

# Barriers and Opportunities in the High-Tech Market Sector

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## ABSTRACT

There are several obstacles to the adoption of energy efficient equipment and facility design within the high-technology market. First, the “high-tech market” is an ambiguous classification that can include numerous business types, cross cutting several industries. This diversity increases the importance of specifying a well-defined target market, which is needed to maximize the effectiveness of marketing efforts. Second, high-tech facilities have unique environmental and/or operational requirements that cannot be compromised. A common misperception among customers in the market segment is that energy efficiency will jeopardize the performance and reliability of vital equipment. Third, there are multiple individuals, both internal and external to the customer’s business, who are influential in the decision to install energy efficient equipment in high-tech facilities. These individuals must be identified, as they can provide an opportunity for targeted marketing and partnerships. All of these unique market characteristics present a challenge to utilities’ successful delivery of energy efficiency programs that specifically target the high-tech market.

Pacific Gas & Electric Company (PG&E) launched one such initiative in 2006. As part of its market-based outreach and delivery strategy, PG&E’s program targets data centers and other high-tech industries prominent in its service area, such as biotechnology and electronics manufacturers. This paper presents the results of a process evaluation and suggests recommendations for high-tech program design. The research was informed by in-depth interviews with program participants, nonparticipants, program staff, and influential market participants, as well as secondary research. The results of our research suggest ways that program implementers can define their target market and leverage opportunities for marketing such a program.

## Introduction

Increasing demand for online communications and data storage calls for the delivery of energy efficiency programs targeting data center facilities. In recent years, much of communication, information storage, and web commerce has shifted online, and as a result, more data and web storage space (i.e., more server storage capacity) has become necessary. In 2007, the U. S. Environmental Protection Agency (EPA) estimated that data centers were responsible for 1.5% of all power usage in the United States, more than double that used in 2000 (U.S. EPA, 2007). Furthermore, the EPA estimated that, at current growth rates, this percentage is expected to double again by 2011.

In 2006, PG&E developed an energy efficiency program to address increasing power used by the sizeable number of data centers<sup>1</sup> as well as other high-tech customers within their service territory, such as: biotechnology, pharmaceutical, electronics manufacturing, cleanrooms, and telecommunications. The program provides energy audits and incentives for the installation of recommended measures for both

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<sup>1</sup> The focus is on larger facilities classified as data centers, but the program also serves smaller data storage sites, such as server rooms.

retrofits and new construction. In addition to traditional energy efficiency opportunities, high technology facilities are unique in that they have intensive and precise heating, ventilation, and air conditioning (HVAC) needs. Among others, efficiency measures for data centers include adoption of virtualization software, HVAC upgrades and replacements, water economizer and outside air-economizer implementation, and air-flow management improvements. PG&E has worked to become an industry leader in the high-tech efficiency realm by participating in numerous conferences and seminars, sharing information with other utilities, and regularly communicating with IT representatives, manufacturers, and vendors.

In 2008, Energy Market Innovations, Inc. (EMI) conducted a Process Evaluation of PG&E's High-Tech Program for the 2006-2008 program cycle. This research consisted of both primary and secondary research to characterize and refine the target market and to provide a recommended strategy for future marketing activities. Primary data collection included in-depth telephone interviews with program customers (20 participants and 20 non-participants), as well as interviews with 16 key market participants (e.g., data center designers, engineers, equipment manufacturers, and vendors).<sup>2</sup> A process-mapping workshop and follow-up in-depth interviews were also conducted with various PG&E staff to define marketing, outreach, and program delivery processes; and identify opportunities for process improvements.

This paper will highlight the key findings of the process evaluation and inform program administrators and implementers about the energy-related needs and decision influences unique to the high-technology market segment. First, this paper discusses considerations for defining the high-technology market segment and the importance of developing a concise target market for energy efficiency initiatives. We then provide an overview of the high-tech market including roles and interactions of key participants in this market, as well as some of the unique characteristics and considerations that influence decisions that impact energy use of high-tech facilities. Using PG&E's High-Tech Program as a case study, this paper will outline the implications of the unique needs and requirements of this market segment on energy efficiency program design and implementation.

## **Stepping Back: What is the “High-Tech” Market, Anyway?**

According to the Program Implementation Plan (PIP) for the program, PG&E defines its high-tech market sector by *facility* to include the following: 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 is defined by *business type*, using the 2002 North American Industry Classification System (NAICS) codes, a common business classification system. Based upon the database PG&E provided to EMI for this research, the high-tech target market in PG&E's service area includes businesses with a NAICS2 classification presented in Table 1. As shown, the target market for the High-Tech Program consists of 38,651 customer sites, the majority of which (31,899) are in the telecommunications industry. Telecommunications sites may house data centers, but may also 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.

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<sup>2</sup> Because sample size was small, we were not able to make conclusive comparisons; instead, general trends are discussed.

**Table 1: PG&E’s High-Tech Business Classifications**

<b>NAICS2 Description <sup>a</sup></b>	<b>Number of PG&amp;E Customer Sites <sup>b</sup></b>
Pharmaceutical and Medicine Mfg	388
Computer and Electronic Product Mfg	716
Communications Equipment Mfg	380
Audio and Video Equipment Mfg	85
Semiconductor and Other Electronic Component Mfg	1,028
Mfg and Reproducing Magnetic and Optical Media	22
Radio and Television Broadcasting	828
Internet Publishing and Broadcasting	6
Telecom (Wired & Wireless Carriers, Paging, Resellers, Satellite, and Cable)	31,899
ISPs, Web Search Portals, Data Processing Services	769
Computer Systems Design and Related Services	843
Scientific R&D Services (Physical, Engineering, and Life Sciences)	1,687
<b>TOTAL</b>	<b>38,651</b>

<sup>a</sup> The NAICS2 codes describe the “primary activity for the account,” while NAICS1 codes describe the “main business of the company.” PG&E uses NAICS2 codes to target customers for the High-Tech Program. The accuracy or comprehensiveness of NAICS2 codes has not been verified.

<sup>b</sup> Data provided by PG&E. 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 targeted outreach and marketing specifically for data centers. 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; EPA, 2007, p. 4), even though the businesses themselves are not classified as “high-tech.” For example, financial institutions are likely to have dedicated data centers or server farms. However, including financial institutions in the target market for a high-tech program is likely to create overlap between other commercial sector programs and may create confusion among those who are conducting program outreach.

For the remainder of this paper, we focus specifically on the Information Technology (IT) related facilities – data centers or “server farms” in particular.

## **Decision Influences and Project Requirements**

A sizeable portion of our research effort was 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 purchasing decisions is valuable for identifying points of influence where marketing strategies may be especially useful. In addition, understanding barriers to energy efficiency in this market segment will enable program managers to strategize regarding how to leverage marketing strategies to address such barriers.

## Customers' Project Requirements

Through in-depth interviews, PG&E high-tech 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 2 lists the requirements that were mentioned, and the number of respondents who vocalized each one. Sixteen of the 27 respondents indicated that energy or energy efficiency was in their top four or five project requirements, possibly a biased response 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 2: Priorities of Equipment Selection and Facility Design Decisions**

<b>Requirement or Consideration</b>	<b>Mentioned as One Decision Factor</b> (n=27)	<b>Mentioned as the Top Priority</b> (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 also the reliability and flexibility of equipment.

## Customers' Equipment/Design Decision Process

We examined influences on decision-making for energy-intensive equipment and systems design. This included determining the types of individuals within the company who were responsible for such decision-making. We also asked who outside the company was involved in decision-making.

**Involvement of Facilities and IT Staff in Decision-Making.** A 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 the data center at their facility. As shown in **Table 3**, it was very common for some individuals to be responsible for the data center and for other individuals to be responsible for the remainder of the building; this was the case for 19 of the 38 respondents. For example, facilities managers were often responsible for maintaining HVAC equipment, while network administrators or data center operations staff were responsible for selecting equipment in the data center. 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 would be 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.

**Table 3: Decision-making for HVAC and IT Equipment**

<b>Decision Makers</b>	<b>Number of Interviewees (n = 38)</b>
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 also asked customers about other parties outside the company who influence the decision process. In an open-ended 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 stated 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.

In summary, program staff should be aware that it is not always the facilities manager who is responsible for making equipment-related decisions. Often, IT staff are the decision makers for equipment used in the data center. Account managers (staff who manage large C&I customer accounts) and High-Tech Program staff should anticipate the possibility of multiple decision makers and make every effort to engage both facilities and IT staff throughout the various project phases. There are also points of influence external to the customer’s business. 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 high-tech programs.

**Information Sources**

As a stepping stone to assess the program’s current marketing strategy and to recommend improvements, EMI asked customers a variety of questions to learn about how they obtain information necessary to support their facility-related decisions. The purpose was to identify potential marketing outlets and partnership opportunities that may increase program awareness.

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. The most common resources for each type of information source are listed in Table 4. Industry publications, organizations, and conferences were mentioned by over half of the respondents. Interestingly, PG&E was mentioned by only 9 of the 38 respondents. This result indicates that utilities should consider more deliberate marketing and outreach through trade publications and industry organizations to increase (and maintain) awareness of the program.

**Table 4: Primary Information Sources of High-Tech Customers**

Source	Number Using the Source (n = 38)
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.

A list of common publications, trade groups, and websites is included in Table 5. Only sources mentioned by at least two separate individuals are listed.

**Table 5: Common Publications, Trade Groups, and Websites.**

Source	Number Using the Source
<b>Publications</b>	<b>(n = 23)</b>
Broadcast Engineering Magazine <sup>a</sup>	6
International Facility Management Association (IFMA) Magazine	4
TV Technology Magazine <sup>a</sup>	4
Building Operating Management Magazine	3
The BOMA Magazine (Building Owners and Managers Association)	2
<b>Trade Organizations, Conferences</b>	<b>(n = 21)</b>
BOMA (Building Owners and Managers Association)	3
Critical Facilities Roundtable	3
Data Center Dynamics	3
International Facility Management Association	3
National Association of Broadcasters	3
AFCOM	2
ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)	2
Uptime Institute	2
<b>Websites</b>	<b>(n = 12)</b>
www.uptimeinstitute.org	2

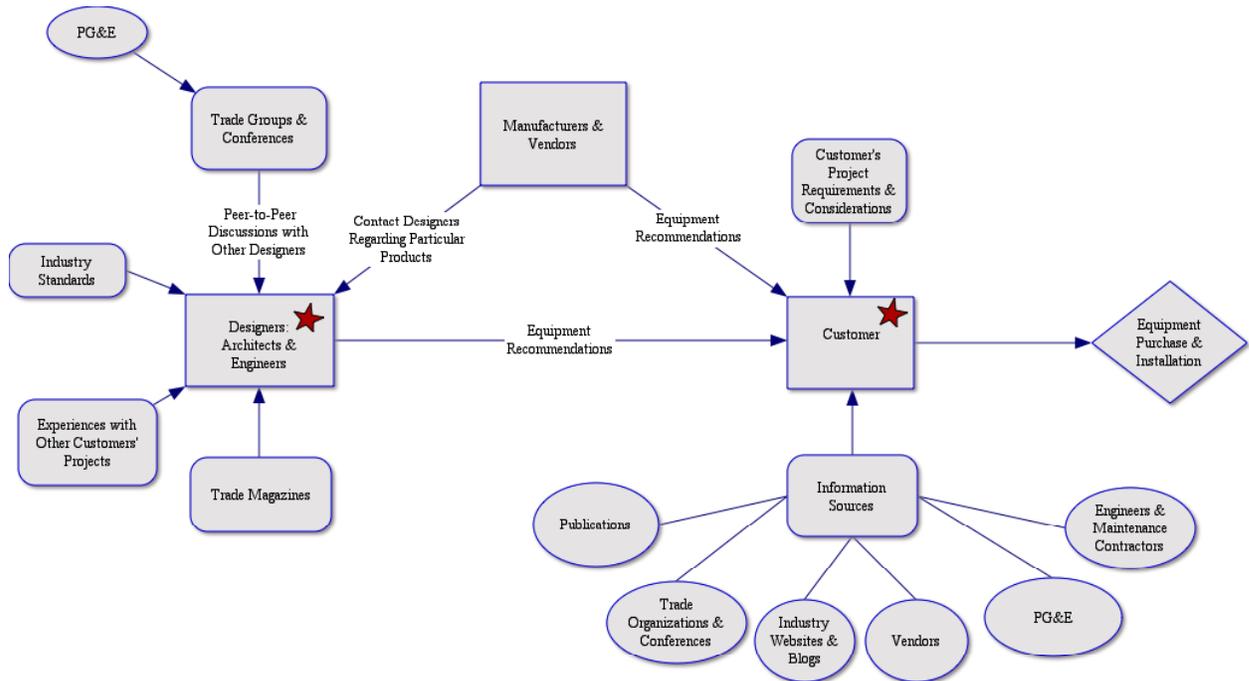
<sup>a</sup>Although our focus was on data center customers, we also spoke with customers for whom the data center was not the core of their business; however, these customers, such as those in television broadcasting, typically had a data facility or server room.

## Data Center Equipment Market Structure

Our interviews with customers and market participants provided a picture of how the market for data center equipment is structured. Figure 1 provides a simplified overview of the flow of information and interactions among those involved in the specification and design of HVAC equipment in data centers. This visual is useful as it illustrates PG&E's 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. These designers in turn get their information from a variety of sources, including vendors, trade magazines, industry standards published by

ASHRAE and LEED, and 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.



**Figure 1: Information Flow and Market Interactions**

Because designers play a key role in the customer’s choice of equipment, they have the unique opportunity not only to inform customers about the availability and benefits of energy efficient equipment, but also to inform unaware customers about program incentives. Incentives can persuade customers to install more energy efficient equipment, and designers could be instrumental in influencing their customers or clients to participate.

Customers also base their decisions on project requirements and considerations that may be unique to high-tech customers, and they may consult various sources of information such as trade journals, industry-specific websites, and PG&E. Some of the unique considerations for high-tech customers can be barriers to participation, which are discussed in detail in the next section.

### Barriers to Energy Efficiency

Understanding high-tech customer barriers to energy efficiency is a first crucial step 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 our interviews with architects and engineers involved in data center design, and to a lesser degree our interviews with customers and secondary research. (Again, we focus here primarily on data centers.)

The unique equipment requirements of data center customers present challenges when attempting to implement energy efficiency. Interview respondents noted that high-tech customers have project requirements and considerations that may be different from those of other customers. These customers tend to place high importance on the following:

- Reliability

- Redundancy
- Uptime
- Security
- Flexibility for expansion

The market participant respondents stressed that those involved in equipment recommendation, selection, and installation must be well versed in these special requirements. A high knowledge level helps gain trust and adoption on the part of customers whose main priorities may not include energy efficiency. Once this trust is developed, customers can rely on these market participants when making energy efficiency decisions. Conversely, a designer or contractor who is not aware of unique data center requirements may inadvertently recommend unsuitable procedures or equipment that will ultimately reinforce the original hesitations or fears on the part of the customer.

Because of these unique considerations, high-tech customers may have other priorities or misconceptions that present barriers to selecting energy efficient equipment. While IT staff are receptive to new technology developments, they do not tend to be early adopters of HVAC equipment. 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 the following:

- Because of the importance placed on uptime, reliability, and redundancy, IT staff may be particularly likely to discount trends in efficiency.
- 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. This makes equipment specification especially challenging.
- Given constantly increasing power demands, there can be long timelines for delivery and installation of data center HVAC equipment.
- Communication between Facilities and IT Departments is often lacking (also see Brown, 2008).

It is important to note that participants of the program were generally quite satisfied with the program. Participants were most satisfied with their interaction with PG&E staff. This was made evident when participants were asked to rate their overall satisfaction with the program. When asked to explain their rating, several participants praised their account manager, 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 [Account Manager]. I don’t think I’ve ever brought anything to PG&E’s attention that I didn’t get a positive response.” The account manager-customer relationship was a key to satisfaction for several participants.

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.

## **Implications for Energy Efficiency Programs**

Based on EMI’s process evaluation of PG&E’s High Tech Program, a number of recommendations for other utility programs can be made:

1. **High-Tech customers are receptive to energy efficiency programs.** Those who had

participated in the program indicated that they were quite satisfied. However, it is important for program staff to be aware of customers' concerns. Customers want to be assured that efficiency measures will not result in the failure of mission critical equipment. Providing case studies of success stories is one way to assure customers that they can accomplish energy efficiency without harming their business.

2. **Define the target market.** Our research found the target market for this program to be too broad for effective communication and marketing – both internally, within PG&E's organization, and externally, to the industry and PG&E's customer base. The key issue is to determine if the program should target high-tech customers or businesses with high-tech facilities. One option, for example, is to narrow the program to a specific facility type – to create a “Data Center Facilities” Program, for example. In this way, utilities can utilize marketing channels to gain the attention of customers who will self-identify as data center facilities. Furthermore, this may help address the communication gap between the facilities and IT departments at many businesses. The challenge will remain to get these two departments to communicate and come to a mutual understanding when it comes to efficiency upgrades, but a more narrow and specific program will facilitate such communication.
3. **Develop messages that address IT concerns.** Customers have a variety of concerns when it comes to implementing new projects. They are not only interested in energy efficiency, but they are also concerned about reliability, performance of equipment, and security, as well as initial cost versus lifecycle cost. Marketing efforts should address these concerns, by for example, emphasizing that efficiency measures can improve performance while maintaining reliability.
4. **Leverage the influence of data center designers and vendors.** Designers such as architects and engineers, as well as vendors and manufacturers, can be critical sources of information for customers. Our conversations with customers revealed that they often rely on the expertise of engineers, architects, and vendors to recommend new and energy efficient products. There is a great opportunity to utilize this relationship to increase program participation. We recommend that utilities partner with data center engineers and architects, as well as manufacturers and vendors of efficient IT equipment such as power systems and efficient servers. There are several partnership models or options to explore, such as contractor training and contractor referrals, as well as providing basic “training” about high-tech programs so contractors have information to provide customers when opportunities arise.
5. **Provide ongoing training to Account Managers and other utility staff on program opportunities.** 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 to build on this positive relationship, efficiency programs often encourage Account Managers to talk to their customers about participation in efficiency programs. In addition, when customers call the utility to learn about efficiency opportunities, they are directed to speak to their Account Manager. In order for the Account Manager to act on a customer's request for energy efficiency information, they need to be fluent in PG&E's efficiency programs. This is especially important for a program that targets high-tech facilities that exist across a variety of business types. In addition, engineers whom Account Managers rely on for support, such as auditors or sales engineers, also need to be fluent in calculating high-tech energy efficiency opportunities. In order for this to happen, formal program training by program staff is required so that utility staff can continuously stay up-to-date on the IT market and efficiency opportunities.
6. **Coordination between departments is required for successful high-tech program delivery.**

The process-mapping session showed that coordination among numerous High-Tech program staff and non-program staff is required for successful marketing, outreach, and rebate processing.

In order for this to occur, efforts need to be tracked and shared among all staff who touch the program. Utilities may consider creating a team of staff (such as Account Managers, Auditors, and Project Engineers), who can work together to successfully solicit, communicate, and implement program offerings to customers.

7. **Market the Program via trusted information channels.** The Facilities Managers and IT professionals we spoke with consult a number of sources to become aware of current technologies and trends in their field. These sources can be utilized by utilities to market 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, utilities can reach out to customers in the places they are already going to find new information about equipment.

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