Addressing Data Center Efficiency: Lessons Learned From Process Evaluations of Utility Energy Efficiency Programs

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ABSTRACT

The growing energy use of data centers has drawn international attention from policy makers, regulators, industry consortiums and electric utilities. Any program effective at improving the energy performance of data centers must include specific strategies and processes aimed at confronting a number of challenges specific to this industry, including: the concentrated and rapidly growing energy use of these facilities, the rapid pace of innovation, the extremely high reliability requirements, and the significant split incentives due to the typical data center management structure.

This paper summarizes these unique challenges related to addressing energy efficiency in the data center industry. The paper draws its conclusions from original research as well as from two process evaluations of energy efficiency programs with components that specifically target data centers: the Pacific Gas and Electric (PG&E) High-Tech program, and the Silicon Valley Power (SVP) Public Benefits Program.

While the PG&E evaluation was a more complete process evaluation, the SVP evaluation focused specifically on participation from colocation facilities. These process evaluations together included interviews with program participants, nonparticipants, utility staff, and also included outreach to a large variety of industry stakeholders. In addition, the PG&E evaluation included detailed process mapping used to identify the necessity and importance of all program processes. The insights gathered from these evaluations are not only applicable to U.S. electrical utilities, but can also be applied to any international organization looking to create incentives for energy efficiency or demand reduction in this industry.

Introduction

Information Technology (IT) equipment (e.g., computer servers, data storage equipment, networking equipment, etc.) and the data centers that house and support it provide high potential for energy efficiency and demand reduction programs because they are particularly energy dense and are a rapidly growing part of the global economy. As the penetration of efficient lighting increases and various increases in federal standards threaten to lower the potential for energy savings from these products, IT equipment and data centers are being looked to for a new generation of energy savings and demand reduction programs[1].

It has been estimated that data centers can be as much as 40 times as energy intensive as conventional office buildings (Greenburg et al. 2006, 3:76). It has been estimated that data centers worldwide consumed about 1% of global electricity use in 2005, and that this electricity use doubled from 2000-2005. At an estimated growth rate of 12% per year after 2005, the absolute electricity use could be on pace to double again by 2011 (Koomey 2008, 1, 12). In Western Europe alone, data centers are estimated to have used 56 TWh in 2007, which is expected to rise to 104 TWh in 2020 (Bertoldi 2009, 4).

The large energy intensity of data centers has received attention worldwide, with various government agencies, voluntary programs, industry trade groups, and U.S. utilities looking for ways to advance energy efficiency in this industry. In the U.S., the Environmental Protection Agency

[1] From this point on, the term "energy efficiency" will broadly refer to both energy savings and demand reduction.

(EPA) brought this issue to the forefront with the Report to Congress on Server and Data Center Energy Efficiency in 2007.

The focus from U.S. utilities is especially present in Silicon Valley, which has one of the highest concentrations of data centers in America, as this is where many high-tech companies are headquartered. As a result of the number of facilities and the high concentration of energy use in these buildings, local utilities look towards data centers as an important strategic focus to meet growing energy efficiency and demand reduction goals. The largest utility in the area, PG&E, has one of the longest running and largest data center programs in the country. In addition, nestled within the PG&E service territory are a number of municipal utilities, including some in Silicon Valley. One such utility is Silicon Valley Power (SVP), located in Santa Clara, California.

These utilities have been working directly with data centers for a number of years looking to implement a first generation of data center energy efficiency and demand reduction programs. For this reason, the study of these utility administered programs offers an excellent opportunity to understand the challenges faced by program designers trying to increase the efficiency of this industry. Process evaluations looking at these programs can be of particular value since evaluators get an objective view at the program implementers, the participating and nonparticipating customers, and a range of other stakeholders. This work gives a broad perspective on how programs of all kinds can be improved to overcome these challenges. This paper aims to use the results of two such process evaluations of data center energy efficiency programs to summarize the identified challenges and the lessons learned from secondary research and primary interviews with a range of stakeholders.

Data Center Energy Efficiency and Demand Reduction Program Overview

To provide context for the study of challenges faced to improving the energy efficiency of the data center industry, this paper will first provide an overview of programs available in this area. This overview will focus on government-led efforts in Europe and the U.S., as well as utility and regional programs in the U.S. offering incentives for data center efficiency improvements.

International Data Center Program Overview

Among the recommendations in the U.S. EPA Report to Congress was to investigate energy efficiency product specifications for IT equipment, which the EPA ENERGY STAR program has begun with a new specification for computer servers and ongoing investigations into data center storage equipment and uninterruptable power supplies (UPS). In addition to these focused product specifications for IT equipment, ENERGY STAR has also developed a whole building efficiency rating for data centers. The U.S. Department of Energy has also begun addressing this industry with the "DC Pro" tool for profiling Data Center energy usage, available through the Save Energy Now program, and a training program called the Data Center Certified Energy Practitioner program.

Governments around the world are also focused on this issue. There are several European efforts addressing IT equipment and data center efficiency. The first is the Code of Conduct on Data Centers from the European Commission (EC), which is a voluntary commitment to increasing the energy efficiency of data centers based on the adoption of best practices using a point system similar to the U.S. Leadership in Energy and Environmental Design (LEED) building standard administered by the U.S. Green Building Council. In addition, the EC is working on a voluntary energy efficiency standard for computers, that could include requirements for servers, through the Ecodesign Program, and the European ENERGY STAR program is also expected to adopt the U.S. EPA ENERGY STAR standard for computer servers.

In addition, there have been a number of country-specific activities to address the energy use of IT products and data centers. These include the Efficient-Servers Initiative by the Austrian Energy Agency, which has done research and identified best practices for servers and data centers. Other examples include national energy conservation programs such as the Environment and Energy

Management Agency in France that works to reduce energy use in the country through a combination of research, information sharing, financial support and technical assistance.

U.S. Utility Administered Data Center Energy Efficiency Programs

Another recommendation from the EPA Report to Congress was for electric utilities to get involved by offering incentives for IT equipment and data centers. Utilities such as Pacific Gas and Electric (PG&E) in the San Francisco Bay area have had data center focused programs since roughly 2006, and recently more and more utilities are looking towards data centers as an area for possible energy savings and demand reduction. Other utilities offering these programs include: Austin Energy, BC Hydro, Focus on Energy, Oncor Electrical Delivery, Silicon Valley Power, and Xcel Energy (in Colorado and Minnesota only). Although in many places these programs are administered directly by the utilities, some states have programs run by regional authorities. Examples of such authorities with data center specific energy efficiency incentives include: Efficiency Vermont, Energy Trust of Oregon, and the New York State Energy Research and Development Authority (NYSERDA)[2]. Efficiency programs focused on IT equipment and data centers are relatively new, and so there continues to be increasing development in this area.

Many of these programs and measures can be fit into a few defined categories:

- **Custom Incentives.** Utilities offer incentives for custom measures with verifiable energy efficiency improvements, calculated by engineers on a project-by-project basis. Incentives can be paid based on either energy savings (kWh) or demand reduction (kW).
- **Prescriptive Rebates.** Rebates include fixed incentives paid for equipment or upgrades with deemed per-unit energy savings. Prescriptive rebates in data center programs can be for technologies specific to data centers (e.g., server virtualization, efficient uninterruptable power supplies [UPS], etc.) or not (e.g., lighting, HVAC, Variable Frequency Drives [VFD]).
- **Design Assistance.** Design assistance is offered in the form of subsidized engineering support, design services, or "checklist" energy audits. Programs often pay all or a portion of study costs. Such assistance programs often lead to additional installations that are eligible for other incentives.

Most measures specifically targeted at data centers receive custom rebates, though some utilities have prescriptive measures such as server virtualization and UPS efficiency. Utility incentives can also be separated into measures that address whole-building efficiency and those that address specific equipment types within the data center. A break down of measures separated into data-center-wide measures and measures separated by equipment type is shown in Table 1.

Table 1: Data Center Utility Incentives by Equipment Type

Whole-Building Data Center Measures			
• Engineering Support (Technical Assistance and Energy Audits) • Custom Measures			
Cooling Measures	**Power Measures**	**IT Measures**	**Other Measures**
• Chillers / HVAC / Economizers • Air Flow Management • VFDs • Advanced Controls	• UPS • PDU • Transformers • Inverters	• Efficient Power Supplies • Efficient Servers • Server Virtualization	• Lighting • Computer Power Management • Desktop Virtualization • Plug Load Management

[2] While these regional authorities are not run by utilities, these programs are included in all references to "utility" programs throughout this paper.

Process Evaluation of the PG&E High-Tech Program

In 2006, PG&E developed an energy efficiency program to address increasing power used by the sizeable number of data centers as well as other high-tech customers (e.g., biotechnology, pharmaceutical, electronics manufacturing, cleanrooms, and telecommunications facilities) within its service territory. The program provides energy audits and incentives for the installation of recommended measures for both retrofits and new construction. In addition to traditional energy efficiency opportunities (i.e. typical commercial and industrial buildings), high-tech facilities are unique in that they have intensive and precise heating, ventilation, and air conditioning (HVAC) needs, which is especially true of data centers. PG&E has worked to become an industry leader in the high-tech efficiency sector by participating in numerous conferences and seminars, sharing information with other utilities, and regularly communicating with IT representatives, manufacturers, and vendors.

Energy Market Innovations, Inc. (EMI), under contract with PG&E, conducted a process evaluation of the PG&E High-Tech Program for the 2006-2008 program cycle to document the delivery processes of this program and provide recommendations for process improvements.

Evaluation Purpose and Methods

The overarching objectives of the process evaluation were to document the processes of program delivery and assess its operational efficiency. Because the 2006 – 2008 program was the first generation of this initiative, PG&E was ultimately interested in how to expand program enrollment to meet the increased goals established for the next program cycle. Thus, evaluating the *scalability* of the program was of primary importance for this study.

This process evaluation of the PG&E High-Tech Program 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 nonparticipants), as well as interviews with sixteen key market participants (e.g., data center designers, engineers, equipment manufacturers, and vendors). 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 to identify opportunities for process improvements.

To better understand the effect of the processes undertaken by PG&E, and to identify particular barriers and opportunities for improvement, this study focused on a number of different elements of the data center market in the PG&E service territory. These included:

- **Decision-Making.** This study found that there are a range of professionals involved in the process of selecting energy-intensive equipment for data centers. Design consultants and contractors influence equipment selection because the hired engineers are familiar with new products, so managers often leave it up to the engineering contractors to select equipment that supports their requirements. In addition, data center managers stated that vendors or manufacturers also influence their decision-making when selecting or installing equipment. Decision-making related to improvements of existing data centers are further complicated because facility operations and IT equipment procurement decisions are made separately, with little communication between the two sides. As a result, there is little opportunity for the facility operators and IT managers to understand the overlapping effects of their decisions.
- **Target Market Identification.** 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 to maximize the effectiveness of marketing efforts.

Key Findings from the PG&E Process Evaluation

Understanding high-tech customer barriers to energy efficiency is a crucial first 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, interviews with customers and secondary research. Barriers to the adoption of energy-efficient strategies 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.

The unique equipment requirements of data center customers present challenges when attempting to implement energy efficiency. Because of these unique considerations, high-tech customers may have other priorities or misconceptions that present barriers to implementing energy-efficient strategies. While IT staff are receptive to new technology developments, they do not tend to be early adopters of new HVAC technologies. As one interview participant described, "No IT people get fired for not saving money, but they can get fired if their systems go down."

The market actors interviewed for this study stressed that those involved in equipment recommendation, selection, and installation must be well versed in these special requirements. A high level of industry knowledge helps gain the trust 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.

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 the data center at their facility. As shown in Table 2, it was very common for some individuals to be responsible for the data center while others are 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 2: Decision-making for HVAC and IT Equipment

Decision Makers	Number of Interviewees (n = 38)
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

Another key result of this study is the challenge in defining the target market of a "high-tech" program and the repercussions of this definition on the marketing, outreach and delivery of program services. The target market of the PG&E program was broadly defined and included several business sector classifications: biotechnology facilities, pharmaceutical facilities, electronics manufacturing and support, cleanrooms and mini-environments, data centers, and telecommunications facilities. While these classifications all embody some "high-tech" industry characteristics, the customer site may not actually have any high-tech equipment or facilities (e.g., it could be a transmission tower, or simply an office building). Moreover, the business classifications targeted by the program excluded other industries that rely heavily on data center facilities. For example, financial institutions and large commercial office spaces often house data centers even though the businesses, themselves, are not classified as "high-tech." 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 staff that are implementing one or both programs.

In this way, an effective program with a focus on data centers must strike a delicate balance between being specific to the technologies and their unique requirements, while staying broadly applicable to a range of business types that include these facilities.

Process Evaluation of the Silicon Valley Power Public Benefits Program

The SVP service territory in Santa Clara is seen as an attractive place to locate high power data centers, as they have relatively low electricity rates and high reliability power delivery. This leads to Santa Clara having an unusually large concentration of data centers, both enterprise data centers and colocation facilities. Therefore, a key focus of the SVP energy efficiency program, the Public Benefits Program, is to address energy savings and demand reduction opportunities in data centers.

One area of frustration for organizations trying to implement energy efficiency programs for data centers is in trying to get colocation data centers to participate. Colocation data centers provide an important service to companies around the world by offering data center infrastructure for different companies to locate the IT equipment that run the mission-critical applications relied upon by these businesses. Colocation providers offer companies a highly scalable alternative to developing their own data centers, and also offer the high levels of reliability required for these important applications.

EMI, under subcontract to Summit Blue Consulting (now Navigant Consulting), conducted a process evaluation to provide targeted information on opportunities for increased participation from the colocation data center market in the SVP service territory.

Evaluation Purpose & Methods

In the 2007-2008 program year, over half of the energy savings from the SVP program came from data center related projects. While SVP has had considerable success with enterprise data centers, SVP staff has found it more difficult to recruit colocation facilities to participate in the programs. The large concentration of colocation data centers in the SVP service territory makes this as an important area of potential expansion of the Public Benefits Program to help SVP achieve its energy saving goals.

Identification of key challenges is an important first step to design or modify a market intervention strategy. As such, the purpose of this research was to begin to characterize the barriers unique to colocation data centers in order to inform effective strategies to increase their participation in energy efficiency programs. To identify barriers and potential recommendations, EMI conducted preliminary research (literature review and online research) and in-depth interviews with:

- SVP program staff,
- Program staff from other utilities with data center focused initiatives,
- Colocation providers within and outside the SVP service area, and
- A data center design consultant.

While interviews focused on colocation providers within the SVP service territory, EMI also interviewed a number of program staff and colocation providers outside of Santa Clara to gain a broader perspective at this industry. This allowed EMI to identifying both industry-wide and SVP-specific challenges and helped identify best practices that might be replicated by SVP.

The research focused on identifying the primary challenges to colocation provider participation in the SVP Public Benefits program. EMI focused on two key drivers that influence the participation of colocation facilities:

- **Colocation decision-making practices relating to energy efficiency.** Colocation facilities come in many shapes and sizes. In addition, many colocation facilities in Santa Clara are national or international organizations where decision-making can involve securing additional approval from off-site headquarters. Understanding the decision-making practices within these organizations helped EMI understand how a company might choose to participate or not participate in a program.
- **Pricing models of colocation facilities.** EMI also focused on the pricing models for space, power, and cooling within the colocation facilities. Pricing models are important because how power costs are allocated affects decisions to invest in energy efficiency improvements. It is difficult to get decision makers to invest in energy efficiency if they are not going to receive the benefits (in the form of reduced power bills) of the efficiency upgrade.

Key Findings from the SVP Process Evaluation

The process evaluation confirmed that significant barriers exist to wider participation from colocation facilities in the SVP Public Benefits program. Many of these barriers are a result of the unique business models of colocation facilities, such as split incentives, typical colocation pricing structures, and the emphasis on reliability over energy efficiency in the industry. In addition, some barriers are due to limitations on the SVP programs (such as overall program budget) and the need to properly mitigate the risk that energy saving measures will not stay installed for the five-year period needed for SVP to claim full savings. Older operational facilities face the deepest challenges, as these facilities focus mainly on maintaining continuous operation. New facilities or existing buildings being converted to data center space are more likely to invest in energy efficiency because they can include more energy saving measures before the facility comes into operation.

In addition, the evaluation determined that different pricing models affect decision-making in regard to energy efficiency improvements. Colocation data centers use a variety of pricing models to charge tenants for hosting IT equipment in their facilities. These pricing models include different approaches to charging for space, power use, or for use of cooling in the data center. With the prevalence of different methods for charging for power and cooling, these pricing models affect the motivation to participate in energy efficiency projects of both colocation customers and their tenants, as different pricing models affect whether more money is saved/spent due to efficiency improvements. Ideally, a colocation facility would charge their customers a fixed space/cooling charge as well as charge through power directly to the tenant. This would mean both the facility and tenant would save money by applying efficiency upgrades directly to the portion of the facility under their control. Unfortunately, pricing models of this sort seem rare. Instead, colocation customers are typically charged "per-whip" for power, a charge based only on the maximum power capacity supplied to the customer. This means the customers do not have an incentive to invest in efficiency unless they are close to this limit, as they will not save money for incremental reductions in power use.

In addition, the evaluation found that some colocation facilities felt that the incentive cap was too low, as the incentive cap is limited by the overall funding for the Public Benefits Program as a whole. Since SVP is a small municipal utility with limited resources, the budget for these programs is modest. The result is that the demand for energy efficiency incentives for data centers exceeds the possible funding of the program. This creates a limitation for colocation facilities that need significant additional funding to perform their desired energy efficiency upgrades. In addition, because many colocation providers have multiple data centers within the SVP service area, they are further limited because they must split the limited incentives amongst all of their facilities.

Broad Challenges Specific to the Data Center Industry

Understanding challenges to energy efficiency for data center facilities is a crucial step to improving program processes. By identifying these barriers, it is easier to understand the challenges program staff face implementing these programs, and also helps craft effective communications and messages about energy efficiency and program opportunities that target the data center market. Through both the PG&E and SVP process evaluations, EMI was able to identify barriers to energy efficiency program participation through our interviews with architects and engineers involved in data center design, data center managers, program staff from other utilities and through secondary research.

Rapid Changes in the Market. The data center market is a very dynamic market where technology is updated at a very rapid rate (one to three years). These changes match the rapid expansion of need for data center services. As technology evolves some IT equipment gets more and more power dense, which results in a corresponding increase in the power and cooling requirements on the data center infrastructure. This makes the specification of energy efficiency in this industry especially challenging, as program designers are effectively trying to hit a moving target.

The Extreme Focus on Reliability. Data center operators make a career out of providing high reliability infrastructure to house IT equipment used for mission-critical applications. The redundancy and reliability of the data center, or the "Tier" level, of the data center is an important metric for potential customers. The different Tiers are expressed in levels I – IV, with I having the least redundancy and IV having the most[3]. Reliability of a data center is often also expressed in the number of "nines" – a facility with 99.999% uptime would be considered to have "five nines" of reliability which equates to about five minutes of downtime a year. The importance of reliability leads colocation managers to resist making any changes (such as energy efficiency upgrades) to an operational data center. As a result, convincing colocation facilities to do an efficiency upgrade, even with significant incentives, can be a very tough sell. Providing reliable data center space to customers in colocation facilities is particularly important, because that is their primary business. For this reason, colocation managers can be even more risk averse than enterprise data center managers.

[3] Tier levels are defined by the Uptime Institute (http://www.uptimeinstitute.com).

Aggravated Split Incentive. Many data centers suffer from split incentives based on their organizational structure because the purchaser of the IT equipment (the IT department) does not see the money savings from purchasing more efficient equipment. This is because the facilities department pays the power bill, so the IT department never sees the operational cost (e.g., energy cost) of the equipment they purchase. Colocation facilities have an even more extreme example of the split incentive, as the IT and facilities are owned not only by different divisions of the same company (as is typical for corporate enterprise data centers), but by separate companies entirely. In this case, the split incentive is a result of the pricing model of the colocation facilities, where colocation customers often pay by the square foot or the power capacity instead of paying directly for the power they consume. As power becomes more of a limiting factor to data centers than space, many colocation facilities are changing their pricing structures to sub-meter or charge directly for power. In many cases, however, utilities have significant restrictions on the ability for customers to resell power, as they do not want companies becoming their own effective utility by buying and reselling power.

Knowledge Gap Between the Utility and Data Center Industries. As is also typical of other utility sponsored incentive programs for data centers, the programs researched in this paper rely largely on custom incentives for energy savings from equipment specific to the data center. One of the drawbacks of this is that, unlike more prescriptive incentives or "deemed" measures, custom incentives take more effort from the customer and utility sides to calculate the energy savings on which the incentives are based. In the case of the colocation providers interviewed for the SVP evaluation, EMI found that colocation facilities often had difficulty in filling out these applications. Some stated that they did not have the technical expertise in house to complete the required calculations. One colocation staff stated, "We're basically an IT department with some sales people." In some cases colocation facilities actually hired outside consultants to help complete the applications, which lowers the cost effectiveness of applying for incentives. After identifying this issue, SVP program staff indicated that they can provide technical support to customers applying for incentives, but from the interviews it was clear that some colocation customers were not fully aware that this support was available.

This lack of expertise is also a wider barrier for utilities working with data centers. Because data centers represent a relatively new industry where utilities are offering incentives, utility program staff needs to better understand the requirements and needs specific to the data center market. The utilities themselves often also lack the expertise to perform the needed calculations. To illustrate this point, the former manager of the PG&E high-tech data center program indicated, "We rely on engineering consultants who can accurately calculate the energy savings from implementing facility and IT improvements, and … we have a hard time finding firms that have this competency – especially on the IT equipment side." (Data Center Dialog 2009)

High Costs of Data Center Efficiency Upgrades. Data centers are extremely power dense facilities that require very advanced and expensive equipment to continuously provide that power. These facilities provide a substantial opportunity for energy savings, however efficiency upgrades can be very capital intensive. As a result, one barrier colocation providers indicated was that the incentive cap was too low, as the amount that could be paid in incentives is limited by the overall program budget, which for a relatively small municipality is fairly low. This creates a limitation for colocation facilities that need additional funding to perform their desired energy efficiency upgrades. In addition, the incentive limits are done on a customer basis, not on a site basis, so colocation providers with multiple data centers within the SVP service area are further limited when they must split the limited incentives amongst multiple facilities. In addition, smaller colocation facilities indicated that they had trouble securing bank financing for efficiency upgrades and that prospective financers did not understand the business case for investing in greater efficiency.

Restrictions to Providing Incentives only to the Customer of Record. Both utilities are restricted to only giving incentives to the actual bill-paying customer on record with the utility. This requirement is included in order to ensure that the utility has a means to recover incentives paid, if the measures are removed within the contract period (five years in the case of SVP). This requirement makes it very difficult for colocation customers to take advantage of incentives. For instance, if a colocation customer wanted to virtualize some of their servers and take advantage of server virtualization incentives, they would not be able to because the colocation provider would be the customer of record, not the colocation customer. In some cases for SVP, the colocation provider has applied for the incentive on behalf of the customer. In this case the colocation customer can receive the incentive check, but the colocation provider assumes all the risk. In addition, the incentive amount goes against the limit of the provider, another reason they may not want to apply for their customers to keep incentive funds available for their own projects. SVP indicated that this was one of the largest issues in trying to get colocation customers to participate in the program.

Lessons Learned from Evaluations of Data Center Efficiency Incentive Programs

Performing process evaluations of energy efficiency programs gives evaluators a broad, high-level view of program processes, and gives good perspective on what works well and what needs improvement for various programs. Evaluations of different program types across different utilities gives an even broader view of the industry and gives evaluators an opportunity to see what barriers are endemic to an industry and what barriers are results of certain utilities' processes. Observing processes across utilities also helps identify best practices used by different utilities and helps give perspective to develop recommendations based on wider industry trends.

As a result of these trends, EMI has been able to develop a list of lessons learned from these evaluations of two different programs that are similar in many ways. This section highlights these lessons learned. While many of these lessons are applicable both to the PG&E and SVP programs, some are more characteristic of one or the other of these programs. However, EMI believes that each lesson provides important perspective to many different energy efficiency programs, whether they are U.S. utility programs or other international programs.

Creating Programs Specific to Data Centers. The data center is a complicated facility with many specific challenges and needs. Programs that are specifically focused on data centers are effective because they allow program staff to focus on these unique factors and develop knowledge and technical expertise specific to this industry. Data center programs also have the opportunity to be crosscutting. For example, many commercial office buildings contain small data centers, while other large enterprise data centers function more like industrial facilities. Having staff focused specifically on data centers would allow them to address these very different opportunities. In addition, focusing specifically on data centers as their own industry allows for easier marketing, as the data center industry has an established set of journals, conferences and other sources of information trusted by data center managers.

The Importance of Understanding Influences on Decision-Making and Decision Influences. The data center industry also has its own set of factors which influence how decisions are made regarding energy efficiency. To create effective programs, program designers and implementers must understand what barriers exist here and work to overcome or work around these barriers. This can include the importance of pricing structures in colocation facilities and the influence of external architects and engineers in the selection of new data center equipment. This also includes the significant split incentives still prevalent in many companies with data centers. Understanding these decision-making factors also requires understanding who is taking the risk for investing more expensive or less trusted technologies. This is especially important in an industry with a deep seeded aversion to risk.

Effectively Communicating Program Opportunities. Data center program staff must be able to effectively communicate the offerings of the program and the support that is available. The data center industry has historically only been interested in reliability and the interest from data center managers in energy efficiency is relatively recent. In addition, staff managing older data centers do not always have a high level of expertise when it comes to understanding energy efficiency or the benefits of newly available technology. A lot of these managers rely on external engineers or consultants to understand how newer, more energy efficient equipment can benefit their facility. As a result some of these managers could require additional support from the utility in performing the calculations to apply for the incentives. Getting support from the utility, and therefore not having to pay an external consultant to perform the calculations can help make the project more cost effective.

The Need for Identification of Target Data Centers. High availability requirements and the expense of potential upgrades make it difficult for existing operational data centers to invest in energy efficiency upgrades. New facilities often make the best opportunities for programs to get participation from data centers in their energy efficiency programs. For this reason, account representatives and program staff should stay in close contact with existing managers and local design professionals to learn about new data center developments and should engage these new projects early. Similarly, program designers should find methods of identifying hard to reach data centers such as the small data centers present in existing office buildings, or colocation facilities that are near capacity and that could benefit from increased business after efficiency upgrades. An important first step to this end is to train account representatives from other groups (commercial and industrial) to be able to identify data center opportunities and to share those with data center specialists.

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