalable to a larger-scale effort. Many of the recommendations presented above are intended to help PG&E develop program infrastructure and processes to support future expansion.

There is still much to learn about energy efficiency opportunities and effective and efficient means for serving customers with critical facilities. Despite rapid growth in recent years, the industry was relatively inconsequential in the not-so-distant past. Thus, utilities and energy efficiency organizations have relatively little institutional knowledge about this market. In addition to the recommendations presented above, EMI suggests the following additional research:[16]

1. **Detailed IT Characterization Study.** Nearly all medium and large nonresidential customers have IT departments with data centers and computer networks. EMI recommends research to characterize the structure of the IT organizations across major nonresidential market segments, including (but not limited to) trends in the use and procurement of IT equipment and decision making practices. Such a study would directly support PG&E's efforts to develop a strategic marketing strategy and will support Program staff outreach efforts.
2. **Market Segmentation Study.** As explained previously, EMI found the Program's target market too ambiguous for an effective and strategic marketing and delivery strategy for a larger-scale program. EMI recommends a market segmentation study to classify specific market segments according to the size and operation of in-house and stand-alone data centers. This research would necessarily include new construction trends. Such a study would directly support a systematic marketing and outreach strategy and support PG&E's

[16] We note here that the impact evaluation covering this program was not complete at the time this report was produced. Impact evaluation findings will likely reveal a need for other research not mentioned here. Program attribution will be of particular interest, since industry trends are heading toward more dynamic management of computer operations with virtualization and cloud computing, for example, are reducing computing load. Research on the impact of energy efficiency programs and demand response may be of particular interest.

efforts to target data center new construction in addition to identifying customers within its service area with hidden data centers.

3. **Review of Program Coordination with Other Organizations and Programs.** While the focus of this process evaluation centered on PG&E's Core Program, it is important to acknowledge other third-party programs and industry efforts (independent of PG&E's program) that are seeking to understand energy use and demand reduction strategies associated with data centers. EMI recommends an effort to identify these other efforts and the extent that PG&E has and should coordinate with them, as a means of exchanging information but also leveraging resources.
4. **Review of Program Coordination with Other PG&E Programs.** EMI understands that revisions to the 2009 – 2011 High-Tech Program are intended to address "non high-tech" customers that have significant IT equipment and in-house data centers. In other words, this High-Tech Program has or will develop energy efficiency/demand reduction measures that other sector initiatives (or the mass market program) will market to its customer base. Success of this strategy will ultimately depend upon the effectiveness of coordination between the High-Tech program and other groups within PG&E's energy efficiency organization. EMI recommends, therefore, that PG&E seek outside assistance to facilitate the development of such coordination. Such assistance, for example, would build upon the process mapping conducted as part of this research to develop effective work flows between the High-Tech and other sector initiatives.

APPENDIX A: REFERENCES

Aperture Research Institute (2008). *Data Centers are Adopting Green Initiatives but are Wary of Vendors' Marketing Messages*. Available at http://www.aperture.com/about/research_institute/research.html Accessed June 19, 2008.

Brown, B. (2008, Spring). *Bridging the Communications Gap Between IT and Facilities*. Mission Critical Magazine, 37–38, 40.

Data Center Dynamics, Ltd. (2008). Top 10 Themes 2008. Available at http://www.datacenterdynamics.com Accessed November 14, 2008.

European Commission, Institute for Environment and Sustainability, Renewable Energies Unit (2008, April 8). *Code of Conduct on Data Centres. Version 0.8 (Working Draft)*. Available at http://sunbird.jrc.it/energyefficiency/html/standby_initiative_data%20centers.htm Accessed November 14, 2008.

European Commission, Institute for Environment and Sustainability, Renewable Energies Unit (2008, April 21). *Best Practices for the EU Data Centre Code of Conduct. Version 0.2.2 (Draft)*. Available at http://sunbird.jrc.it/energyefficiency/html/standby_initiative_data%20centers.htm Accessed November 14, 2008.

The Green Grid (2007). *The Green Grid Data Center Power Efficiency Metrics: PUE and DCiE*. Available at: http://www.thegreengrid.org/gg_content/ Accessed July 23, 2008.

The Green Grid (2008). *The Green Grid Productivity Indicator*. Available at: http://www.thegreengrid.org/gg_content/ Accessed November 14, 2008.

Lawrence Berkeley National Labs. (2008). *Data Center Energy Management. Best Practices Checklist*. Available at http://hightech.lbl.gov/DCTraining/Best-Practices.html Accessed November 14, 2008.

McEnroe, M. M., Vadakkath, A., & Peterson, M. (Jan. 29, 2009). *Silicon Valley Power's Data Center-Focused Energy Efficiency Programs*. Paper presented at the 19th National Energy Services Conference & Expo, San Diego.

Pacific Gas & Electric Company (2005). High-Tech Facilities Program Implementation Plan (PIP). Available at http://www.californiaenergyefficiency.com/calenergy_old/2006_08_programs.html. Accessed December 12, 2008.

Pacific Gas & Electric Company (2006). *High Performance Data Centers. A Design Guidelines Sourcebook*. Available at http://hightech.lbl.gov/datacenters-bpg.html Accessed July 25, 2008.

Pacific Gas & Electric Company (2008a). Third Quarterly Report. Available at http://eega2006.cpuc.ca.gov/ Accessed December 24, 2008.

Pacific Gas & Electric Company (2008b). October Monthly Report. Available at http://eega2006.cpuc.ca.gov/ Accessed December 24, 2008.

Pacific Gas & Electric Company (2008c). *2008 Event Calendar*. Available at http://www.pge.com/mybusiness/energysavingsrebates/incentivesbyindustry/hightech/whatsnew.shtml. Accessed December 23, 2008.

Sloan, J. (2008, September 2). Personal conversation.

Standard Performance Evaluation Corporation (2008). *SPECpower_ssj2008*. Available at http://www.spec.org/power_ssj2008/ Accessed November 14, 2008.

Tschudi, W, Mills, E., Greenberg, S., & Rumsey, P. (2006, March). Measuring and Managing Data-Center Energy Use. Findings – and Resulting Best Practices – From a Study of Energy Use in 22 Data Centers. *HPAC Engineering*, 45-51.

U. S. Department of Energy, Energy Efficiency and Renewable Energy (2008). *DC Pro Version 1.0*. Available at http://www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html Accessed November 14, 2008.

U. S. Environmental Protection Agency, Energy Star Program (2007). *Report to Congress on Server and Data Center Energy Efficiency. Public Law 109-431*. Available at http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency#epa Accessed May 7, 2008.

U. S. Environmental Protection Agency, Energy Star Program (2008). *Data Collection Initiative to Develop an ENERGY STAR Rating for Data Centers*. http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency#data_collection Accessed November 14, 2008.

APPENDIX B: IN-DEPTH INTERVIEW GUIDES

High-Tech Customer In-depth Interview Guide

Market Actor In-depth Interview Guides

Data Center and Cleanroom Engineers/Designers

Manufacturers and Vendors

HIGH-TECH CUSTOMER IN-DEPTH INTERVIEW GUIDE

[Interview objectives: Participant and nonparticipant interviews will serve to inform the market characterization and strategic marketing plan, as well as provide recommendations for process improvements. We considered the following to be critical questions: 23, 24, 26, 35, 36, 43, 46, 54, 55, 69, 78, 80, and 81.]

[In case they ask for contact numbers to verify the validity of our interviews:

- Tsosie Reyhner (Senior Project Manager, Research & Evaluation) 415-973-0216
- Francois Rongere (Program Supervisor – Hi-Tech, Biotech & Healthcare segments, Customer Energy Efficiency Program) 408-282-7538]

I. Introduction/Identify Respondent

Hello, my name is _____ and I am calling on behalf of Pacific Gas & Electric Company regarding their incentives and services for energy efficiency in High-Tech businesses.

[Intro for Participants:]
We are contacting PG&E customers who have participated in the energy efficiency program to better understand facility-related decision-making and to ask about experiences and overall satisfaction with the program. Your input will help us improve the incentives and services provided to PG&E's high tech customers, like [company name].

1. *Our understanding is that your company participated in the program. Is that correct?*
   [Verify that you are speaking with a participant.]

2. *Are you the person responsible for your company's decision to participate in the program and/or were you the main point of contact with PG&E?*
   a. No [PROBE: *Are you the best person to talk to regarding your company's participation in the program?* If not: *Who should we talk to?* Get contact info for the person we should talk to _____]
   b. Yes – [schedule interview]

[Intro for Nonparticipants, including Audit-Only and Deemed Measure Participants:]
We are contacting high-tech businesses in PG&E's service area to better understand facility-related decisions and energy efficiency. Your input will help us improve the financial incentives and other services provided to PG&E's high tech customers, like [company name] *to help them improve the energy efficiency of their building by reducing energy use associated with data centers, laboratories, clean rooms, etc.*

3. *Our understanding is that your company has not received energy efficiency incentives from PG&E in the past two years. Is that correct?* [Verify that you are speaking with a nonparticipant – if they say they have participated, PROBE to determine what types of measures they installed. If they are deemed measures only, continue with the nonparticipant questions.]

I'd like to speak with the director of facilities, the facility and maintenance director, or someone who makes decisions regarding facility maintenance and improvements.

[Once the correct respondent is identified, schedule interview.]
I would like to schedule a 20 to 30 minute interview so that we could discuss your experiences and perspectives. Is this a good time to talk or would you prefer to schedule a more convenient time? [If no, schedule call back time: _____]

Please be aware that any information you provide will be kept anonymous and confidential.

II. Respondent Expertise and Background

First, I'd like to learn a little bit about what you do at (company name) and your area of expertise.

4. *What is your title and primary job functions and responsibilities at (company name)?*

_____

III. Firmographics and General Decision Influences

Now I'd like to ask you some general questions about your company and some more specific questions about its [*data center, labs, cleanrooms*].

5. *What would you say is the primary business activity of your company?* [Note free response and code below. If not clear, ask what industry they are in.]

_____

a. internet service provider/collocation or data center
b. biotechnology
c. electronics manufacturing
d. telecommunications
e. pharmaceuticals
f. other [SPECIFY:_____]

A. Customers with Laboratories/Cleanrooms:

[If their business is biotech, electronics manufacturing, pharmaceutical, or similar. Otherwise, Skip to Q #19.]

6. *Does your facility have a laboratory (i.e., a lab where research or manufacturing takes place)?*
   a. No [Skip to Q #9]
   b. Yes
   c. Don't know [Skip to Q #9]

[If they have a lab:]
7. *What percentage of the facility is devoted to laboratory space?*
   a. _____
   b. Don't know [estimate? _____]

8. *Is all or part of the laboratory classified as a cleanroom?*
   a. No [Skip to next section, "Data Centers."]
   b. Yes [Skip to Q #10]
   c. Don't know [Skip to next section, "Data Centers."]

9. *Does your facility have a cleanroom?*
   a. No [If they have neither a cleanroom nor lab, Skip to Q #19; if they just have a lab, Skip to Q #14 and ask lab questions.]
   b. Yes
   c. Don't know [If they have neither a cleanroom nor lab, Skip to Q #19; if they just have a lab, Skip to Q #14 and ask lab questions.]

[If they have a cleanroom:]
10. *What percentage of the facility is devoted to cleanroom space?*
   a. _____
   b. Don't know [estimate? _____]

B. Data Centers:

[If answer to Q #5 was (a), Skip to Q #12]
11. *Does your company have a data center or server room?*
   a. No [Skip to next set of questions, "Decision Process Regarding Facility Improvements"]
   b. Yes
   c. Don't know [Skip to next set of questions, "Decision Process Regarding Facility Improvements"]

12. *Which of the following describes your data center/server room?* [Read responses below. Or, you may already know the answer to this from Q #5(a).]

a. *Our servers are onsite* [If they also collocate, just mark (a) and note collocation on Q #13.]
b. *Our servers are somewhere offsite* [Clarify whether this is their own building or whether they collocate]
c. *We are a collocation center/provider* [Skip to Q #16]

[If Q #12 = (a) or (b):]
13. [If (a) servers are onsite] *Do you also collocate*? [If (b) servers are offsite] *Do you collocate* (or is it just that your company's data center is in a different facility)*?*

a. No, we do not collocate [Nonparticipants skip to Q #18, otherwise skip to next set of questions, "Decision Process Regarding Facility Improvements."]
b. Yes, we collocate
c. Don't know [Nonparticipants skip to Q #18, otherwise skip to next set of questions, "Decision Process Regarding Facility Improvements."]

14. *Where is the collocation center located?* [*Is it in California?* Get as specific as possible: Is it in PG&E's service territory: Bay Area/Silicon Valley?]

a. Not in PG&E's service territory [SPECIFY where: _____; Nonparticipants skip to Q #18, otherwise skip to next set of questions, "Decision Process Regarding Facility Improvements."]
b. In PG&E's service territory [SPECIFY where: _____]
c. Don't know [SPECIFY what city:_____][Nonparticipants skip to Q #18, otherwise skip to next set of questions, "Decision Process Regarding Facility Improvements."]

15. *What is the name of the provider?* _____

16. *Do* [*they/you*] *charge based on space or power?* _____

a. Space
b. Power
c. Don't know

[Colocation providers:]
17. *What types of businesses would you say make up the majority of your customer base?*

a) _____
b) _____
c) _____

C. Facility/Equipment Efficiency (Non-Participants, Deemed):

[Q # 18-22 for Non-Participants Only. Participants and Near-Participants, Skip to next set of questions, "Decision Process Regarding Facility Improvements."]

18. *Thinking about your company's* [*data center/cleanroom/laboratory*] *facility, how would you characterize the cooling & ventilation system in terms of efficiency* [most efficient equipment and design .... industry standard .... low efficiency equip and design]*?*

_____
[PROBE how they define their response e.g., *How would you define "industry standard"?*_____]

19. *When was the cooling and ventilation system/equipment last replaced?*

_____

[Q # 20-22 for those with data centers/server rooms only:]
20. *How would you characterize the servers/IT equipment* [e.g., state of the art, most efficient, industry standard]*?* _____
[PROBE how they define their response e.g., *How would you define "industry standard"?*_____]

21. *How often would you say servers and associated IT equipment are replaced?* [If unsure, CLARIFY: *When was the last time that servers/IT equipment were replaced?*

_____

22. *Other than what you've already mentioned, does your data center/server room make use of any specific energy efficient technology or settings such as virtualization software or powering down servers during off-peak hours* [e.g., evenings/ weekends]*?* _____

IV. Decision Process Regarding Facility Improvements (All)

Next, I'd like to ask some questions that will help PG&E identify the right people involved in decision making for certain types of equipment in the [*data center and/or cleanroom/lab*].
[Focus questions – datacenter vs. cleanroom – depending on the industry they are in.]

[For data centers/server rooms:] *We're particularly interested in identifying those in charge of equipment that affects energy use, such as ventilation and cooling, as well as servers and IT equipment.*

[For cleanrooms/labs:] *We're particularly interested in identifying those in charge of equipment that affects energy use, such as ventilation, heating, and cooling -- or any other equipment that affects energy use* (not glassware).

23. *Who makes these decisions* [selecting energy-intensive equipment for data center/cleanroom/lab]*? What is their title and role?* _____] [PROBE to see if anyone outside of facilities operations is involved.]

[PROBE if they do not mention anyone in upper management (e.g., CIO, CFO, VP, etc.) involved in decision making for lab/cleanroom maintenance, facility operations,

servers/IT equipment (particularly those that require significant capital investments and would impact energy use). Question may not be appropriate for small companies. Skip if interviewee is considered "upper management." *Does anyone in upper management get involved in these types of decisions? When do they get involved?* _____ *What aspects of the decision process are they involved with?* _____]

24. *What is the decision process like?* _____ [PROBE: *What influences your/their decisions?* _____ *Who are the types of people you/they work with when making these types of decisions—inside and outside the company?*_____]

25. *When your organization is planning a major renovation, equipment replacement, or even building a new facility, what would you say are the top 4 or 5 project requirements?* [e.g., redundancy, reliability, uptime, security, fire suppression, earthquake-proofing, comfort, aesthetics, lowest cost, payback period, depreciation/ replacement schedules, etc.]
[PROBE if the respondent is not sure what you are asking: *I'm referring to requirements that must be met for the project to be approved – these are sometimes referred to as the "owners project requirements," or OPR.*]

a. (1) _____
b. (2) _____
c. (3) _____
d. (4) _____
e. (5) _____

[If respondent does not mention anything energy-related, PROBE: *I notice that you did not mention anything that is related to energy use.* Record respondent's reaction, if any. _____]

[Other PROBES: *About what percentage of your electricity bill/power usage would you say is associated with your company's* [*data center/server room/cleanrom/lab*]*?* _____ *Do you have an energy management system?* _____*Have you/your company benchmarked your energy use?* _____ *Who is in charge of that?*_____]

V. Information Sources (All)

Next, I'm going to ask some questions about sources of information that you might use.

26. *What sources do you regularly consult, read or subscribe to in order to stay informed of events, issues, or new products relating to your profession?* [Get specific information on titles of publications, URLs, equipment manufacturers, etc. Don't provide examples of sources unless they are stumped.]

a. Publications [SPECIFY: _____]
b. Websites, blogs [SPECIFY: _____]
c. Trade organizations [SPECIFY: _____]
d. Equipment sales representatives [SPECIFY: _____]

e. Other [SPECIFY: _____]

27. *Does your company have an assigned account representative from PG&E?*
a. No [Skip to Q #29]
b. Yes
c. Don't know [Skip to Q #29]

28. *To what extent do you rely on your PG&E account representative for information about energy use or energy efficiency, on a scale of 1-5, with 5 being a great deal and 1 being not at all?*
(not at all) 1---2---3---4---5 (a great deal)

29. *Would you say PG&E provides you with the right amount, not enough, or too much information about energy efficiency for your company?*
a. The right amount
b. Not enough information
c. Too much information
d. Don't know

VI. Program Awareness (Participants)

[If Non-Participant or Deemed Participant, Skip to section "Attitudes/Awareness Regarding Energy Efficiency;" If Near-Participant (Audit Only), Skip to section "Services Received Through the Program"]
Great, thanks. Okay, now I'd like to move on to talk about your experiences and feedback regarding PG&E's energy efficiency incentives program.

30. *When did you first learn about PG&E's energy efficiency incentives for businesses?*
_____

31. *How did you first learn about PG&E's energy efficiency incentives for businesses?*
_____[Record free response, and code it later. Use probes below.]
a. A PG&E account representative contacted me directly.
[Follow-up questions:
Would you be open to (or have you ever?) talking to someone else about participating in energy efficiency programs, such as an independent contractor? Or do you prefer to be contacted only by your PG&E account rep for these types of opportunities?]
b. Other PG&E program representative contacted me directly.
[Follow-up questions:
Would you have preferred to learn about the program through your account representative?]
c. A PG&E representative contacted someone in my office who directed the call to me.
[Follow-up questions:

Who did PG&E originally contact (title/role)*?*]

d. Customer contacted PG&E.
[Follow-up questions:
Did you speak with your account representative or someone else (program representative)*?*
What was the initial reason for your call?]

e. A colleague [external to my corporation] told me about the program.
[PROBE for additional information]

f. A colleague [internal to my corporation] told me about the program.
[PROBE for additional information]

g. An equipment salesperson/contractor or systems installer/integrator.
[PROBE for name of contractor]

h. At a tradeshow/ conference.
[Follow-up questions:
Was there a PG&E representative and/or information about PG&E's program available at the conference? _____]

i. PG&E's Website.
[Follow-up question:
*Was it easy to find the information you were looking for?*_____]

j. Other information published/provided by PG&E (brochure, bill insert, etc.)
[SPECIFY:_____]

k. Other _____[PROBE: if they mention a person, be sure to ask what their affiliation/job title/role is]

32. *What was the primary reason that you decided to participate in the program?*
a. Save energy
b. Save money
c. Increase server productivity
d. "Be green"
e. Directed to participate by someone else [ex. Upper management]
f. Other: _____

[Skip Q #33 depending on response to Q #31]

33. *Before you decided to participate, what type of information* [i.e., marketing materials] *did you receive/review about the program and/or program services?* [e.g., website, brochure, etc] _____
[If none, Skip to next set of questions, "Services Received Through the Program"]

34. *How did you obtain this information?* [Or, who provided it to you?]
a. bill insert
b. at a tradeshow/conference
c. self-directed to PG&E website
d. other [SPECIFY_____]

35. *Thinking about the information you received about the program* [marketing materials/website]*, how relevant was it for your business, on a scale of 1-5, with 5*

meaning "very relevant" and 1 meaning "not at all?" (not at all) 1---2---3---4---5 (very relevant)

36. *How would you improve the information/materials you reviewed/received?* _____

VII. Services Received Through the Program

D. Energy Audit (Participants & Near-Participants):

37. *According to program records, an energy audit* [*was/was not*] *conducted of your company's facility. Is this correct?* [If they did not receive an audit, continue to next question. If they did receive an audit, Skip to Q #39]

[If they did not receive an audit:]
38. *An energy audit identifies cost-effective opportunities for improving the efficiency of a facility. Would an audit have been helpful to you?* _____ [PROBE: *Why/ why not?* _____]
[Then Skip to next set of questions, "Financial Incentive/Measure Installation"]

[If they did receive an audit:]
39. *How did you first become aware of the audit services available through PG&E?* ____

40. *Who made the final decision to have an energy audit performed?* [job title/position] _____

41. *What was the primary reason your company participated in the audit?*_____

42. *Who conducted the audit?* [job title/position] _____

43. *Did you receive a report summarizing the audit, results, and recommendations?*
   a. No [Skip to Q #45]
   b. Yes [PROBE: *How useful was the report?*_____ *Why?*_____]
   c. Don't know [Skip to Q #45]

   PROBE: *Did anyone else at your company receive the audit results?*
   _____If so: *Who?* [job title/position]_____

44. *Did someone review the audit results with you?*
   a. No
   b. Yes [PROBE: *Who?* [job title/position]_____]

45. *Do you remember any results or recommendations that were made during the course of the audit* (*or in the audit report*)*?*
   a. No
   b. Yes [PROBE: *Can you mention a few?*_____]

46. *How comprehensive was the audit? (Did the auditor walk through all spaces of the building?)* _____ [PROBE: *Or did they pick a couple representative areas? What did they look at?____Did it cover the datacenter or cleanroom?*_____]

On a scale of 1-5 with a 5 meaning "very much" and a 1 meaning "not at all", please rate the following:
47. *The extent that the audit informed you about the energy use characteristics of the* [*datacenter/cleanroom/lab*] (not at all) 1---2---3---4---5 (very much)
48. *The extent that the audit informed you about cost-effective opportunities for reducing energy use in your* [*datacenter/cleanroom/lab*] (not at all) 1---2---3---4---5 (very much)
49. *The extent that the audit was relevant and practical for your business*
(not at all) 1---2---3---4---5 (very much)
50. *The overall quality of the audit and recommendations*
(very low quality) 1---2---3---4---5 (very high quality)

51. *Based upon your experience, what suggestions do you have for improving the energy audits provided through this program?*_____

E. Financial Incentives/Measure Installation (Participants):

[For Participants (those who received incentives); otherwise Skip to next section, "Participation in Other Programs"]
According to program records, you received financial incentives for purchasing and installing high efficiency equipment. Is this correct? [If they did not receive incentives, Skip to next section, "Participation in Other Programs"]

52. *What energy efficiency equipment did you install using PG&E incentives/rebates?* [PROBE for detailed list of equipment, not just HVAC.] _____

53. *Was the equipment installation part of a renovation of existing space, addition of new space to an existing building, part of a brand new building, or did it replace failed equipment?*

a. Renovation of existing space
b. Addition of new space to existing building
c. New building
d. Replacement of failed equipment
e. Don't know

54. *What areas of the building were affected by the equipment that was installed?* _____[If they don't mention, PROBE: *Does it include the server room/clean room?*_____]

55. *Who outside of your company was involved in the* [*data center/lab/cleanroom*] *design and/or equipment selection for this project?*_____ [try to get specific company/person names, or type of company at a minimum]

56. *When did you first talk to PG&E about installing this equipment? Was it…*[Read 4 responses below]

a. *During design phase of a project/ deciding to carry out project*
b. *After I decided to carry out a project but before I purchased anything*
c. *After I purchased the equipment but before it was installed*
d. *After the equipment was installed.*

[If Audit Participant; otherwise Skip to Q #58]

57. *Did the audit recommendations influence your decision to move forward with selecting equipment and applying for incentives through PG&E?*

a. No [PROBE: *Why not?* _____
What would have been more helpful/influenced your decision to participate? _____]
b. Yes [PROBE: *Why is that?* _____]

58. *Who made the final decision to apply for incentives for the energy efficient equipment you installed?* _____

59. *Who completed the rebate application*? _____

60. *Who installed the equipment?* [company name]_____

61. *Approximately what % of the project cost was covered by the incentives from PG&E?*

a. _____%
b. Don't know

Now I'd like you to rate the next few questions on a scale of 1 to 5, with 5 meaning "very satisfied" and 1 meaning "not at all satisfied." How satisfied were you with:

62. *The time it took to receive your incentive check* (not at all) 1---2---3---4---5 (very)
63. *The amount of the incentive funds you received* (not at all) 1---2---3---4---5 (very)
64. *The level of customer service from PG&E* (not at all) 1---2---3---4---5 (very)
65. *The performance of the equipment* (not at all) 1---2---3---4---5 (very)
66. *The energy savings resulting from the project* (not at all) 1---2---3---4---5 (very)

67. *Based upon your experience, what suggestions can you offer that would improve this aspect of the program* [e.g., measure installation and rebate processing]*?* _____

VIII. Participation in Other Programs (Participants/Near-Participants)

Your responses have been great so far - just a few more questions - we're almost done.

68. *Did you purchase and install any other high efficiency equipment without PG&E incentives/rebates?* [If they have a data center/server room, ask about specific technology such as virtualization software or settings to power down servers during off-peak hours, e.g., evenings/weekends]

a. No
b. Yes [PROBE: *What were they?* _____
Why did you not use PG&E incentives/rebates? _____]

IX. Overall Satisfaction (Participants/Near-Participants)

On a scale of 1 to 5 with a 5 meaning "very satisfied" and a 1 meaning "not at all satisfied," please rate the following:

69. *Your overall satisfaction with the program* (not at all) 1---2---3---4---5 (very)
[PROBE: *Why that rating?* _____]
70. *Your interactions with PG&E staff* (not at all) 1---2---3---4---5 (very)
71. *Your interactions with those carrying out the audit or inspecting equipment* (not at all) 1---2---3---4---5 (very)

[All:]

X. Attitudes/Awareness Regarding Energy Efficiency (All):

Now I'd like to ask you some more general questions.

72. *In the past year or so, there has been an increased focus on climate change and the "green movement." What comes to mind when you think of the "green movement?"* _____ [PROBE: *In your mind, is energy efficiency a part of this?* _____]

73. *Based on what you just told me, has your company done anything in line with the "green movement?"*_____ [PROBE: *Why/why not?*_____]

74. *Has your organization developed an energy management plan or corporate policy that encourages or requires the purchase of energy efficient equipment* [e.g., LEED]*?*

a. No
b. Yes [If Participant, PROBE: *Do you think this is a result of your participation in this program?* _____]

75. *How important is energy efficiency in your financial decision making process on a scale of 1-5, with 5 being very important and 1 being not at all?*
(not at all) 1---2---3---4---5 (very)

76. *How important is energy efficiency in your facility operations decision making process?*
(not at all) 1---2---3---4---5 (very)

XI. Awareness of PG&E's Programs (Nonparticipants/Deemed Participants/Near-Participants)

[Participants Skip to End]

77. *Are you aware of financial incentives offered by PG&E that are available for businesses?* [Make sure Deemed Participants understand you are referring to the custom incentives: *Are you aware of other incentives available that are separate from those on the rebate list?* Energy savings are calculated as part of the project planning process, and PG&E calculates incentives based on the energy savings.]

a. No [Skip to Q #80]
b. Yes
c. Don't know [Give background info, and see if it jogs their memory; if still don't know, Skip to Q #80]

[Q #78-79 If aware:]
78. *What is the primary reason your company has not participated?*_____
[Deemed Participants: *What is the reason your company has not pursued these customized incentives?*]

79. *How likely are you to participate in this program (installing equipment with customized incentives from PG&E) in the next two years – very likely, somewhat likely, or not at all likely?*

a. Not at all likely [PROBE: *Is there a particular reason you don't think your company will participate?*_____]
b. Somewhat likely [PROBE: *Why do you say this?*_____]
c. Very likely [PROBE: *Why do you say this?*_____]

[Next Skip to Q #82 if Non-participant/Deemed participant; otherwise Skip to End]

[Q #80-81 If not aware:]
80. *What would be the best way for PG&E to inform you about such opportunities* [e.g., print, Website, publication, email, newsletter, bill insert, account exec., blog]*?*

_____

81. *Who at your company should receive this information?* _____

[Non-participants/Deemed participants only; Near-participants Skip to End.]
82. *An energy audit identifies cost-effective opportunities for improving the energy efficiency of a facility. PG&E offers audit services at reduced or no cost to the customer. What is the likelihood that you would have an audit conducted of your facility to identify*

opportunities for energy efficient equipment in the next two years – very likely, somewhat likely, or not at all likely?

a. Not at all likely [PROBE: *Is there a particular reason you don't think your company will want an energy use audit?*_____]
b. Somewhat likely [PROBE: *Why do you say this?*_____]
c. Very likely [PROBE: *Why do you say this?*_____]

[All:]

END:

Those are all of my questions.

Do you have any other comments about the program? _____

Thank you so much for your time!

MARKET ACTOR IN-DEPTH INTERVIEW GUIDE: DATACENTER & CLEANROOM DESIGNERS

[**Interview Objectives:** Market actor interviews will enable characterization of the hi-tech market and inform the strategy for future marketing activities by examining the decision process and influences regarding equipment selection and facility design.]

[In case they ask for contact numbers to verify the intent of our interviews:
- Tsosie Reyhner (Senior Project Manager, Research & Evaluation) 415-973-0216
- Francois Rongere (Program Supervisor – Hi-Tech, Biotech & Healthcare segments, Customer Energy Efficiency Program) 408-282-7538]

I. Introduction/Identify Respondent

Hello, my name is _____ with Energy Market Innovations. I am calling on behalf of The Pacific Gas & Electric Company regarding their incentives and services for energy efficiency improvements for High-Tech businesses. PG&E is striving to improve their energy efficiency offerings for the high tech sector, and we are conducting research to help with their program. As part of this research, we are contacting engineering firms who are involved with the HVAC system design and equipment specification for data centers, server farms, and "clean rooms" and other types of high-tech facilities that have unique HVAC and air exchange and filtration requirements.

It is my understanding that your firm is involved in these types of projects. Is that true?

[If data center and/or cleanroom design, schedule interview.]
I would like to ask you some questions that will help us understand how decisions regarding facility design and equipment selection are made (relating to data centers/clean rooms) *and to help us learn how PG&E might provide information about its program to businesses in this market. Is this a good time to talk or would you prefer to schedule a more convenient time?* [If no, schedule call back time: _____]

Any information you provide will be kept anonymous and confidential, and we will aggregate and summarize all information before providing it to PG&E.

II. Respondent Background

1. *First, I'd like to learn about your professional background, expertise, and responsibilities with your firm.* [*What is your role when a client hires you? What do they hire you to do?* _____]

2. *What type of work does your firm do?*_____
[PROBE: *Do you specialize in any particular industry?*_____ *Do you work in new construction or retrofit*?_____(ask questions throughout interview for both types if applicable)]

III. Data Center Design Process

We're interested in talking specifically about the work you do with respect to [*datacenters and/or cleanrooms*]. *In particular, we want to understand the process you would undergo, the people involved, and what influences your decisions when designing a data center/cleanroom*

3. *Can you explain how HVAC system equipment or systems (including filtration, exhaust, fans, controls, etc.) is selected to meet the requirements of a* [*data center and/or cleanroom*], *as opposed to an office building? What are the steps when you are building (or retrofitting) a server room/cleanroom?* _____

4. *Who are the key decision makers with respect to the final equipment specification?* _____ [PROBE: *Who is making the decisions about which equipment gets selected?*_____ *Does the customer play a part in that, or is it all the designer's responsibility?* _____ (What is the designer's role? Who manages the design process – is it the customer or do they let the designer have complete control?)
Engineering firm: *Is a mechanical contractor part of the design team?* _____ *Do you work directly with a manufacturer or distributor?* _____ *Is it always the same types of people involved, or does it vary?*_____]

5. *What are the top 4 or 5 considerations in the design process?* [e.g., redundancy, reliability, uptime, security, fire suppression, earthquake-proofing, comfort, aesthetics, lowest cost, payback period, depreciation/ replacement schedules, etc.]
[PROBE if the respondent is not sure what you are asking: *I'm referring to requirements that must be met for the project to be approved – these are sometimes referred to as the "owners project requirements," or OPR*.]

a. (1) _____
b. (2) _____
c. (3) _____
d. (4) _____
e. (5) _____

[If respondent does not mention anything energy-related, PROBE: *I notice that you did not mention anything that is related to energy use.* Record respondent's reaction, if any. _____]

IV. Opportunities for Marketing/Education/Training

Now I'd like to ask you some questions about some of the programs and services offered by PG&E.

6. *Are you aware of PG&E rebates and financial incentives for energy efficient equipment?* _____ (Incentives = customized incentives unique to the high-tech sector, specifically for improving energy efficiency in data centers/cleanrooms.) *Have you recommended PG&E incentives to any of your clients?* _____ *If not, why?* _____ [PROBE:Are you familiar with the deemed and/or calculated measures and rebates offered by PG&E?]

7. *Are you aware of any of the following services offered by PG&E? Audits, technology demonstrations, benchmarking, commissioning/retrocommissioning, or best practices design guidelines?*

8. *What do you feel is the best way for PG&E to get information about their program to you and clients in the PG&E service area?*_____

9. *Do you feel like you are you in a position to recommend programs offered through PG&E to your clients? That is, do you feel that if you informed your customers about the incentives, audits, benchmarking, etc offered through PG&E that you could influence their decision to install more energy efficient equipment?* _____ [PROBE: *Would you feel comfortable recommending to your customers that they participate in PG&E's energy efficiency incentive program?*_____ *What would it take for you to recommended to your customers that they participate in PG&E's program? Would PG&E need to provide you training or just a brochure?* _____]

V. Information and Equipment Sources

Now I'm going to ask some questions about your sources for information and equipment.

10. *Where do you get your information to keep up with your industry (issues, events, new products relating to your profession)?* [Get specific information on titles of publications, websites, names of trade organizations, equipment sales reps, blogs, etc.]

a. Publications [SPECIFY: _____]
b. Websites, blogs [SPECIFY: _____]
c. Trade organizations [SPECIFY: _____]
d. Manufacturers, equipment sales representatives [SPECIFY: _____]
e. Other [SPECIFY: _____]

11. *Can you describe differences in the distribution channel from the manufacturer to customer site between the high tech market and the typical C&I market?*_____
[PROBE: *How does this HVAC market (i.e., for DCs or cleanrooms) differ from normal HVAC distribution channels?*_____]

12. *We are trying to collect names of other people we should interview. Are there other people you would recommend that we talk to (architects, engineers, mfrs, distributers that specialize in high-efficiency equipment, monitors and controls for these types of businesses)?* _____

VI. Closing

[If time:]
13. *What is the state of the industry, in terms of what the customer wants? Do they choose high efficiency equipment? What do they look for?* _____

[If time:]
14. *What are the big industry developments or trends?* (E.g., What is the new technology everyone's talking about? Is the economy affecting this market sector?) _____

Those are all of my questions. Thank you so much for your time!

MARKET ACTOR IN-DEPTH INTERVIEW GUIDE: MANUFACTURERS & VENDORS

[**Interview Objectives:** Market actor interviews will enable characterization of the hi-tech market and inform the strategy for future marketing activities by examining the decision process and influences regarding equipment selection and facility design.]

[In case they ask for contact numbers to verify the intent of our interviews:
- Tsosie Reyhner (Senior Project Manager, Research & Evaluation) 415-973-0216
- Francois Rongere (Program Supervisor – Hi-Tech, Biotech & Healthcare segments, Customer Energy Efficiency Program) 408-282-7538]

Instructions for interviewers: The interview questions are to be reviewed and modified appropriately for each respondent, so the interview is meaningful to their company's equipment and primary business function. The questions outlined below are not to be asked verbatim, nor are they all relevant for each potential respondent.

I. Introduction/Identify Respondent

Hello, my name is _____ with Energy Market Innovations. I am calling on behalf of The Pacific Gas & Electric Company regarding their incentives and services for energy efficiency improvements for High-Tech businesses. PG&E is striving to improve their energy efficiency offerings for the high tech sector, and we are conducting research to help with their program. As part of this research, we are contacting manufacturers and vendors of equipment that increases the energy efficiency of data centers, server farms, and "clean rooms" and other types of high-tech facilities that have unique HVAC and air exchange and filtration requirements.

Any information you provide will be kept anonymous and confidential, and we will aggregate and summarize all information before providing it to PG&E.

II. Company and Respondent Background

1. Please describe your companies primary business activity and the products/services it [manufacturers/sells].

2. How would you characterize your company's customer base?

3. What is your personal professional expertise? *[Role/responsibility in the company]*

III. Company role and influence in the high tech sector

3. What role/function does your company have with respect to equipment specification for high-tech facilities? *[Depending on respondent's company, refer to specific businesses/industry instead of "high tech" throughout the interview]*

4. How influential do you believe you/your company is with respect to availability of equipment availability in the market?

5. How influential do you believe your company is with respect to equipment selection/specification?

6. Does your company play a role or participate in deliberations for establishing guidelines and equipment standards? How so? *[such as ENERGY STAR, state/federal standards, ASHRAE, etc.]*

IV. Awareness/Involvement with PG&E's HT sector initiatives

7. Are you familiar with PG&E's current program that offers financial incentives for energy efficient equipment, high performance new construction projects? Are you familiar with PG&E's program that specializes in providing customized incentives for high-tech customers?

8. [If yes] What is your general impression of the program? *[In terms of services offered to customers, level of financial incentives, infiltration into market, etc.]*

9. How did you learn about the program?

10. How would you characterize your/your company's relationship with PG&E and the HT program, in particular? *[i.e., none, program marketing, general industry outreach, tech assistance, etc.]*

11. (if applicable) Who at PG&E do you interact with most?

12. (If applicable) Based upon your knowledge about the program, how well would you say the program (incentives, technical assistance, etc.) influences PG&E's customers to select and install [more energy efficient equipment/improve facility performance]?

V. Industry Trends, Program Influence

13. The program offers financial incentives for measures that reduce energy use of heating and cooling of data centers and server virtualization, as well as other measures specific to air filtration and other environment controls for labs & clean rooms. What types of equipment and high-tech facility design would you say are standard practice and what would you consider to be "high efficiency" or "high performance"?

14. Can you offer insight into upcoming trends that PG&E should be aware of, with respect to equipment/data center design research that is "cutting edge" or that are in development that PG&E should consider incorporating into its program offerings?

VI. Barriers

16. What would you consider to be the primary obstacles high-tech industry customers to adoption of more energy efficient equipment in the high tech sector? *[availability of energy efficient equipment, awareness of energy efficient equipment/design options, first cost, lack of understanding of benefits of energy efficient equipment, lack of industry expertise, etc.]*

VII. Recommendations for Program Improvements

17. Can you offer any suggestions or insight into how PG&E can best serve their high-tech/data center customers and/or improve the energy efficiency services it currently offers? *[Do Not Read … add measures to the program, provide incentives for design assistance, energy audits, demonstration/case studies]*

18. What do you feel would be the most effective means for marketing this program to high-tech companies? *[not only how to market the program, but WHO should PG&E be targeting within the organization?]*

19. Do you have any other thoughts or comments?

Those are all of my questions. Thank you so much for your time!