A New Frontier for Energy Savings
Utility Energy Efficiency Programs for Data Centers and Distributed Information Technology Devices

Introduction
The past two decades have seen an incredible proliferation of energy-consuming IT devices that have penetrated virtually every area of the U.S. economy. Servers, whether deployed in closets or in large data centers, desktop computers, and mobile computing devices of all types have transformed the way in which our society exchanges information and conducts business.

This expansion of IT equipment deployment has also created an unintended consequence: an increasing portion of our energy use is now devoted to IT. Indeed, data and distributed IT device energy use represents one of the fastest-growing sectors of commercial and institutional (government, education, etc.) energy consumption.

The good news is that recent advances in the energy efficiency of IT equipment, combined with innovative methods for managing its energy consumption when not in use, have created a large and relatively untapped opportunity for capturing energy savings. The bad news is that despite these advances, consumers have been slow to purchase efficient IT equipment and/or to manage it for maximum efficiency. The reasons for this slowness are complex and varied, but the impact is clear: huge amounts of energy are unnecessarily wasted as a result of inefficient and poorly managed IT devices.

For utilities and other energy efficiency organizations looking to curb energy use and demand in their service areas through energy efficiency programs, there is a growing set of proven, cost-effective program designs addressing the opportunities in this fast-growing sector. Further, there are increasing opportunities for the utility regulatory community, in partnership with federal government agencies such as the Department of Energy and Environmental Protection Agency, to support this nascent energy efficiency market by ensuring appropriate program evaluations.

This white paper will explore energy efficiency program options in greater detail and will discuss at length the successes that some utilities have had with their efforts in this arena. Whether your utility is deeply experienced in creating and managing incentive programs or is in the initial stages of establishing your portfolio, this white paper will provide you with a variety of proven IT-related utility program designs that can deliver cost-effective energy savings that are easily implemented, measureable, and highly verifiable.
Figure 1 illustrates both a historical and projected assessment of U.S.-based data center energy consumption. The disheartening news: much of this energy (as much as half in some cases) is being wasted, due to an inadequate focus on energy efficiency on the part of IT managers. There are, however, technologies available today that can mitigate the inefficient use of power in data centers, often with compelling economic benefits. The huge potential for energy efficiency upgrades in data centers offers a tremendous opportunity for utilities to offer proven, cost-effective programs to support customer engagement and project implementation. These programs not only deliver results, they also support customers who are facing crippling data center infrastructure capacity challenges. Data centers are not the only topic of the IT energy efficiency discussion. In 2003, the Department of Energy predicted that annual energy use for personal computers would grow at a rate of 3 percent per year. As in data centers, there are compelling technologies to address efficiency opportunities in desktop IT infrastructure, including deployment of higher efficiency equipment and better control of desktop systems. Despite this wealth of compelling data, IT-specific energy efficiency is an area that is relatively unexploited in terms of being addressed by utility incentive and education programs. This white paper describes a series of cost-effective, innovative design and delivery mechanisms that utilities can adopt to begin driving efficiency accomplishments—supporting regulatory goals, driving market transformation, and meeting rapidly evolving customer needs.

**Background**

According to the U.S. Department of Energy, an estimated three percent of commercial energy use can be attributed to personal computers, with an additional two percent or more directed toward data centers. In combination, these end uses represent one of the fastest energy consumption growth segments. For example, data centers in the United States consumed 61 billion kWh of electricity in 2006, representing 1.5% of all U.S. electricity consumption, and double the amount consumed in 2000. Based on current trends, energy consumed by data centers will continue to grow by 12 percent per year.

At that growth rate, the EPA indicated that the energy consumption of U.S. servers and data centers could nearly double again by 2012, representing an unprecedented $7.4 billion electricity bill. Data centers are not the only topic of the IT energy efficiency discussion. In 2003, the Department of Energy predicted that annual energy use for personal computers would grow at a rate of 3 percent per year. As in data centers, there are compelling technologies to address efficiency opportunities in desktop IT infrastructure, including deployment of higher efficiency equipment and better control of desktop systems. Despite this wealth of compelling data, IT-specific energy efficiency is an area that is relatively unexploited in terms of being addressed by utility incentive and education programs. This white paper describes a series of cost-effective, innovative design and delivery mechanisms that utilities can adopt to begin driving efficiency accomplishments—supporting regulatory goals, driving market transformation, and meeting rapidly evolving customer needs.
**Servers and Data Centers: Market Overview and Energy Efficiency Program Options**

**Market Overview**
It is widely understood that data center energy demands have been steadily on the rise for the past several years. The ENERGY STAR* program of the U.S. Environmental Protection Agency (U.S. EPA) confirms this understanding, stating that in 2006, “U.S. servers and data centers alone accounted for 1.5 percent of total U.S. energy consumption.”

And the impact of this growth doesn’t stop there, as data centers are also running out of space and facing shortages in available power and cooling. The Uptime Institute conducted a survey in 2008 of more than 300 IT professionals which revealed that within one to two years a third of respondents predicted they would run out of space, 42 percent predicted they would run out of power, and 39 percent predicted critical shortages of cooling capacity.

Also on the rise is the emergence of “utility scale” data centers, a trend that is being accelerated by the move to “cloud computing.” These data center facilities are so vast that they rival those of heavy industries such as paper mills and aluminum smelters in terms of overall energy consumption. In some parts of the country, the Pacific Northwest for example, these facilities have been sited close to electrical generation facilities such as hydroelectric dams. Power is often pumped directly from the point of generation to the facility, and is increasingly putting some utilities in a situation where available energy supply is approaching insufficient levels to meet increasing demands.

For its part, the IT manufacturing sector has placed enormous focus on improving the energy efficiency of data center and server products over the past decade, and it is clear that energy efficient IT best practices in the data center provide tremendous opportunities for organizations to reduce energy consumption, free up space, alleviate power supply and quality concerns, and improve existing cooling capacity. However, for a variety of reasons—troubled economy, lack of organizational ownership for the energy bill, and lack of awareness—most organizations have been slow to invest in new technologies or to embrace IT efficiency projects. Today, more than ever, customers are in need of services and support to help them address IT energy efficiency and related energy capacity challenges.

This demand from customers presents a significant opportunity for electric utilities to create innovative new programs, to drive substantial energy savings in a fast-growing sector, and to help transform the IT marketplace and customer behavior. This statement is substantiated by the ever-increasing efficiency standards for EPA ENERGY STAR compliance.

**Data Center Energy Efficiency Program Options**
There are a plethora of technologies and measures that can be introduced in new data center designs or as retrofit measures in existing data centers to improve efficiency, with supplemental benefits of maximizing the capacity and longevity of new or existing facilities. Data centers are typically viewed in three parts from an energy usage perspective: the IT load (servers, storage, and networking), the cooling load (chillers, fans, etc.), and the power distribution load (UPS, PDU, transformer, etc).

When evaluating data center energy efficiency opportunities, all three portions of the energy load should be considered. However, a decrease in the IT load of 1 watt can result in 2.84 watts saved at the data center meter. This multiplicative benefit is achieved by eliminating not only the root cause of energy consumption (the 1 watt in the IT load), but by reducing the significant cooling and power distribution burden and losses that are associated with that load.

Utilities can offer a wide range of program designs to address this energy efficiency potential, including traditional calculated incentive programs for new construction and retrofit projects, as well as upstream prescriptive programs for IT equipment purchases, and “retro-commissioning” (or “tune-up”) services that address airflow management opportunities.

These programs run the gamut from small incremental energy savings across large volume equipment purchases (for example, a program to reward the purchase of ENERGY STAR servers on an upstream basis), to very large engagements with customers developing new “utility scale” data centers.

Data center retrofit energy efficiency programs are intended to provide organizations with motivation to replace older, less efficient equipment with new equipment. This is possible through more-efficient computer hardware and/or innovative software technologies, such as virtualization software. Additionally, various data center cooling efficiency projects are often subject to utility incentives. Consideration should also be given to building energy efficiency programs that encourage continuous operational improvements in data centers. Some of the available data center programs and their related benefits are described next:

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Utility Energy Efficiency</td>
<td>Provide incentives to customers who purchase energy efficient equipment.</td>
</tr>
<tr>
<td>Data Center Retrofit Energy</td>
<td>Help organizations replace older, less efficient equipment.</td>
</tr>
<tr>
<td>Efficiency Projects</td>
<td>Offer incentive programs for new construction and retrofit projects.</td>
</tr>
<tr>
<td>Virtualization Software</td>
<td>Reduce energy consumption by optimizing IT infrastructure.</td>
</tr>
<tr>
<td>Environmentally Friendly</td>
<td>Encourage sustainable practices in the data center.</td>
</tr>
<tr>
<td>Energy Management Software</td>
<td>Enable proactive energy management and real-time data feed-back.</td>
</tr>
<tr>
<td>Power Distribution Optimization</td>
<td>Improve power distribution efficiency across the data center.</td>
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<tr>
<th>Energy Efficiency Standards</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGY STAR</td>
<td>Certified energy efficient equipment that meets EPA’s energy efficiency</td>
</tr>
<tr>
<td>Standards</td>
<td>requirements.</td>
</tr>
<tr>
<td>ASHRAE Standard 90.1</td>
<td>Energy savings guidelines for commercial buildings, including data centers</td>
</tr>
<tr>
<td>LEED Certification</td>
<td>Green building certification program for energy efficient data centers</td>
</tr>
<tr>
<td>HOTP Program</td>
<td>Promotes energy efficiency practices in the data center.</td>
</tr>
<tr>
<td>Data Center Energy Efficiency</td>
<td>Provides incentives for energy efficient data center designs and retrofit</td>
</tr>
<tr>
<td>Programs</td>
<td>projects.</td>
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**Utility Energy Efficiency**
## Data Center Energy Efficiency Programs

<table>
<thead>
<tr>
<th>PROGRAM DESCRIPTION</th>
<th>BASIC PROGRAM OBJECTIVE</th>
<th>ANNUAL ENERGY SAVINGS</th>
<th>MARKET BARRIERS OVERCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Virtualization and Consolidation</td>
<td>Motivate customers to use virtualization software to improve server utilization rates and consolidate equipment infrastructure</td>
<td>A 10:1 consolidation ratio is typical, with 1,950 kWh and 225 W per server removed in direct energy savings</td>
<td>• Less expensive than server hardware replacement&lt;br&gt;• Recaptures data center power and cooling capacity</td>
</tr>
<tr>
<td>ENERGY STAR* Server Rebate</td>
<td>On an upstream or midstream basis, reward the purchase of qualifying equipment</td>
<td>Approximately 10% better than standard equipment (generally the top 25%), with a five-year measure life</td>
<td>• Addresses current price premium for qualifying equipment, and spurs equipment makers to offer more models</td>
</tr>
<tr>
<td>Server Replacement/Refresh Incentive</td>
<td>Encourage customers to buy new, highly efficient servers to replace multiple old, inefficient servers</td>
<td>Provides an alternative to the ENERGY STAR* program (above)</td>
<td>• Overcomes cost barriers to new equipment purchase (e.g., shorten refresh schedules)</td>
</tr>
<tr>
<td>Data Storage Hardware</td>
<td>Reward customers for purchase of efficient technology like Massive Array of Idle Disks (MAID)</td>
<td>Varies by technology, with MAID systems using 75% less than typical storage arrays</td>
<td>• Addresses burgeoning data storage requirements</td>
</tr>
<tr>
<td>Airflow Management and Control (Retro-commissioning)</td>
<td>Pay customers for monitored reductions in energy use for airflow management improvements</td>
<td>Often results in significant reductions in fan energy use</td>
<td>• Recaptures data center cooling capacity</td>
</tr>
<tr>
<td>Cooling System Retrofits</td>
<td>Pay incentives on a calculated basis for implementation of free-cooling measures and other equipment upgrades</td>
<td>Significant energy and demand savings are achievable depending on measure</td>
<td>• Improves project economic returns to encourage implementation</td>
</tr>
<tr>
<td>New Construction Program</td>
<td>Reward customers for design and construction of “best in class” efficient data centers</td>
<td>10% demand reduction not uncommon, with even higher energy savings</td>
<td>• “Builds in” energy savings for a facility with a typical twenty-plus-year lifespan</td>
</tr>
</tbody>
</table>
### Market Overview

While data center energy consumption receives more attention because of the concentration of equipment in a single location, many opportunities exist to reduce energy consumption elsewhere in the IT infrastructure. In fact, PC networks collectively represent more energy use than all server computers combined. PC computing platforms have become dramatically more efficient; however, PC refresh cycles have extended over the past few years as the economy has softened and capital budgets have constricted. Additionally, Intel has developed Intel® vPro™ technology, which is included in most higher-end commercial PCs, and allows more reliable and efficient power-management of PCs.

### Desktop and Mobile Energy Efficiency Programs

The following are a series of utility incentive program options for desktop computers and mobile computers, specifically notebook computers.

<table>
<thead>
<tr>
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<th>ANNUAL ENERGY SAVINGS</th>
<th>MARKET BARRIERS OVERCOME</th>
</tr>
</thead>
</table>
| Desktop Computer Replacement Program       | Motivate customers to replace unmanaged* old desktop PCs with unmanaged new desktop PCs | 217 kWh to 448 kWh^^  | • Compresses increasingly long buying cycles  
• Encourages purchase of the most efficient PCs on the market                                                                                      |
| Intel® vPro™ technology Automated Shutdown | Encourage customers to leverage Intel vPro and existing systems management tools to ensure that PCs are powered off at night and on weekends | 386 kWh to 617 kWh^^^ | • Provides power management opportunity for those customers who wish to leverage existing tools  
• Expansion of traditional PC Power Management Programs                                                                                           |
| Move to Mobile Program                     | Motivate customers to migrate from traditional desktop PCs to highly efficient laptop computers | 418 kWh to 649 kWh^^  | • Mobile computers have a higher price and larger barrier to entry  
• Mobile devices have the added bonus of having superior power management capabilities                                                            |
| PC Power Management Program                | Encourage customers to purchase a dedicated PC power management product to manage PC power settings | 200 kWh^^^^           | • Improves ROI of purchase of a third-party tool  
• Improves adoption rates of PCPM                                                                                                                       |

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* Actual savings depend on the age and type of equipment being replaced.  
^^ Actual savings depend on the age of equipment and configuration of power settings.  
^^^^ 200 kWh is the ‘deemed savings’ of a standalone PC Power Management product as determined by the Regional Technical Forum of the Bonneville Power Administration.
Existing IT Energy Efficiency Programs and Recommended Program Portfolio Elements

In 2003, the Northwest Energy Efficiency Alliance was the first utility organization to officially step into the world of IT energy efficiency when it invested in a PC power management company and encouraged the Bonneville Power Administration (BPA) to review the potential savings from using such technology. The result of that review was that BPA assigned a ‘deemed savings’ value of 200 kWh to PC Power Management software and set the stage for utilities throughout the Pacific Northwest to provide incentives for adoption of the software.

Since that time, utilities throughout North America have begun to support IT energy efficiency programs of all types. These programs take many forms and support many aspects of IT energy consumption, including server refresh/virtualization/consolidation, ENERGY STAR PC refresh, PC Power Management, Intel vPro-enabled automated PC shutdown, "move to mobile" programs, and others. Some of the utilities and regional programs that are currently supporting some level of IT incentive program include:

<table>
<thead>
<tr>
<th>Arizona Public Service</th>
<th>Austin Energy</th>
<th>Avista</th>
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<tbody>
<tr>
<td>BC Hydro</td>
<td>Bonneville Power</td>
<td>City of Palo Alto</td>
</tr>
<tr>
<td>Efficiency Vermont</td>
<td>Energy Trust of Oregon</td>
<td>Focus on Energy-Wisconsin</td>
</tr>
<tr>
<td>Hawaii Electric Company</td>
<td>Idaho Power</td>
<td>LA Dept. of Water &amp; Power</td>
</tr>
<tr>
<td>Toronto Hydro</td>
<td>Pacific Power</td>
<td>Pacific Gas and Electric</td>
</tr>
<tr>
<td>Puget Sound Energy</td>
<td>San Diego Gas &amp; Electric</td>
<td>Seattle City Light</td>
</tr>
<tr>
<td>Silicon Valley Power</td>
<td>SMUD</td>
<td>Southern California Edison</td>
</tr>
<tr>
<td>NYSERDA</td>
<td>Duke Energy</td>
<td>Consolidated Edison</td>
</tr>
<tr>
<td>Xcel Energy</td>
<td>Oncor Electric Delivery</td>
<td>American Electric Power</td>
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</tbody>
</table>

NOTE: This is not a complete listing of current programs. Contact the utility in your region for more details.

The utilities listed have elected to participate in IT-related activities that vary greatly in terms of program design. Available incentive funds, program management resources, regulatory constraints, and a variety of other factors ultimately influence the exact composition of individual program design. Some of these program design options are described in detail in the next section.

Introducing a Program Portfolio

A wide variety of energy efficiency measures and technologies for data centers and information technology infrastructure exist, along with many program approaches that utilities can offer to encourage market penetration. In the face of the broad range of program options, what should a utility consider as an initial program offering to engage customers and generate program accomplishments?

Education and outreach program elements are essential for success in this sector and, coupled with a selected set of prescriptive rebate measures, can form the basis for initial and continued success.

Education and Training

Many utilities (such as the Sacramento Municipal Utility District, and the Wisconsin Focus On Energy program) have found that offering education and training programs that focus on energy efficiency opportunities can draw significant participation from data center facility managers and information technology professionals. Industry representatives are available to deliver short or full-day programs covering data center design, retrofit opportunities, and IT energy efficiency opportunities.

The Department of Energy now offers a data center energy evaluation training program; the Green Grid offers an online training curriculum; and Data Center Dynamics offers a data center operations certification program that includes a full-day session on energy efficiency.
Market Outreach
Utilities are uniquely positioned to draw customers into discussions about energy efficiency opportunities because they are vendor agnostic: able to recommend measures and technologies without pointing to specific vendors or equipment manufacturers.

Nevertheless, either as an adjunct to an education program or entirely separate from it, utilities can rely on industry partners to reach key decision makers in this market. Partnering with industry groups such as the Green Grid and Climate Savers Computing Initiative can help reach IT decision makers. Securing speaking engagements at vendor events to describe program offerings is a powerful market outreach strategy.

Similarly, industry partners such as Intel can provide support for marketing and outreach events by providing speakers and informational materials.

Utilizing industry partner channels can be a key component of a successful utility program marketing effort because these partners often have better contacts with IT professionals, in comparison to utility representatives, who typically have better contacts with facility managers.

Custom and Prescriptive Incentive Programs
Custom incentive programs provide incentives on a case-by-case, project-by-project basis. Customers may submit a project for consideration and, if accepted, the utility will pay an incentive based on the actual amount of energy saved as calculated during pre- and post-project energy measurements. Many utilities begin their efforts with IT-related projects by first starting with a few custom programs. However, many IT projects are now well documented and are worthy of a quick migration to a prescriptive program offering.

Prescriptive programs provide incentives based on pre-established energy savings projections for selected technologies and typically have streamlined application and approval processes. There is a subset of IT energy efficiency measures that fit well into a prescriptive utility rebate model, allowing utilities to offer programs without requiring extensive management resources.

Examples of IT energy efficiency measures and technologies supported with prescriptive programs include:

- ENERGY STAR PCs, monitors, and servers
- PC Power Management Software, including activation of Intel vPro technology
- Bonus rebates for early retirement of IT equipment
- Server virtualization and consolidation and consistent/shortened refresh cycles
- Replacement of desktop computing with mobile platform technology

Extending the Portfolio to Data Center Facility Measures
There is a subset of retrofit and new construction measures that can supplement an initial program portfolio, and/or be combined with an existing prescriptive incentive program. These measures include power delivery and conditioning equipment replacement and additions, and replacement of air conditioning systems. Several utilities have also offered purely performance-based programs, notably for “retro-commissioning” of data centers to improve airflow management and control.

Phase II: Extending Program Portfolio and Reach
Utilities can add data center and IT measures and technologies to existing calculated or performance-based incentive programs. While there are calculation methodologies that have been developed and adopted by leading utilities engaging in this market, there are no utility industry standard methodologies, or calculation tools offered by energy modeling firms or standards agencies.

For example, a calculation model developed and subsequently refined by Pacific Gas and Electric Company to estimate energy savings from server virtualization projects is being used throughout California and by other utilities. Some utilities, however, have questions regarding the validity of the model and have pursued costly and time-consuming efforts to verify its accuracy.

A set of standard calculation models and methodologies provided by a government agency such as the Department of Energy or a standards body such as the Green Grid may remove a barrier to broader adoption of calculated incentive programs for this market. Intel is working with stakeholders from the utility industry to develop a calculation tool that specifically focuses on server energy efficiency, and is providing this tool to interested utilities across the country. Additionally, Intel is working with the server OEMs to get published data on vintage systems in order to identify deemed savings estimates between generations of servers.

It is vitally important that utilities engage qualified engineering firms to evaluate retrofit and new construction projects. While many data center energy efficiency projects appear to be comparable to projects for other types of buildings and end uses, there are significantly different conditions that require substantially
different knowledge on the part of engineers and evaluators. Some utilities have chosen to engage energy service companies to manage their data center and IT program portfolios, though it is too early to ascertain whether this approach is generally successful.

Finally, for a group of airflow management measures, utilities are having success offering purely performance-based programs, with pre- and post-measurement of system performance to verify savings and determine incentive levels.

While there is not a large body of program delivery experience in this market, utilities that have extended calculated incentive programs to data center measures report cost-effectiveness that is on par with industrial sector program measures.

**Program Implementation Strategies: Upstream and Midstream Prescriptive Incentive Opportunities**

An exciting opportunity for the IT and utility industries to partner to deliver superior energy efficiency program results resides in a multi-utility upstream and/or midstream rebate program for the purchase of energy efficient IT equipment. Upstream (rebates paid to manufacturers) and midstream (rebates paid to retailers) programs leverage utility funding at the wholesale level to send larger price signals directly to consumers, and offer the ability to reduce program administration costs. Further, these programs address all commercial market sectors and even the broad consumer market (for PCs and monitors).

Leading IT companies, and retailers such as HP, Dell, Lenovo, and Best Buy have energetically supported upstream and midstream programs for desktop IT equipment, and are likely to continue their support for programs that extend product lines (such as servers). For the IT industry, this program model, if replicated across a meaningful portion of the country, offers the ability to significantly increase the market share of efficient products by reducing price differentials or devoting rebates to targeted marketing programs.

**New Construction Programs for Data Centers**

Given the intense rates of data center expansion and development, a new construction incentive program can have tremendous impact in a utility program portfolio. In particular, promoting free cooling strategies (the use of air-side and/or water-side economizers), and high efficiency power delivery and conditioning systems through an incentive program can yield significant decreases in energy demand and usage in new and expanded facilities. The EPA has implemented an ENERGY STAR standard for data centers using a “Power Usage Effectiveness” (PUE) metric. The PUE may provide a standard against which to provide incentives.

**Preparing for EM&V and Mitigating Program Risk**

Just as most utilities are entering the data center and IT energy efficiency market for the first time, evaluation, measurement, and verification (EM&V) professionals have rarely been exposed to the measures and technologies applicable to this sector. While the program approaches used by utilities for this market are not different than those employed for other sectors, the pace of technology change is dramatically more rapid, posing a challenge for program evaluators. We recommend that utilities work closely with evaluators as programs are developed and delivered, helping to ensure that program portfolios are appropriately reviewed and that achieved savings are justifiable.

For example, Pacific Gas and Electric Company worked closely with both the California Public Utilities Commission and evaluation staff before initiating an upstream/midstream consumer electronics incentive program that covered televisions, as well as desktop computers and monitors. This ensured that the program was measured against design intent, and that nuances in program design and delivery were clearly understood before the program was evaluated.

There are a variety of program design approaches that can mitigate the potential risks of regulatory disallowance of program accomplishments, and these approaches should be shared with EM&V administrators.

**Is Free Ridership a Concern for a Typical IT Incentive Program?**

There is a reasonable concern that for some customers and certain program measures, there may be a significant level of free ridership: customers who seek incentives for projects they would have undertaken regardless of the program. For example, it is widely believed that developers and operators of “utility scale” data centers, due to their intense focus on efficiency and operating costs, will undertake any and all efficiency projects and should not require utility program incentives. Similarly, server virtualization projects have been undertaken at the majority of major enterprises, according to market research, so incentives for this measure might be considered questionable by an EM&V evaluation.

The reality of the market for energy efficiency improvements in data centers and IT infrastructure belies many of these concerns. Market data shows and the IT industry broadly agrees that there are inherent barriers to efficiency measure adoption that utility programs can help overcome. These include:
• The “split incentive” paradigm associated with IT energy savings. It is rare that data center and IT managers pay utility costs, so they have no imperative to specify products or implement measures that save energy. Utility incentives address up-front capital costs, and can thereby encourage the purchase of premium efficiency products.

• IT and data center managers have a plethora of technology projects to consider, including replacement of existing systems and deployment of new applications. Incentives that reward those projects that have energy efficiency attributes make it more likely that these projects will be considered a priority for implementation.

For some measures and technologies that provide energy efficiency advantages, there are concerns that market penetration is such that incentives or rebates should not be needed to spur adoption.

The reality of the market again belies these concerns:

• In a March 2010 Press Release Gartner states, “At the end of 2009, only 18% of enterprise data center workloads that could be virtualized had been virtualized.”

• Desktop power management software, which has very good financial returns based on energy savings and is in some cases fully funded by utility rebate programs, still has a low market penetration rate according to the EPA.

• Despite the establishment of an ENERGY STAR standard for servers in 2009, there are only a few qualifying models available, and little to no evident market demand.

For utility program managers, there are a variety of program design models and features that can mitigate the evaluation risks described above. These can include:

• Offering program elements on a limited or trial basis, with a cap on applications, program funding, or time frame. Performing a rudimentary program evaluation immediately after the trial period can inform future program offerings.

• Limiting program eligibility to certain customer classes. For example, a PC replacement program could be directed to the educational and institutional market, in recognition that this market sector typically has longer IT equipment replacement cycles.

In summary, using prudent program design and implementation techniques, and working closely with program evaluators, the viability and success of efficiency programs for the data center and IT markets can be assured.

Cost-Effectiveness of IT Incentive Programs

When utilities first began to provide incentives for certain types of IT devices back in 2003, they did so cautiously and with great concern that the programs would not ultimately pass cost-effectiveness tests. Years later, those concerns have been largely allayed. Still, utilities new to this family of programs, particularly those with limited incentive budgets and strict cost-effectiveness requirements, are often wary of the costs and benefits associated with providing IT-related incentives.

As utilities have gained more and more experience with IT incentive programs, they have few concerns about their cost-effectiveness. In many cases, those concerns have been replaced with excitement regarding the terrific cost-benefit ratios associated with many of these program opportunities.
Case Study: The Energy Trust of Oregon

The Energy Trust of Oregon is an independent nonprofit organization dedicated to helping Oregonians benefit from saving energy and generating renewable resources. Energy Trust manages energy incentive programs for the customers of Oregon’s four largest utilities—Portland General Electric, Pacific Power, NW Natural, and Cascade Natural Gas—by investing ratepayer dollars in cost-effective energy resources. To date, the nonprofit has helped save 222 average megawatts of electricity and 13 million annual therms of natural gas, and helped produce 99.7 aMW of renewable energy. Customers participating in Energy Trust programs have saved more than $600 million on their energy bills.

History of Energy Trust’s Technology Incentive Programs

Energy Trust began incenting custom efficiency projects related to IT efficiency projects in 2006. Market analysis of commercial and institutional buildings, both existing and new construction, yielded data that showed great opportunity for IT energy savings in its electric service territory (Portland General Electric and Pacific Power). Based on that information, Energy Trust began offering cash incentives for data center retrofits, power management projects, and a variety of other projects through both a custom and prescriptive program approach. In late 2008, Energy Trust began offering a prescriptive server virtualization program targeted at small- to medium-sized data centers. In early 2009, it followed suit by offering a prescriptive PC Power Management program targeting small offices and schools. More recently, Energy Trust began funding the 80 PLUS Program, an upstream initiative intended to motivate computer OEMs to build and market more efficient devices. This collaborative initiative involves the Northwest Energy Efficiency Alliance and a number of regional utilities in Oregon, Washington, and Idaho.

Accountability and Regulatory Oversight

An independent nonprofit organization, Energy Trust is accountable to the Oregon Public Utility Commission (OPUC) and has operating agreements with each utility to deliver efficiency resources. Energy Trust’s funding agreements identify savings goals related to an integrated resource planning process for each utility and are reflected in rate filings with the OPUC. Energy Trust reports progress toward OPUC-set performance metrics to the OPUC on a quarterly and annual basis. Within this larger regulatory framework, Energy Trust scopes and implements efficiency programs semi-autonomously according to program budgets and action plans that are approved annually by the Energy Trust board of directors, after a public and industry engagement process.

EM&V

Energy Trust has streamlined savings measurement and verification processes for its technology incentive programs. For server virtualization, customers must simply be consolidating at a 10:1 ratio (i.e., replacing 10 old servers with one new) and old devices must have certifiably been removed from operation. For PC Power Management, customers must demonstrate that they have paid for a qualifying product and verify that it has been deployed within their IT environment. EM&V for the 80 PLUS Program is even simpler as it is facilitated by a third-party program administrator. Sales and product shipment data is provided in bulk by the OEMs to the third party administrator, who sorts it by zip code, aggregates sales numbers by service territory, and then provides reports and invoices based on the actual numbers of qualifying products sold and shipped.

Program Performance

Despite a challenging economy that has affected program uptake rates over the past several months, overall interest and participation in Energy Trust’s technology incentive programs has remained relatively strong. In general, the programs have met or exceeded savings goals, and Energy Trust is currently analyzing adoption trends to determine if participation in one part of its technology program directly drives uptake in others. Typical participants in the program have included schools, local governments, corporate data centers, and large commercial organizations.

Future Strategies

Energy Trust is in the process of reviewing expansion opportunities for its technology incentive program, which may include programs to support high-efficiency UPSs, 80 PLUS for ENERGY STAR 5.0 servers, efficient storage devices, and working with ENERGY STAR and other regulatory bodies to drive new efficiency specifications.
Advice for Peers
Nick O’Neil, senior planning engineer for Energy Trust, offers the following advice for his peers in the utility sector: “Don’t be afraid to engage with industry and to use them as a driver to change behavior, particularly when working with something like IT devices that are inherently complex and that so few people understand.” Further, says Nick, “Run pilot programs to get your feet wet and then fine-tune your program before you launch into a full-blown effort. In other words, start small and build from your own experience.”

Sources for Support
There are a number of independent industry consortiums that focus on IT energy use and are terrific resources for those utilities wishing to gain more exposure to the industry, its challenges, and the resulting opportunities. The Green Grid (www.thegreengrid.org) and the Climate Savers Computing Initiative (www.climatesaverscomputing.org) are two organizations with diverse membership that are chartered to find real solutions to IT energy issues that can be brought to market quickly and efficiently.

Conclusion
While the proliferation of IT devices has grown to create a variety of unintended and unexpected energy consumption challenges, the industry has been active in addressing energy issues and providing new technologies and management opportunities to drive energy savings for IT departments of all sizes. However, in these tough economic times organizations are very slow to upgrade IT infrastructures or to make investments in new technologies that aren’t vital to the survival of their business. Unfortunately, that often means that energy efficiency opportunities are delayed or even eliminated from consideration by many organizations.

This market inertia represents unfortunate energy waste, but simultaneously presents enormous opportunities for progressive utilities to motivate their customers to more quickly invest in IT efficiency and to drive substantial and measurable energy savings. As the U.S. economy continues to evolve and become more information-based and IT-intensive, data centers and their associated energy footprint will continue to grow. By proactively addressing this change, progressive utilities will be better able to manage increasing IT energy demands, while simultaneously optimizing customer buying behaviors and operational practices.
Utility Energy Efficiency

4. LBNL-53729 “After-hours Power Status of Office Equipment and Energy Use of Miscellaneous Plug-Load Equipment,” Dept. of Energy (United States)

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