



Northeast Energy Efficiency Partnerships

DATA CENTER WHITEPAPER

(Authored by Deborah Grove)

July 31, 2009



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I Executive Summary

“Data center power and cooling infrastructure worldwide wastes more than 60,000,000 megawatt-hours per year of electricity that does no useful work powering IT equipment. This represents an enormous financial burden on industry and is a significant public policy environmental issue.”

Source: APC White Paper #126 by Neil Rasmussen

This issue has already been recognized to be of strategic importance by the EPA, the DOE, the EU, and several North American utilities. NEEP sponsors have many resources to tap as they create a strategy for 2010 and beyond.

In interviews, NEEP stakeholders express a certain hesitation about tackling this issue. The hesitation to date seems to hinge on a divergence of opinions about whether infrastructure or IT is the major culprit, and what should be tackled first.

The process of Data Center Energy Efficiency incentives and take-up is an iterative one: low-hanging fruit beckons in air management, followed by improved consolidation and virtualization, with additional power efficiency strategies to follow, combined with operating system and semiconductor chip density improvements with energy-aware capabilities (2-6 years down the line), etc.

If this process is undertaken, the size of the potential savings in NEEP sponsors' service territories is estimated to be 1500 - 3000 MW. The authors of this report believe that an overall savings of 30% of energy used (across all data center sizes in the Northeast region) can be achieved without IT improvements. Leveraging IT improvements, that target can be as high as 50%. Clearly, there is no reason to wait longer to begin offering awareness and education programs followed by incentives, where possible.



II. Background/Context

The outline of this report was provided by Ed Schmidt. The research was conducted by Grove Associates. Interviews were conducted by Deborah Grove.

This report is prepared for the 18 current sponsors of NEEP as of May 2009. Recognizing that the size and complexity of the 18 sponsoring organizations varies greatly from large entities such as NYSERDA to smaller ones such as Cape Light Compact, these are assumptions for the action plan.

- All data center energy efficiency initiatives will be housed within individual sponsor programs, however strategy development and information sharing will continue in the context of NEEP's Commercial Buildings & Technologies Initiative.
- While the state regulatory agencies that govern each of the sponsors vary, a regional strategy or approach is preferred.
- Federal funding may be sought from DOE and other agencies to pay for data center energy efficiency programs.

Grove Associates believes that there is sufficient knowledge from state-of-the-art programs at other North American utility companies, so that regional Data Center Energy Efficiency programs can be launched using Evaluation Measurement & Verification developed elsewhere.



III. Market Characteristics

There are four different types of data centers:

1. Internet server farms (mostly Amazon, Google, Microsoft, Yahoo, etc)
2. Co-location services and turn key management for enterprises by the major property management companies (DRI, CBRE, Savvis, Equinix, Level3, Switch & Data)
3. Enterprise data centers for 5 - 20K square feet in office buildings
4. Server closets in small to medium size businesses - 1 - 5k square feet

This report will not focus on the opportunity for utilities to provide incentives or programs for server closets, because the market is fragmented, difficult to discover and measure, and the rate of return for resources spent is smaller than for the other three opportunities. It is likely that the lion's share of savings from these types of data centers can be achieved through straightforward approaches such as supporting ENERGY STAR IT equipment.

Clearly, the internet server farms have created the most disruption for utilities over the past three years. When Grant County (state?) Public Utilities Department was approached to provide 20 MW for Microsoft, "it doubled our demand overnight". Austin Electric and Duke Energy have experienced similar disruptions. Utilities in the Pacific Northwest are now anticipating more of these disruptions according to sources within the Bonneville Power Authority.

The reasons for this are that Internet server farms choose to locate where they expect to have:

- Access to hydro (clean) power
- Availability of lots of water (taking a long-term outlook)
- Proximity to existing data pipes
- Attractive utility rates
- Safety from terrorist threats and weather or geography-related disasters.

Internet server farms are few and far between, well planned with lots of lead time, well negotiated on the customer-side, and very demanding of their utilities.

Co-location service providers are changing rapidly from regional to global players. This will be discussed more below because they are expanding for myriad reasons.

Enterprise data centers in office buildings are the most stable of all of the four types of data centers, largely because there are limited retrofits that can be done to existing premises. This will be discussed more below.

The data center industry is in transition. To have impact on the energy efficiency of server farms, co-los and enterprise data centers, it must be recognized that the entire data center industry is in transition. The reasons for this transition are many, including but not limited to:

Immediate:

1. Managing a data center is increasingly complex and difficult
2. The infrastructure guidelines (ASHRAE, LBNL) are in a state of flux
3. New data center construction costs are prohibitive and hard to finance
4. Alternatives exist in co-location facilities that manage the infrastructure



5. Technologies including air economizers, outside air usage, and Kyoto cooling, are rapidly improving.

Long term:

1. Water for cooling will increasingly be under stress nationwide
2. Opportunities to outsource more to cloud computing means that with more volume the cloud providers may be able to compete with internal data centers on a cost per transaction basis
3. BMS (building management systems) are increasingly able to include data center metrics and interact accordingly (3 - 5 years)
4. IT chips will be manufactured and operating systems software recoded to be more energy aware and efficient over the next several years
5. Cap & Trade mechanisms may pressure data enterprise data centers operations managers to consider scaling down or moving offshore

Industry predictions for data centers:

"A particularly popular subject in 2008 concerned the emergence of cloud computing, largely centered on the outsourcing of IT to cloud services available over the Internet. Gartner's opinion is that the future of corporate IT is in private clouds - flexible computing networks modeled after public providers such as Google and Amazon but built and managed internally for each business's users. The effect of cloud computing on data centre floor space is as yet unknown. IDC predicted that cloud computing services will represent a US\$42 billion market by 2012 whilst Merrill Lynch believes that by 2011 the volume of the cloud computing market opportunity could amount to US\$160 billion."

Source: CBRE European Data Centre Q4 08 Report

Note: CBRE manages several million square feet of data centers globally so while the above comments are about Europe, the major assumptions are also true for the USA.

Another research conclusion:

"Many large enterprise users with multiple major, stand-alone data centers have started to seriously consider co-lo opportunities. Traditionally, these users spent the money and time to build their own data center, and operate and maintain it internally. That trend has started to change and we are seeing an increasing number of large co-lo requirements in the market.

Fortune 1000 budget cuts and decisions to reduce capital spending on large, costly, stand-alone data centers can be attributed to this increasing trend. While funding is decreasing, internal demand is increasing resulting in the need for smaller footprints (<10,000 square feet) or pods that can be acquired and in operation within six to nine months. The natural alternative is co-location.

The square footage commitment is usually a smaller footprint providing more flexibility. The one hurdle the collocation industry has to solve is the vanishing supply of space... Demand continues to increase for the co-lo product. Requirements for large pods and footprints up to 1MW and more of power are becoming common."

Source: JLL: Data Center Users Shelve Stand Alone Plans, pub. March 9, 2009

III. Market Opportunity



The EPA and the DOE both agree that the amount of energy consumed by data centers across America is worrisome. The demand is already huge and growing annually. At present, IT staff is not compensated for taking energy efficiency measures and they are punished for any downtime that might result.

On the other hand, EPA and DOE also understand that the 2% of the nation’s utility bill that is consumed in data centers drives the business infrastructure for the remaining 98%. So their intent is not to curtail business growth, rather to be prudent (i.e., not wasteful) with its use. Across the board, including university research institutions, federal labs, vendors, users, and industry associations, there is agreement: 20% - 50% of the energy used in data centers is wasted.

Market Size

The overall size of the NEEP sponsors’ utility usage is roughly equal to that of California with the data center energy requirement using approximately as much as one or possibly two Rhode Islands.

Data from 2007 EIA Electric Sales			
	Summer Peak mW	Winter Peak mW	% Summer
CT	7,626	6,221	9%
MA	15,038	10,931	18%
ME	2,099	2,037	2%
NH	2,430	2,076	3%
NJ	10,840	7,452	13%
NY	43,774	34,184	52%
RI	1,974	1,344	2%
VT	1,041	1,020	1%
Total	84,822	65,265	100%

Using a calculation of 2-4% of an average of summer and winter peak load, the data center usage would be roughly 1,500 to 3,000 MW. After a quick assessment of New England’s economy estimating the number of universities, hospitals, and financial company headquarters with data centers in the NEEP sponsor area, the percentage may be closer to 3,000 MW.

If we assumed that the entire NEEP region data center demand in 2010 were 1,585 MW, a 20% savings annually would be 300 plus MW on the low end and 750MW annually on the high side. It may take 5 - 10 years to achieve 300 MW savings using the programs piloted at other utilities. The “how” is addressed in the “Action Plan” section of this report. The obvious places to begin curbing inefficiencies are briefly described below.

A major vendor to data center infrastructure has articulated the five contributors to inefficiency in the data centers. It is useful to recount them here with their solutions, i.e., the opportunities NEEP sponsors have:



- PROBLEMS (1 and 2): Inefficiencies of the power equipment & Inefficiencies of the cooling equipment
- SOLUTION: Optimize subsystems for fractional-load efficiencies
- PROBLEM: Power consumption of the lighting
- SOLUTION: Efficient technologies (e.g. LEDs), controls to minimize use.
- PROBLEM: Over-sizing of the power and cooling systems
- SOLUTION: Modular growth & variable fans
- PROBLEM: Inefficiencies due to configuration
- SOLUTION: Raising inlet temperatures and containing hot and cold aisles to reduce conflict

Data Center Energy Savings Initiatives: “The Cascading Effect”

	Efficiency Strategy	Optimized DC	Savings	kW
1.	Low power processors	90 watt → 70 watt	10%	110kW
2.	Efficient power supplies	80% → 90% AC/DC	11%	140kW
3.	Server power mgmt.	80%→45% idle load	8%	125kW
4.	Blade servers	Rack → 20% blade	1%	10kW
5.	Server virtualization	Dedicated → 20% virtual	8%	155kW
6.	Power distribution arch.	208V → 415V AC	2%	35kW
7.	Cooling best practices	H/C aisle → optimized aisle	1%	25kW
8.	Variable capacity cooling	Fixed → variable	4%	80kW
9.	Supplement cooling	Floor mount + supplemental	6%	200kW
10.	Monitoring & optimization	Cooling team coordination	1%	25kW

Total saving: 50%

IT hardware (34%)
 Operations (19%)
 P&C efficiencies (27%)

1 watt saved at the server saves 2.8 watts in total DC consumption

Source: IDC

With a robust economy in 2010, new and enlarged data center activity will certainly drive up existing requirements. In a stagnant economy, we still have the 1,585MW to contend with. Bringing awareness and education of the above solutions could result in significant savings.



IV. Barriers to Adoption of Energy Efficiency Measures

Split incentives, limited capital, regulation distortions, and confusion resulting from co-mingling of energy efficiency features from other desirable or undesirable/product features can all contribute to reasons why customers do not embrace the opportunity for energy efficiency.

Recent research indicates that barriers such as those described in the previous paragraph can distort the prices of energy and energy efficient alternatives, and block out information about energy efficient alternatives, thus interfering with the ability of company managers to make economically rational decisions.

Three types of barriers to data center energy efficiency measures in particular can be described.

Market barriers (from the utility perspective):

- Customers misunderstanding the opportunity
 - What do I have to spend in order to save?
 - Given other opportunities to save money, is this urgent?
 - Will the reliability of my IT operations be at risk?
- Split incentives for customer base
 - Landlord/lessee relationships mean that the investment often does not meet an internal rate of return that makes this viable
 - Regional and local sub-metering regulations do not allow for measurement
- Utility perception that incentives aren't needed because vendors can drive this change without them
- Utilities are not organized to leverage the opportunity if their programs are technology based (lighting model) versus vertical based (*They are not selling energy efficient lighting, boilers, motors and controls anymore. They are selling EE solutions.*) Source: p 39, CIEEE
- Utility staff not confident to open conversations with customers
 - Sales & service staff may be unfamiliar with data center jargon
 - They lack role models for approaching data center staff
 - They are waiting for an invite, not "selling" the benefits
- Confusion among vendors & customers
 - Why should a utility provide incentives for virtualization if 80% of the revenue is earned by a single vendor
 - Is this fair? Is this relevant? Is this a conflict of interest?
- Utilities may not believe their own energy efficiency programs are optimally implemented and therefore hesitate to make more choices available to customers.

Technology barriers (from the utility perspective):

- Regulation can't keep up with speed at which IT appliances are launched
 - Moore's Law¹ drives semiconductor introductions every 18 months
 - PCs, servers, routers, etc offer efficiency gains faster than traditional products such as refrigerators, washers, HVAC, etc
 - In 2010, there will be 43 million physical servers as well as an additional 15 million virtual servers installed worldwide (IDC)

- Rate-payer base is changing as co-los and cloud providers carve out a substantial niche
 - Co-location may be the wave of the future - starting now
 - Co-location facilities may be leased or owned
 - Co-location facilities would require sub-metering permission to incentivize each of their own customers

Business process barriers:

- Organizational inertia: Lack of communication between facilities and IT

- Split incentives on performance for EE gains

- Accounting and definition problems; cap ex v op ex

- Unaccounted costs for energy efficiency implementation
 - Staffing hours go up
 - Software driven dashboards are purchased
 - Utility bill savings may be erased by either or both of those

An observation about EPA and other federal agency initiatives:

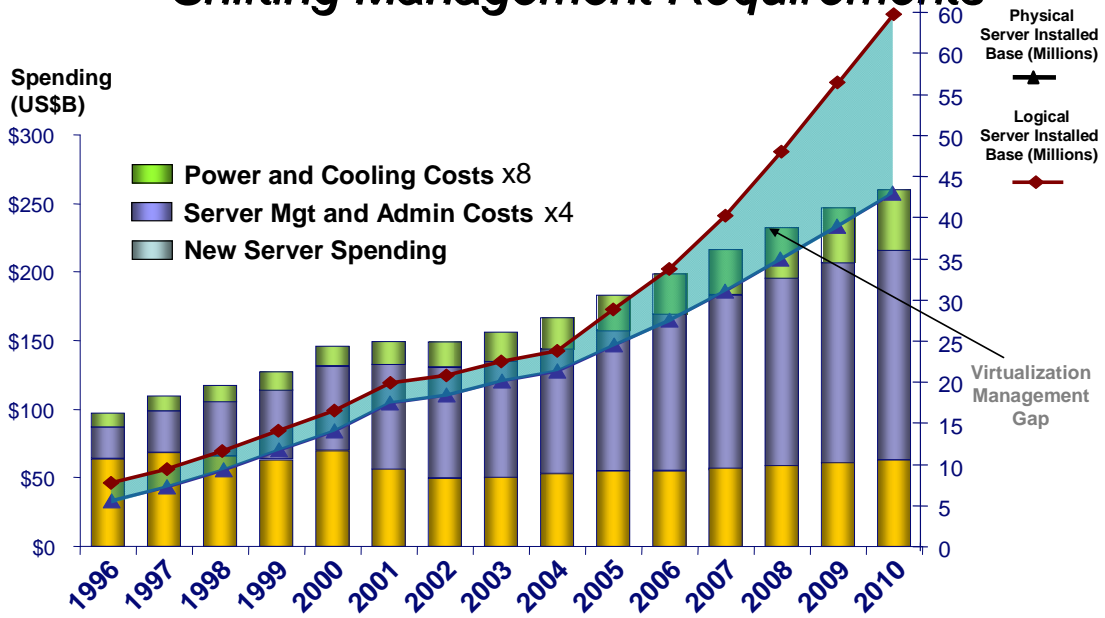
Federal appliance standards will not move the IT industry forward over the next five years. Although a company such as Sun Microsystems can deliver energy efficient servers to market within 6 months of design to delivery, the refresh rate for the total array of servers in most enterprises is 36 months in a good economy, and more likely, 48 months in a stagnant economy, (and servers recognized to be running applications with low priority or at 15% utilization are replaced far less frequently). Therefore, if 25% to 33% of critical-mission servers in every enterprise data center will be replaced annually, this process might take five years. See following IDC chart.

¹ Moore's Law applied to semiconductors suggests that semiconductor capacity and thus cost-effectiveness doubles every 12-18 months (see: <http://www.capmag.com/articlePrint.asp?ID=1686>)



Data Center Economics 2.0

Shifting Management Requirements



Source: IDC, Sept. 2007



V. M&V/Evaluation Issues

Three different program types are addressed here:

1. Upstream Rebate
2. Deemed Rebate
3. Calculated Incentive

1. Rebates

Upstream Rebates have generally only been used for the following three technologies: 80-plus for servers, 80-plus for PCs, and premium efficiency LCD monitors. Ecos Consulting (<http://www.ecosconsulting.com/>) is the preferred partner on these programs across the nation's utilities.

2. Deemed Incentives

Deemed Incentives have been adopted for the following programs:

- A. PC Power management examples
 - I. BC Hydro offers \$6 per power management software license.
 - II. Silicon Valley Power pays a \$15 rebate per controlled PC for network server software that maintains power management settings on connected PCs and can shut down computers remotely according to a schedule. Rebate applies to desktop computers only.
- B. Multi-User CPUs (virtualization)
 - I. Seattle City Light Incentive offers payment of \$25 per connected workstation for software and hardware that enables the operation of multiple workstations from a single central processing unit. CPU must serve three or more workstations; must be equipped with an 80-plus qualified power supply; workstations must have LCD flat-screen monitors
- C. Virtualization/Consolidation
 - I. Both PG&E and Silicon Valley Power are offering these. PG&E started out their virtualization program as a Calculated Incentive and is transforming the program to a Deemed Incentive because of market resistance (effort required to participate in the CI program)
 - II. Both BC Hydro and Efficiency Vermont offer this as a Calculated incentive as well.
- D. Energy efficient power bars
 - I. BC Hydro offers a \$7 incentive per EE Power Bar (Strip) Bar



3. Calculated Incentive

A. Airflow Management

- I. PG&E offers Retrofit installation of temperature monitoring sensors, control technology, and variable-speed drives on Computer Room Air Conditioners or Computer Room Air Handlers to adjust airflow in data centers to match equipment demand
- II. BC Hydro offers incentives for continuous optimization of data center Air Management using wireless sensors

B. Data Center New Construction

- I. PG&E relies on technical analysis of measures compared to established baselines. Strong knowledge of HVAC and power conditioning and distribution systems. Can involve self-generation and load-shifting technologies also.

C. Customer Directed Rebates

- I. Silicon Valley Power: This provides unique opportunities for energy-efficiency projects that may not otherwise fit into our standard rebate and customer assistance offerings. Most data center infrastructure projects have fallen into this category. More than 50% of total energy savings each year comes from this program. In FY 07-08, 16.9 MWh out of our total 26 MWh was attributed to data center participation in this program
- II. Xcel Energy: Program designed to encourage a holistic approach to energy efficiency in the data center by offering study funding and project implementation rebates.



VI. Actions: Program Strategy

1. Discover and describe the total addressable market (TAM):
 - a. Colleges and universities
 - b. Enterprise (1000 plus employees)
 - c. Public sector offices
 - d. K - 12 school - private and public
 - e. Medium size service companies (200 - 999 employees)
 - f. Small size companies per list of business licenses (less than 199 employees)

Timeline: September 2009

2. Identify target audience for "big" projects (2 MW or above)
 - a. Determine what stage of development greenfield projects are in using low-cost market research tools such as customer surveys, interviews with account executives, outreach events to engineers and architectural firms, and customer education events,
 - b. Set internal milestones for each new project and retrofits before drawings are finalized in order to influence the EE outcome
 - i. Understand who the customer is
 - ii. Understand what they are trying to achieve (cost savings over reliability, corporate security over cost savings, project time constraints)
3. Estimate savings over five years in those 2-MW+ projects using existing MVEE models already in place around North America

Timeline: November 2009 (8 weeks elapsed time)

4. Determine what internal and external resources are required to earn those MW saved and at what cost
 - a. Internal:
 - i. staff for MVEE, internal education
 - ii. overhead allotment for
 - a. collateral
 - b. education
 - c. sponsorships at community event
 - b. External:
 - i. local architectural and engineering firms
 - ii. global, regional, and local property management companies

Timeline: January 2010 (14 weeks elapsed time)

5. Compare the cost of various channels of program delivery:
 - a. Programs offered directly to utility customers (Core)
 - b. Programs offered through Third Party Programs
 - c. Programs carried out by local and state Government Partnership

(The first two build market awareness whereas the third type creates market transformation mechanisms)



6. Retain and train external services for upstream and downstream incentives as well as MVEE calculations to jumpstart programs. There is a perception that only utility staff can make the calculations, but with experienced MEs on staff at architectural and engineering firms, this could be taught in .5 day workshops.

Note: "I have reviewed the energy calculation forms and believe that even a junior engineer in my office could easily complete these. We routinely evaluate and compare alternative mechanical equipment to be able to provide options to our clients so they can make the choice based on Life Cycle Costs analyses. Some of the equipment encountered will have variable efficiencies which may vary seasonally or by load but a suggested range can be provided and factors can be made for an equivalent full load or computer modeling can be done as well." *(Quoted from John Pappas of Mazzetti, Nash, Lipsey, Burch when asked whether his firm could complete evaluation forms provided by two utilities as examples)*

The choices between developing in-house evaluation teams and contracting such work to engineering firms requires thoughtful consideration and pricing models. In the short term, much more can be accomplished using external resources. In the long term it may be a more expensive solution. Perhaps NEEP shareholders can explore a hybrid model that uses 3rd parties for some programs and internal employees for others.

7. Conduct semi-annual workshops for end users regarding the best practices and relevant rebates. Use educational course material from LBNL, available on the IT EE or LBNL URLs and ready to reformat and hand out. It may take 18 months (offering the workshop 3x) for evidence of results (one metric could be a spike in rebate applications) that the workshops are reaching their target.

Timeline: March 2010 (22 weeks elapsed time) to present first five workshops

Divergence of Program Goals:

While some NEEP sponsors will be motivated to reduce demand, others will set as their primary target lowering consumption.

Demand reduction is difficult to achieve unless it is incorporated very early into the design process so that airflow and HVAC purchases and upgrades are incorporated. New construction programs offer the biggest opportunities. Within the IT realm, virtualization is most often classed as both a demand reduction as well as savings opportunity.

For those utility programs focused on lowering consumption, the options seem to be much easier to implement and manage than demand reduction. PC Management, energy efficient power bars, 80-Plus for servers and desktop computers, thin clients, are all reported by utilities to produce consumption savings, not demand savings. Interestingly, the range of savings varies considerably. For example, Seattle City Light offers a deemed incentive of 450 kWh per PC Management license, Silicon Valley Power's deemed incentive for the same type of software is just 125 kWh, similar to Austin Electric's 120 kWh.



VII. Resources

Active communities on the topic of data center energy efficiency are already in existence.

PG&E -sponsored Utility Information Technology (IT) EE Coalition online collaborative community can be viewed here. Membership is free.

<http://grovesite.com/page.asp?o=utilitieshightech&s=Visitors&p=284107&i=0>

In addition, CEE has a committee chaired by Jason Erwin, for the topic of data center energy efficiency. <http://www.cee1.org/com/dcs/dcs-main.php3> Membership is not free.

The following notes are quoted from a January 2009 report prepared for CIEE Behavior and Energy Program by Edward Vine, Program Manager, *California Institute for Energy and Environment*, (1333 Broadway, Suite 240, Oakland, CA 94612-1918)

"California's energy efficiency programs have been successful in flattening demand over the last 3 years. "This has generally been accomplished by providing utility customers with information about the availability and cost of energy efficient alternatives and economic incentives designed to make these alternatives more economically attractive. The policy paradigm underlying these programs is what has been called the Physical Technical Economic Model (PTEM)." (source: page 5)

The limitations of the PTEM model for achieving significant *further* improvements in energy efficiency are becoming increasingly apparent. In response to this situation, new programs have been proposed by PG&E (and the other California IOUs) that incorporate a wide range of efforts to transform markets and take advantage of marketing strategies that do not rely solely on the assumption that consumers are making rational decisions about the costs and benefits of energy efficiency.

Unfortunately, these new programs do not fit well within the existing regulatory framework that treats savings obtained from energy efficiency improvements as an energy supply resource. They do not fit well within the existing framework for evaluating the efficacy of energy efficiency programs which is focused on documenting direct energy savings. **"Lastly, because the proposed next generation of programs is still under development, it remains to be seen how well they will work. These are all considerations that stand in the way of the next generation of more effective energy efficiency programs."** (Text bolded by Grove-Associates.)

Summary:

These three paragraphs are included to demonstrate that even in mature programs, the dynamics change so rapidly that traditional evaluation tools may not serve ratepayers and utilities best, and that some of the evaluation tools may require tweaking.

NEEP can start pilot projects with incentives or rebates for data center design, air management, virtualization, and PC Management, and experiment with different deemed or custom programs, using existing evaluation tools from California, Texas, and elsewhere, with the knowledge that they may be under scrutiny there as well. As reported earlier, deemed savings vary by 300% for PC Management per-seat licenses.



VIII. Case Study: Austin Electric's Data Center Energy Efficiency Program

Austin had a small data center "population" until 2007 when a new business park opened north of the city and offered attractive rates and services that resulted in a huge data center being built for an IT services provider. Within 12 months, it seemed that the data center demand would double from 50MW to 100MW. What to do?

Today the manager of the rebates and incentives programs says that 10% of her time is spent on data centers and that no single person has responsibility solely for data centers. Instead teams work on an "as needed" basis.

AE's #1 objective is to reduce emissions and carbon footprint (kWh), followed by power reduction (kW), their #2 goal. Sometimes programs provide both benefits. Since data centers have a 24/7 load, they provide both types of savings. AE does not claim power savings.

AE initiated their Data Center EE program with incentives for 90% EE UPS systems. (In contrast, the PG&E program is for 85% EE UPS systems.) They followed with virtualization, based on evidence of reductions in actual servers, using a 50% de-rating on total power of nameplate power. The agreement with ratepayers requires them to keep existing servers in place for three years but they earn only a 1x savings of \$150 - \$200 per server displaced based on a \$750/kW removed rate.

AE has successfully adopted a PC Power Management program. As a result of a state mandate that was passed, all state buildings need to evaluate PC Management software. Their first State customer to receive the rebate installed this on 3000 PC's, 1100 of which are located in the Texas Capitol complex. While PG&E offers 200kWh for estimated savings, AE assigns just 120kWh - still a far cry from a vendors' preference for just 50 - 60 kWh.

Because the enterprise data center business park was a 1x anomaly and AE's overall market is more broadly small to medium businesses, the data centers served by AE typically are low density environments with a few high density racks. So AE is building their program around prescriptive measures for PC Power Management, virtualization and more energy efficient UPS choices, and all the while considering a broader approach through a "custom technology" offering that takes into account any technology that has not been evaluated yet that will result in demand savings. Data Centers are still eligible for the remainder of the standard rebates such as: lighting, a/c, chillers, VFDs, motors, etc. On the horizon being considered are storage virtualization and thin client systems.

AE is currently working on a grant funded from the Texas State Energy Conservation Office to help the EPA get their baseline data and in addition, to conduct some data center assessments.



About Grove-Associates

With over 30 years of experience in IT industry thought leadership Grove-Associates (G-A) can offer a wealth of expertise in leading teams to leverage successes with an enhanced reputation throughout eco-systems of customers, partners, and influencers. G-A develops and delivers online community, blogging/podcasting, social networking, and more traditional gotomarket strategies that result in widespread industry leadership perceptions. G-A's rolodex in data center energy efficiency is nonpareil for access to vendors, users, analysts, utility program managers, and Energy Efficiency academics at research institutions. G-A's strength is in building 3-5 year strategies and programs in a resourceful and cost-effective manner.

On behalf of PG&E's data center energy efficiency program, G-A created an industry analyst awareness project that successfully broadcast the California story around North America and to Europe. Industry recognition as a result of that include awards from the Computerworld 2008 Top 100 and the Uptime Institute 2009 GEIT, several conference keynote invitations, and numerous industry analyst papers published by IDC, Forrester, Gartner, AMR Research, and APPA.

In addition, G-A designed an online collaborative community providing \$1 million intellectual capital database for every utility program manager to access and use. With responsibility for day to day community management (45 utilities enrolled to-date), G-A contributes content and manages member blogs, organizes activities, analyzes usage, and other logistical details. Milestones include three face to face meetings over 18 months with IT EE members, and a cohesive Climatesavers strategy. The site may be viewed at:
<http://grovesite.com/page.asp?o=utilitieshighstech&s=Visitors&p=284107&i=0>

In ongoing conversations with utility program managers whose responsibility includes strategy for and development of an implementation plan, G-A has a unique perspective on utility-specific challenges and opportunities as well as trends across the industry. These personal relationships with each utility enable G-A to understand regional differences, solicit ideas, test recommendations, and facilitate peer to peer exchanges. Recognized as a thought leader in this field, G-A was invited to prepare a whitepaper on Data Center Energy Efficiency for the Northeastern Energy Efficiency Partnership.

For the General Services Administration, G-A recommended a QuickStart "menu" for federal employees who are engaged in data center energy efficiency. This document has been handed out at private sector and federal conferences and various workshops related to DC-Pro and other initiatives. Working with LBNL, G-A created a document that serves as motivator and reminder of key concepts.
http://www.gsa.gov/graphics/pbs/Final_GSA_govEnergyCard_10_08.pdf