Energy Efficiency in Data Centers: Recommendations for Government-Industry Coordination

Results of the U.S. Department of Energy
and U.S. Environmental Protection Agency's
National Data Center Energy Efficiency Strategy Workshop,
Held July 8, 2008

October 16, 2008

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OVERVIEW AND RECOMMENDATIONS

The U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA) held the National Data Center Energy Efficiency Strategy Workshop on July 8, 2008. The workshop was hosted by Microsoft at its Corporate Campus in Redmond, Washington, and was attended by more than 150 industry and government leaders. DOE and EPA convened the workshop to provide an opportunity for all data center energy efficiency stakeholders to look at the big picture of how government and industry are advancing toward the goal of improved energy efficiency in data centers. The goal was to help identify a series of next steps that the government can take to fully leverage and complement industry, utilities, and other stakeholder activities.

The morning session of the workshop featured speakers discussing key trends and recommendations for government and industry to collaboratively advance energy efficiency in data centers. The afternoon session provided opportunity for all attendees to offer insights and recommendations through interactive small group sessions. This report provides a summary of the workshop, recommendations for next steps for public and private collaboration, detailed descriptions of the afternoon's interactive small group sessions, and a list of participants. Exhibits at the end of the report include point papers submitted by the organizations featured in the morning sessions. In addition, sponsoring organizations were invited to submit descriptions of their programs and services. The U.S. DOE and EPA would like to thank Microsoft Corporation for providing the meeting space and meals during the workshop, and the following companies for hosting the evening reception: OsiSoft, Power Sources Manufacturers Association (PSMA), Sabey Corporation, 7x24 Exchange, Green IT Alliance, the Telecommunications Industry Association's ICT Green Initiative, and Seattle City Light.

Morning Session: Leading Perspectives
Paul Scheihing (DOE) and Andrew Fanara (EPA) opened up the workshop by identifying some of the market challenges and opportunities for data centers in regards to energy efficiency efforts, and provided a framework for the day's discussions. They were followed by several speakers presenting the results of energy-management best practices being implemented in data centers. Christian Belady of Microsoft described monitoring and incentive systems that Microsoft has put in place in its data centers to motivate energy efficient behaviors, which have led to a 22% improvement in power usage effectiveness (PUE) in 3 years. Ray Pfeifer of Silicon Valley Leadership Group and Teresa Tung of Accenture Consulting described a series of energy-efficiency demonstration projects that SVLG members have implemented, the results of which were used to validate the data center energy savings estimates published in EPA's 2007 report to Congress. Finally, Miles Kelly of 365 Main described a series of energy efficiency projects that his company has implemented in its data centers, which had paybacks of 2 years or less and improved their PUE.

The rest of the morning was comprised of brief 5-minute overviews of key activities and collaboration opportunities by government, utility, and industry representatives, including: DOE, EPA, European Union, Utility IT Energy Efficiency Coalition, Consortium for Energy Efficiency (CEE), The Green Grid, Standard Performance Evaluation Corporation (SPEC), Storage Networking Industry Association (SNIA), Uptime Institute, and 7x24 Exchange.

Afternoon Session: Interactive Discussion Groups
The afternoon was devoted to smaller group discussions to identify approaches for joint government/industry cooperation to further increase data center efficiency. Attendees were given the choice to participate in one of three break-out groups, summarized below. Each group was tasked with identifying key gaps in knowledge and developing recommendations for areas of coordination between government and industry to address these gaps. In-depth reports of the break out groups' discussions and key points are provided later in this report.

(1) **Defining** energy efficient data centers: This workgroup discussed the topic of creating better transparency in the energy use of data centers and IT equipment through metrics, standards, and best practices. The group recommended that an important next step is finalizing the development of and harmonizing standard metrics for IT equipment, infrastructure, and facilities. With this, there needs to be robust definitions for useful work for different classifications data centers and IT equipment as well as education and outreach on existing standardized metrics.

(2) **Advancing** energy efficient data centers: This workgroup explored how to accelerate the adoption of energy efficient technologies and practices in data centers though building skills and knowledge throughout the organization. This group suggested that industry and government work together to consolidate best practices, perform outreach and education with a special focus on executive levels, and develop pilot projects to demonstrate the performance of energy efficient practices and technologies.

(3) **Rewarding** energy efficient data centers: This working group focused their discussion on ways to help organizations better quantify and understand the internal "rewards" from energy efficiency. The group recommended that industry and government develop tools to help decision-makers better understand the benefits from energy efficiency data centers and checklists that identify the basic considerations for new IT projects. In addition, the group recommended that incentives are needed for sub-metering and energy management systems in data centers.

Recommended Areas of Coordination between Government and Industry: The recommendations from the afternoon sessions are summarized below. Full descriptions of the discussions and notes from each session are included in the remainder of the report.

1. **Coordinate activities** – Put in place a process to coordinate energy efficiency activities of government and industry groups; possibly form an organization for this purpose.

2. **Standardize metrics and definitions** – Standardize and harmonize metrics for IT equipment, infrastructure, and facilities; develop definitions for useful work output from IT equipment and data centers as a whole.

3. **Improve access to information** – Develop and consolidate information about technical and organizational (or "management") best practices for energy efficiency in data centers; information should include analytical tools for technology, as well as financial and risk assessments; information should also include simple checklists, such as basic items to consider for new IT projects; use pilot projects and test centers to develop real data on costs and benefits.

4. **Promote training and education** – Perform outreach to raise awareness about metrics and best practices, with a special focus on senior executives.

5. **Provide incentives for implementing best practices** – Promote internal reward systems (e.g., employee recognition programs) as well as external rewards (e.g., financial incentives or recognition programs) for organizations that implement best practices.

6. **Better understand decision-making for data centers** – Conduct market research to better understand why data center managers are not adopting efficiency, what barriers they face, and what they need to overcome those barriers.

U.S. DOE and U.S. EPA Next Steps: Based on the discussions and recommendations from this event, DOE and EPA have identified the following future directions. Government activities will be subject to interest from stakeholders and available resources.

1. **Develop an online information portal** – Create a Web site that provides easy access to energy efficiency resources and information, such as industry best practices, metrics development, industry initiatives, education and training opportunities, technology demonstrations, and incentives.

2. **Release DC Pro Tool Software** – This software will help companies define baseline energy use of data centers and identify potential energy savings and to reduce environmental emissions. This tool provides quantification of key metrics including cost, primary energy (Btu), and carbon. DOE is in the final stages of the beta test period and will release the DC Pro Tool Version 1 software in September 2008, which includes a high level energy profiling tool as well as the electrical distribution system assessment tool. Other assessment modules will be available in future versions. One of objectives of the tool is to assist datacenter operators with performing self-assessments of their operations.

3. **Joint training** – Develop training through industry groups such as ASHRAE and others and deliver through multiple sponsors to data center operators. DOE will facilitate the delivery of training workshops with a variety of cost-sharing sponsors similar to the training delivery model used by Save Energy Now.

4. **Technical assistance** – DOE is developing a program to train and certify Qualified Specialists to assist data center operators in identifying and implementing energy saving projects. Qualified Specialists would be expected to have the skills necessary to perform energy assessments in datacenter operations. DOE will include industry input in the development and formation of the certification program.

5. **Investigate the feasibility of developing a Federal pilot project** – Investigate the feasibility of developing a pilot site at a federal agency through collaboration with FEMP. The pilot site conducts energy-efficiency assessments, implements cost-effective improvements, and shares results and lessons.

6. **Complete the ENERGY STAR specification for computer servers V1.0.** – This is the EPA's first specification for IT equipment typically found in the data center. EPA plans

to finalize the specification by January 1, 2009, and the new specification would be effective immediately.

7. **Initiate a workgroup to start researching a Tier 2 server specification** – The Tier 2 specification for servers would broaden the scope of the specification to larger server types and more holistically address the performance and energy use of servers using applicable server benchmarks.

8. **Continue research into specifications for other IT equipment** – The EPA has already begun discussions with storage equipment industry representatives and has also started thinking about specifications for networking equipment. The EPA plans to continue research in these areas starting in 2009.

9. **Finish data collection effort on data center energy use** – Data collection on data centers will start on August 15, 2008. The EPA has over 125 companies that have pledged to collect regular data on over 240 Data Centers throughout the US and abroad. The EPA plans quarterly updates to inform stakeholders on the progress of the data collection effort.

10. **Pursue completion of research into a benchmark rating system for data centers** – Using the data collected, EPA plans to pursue a data center rating system that could be used for an ENERGY STAR buildings program for data centers. The target launch date for the rating system is January 2010.

11. **Engage in dialogue with telecommunication companies** – Telecom companies have expressed to EPA an interest in creating a rating system for telecom facilities. EPA will consider this opportunity and engage the industry in further discussions, as appropriate, as time and resources permit..

12. **Explore research and development opportunities in data center and telecommunications applications** – The DOE will conduct a workshop in fall 2008 to identify collaborative industry-government RD&D which ultimately will increase the energy efficiency of telecommunications systems and data centers.

Recommended Industry Actions: The following recommended industry activities complement the activities above and will help to accelerate the adoption of energy efficiency in data centers:

1. **Coordinate activities** – Work with government to coordinate energy efficiency activities.

2. **Standardize metrics and definitions** – Participate with government in a metrics harmonization process.

3. **Improve access to information** – Work with government to develop consolidated information on best practices; develop tools to assess technology, financial, and risk benefits of energy efficiency in data centers; document and publish results of pilot/demonstration projects.

4. **Promote training and education** – Develop education program targeted at senior executives to raise awareness about benefits of energy-management best practices; work with DOE to develop the Qualified Specialist certification program.

5. **Provide incentives for implementing best practices** – Implement reward and recognition programs for improved energy management within their organizations; document and publish successful programs so that they may be replicated in client organizations.

6. **Better understand decision-making for data centers** – Study current data center management practices and how the market for energy efficiency in data centers functions; document and publish findings to guide next steps in this area.

BREAKOUT SESSION 1: DEFINING ENERGY EFFICIENT DATA CENTERS

This workgroup discussed creating better transparency in the energy use of data centers and IT equipment. The focus was on the creation of clear and easily understood metrics and standards to help managers and executives procure efficient equipment and improve operations for greater energy efficiency in the data center. In addition, the workgroup discussed recognized best practices and how to best proliferate that information. Additional themes included the use of all fuels/resource inputs in data center metrics and how to measure useful work for data centers or IT equipment.

Much of the discussion focused on what is needed to create an effective measure of productivity in relation to energy use in the data center. A key question here is how to define the useful work output of a datacenter. Such a definition, if standardized, would allow the creation of an effective metric that relates work output to the energy consumed to produce that work. Such a metric would rely on vendor neutral benchmarks for data centers and IT equipment. Although many methods and benchmarks exist, a set needs to be agreed upon across vendor and company lines.

This conversation also resulted in a discussion of what different types of data centers exist and how the measure of useful work might change for different data center types. Another key area of discussion was on the collection of appropriate data to help create these important metric. To this end, the group discussed the gaps in data present on the energy use of IT equipment in the data center, and what incentives might be needed to help with the collection of this data. This led to a discussion of how to get executives interested in measuring their data centers to help focus on efficiency, for example if metrics that focus on the business case of efficiency (e.g., money saved, etc.) were developed it might help get more interest in efficiency and data collection on the executive level.

Key gaps:
- Need metrics and incentives which focus on business/financial case
- Need for more widespread use of effective instrumentation and connectivity of data in the data center
- Need vendor neutral technology benchmarks for most classes of equipment.
- Need standard definition for data center productivity, or "useful work"
- Lacking efficiency data for computing and infrastructure equipment

Key recommendations:
- Finalize development of and harmonize standard metrics for IT equipment, infrastructure and facilities as a whole. Form a coordination team with representatives from all the organizations working in this area to create a formal structure to share information and progress and work towards consensus.
- Develop robust definitions for useful work for different classification of data centers and IT equipment to move toward more holistic metrics of useful work/watt.
- Perform outreach to raise awareness on existing/standardized metrics, with a special focus on senior executives. One example could be a demonstration project involving multi-level instrumentation and data collection for specific metrics.

DEFINING ENERGY EFFICIENT DATA CENTERS
(● = MOST CRITICAL GAPS)

EXHIBIT 1 – GAPS

- Efficiency data for computing and infrastructure equipment - servers, chillers, ups, etc. ●●●●●●●●●●●●●●●●●●●
- Technical metrics must be converted to business/financial metrics/incentives ●●●●●●●●●
- Lack of instrumentation and connectivity of the data ●●●●●●●●
- Vendor neutral technology benchmarks ●●●●●●
- Need standard definition for DC productivity ●●●●●●
- Dynamic baseline ●●●●
- Computing output needs to be defined and made part of the equation. Idle servers don't count in POE. Source of energy should matter, especially if on-site generation become common ●●●
- Water use - metric ●●●
- What is the definition of "Useful Work?" this is needed to develop a productivity metric (or set of metrics) ●●●
- "Productive work output" hard to standardize - going to be different for a web farm than for an archival storage oriented application (metrics) ●●●
- Clear and consistent metrics; overall performance metrics vs. metrics for diagnosing problem areas, or areas of efficiency opportunities; benchmark metrics for cooling chain power use: airflow, chilled water pumps, cooling coils, chillers, condenser water pumps and cooling towers/fans (best practices requires metrics for components/sub-systems) ●●
- Benchmark PUE during commissioning 50%, 80%, 100% loads. This separates hardware/APPS performance for the infrastructure performance "divide and conquer". Different metrics for different areas of the data center ●●
- Common set of granular data all parties can share representing data center subsystems, with a one pass attempt to make the data center efficient with best practices, methods, and configurations ●●

- Agreement and adoption of appropriate metrics for measuring and driving energy efficiency - how to incorporate functionality into energy efficiency management. Promulgation of industry standards for measuring energy efficiency ●●
- Data center productivity metric that drives the right behavior - how do you drive the right IT behavior for improving efficiency? ●
- Lack of decision making process ●
- Productivity and bits (data) developed have economic value. Any efficiency metric, process, or standard must enhance that economic value ●
- Business drivers (more than cost) to drive change ●
- IT buyers/managers do not see full life cycle cost of their decisions ●
- Standards - classify servers ●
- Proxy for IT productivity ●
- Exactly what do you measure to determine efficiency (standards)? ●
- Productivity = $ gross income from IT services
- Inconsistent best practices
- Useful work needs to be measured as work per unit in chargeback, e.g. data stored $ per GB/PB watts per GB/PB, data trans - $ per MB/GB watts per MB/GB tx transferred (not bandwidth), data computed in CPU hours watts per CPU hr. - transactions (total # not per second), possibly various rates as new CPU's improve i.e., set a baseline
- Define "useful work", getting vendors to agree on metrics, transparency in IT industry, Identify various "class" characteristics of data centers, e.g., internet vs. classic data processing, etc.
- Data centers CAPEX + OPEX visible in standard account reports and "valuation" accordingly
- No common protocol for data/metric collection
- Data centers are unique purpose - built systems
- Using aggregate efficiency targets might allow for obfuscation, we should plan on enough granularity of efficiency measurements (down to efficiency for each given class of equipment - chillers, air handlers, servers, etc.)
- Clear simple metric definition; metrics that can be easily implemented (collected); common standards (protocols) for collection
- Variations in data center internal environmental criteria and location affects opportunities for energy usage reductions

DEFINING ENERGY EFFICIENT DATA CENTERS

EXHIBIT 1 – GAPS (CONT'D)

- Best practices: Operator training
- Standard network protocols for reporting energy-relevant information, power, temperature, utilization
- Diversity of data center functionality vs usages
- Real and relevant measurement and data
- Metrics: what is "useful work?" Ratings: what instrumentation?
- Need a standard measurement metric that can be measured in a non-subjective manner that is easily applied
- Defining "useful work" of IT equipment in order to have an industry-accepted productivity metric
- Metric definition: Tools - standardize storage power; bodies – resources; standards definition and industry-wide acceptance
- Lack of common matrices "performance". Total power for whole facility
- knowledge of non-server equipment energy consumption; knowledge of telecom facilities; standards work
- Lack of clear ideal target to pursue to be considered green (a data center which does A+B+C should only consume Y amount of energy)
- Old school practices prevail better and best practices not well known to A&E's designing facility upgrades
- Harmonization of standards
- Consistent measurement method needed
- No current way to benchmark data centers on energy efficiency - independent benchmarking
- To management education common metrics
- Mutual benefit (macro view)

DEFINING ENERGY EFFICIENT DATA CENTERS

EXHIBIT 2: KEY AREAS OF COORDINATION

- Metrics must be converted to business/financial metrics and incentives
  - Properly classify data centers to allow comparison to peers (i.e., too many types of data centers)
  - Develop well defined & robust metrics – some may be unique to a particular type of data center
  - Create awareness at the senior executive level so they will drive the needed changes in IT
- Lack of instrumentation and connectivity of data
  - Common protocol for IT and facilities equipment to report energy utilization on common platform
  - Government incentives to install instrumentation and collection of data
  - Set up showcase data center to demonstrate the benefits of instrumentation from utility or down to branch circuit or server levels
- Need vendor neutral technology benchmarks
  - Vendor neutral: industry standard, enable cross architectural comparison, defined specific process
  - Need metrics for IT equipment, cooling, infrastructure (i.e., down to product category level)
  - Vendors, utilities, DOE, and EPA need to agree to these industry standard metrics, incentive driven
  - Some organization needs to take the lead on combining these metrics (measurement procedure) into one data center efficiency metric
- Need standard definition for DC productivity; Perceived need is actually to standardize "useful work"
  - Need to dialogue within industry on definition of "useful work"
  - Create a chargeback model to measure productivity of equipment versus energy etc consumed (Individual data centers already do) An example: $ per data stored, data transferred, data computed versus total energy used
- Lack of efficiency data for computing and infrastructure equipment
  - Gather and benchmark equipment specifications for each class of data center equipment; several industry groups and associations should provide benchmarks to ensure objectiveness (chillers, CRAC, UPS, power conversion / distribution, servers, networking, lighting, etc.)
  - Need in-operation info on: IT equipment utilization; and cooling, air management, air handling, and power supply efficiency

BREAKOUT SESSION 2: ADVANCING ENERGY EFFICIENT DATA CENTERS

This workgroup explored the resources and actions needed to accelerate industry adoption of energy efficient technologies and practices in data centers. The focus was on building skills and knowledge within the company and communicating the benefits of energy efficiency beyond IT managers to facility staff and senior executives. This included equipping IT managers with access to information that allows for technology comparisons, a better understanding of total cost of ownership, industry best practices, and energy management standards.

A central theme that emerged in the discussion was the need for education at all levels in the business. Key audiences identified were data center operators, IT staff, facility managers, and executive management. Participants cited the lack of one single portal for industry best practices, relevant energy efficiency resources, and training opportunities. In addition to lack of knowledge within the organization, coordination between different business units also needs to be addressed. Participants noted the need for greater cooperation between facilities and IT staff and more effective communication with executive levels.

At the same time, other participants noted that despite having access to information and technologies, many data centers are not taking the first step toward energy efficiency. Misperceptions persist about the impact of energy efficiency measures on reliability and performance. Pilot projects and test centers, participants noted, would demonstrate actual performance and provide a useful reference of the steps involved. Risk assessments of new technologies and applications with a statistical sample that is large enough to validate the findings are needed. Exhibit 3 summarizes all of the gaps raised during the discussion.

Key Gaps:
- Need to consolidate industry best practices
- Need standardized measurements and practices
- Need facilities and IT to interface and cooperate
- Need pilot projects & test centers
- Charge back based on power

Key Recommendations:
- Assemble and organize industry best practices, case studies, and technical tools in one single source. Provide links to industry and government initiatives with documentation on the roles and resources of each group.
- Perform outreach and education to raise awareness of the benefits of data center energy efficiency, with a special focus on executive levels. Provide training to help datacenter operators implement the tools and resources currently available to measure, evaluate, and improve energy efficiency.
- Develop pilot projects and test centers to demonstrate actual performance.

ADVANCING ENERGY EFFICIENT DATA CENTERS
(● = MOST CRITICAL GAP)

EXHIBIT 3 – GAPS

- Need to consolidate industry best practices ●●●●●●●●●●●●●●●●●●
- Integrated energy management (standards, metrics, etc.) Design standard gap – there is no universally recognized nationwide industry standard for energy efficient data centers. What's being measured and how? ●●●●●●●●●●●●●●
- Facilities/IT interface and cooperation ●●●●●●●●
- Pilot projects and test centers reference account savings ●●●●●●
- Charge back based on power: getting real costs allocated correctly ●●●●●●
- Application layer power controls/measurement ●●●●●●
- There is no mpg rating ●●●●●●
- Permanent monitoring IT and utilities. Design and operation optimization ●●●●●
- Knowledge about what you can do (to improve energy efficiency). Need to build knowledge and skills within the company ●●●●●●
- List of key questions C-level project managers should be asking staff ●●●
- Standardized IT work output metric, built-in to equipment service processor ●●●
- Industry is driven by vendors and not end users. Need end user engagement ●●●
- Convergence of IT and facilities organization/technologies ●●●
- Market development (mid-stream) IT and facilities ●●●
- Presenting information and resources back to industry ●●
- Facilities maintenance education ●●
- Lack of energy management standards for data centers to adopt and be certified as meeting standards ●●
- Over design/under design actual redundancy required vs. infrastructure designed impact on efficiency ●
- Triple bottom line business goals and mission ●
- Incentives for implementing energy savings technologies such as DC power ●

- Risk assessments of various technologies and applications ●
- "Actionable feedback" ●
- Best practices for airtight construction
- Need to adopt best practices from other high power industries
- Operator training operators don't get needed training for tools
- Supply side management
- Cost transparency - charges for energy provisioning and supply
- Open source model
- Scalability: scale energy with load
- Data Center Pro Tool case study, taking first step
- Resistance to new ideas (aisle barriers)
- Education - reliability and energy efficiency not in conflict
- Misconceptions about data center requirements. Need education - user slow to adapt new technology due to "risk factor" perception
- Commoditization
- Adopt best practices from other high power consumption industries
- ASHRAE TC9.9 - recommended temperature/RH ranges
- Cogeneration: market support backup power and stranded costs
- Validated TCO models for various component technologies
- Cost/charge incentives
- Low awareness of energy efficient data center power consumption impact
- End-user rental incentives - up front
- Design budget vs. construction budget
- Culture-need for shifts in temperature/RH, capacity, availability
- Lack of neutral easy-to-use equipment efficiency ratings
- Independent 3rd party certification
- Validated TCO for various component technologies

ADVANCING ENERGY EFFICIENT DATA CENTERS

EXHIBIT 4 – KEY AREAS OF COORDINATION

- Consolidating industry best practices
  - Consolidate "best practice" lists (DOE/LBNL; TGG; EU CoC; others) and manage with single global entity
  - Collect and publish data and case studies
  - Establish education programs to facilitate best practices implementation
- Standardized measurements and practices
  - Measurement protocols
  - Energy technical and management practices
  - 3rd party validation of minimum performance
- Facilities/IT interface and cooperation
  - Standardize accountability
  - Educate all parties of the benefits of working together
  - Benchmark and award improvements
- Pilot projects and test centers
  - Open source of information 3rd party implemented or validated
  - Industry provided vendor equipment and technology - federal and industry sites
  - Joint industry/government priority list of technologies for comparison
- Charge back based on power: getting real costs allocated correctly
  - Simple, affordable monitoring; industry standards measurement tools included in OEM equipment
  - Identify / develop standard charge backs fixed costs/variable costs/TCO

BREAKOUT SESSION 3: REWARDING ENERGY EFFICIENT DATA CENTERS

This working group discussed ways to raise the profile of energy efficiency in data centers through reward mechanisms such as recognition programs and utility incentive programs. Most of the discussion focused not on external rewards (e.g., recognition programs), but rather helping organizations better quantify and understand the internal "rewards" (financial and risk) from energy efficiency.

Several participants brought up the problem that companies are not able to adequately quantify the financial benefits of energy efficiency in order to make a business case for energy efficiency projects. One explanation mentioned is that the IT organization (from the CIO down) does not tend to be as well versed in financial techniques as the traditional business units. One solution suggested is to develop better financial analytic tools.

Another problem identified is that changes to improve energy efficiency are perceived as increasing risk, when in fact they may reduce risk in the long-run. One suggestion was to develop tools to help better quantify and understand this risk, as well as case study and demonstration projects to help provide better data on risks associated with energy efficiency projects. Another area of discussion was how to improve existing (utility) incentive programs. Clear, understandable incentive programs that are sustained over time are essential to getting participation from data center operators. The timing of incentive programs is also important. Projects are often long-completed before the incentive is available. Financial incentives also need to be large enough to get decision-makers' attention. It was suggested that there be better consistency and coordination between the existing recognition programs in place today.

Finally, the group discussed breaking down the barriers between IT and facilities managers and the need to have top management involved in this process. It was suggested that we need to better understand what motivates these decision-makers, so that reward programs can be designed accordingly. Monetary rewards need to be made more obvious to draw the attention of top management. By making the internal (financial and risk) benefits clearer, top management will more easily see the need for energy efficiency projects.

Key gaps:
- Lack of financial analytics
- Disconnect between who uses the energy and who pays for it
- No correlation between energy efficiency and reliability/availability
- Lack of information for a compelling business case
- Disconnect between fund allocation for first cost versus operating cost
- Lack of top management commitment and prioritization

Key recommendations:
- Develop information and analytical tools to help decision-makers better understand the direct benefits (financial and risk reduction) from energy efficiency in data centers.
- Provide incentive for sub-metering and EMS (Energy Management System) in data centers.
- Develop checklist of basic items to consider for new IT projects.

REWARDING ENERGY EFFICIENT DATA CENTERS
(● = MOST CRITICAL GAP)

EXHIBIT 5 – GAPS
- Lack of top management commitment and prioritization - way to make monetary reward obvious to senior executives ●●●●●●●●●●● - Lack of financial analytics ●●●●●●●●●●● - Disconnect between who uses the energy and who pays for it (as it relates to incentives) ●●●●●●●●● - Disconnect between fund allocation for first cost vs. operating cost ●●●●●●● - Lack off information for a compelling business case ●●●●● - No correlation between energy efficiency and reliability/availability ●●●● - Incentivize the risk holder ●●● - Figure out what motivates decision-makers (what rewards matter) ●●● - True cost of end-user service, i.e., You Tube, Yahoo.com, hotmail.com, My Space. True burden to the beneficiary - flipside to reward - departments, public ●●● - Federal and state policy/incentive information ●●● - Broad based will to optimize priority ●● - Carbon credits ●● - Incentive not high enough ●● - Peak demand (kW) vs. energy savings (kWh) ●● - Management involvement and leadership of data center costs and performance ●● - How persistent are the rewarded savings? ●● - Facts tell - stories sell, we need to market ● - Consistency among various industry recognition programs - Leed, Energy Star, Uptime ● - Why? What's in it for me? ● - Career risk ●	- Link facility manager with IT managers - Wrong stakeholders - what's in it for me (CFO level) - Pain (lack of pain) - User knowledge in energy efficient technology implementation and consumption management - Transparency (vendor - influenced incentives) - Reach consensus as a community - People are too busy - Lack of technical knowledge - Simple understandable incentives - Need to assess risk - Make profits the ultimate reward - Design program on technology, control, or behavior basis or combo - Reward a product or system - both - Utilities don't have standards to determine absolute energy savings, i.e., what is the right baseline - Timing of incentives - Persistent energy incentive programs - National monetary award recognizing top 20 data centers for efficiency design or efficiency improvements - Reconciling capacity and performance growth rates with energy costs - Visible comparisons to peers/competitors - benchmarks - Tracking fine grained energy per server and service

REWARDING ENERGY EFFICIENT DATA CENTERS

EXHIBIT 6 – KEY AREAS FOR COORDINATION

- Lack of financial analytics
  - Bring in outside help with special skills to provide analysis
  - Policy needs to ensure analysis is adequate (capital vs. operating costs)
  - Policy to provide training in analysis and tools...for internal resources
  - Make existing analysis less proprietary so it can be reused by other companies
- Disconnect between who use the energy and who pays for it
  - CSR/BPI annual goals achievement
  - Incentive for sub-metering/BMS in data centers
  - Employee recognition/awards for buying decisions
  - Marketing recognition amongst peers
  - Reward cross department awareness
- No correlation between energy efficiency and reliability/availability
  - Collect reliability data when efficiency efforts are implemented
  - Advocate exchange of reliability data from the most efficient data centers
  - Incentivize central power and cooling designs
- Lack of information for a compelling business case
  - Energy czar coupled with timeline and specific quantifiable goal
- Disconnect between fund allocation for 1st cost vs. operating cost
  - Checklist for new IT projects
  - Software tools/Excel deployed to key decision-makers
  - Facility/operating costs under CIO responsibility
  - Identify targets laggards
- Lack of top management commitment and prioritization
  - What's in it for top management? Spell it out
  - Delivering it: how do we get their attention?
  - How to balance risk vs. reward
  - Does it provide a competitive advantage

APPENDIX A: LIST OF PARTICIPANTS

Last Name	First Name	Organization
Adams	Wayne	EMC
Aggar	Mark	Microsoft
Ambarian	Christopher	Atomate, Inc.
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Bailey	Mike	Ecos Consulting
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Bean	John	APC
Belady	Christian	Microsoft
Bellandi	Dave	ICT Green Initiative
Boeve	Tim	ATT Mobility
Brill	Kenneth	Uptime Institute
Brown	Rich	Lawrence Berkeley National Laboratory
Buchanan	Herman	City of Seattle
Buck	Lawrence	Eaton Corp.
Burke	Matthew	Thinkbox Technology Group
Cader	Tahir	SprayCool, Inc.
Cahill-Myers	Vickie	MS - IT Lab Operations
Cameron	Kirk	Virginia Tech
Carlson	Andrew	Google
Carroll	Michael	RTKL
Cassano	David	Apple Inc.
Cassiliano	Robert J.	Business Information Services, Inc.
Chen	Chao	PSE
Chiste	Alan	Eaton Electrical
Christopher	Jean-Michel	JT Packard
Chu	Patrick	Seagate Technology
Cline	Jennifer	Corning Cable Systems
Croce	Ronald M.	Validus DC Systems, LLC
Cronin	Dennis	Gilbane Building Co.
Dewan	David	IMS Research
Dietrich	Jay	IBM Corporation
Dixit	Sachin	Emerson Network Power
Dudek	Jason	APC by Schneider Electric
Duff	Rebecca	ICF International
Fabian	Henry	Seagate Technology
Fanara	Andrew	U.S. Environmental Protection Agency
Fisher	Tracy	Energetics Incorporated
Fleck	Dennis	Campbell Company
Fortenbery	Brian	EPRI
Frank	Michael	McKinstry Co.
Freeman	Elisabeth	Walt Disney Internet Group
Geffin	Steven	Avocent Corp
Gideon	Rick	King County
Gray	Doug	American Express
Greco	Richard	California Data Center Design Group
Griffith	Brian	Intel Corporation

APPENDIX A: LIST OF PARTICIPANTS (CONT.)

Last Name	First Name	Organization
Gruendler	Nick	IBM Corporation
Gunn	Susan	Con Edison
Haas	Jon	Intel Corp.
Haigh	Chuck	Mortenson
Hammond-Doel	Tom	LSI Corporation
Hartley	Robbie	Verari Systems, Inc.
Healy	James	Seattle City Light
Hencz	Jeff	Thinkbox Technology Group
Henning	Bernd S.	Fujitsu Siemens Computers, Inc. USA
Howard	Arthur	ICF International
Hunter	William	Walt Disney Internet Group
Igoe	Scott	Lockheed Martin
Ikemoto	Sherman	Future Facilities Inc.
Johnson	Joe	Cisco
Jorgensen	Paul	Holder Construction Co
Justiniano	Mauricio	Energetics Incorporated
Kelly	Miles	365 Main Inc.
Khaleel	Moe	Pacific Northwest National Lab
Kim	Nam-Kyun	Korea Electrotechnology Research Institute
Kucera	Kevin	RPM Electric, Inc.
Kuo	Steven	Apple
Lange	Klaus-Dieter	SPEC
Langran	Thomas	WaMu
Leedecke	Bill	Vanguard
Lester	Corban	Lockheed Martin
Libby	Richard	Intel
Libby	Richard	Intel Corporation
Lundquist	Patrice	Snohomish County Public Utility District No. 1
MacFie	Jim	Nortel
Malone	Chris	Google
Mares	KC	MEGAWATT Consulting
Marquez	Andres	Pacific Northwest National Lab
Mascia	Robert	SGI
McDaniel	Don	Tate Access Floors, Inc.
McMullen	Matthew	Nalco Company
Mendo	David	Comcast
Mercier	Catherine	Ecos Consulting
Meyer	Peter	Tacoma Power
Mitchell	Don	APC/Schneider Electric
Mulford	Vernon	Seven-K Company
Mykytyn	Russ	7x24 Exchange
Noer	Geoff	Rackable Systems
Nordman	Bruce	Lawrence Berkeley National Laboratory
Ohara	Dave	Green M3 LLC
O'Hara	Dan	Switch and Data
Orr	Ryan	The Boeing Company
Pappas	John M.	Mazzetti & Associates
Partowkia	Pouneh	Microsoft

Last Name	First Name	Organization
Patterson	Michael	Intel
Pfeifer	Ray	SVLG/SynapSense
Picardal	Chelo	City of Bellevue
Pouchet	Jack	Emerson Network Power
Rapaport	Tali	Matrix Partners
Rawson	Andrew	AMD
Renne	Ralph	NetApp
Richard	John	Johnson Controls, Inc.
Roam	John	Comcast
Rongere	Francois Xavier	PG&E
Rosenstock	Steven	Edison Electric Institute
Sadowy	Donna	AMD
Salaets	Ken	Information Technology Industry Council
Samanns	John	Vanguard
Sartor	Dale	LBNL
Sasser	John	Sabey Corporation
Scheihing	Paul	U.S. Department of Energy
Seger	David	IDC Architects
Sharma	Ash	IMS Research
Shover	Dale	Energy Future Holdings
Siu	Pauline	Intel
Sloan	Jeff	McKinstry Co.
Stolarski	Bob	Puget Sound Energy
Sweet	James	Campbell Company Inc.
Taylor	Jay	Dell, Inc.
Thomason	Al	IBM Corporation
Tilton	Donald	Green IT Alliance
Tipley	Roger	Hewlett-Packard Company
Tippen	Forrest (Peter)	Rackhouse Group, LLC
Tung	Teresa	Accenture
Uhault	Jim	JT Packard
Varga	Gideon	U.S. Department of Energy
Viegand	Jan	European Commission
VoBa	Son	Microsoft
Vokes	Kathleen G.	U.S. Environmental Protection Agency
Warren	Phoebe	Seattle City Light
Watanabe	George	Perfect Search Corp.
Whitcomb	Wayne	The Boeing Company
Whitsett	Donna	Energy Market Innovations
Wigle	Lorie	Intel Eco-Technology
Wilson	Randy	Cummins Northwest, LLC
Wisniewski	Ed	CEE
Wofford	Randall	Dell, Inc.
Woolf	Alan	The Boeing Company
Worth	SW	Microsoft
Young	Stewart	OSIsoft, Inc
	Mukesh	Oracle

Organizations participating in the National Data Center Energy Efficiency workshop were invited to submit "point papers" to share with attendees. The presentations and papers offered descriptions of programs, key observed trends influencing the decision-making related to energy efficiency in data centers today, and key areas for collaboration between industry and government. The following pages feature the point papers submitted by the presenting organizations prior to the publication of this report.

Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE)

<u>Program</u>: Save Energy Now and Federal Energy Management Program (FEMP)
(http://www1.eere.energy.gov/industry/saveenergynow/partnering_data_centers.html)
<u>Point of Contact(s)</u>: Paul Scheihing (Save Energy Now) and Will Lintner (FEMP)

Description of Program:
The DOE Save Energy Now program is developing a portfolio of energy efficiency tools and training to assist data centers in identifying cost effective, system-oriented energy saving opportunities. From 2006 to present, Save Energy Now has helped manufacturing facilities identify over $750 million per year in energy saving opportunities. FEMP is coordinating with the Save Energy Now and ENERGY STAR programs to deploy energy efficiency strategies to Federal data centers. Save Energy Now program activities include:

- **Tools, Training and Metrics:** Create the Data Center Assessment (DC Pro) tool suite that will assist data center managers to holistically evaluate and measure, system-related energy saving opportunities. DC Pro will perform a high level profile of the data center which will then point to more detailed energy assessments for IT, cooling and air management, electrical distribution systems and on-site generation with specific metrics. The DC Pro tool suite will be complemented with a basic awareness training curriculum.
- **Recognition:** Save Energy Now will recognize those data centers that have demonstrated significant energy savings using the DC Pro tool as a means to validate performance improvement from best practice and technology adoption. FEMP will recognize the achievements in energy efficiency of Federal data centers in its award programs.
- **Distributed Generation options:** Save Energy Now will assist data center facilities in evaluating and implementing distributed generation (DG) technologies, such as: reciprocating engines, gas turbines, fuel cells and photovoltaic energy systems. DG demonstrations will be sponsored by DOE.

Other activities to be supported by DOE subject to FY2009 appropriations are:

- **Best-in-Class Guidelines:** Save Energy Now and FEMP, in collaboration with the Federal agencies, will raise awareness for increasing data center energy efficiency through various means including developing Best-in-Class guidelines for Federal data centers. Federal centers will be first adopters of the guidelines using a common set of performance metrics developed by DOE, EPA and industry.
- **Qualified Specialists:** Save Energy Now will work with industry to create a Qualified Specialist program to certify professionals in their knowledge and practice in designing, implementing and measuring data center energy efficiency.
- **Third party certification:** Begin creating third-party certification process to validate and recognize data centers that have improved energy efficiency (based on new IT work productivity metrics), energy savings and Best-in-Class performance.

Key Trends

Many industry organizations are beginning to focus on energy use in data centers. Data centers are demanding new technology solutions to:

- Contain the rise in Total Cost of Ownership (TCO): increasing demand for IT services increases facility infrastructure capital and energy operating costs.
- Relieve strained power grids. Strained power grids impact data center reliability and restrict business growth.
- Support heightened emphasis by corporations on sustainability demanding a longterm energy management plan.
- Address public perception and concern that data centers are a drain on the US electric grid and are a significant source of carbon emissions: need to balance productivity gains through IT with sustainable energy practice in data centers.

Benefits to improving energy efficiency in data centers:

- Maximize capital equipment utilization and minimize TCO.
- Public recognition for corporate energy efficiency and environmental leadership.
- Increase regional electric grid and data center reliability.
- Postpone the need to build new electricity generation capacity.
- Postpone capital expenditures for increased computing needs.

Key barriers to energy efficiency in data centers:

- Lack of consensus, industry-recognized metrics defining overall and subsystem data center energy efficiency.
- Lack of understanding of efficiency opportunity.
- Overcoming paradigms of traditional data centers.
- Lack of engineering data and scientific studies to convince market to try new data center operation configurations.
- Disconnect of IT and facility organizations and lack of central budget authority.
- Lack of corporate energy management program with goals and accountability.
- Lack of design standards for data centers using life cycle costing principles.

Top three activities and achievements - Helping data centers in the following areas:

- DC Pro tool assists in measuring data center energy efficiency and benchmarking subsystem performance. DC Pro tool lists potential energy saving actions.
- New training curriculum on energy efficiency basics (in coordination with ASHRAE)
- Recognition of data centers' continual improvement and energy savings.

Key areas for collaboration - Gaps

- Establish metrics for data center energy intensity-work output performance, as well as, a new primary energy DCiE that measures and rewards more optimal use of primary (source fuel) energy, for example, by using distributed energy.
- Create technologies, tools and guidelines to define a highly energy efficient data center and to drive continuous improvement in energy efficiency.
- Develop standards and third-party certification process to validate and recognize data centers achieving energy savings and Best-in-Class performance.
- Research end-to-end efficiency - source to chip power distribution - source to sink heat removal - heat recovery.

Environmental Protection Agency (EPA), Climate Protection Partnership Division (CPPD)
Program: ENERGY STAR® Program, Commercial Buildings and Products
(www.energystar.gov)
Point of Contact(s): Michael Zatz, Commercial Buildings; Andrew Fanara, Products

Description of Program:
The EPA ENERGY STAR commercial building and product programs are voluntary market based efforts designed to help transform the marketplace by making energy use more transparent for building operators and product purchasers. The primary strategy to accomplish this goal is the use of energy efficiency benchmarks and the encouragement of strategies for continual improvement. As of 2007 there were more than 60,000 US buildings, representing almost 8 billion ft2 that had been benchmarked using ENERGY STAR's Portfolio Manager tool, and more than 2,000 product manufacturing partners participating in ENERGY STAR. Their efforts helped to avoid greenhouse gas emissions equivalent to 27 million cars while reducing utility bills by $16 billion. ENERGY STAR is expanding its efforts to address new cost effective opportunities in datacenters (DC) and in enterprise IT products. It is also coordinating its efforts with DOE including outreach to the Federal sector. ENERGY STAR program activities include:

- **Tools, Training and Metrics:** EPA recently launched an effort to develop an ENERGY STAR rating for data center infrastructure. This metric will measure the energy efficiency of DC infrastructure by comparing the IT energy use to the energy use of the entire facility. In order to develop this rating system, EPA is solicited participation from DC operators to provide data on energy use over a period of one year, beginning no later than July 1, 2008. Well over 200 DCs across the US, including both stand alone DCs and those inside another facility, have signed on to participate in this data collection initative, the data from which will be analyzed to develop the ENERGY STAR rating for data center infrastructure. Such a benchmark is intended to standardize the energy consumption measurement process in order to compare the efficiency of one DC with that of its peers nationwide. EPA will strongly encourage benchmarking using this method as a first step in an efficiency improvement plan and this benchmarking could be coordinated with utility incentive programs. ENERGY STAR also recognizes the need for continued collaboration with stakeholders over time to ultimately enhance the metric to reflect the relationship between the energy consumed the work output for different facility and business types. ENERGY STAR is also researching the viability of performance benchmarks for servers based on its *guiding principles*. ENERGY STAR for servers would provide standard information to IT buyers to help locate the most efficient models in the marketplace while also helping facility operators estimate the power and energy impact from those purchases on the facility. ENERGY STAR will also determine the need to address data storage and networking equipment by the end of 2008.
- **Recognition:** Once the ENERGY STAR metrics are available, organizations may use them to demonstrate and compare the efficiency of their datacenters and products and to be recognized by EPA. DC operators will be able to use the ENERGY STAR rating system to qualify for the ENERGY STAR label for their building, and an ENERGY STAR category for servers will serve as a marketing tool for server vendors with qualifying products and as a procurement tool for IT purchasers.

Other activities:
International: ENERGY STAR is sharing information on building and product benchmarks with other governments including Japan, Canada, China, the EU and others. In the UK, The British Computer Society (BCS) and the UK IT professional body, with funding from the Carbon Trust, have been developing an open source software tool that is designed to predict energy savings from particular improvements. This tool is based on DOE's DC Pro tool. In China and India, EPA and DOE, through the Asia Pacific Partnership for Clean Development and Climate, is beginning a program to more actively encourage those markets to pursue the design and operation of more efficient datacenters as their economies expand.

Key Trends

Many industry organizations are beginning to focus on energy use in data centers. Data center operators are demanding new solutions to:

- Evaluate the energy performance of existing DCs and identify the best opportunities for improvement.
- Ensure sufficient availability of power as new DCs are sited and existing DCs are expanded. Strained power grids impact data center reliability and restrict business growth.
- Support heightened emphasis by corporations on sustainability, and risk management through long-term energy management plans.
- Address public perception and concern that data centers are a drain on the US electric grid and are a significant source of carbon emissions: need to balance productivity gains through IT with sustainable energy practice in data centers.

Benefits to improving energy efficiency in data centers:

- Maximize capital equipment utilization.
- Public recognition for corporate energy efficiency and environmental leadership.
- Increase regional electric grid and data center reliability.
- Postpone the need to build new electricity generation capacity.
- Postpone capital expenditures for increased computing needs.

Key barriers to energy efficiency in data centers:

- Confusion among users about the various metrics being promoted by different organizations.
- Lack of understanding of efficiency opportunity.
- Tendency to delay benchmarking action until the ideal metric (one involving a comparison or work output to energy use) can be developed.
- Concern that metrics may lead to regulation in the sector.
- Concern that metrics may lead to unfair comparisons
- Overcoming paradigms of traditional data centers.
- Lack of engineering data and scientific studies to convince market to try new data center operation configurations.
- Disconnect of IT and facility organizations and lack of central budget authority.
- Lack of corporate energy management program with goals and accountability.

Top three activities and achievements - Helping data centers in the following areas:

- Complete data collection initiative to enable the development of the ENERGY STAR rating for data center infrastructure (projected for release in Portfolio Manager in January 2010).
- Establish an ENERGY STAR benchmark specification for servers, and announce plans for data storage and network equipment by January 1, 2009.
- Market to DC operators and to IT product manufacturers the benefits of participation in the ENERGY STAR Building and Products programs and to encourage utilities to include these as part of their efficiency programs.

Key areas for collaboration - Gaps

- Establish metrics for data center energy intensity-work output performance.
- Ensure the availability of educational materials for key stakeholders that can be used to implement more sustainable computing strategies from the desktop to the datacenter.
- Establish server working group to consider holistic metrics for energy efficiency.
- Coordinate the sharing of information between the US and other countries interested in encouraging efficient computing in their markets.

European Commission and EU Member States

Program: Code of Conducts and other programs
Point of Contact(s): Paolo Bertoldi, EC and Jan Viegand, Danish Energy Agency and Danish Electricity Saving Trust

Description of Program:
- ENERGY STAR: The European Commission is an international partner in the ENERGY STAR program for office equipment following an agreement between the US Government and the European Community. New and revised specifications are developed in collaboration between the two entities and both sides need to approve specifications before taking effect. Servers are part of this agreement and therefore the European Commission takes an active part in the specification development.
- EU Code of Conduct on Data Centres: The European Commission, EU Member States, the industry and other relevant stakeholders develops Code of Conducts (COCs) that both manufacturers and large purchasers can sign up to. Until now, Code of Conducts have been launched for external power supplies, digital TV services systems, broadband equipment and UPS systems. A new CoC on data centres is being developed and it is expected to be ready for signature in 2008. It will comprise a best practices guide, monitoring and data collection and simple metrics.
- Procurement guidelines and regulation – government and private sector: Several procurement activities are taking place in the European Community, which supports the development of energy efficient products including for data centres. At the European Community, the ENERGY STAR regulation requires that the European Commission and central governments should specify energy-efficiency requirements not less demanding than Energy Star for larger contracts.

National activities: Furthermore, there are national procurement initiatives such as:
- Top ten for 14 EU countries - www.topten.info
- The Netherlands: Senter-Novem government procurement, www.senternovem.nl
- Denmark: Danish Electricity Saving Trust Purchasing Guidelines www.savingtrust.dk
- Other Member States

Many national activities on servers and data centres take place, including the following:
- The Austrian Energy Agency is leading the project 'Efficient Servers' within the EU programme Intelligent Energy Europe (www.efficient-server.eu). The project is focused on the following measures:
  - Case studies for energy efficient optimisation of servers to demonstrate the energy saving potentials and evaluate the effects on performance, costs and safety
  - Practical guidelines to support the procurement and management of energy efficient servers
  - Contracting and rebate concepts to support the market development
- The Danish Electricity Saving Trust is working on developing data centre productivity index and on energy efficient measures including use of demo projects and outreach activities).

Key areas for collaboration -Gaps
These key areas are important for the improvement of data centre energy efficiency:
- Development of real energy efficiency metrics for data centres, servers, storage etc.
- Procurement policies that government and private organizations apply for tendering
- Outreach activities based on real consumer information based on TCO and life cycle benefits
- International collaboration is essential for achieving fast results within these areas. Furthermore, it is needed to get experiences during a step-by-step process.

Climate Savers Computer Initiative (CSCI)

Program: Driving the adoption of energy-efficient servers and PCs
Point of Contact(s): Lorie Wigle (President), Bill Weihl (Vice President)

Description of Program:
The Climate Savers Computing Initiative brings together industry, consumers and conservation organizations to significantly increase the energy efficiency of computers and volume servers, which together are responsible for the majority of the overall computer energy consumption. The Initiative is attempting to reduce energy consumption not only by motivating the technology industry to increase the efficiency of its products, but also by encouraging individuals and businesses to purchase energy efficient computers and use power management tools.

The Climate Savers Computing Initiative is complementary to the Green Grid, which focuses on datacenter power management, including servers, cooling for the buildings, and other facility-related energy issues. The Initiative is also a resource for consumers and IT personnel whom want to learn more about reducing the power footprint of their computers without any results loss of productivity. By 2010, the Climate Savers Computing Initiative seeks to reduce computer power consumption by 50%, thereby reducing global CO_2 emissions by 54 million tons per year.

- **Tools, Training, and Metrics**: The Climate Savers Computer Initiative has set aggressive server power efficiency targets in order to meet its stated energy and CO_2 reduction goals by 2010. Overly aggressive efficiency targets can be cost prohibitive for the market, while too lenient targets will prevent the IT industry from meeting the Initiative's intended CO_2 emissions reduction. Climate Savers Computing server efficiency levels have been set with these factors in mind. The Initiative introduces Bronze, Silver, and Gold level efficiency targets for single-output power supplies for data center servers in redundant configurations. The EPA's Draft Energy Star v1.0 single output efficiency targets for power supplies are expected to align to Climate Savers Silver level efficiency targets for power supplies </=1000W and to Gold level targets for power supplies > 1000W when the final Energy Star program requirements are published in January 2009. Climate Savers Computing's energy efficiency targets for high volume single-output power supply for data center server are listed in the table below.

	CSCI Bronze	CSCI Silver	CSCI Gold
Load Condition			
20%	81%	85%	88%
50%	85% (Pf=0.9)	89% (Pf=0.9)	92% (Pf=0.9)
100%	81%	85%	88%

- **Recognition**: All member companies and organizations are listed on the Initiative's website as participating members and can use the Climate Savers Computing logo to showcase their participation in the Initiative and their products as being Climate Savers Computing-compliant. Servers and PCs that meet CSCI energy efficient targets are listed in the Climate Savers Computing Smart Computing catalog. The Initiative maintains a catalog of energy-efficient PCs and servers to help members identify compliant products, and provides informational resources such as technical specifications, best practices, white papers, technical instructions and research to help members more easily find, deploy and better use energy-efficient technology.
- **Distributed Generation Option**: Climate Savers Computing is focused on creating awareness around the issue of energy-efficient computing and on driving demand and adoption of energy-efficient technologies. Membership dues are used primarily for marketing programs to boost the consumer and enterprise awareness of the need for energy efficient computing. In addition to

driving awareness and education, Climate Savers Computing Initiative is also creating tools and information to help users evaluate the ROI of investing in energy-efficient computers, finding compliant systems and more.

Other Activities:
Throughout its first year, Climate Savers Computing has secured partnerships, collaborations and signed memorandums of understanding with six organizations. Collaborating with these organizations will help further the Climate Savers Computing mission and spur the deployment and adoption of energy-efficient technologies and power management tools. These organizations include:
- U.S. Environmental Protection Agency's ENERGY STAR Program
- The Climate Group – Together Campaign
- Green IT Promotion Council (Japan)
- Software Association of Oregon
- National Governors Association
- China Electronics Energy Saving Committee (CEESC)

Key Trends:
Today the typical desktop PC wastes half of its power as heat dissipation, and servers waste roughly one third of their power. The majority of this unused energy is wasted as heat and never reaches the computing components. As a result, offices, homes, and data centers have increased demands on air conditioning which in turn increases energy requirements and costs. In addition, an estimated 90% of desktop computers do not have power management features enabled. Utilizing power management can reduce computing energy consumption by as much as 60% without impacting productivity or performance.

The Climate Savers Computing Initiative is working to improve computer energy consumption by boosting energy efficiency and educating end users and OEMs about power management features. By achieving our goal of 50% reduction in power consumption for the IT industry by 2010, we expect to collectively save the IT industry $5.5 billion in energy costs. At the same time, we expect to reduce CO_2 emissions by 54 million tons per year, which is the same as removing 11 million cars from use, moving 20 power plants from production, or planting 25,000 square miles of trees.

Top Three Activities and Achievements
- Growing membership from 40 to 250 companies in the first year of the Initiative.
- Publishing motherboard energy efficiency recommendations.
- Raising awareness of energy efficient computing worldwide.

Key Areas for Collaboration - Gaps:
- Drive awareness and education of energy-efficient computers and power management. Evaluate approaches for auditing member compliance with the program criteria. Create tools and information to help users evaluate the ROI of investing in energy-efficient computers and to find compliant systems.
- Develop training and incentive programs to ensure that data center operators clearly understand how to take advantage of current and future opportunities.
- Continue to work to align energy efficiency metrics for servers and desk top computers.

Consortium for Energy Efficiency

<u>Program:</u> CEE Data Centers Initiative
<u>Point of Contact:</u> Ed Wisnewski

Description of Program:
The Consortium for Energy Efficiency (CEE) prepared this overview document at the request of the U.S. Environmental Protection Agency, ENERGY STAR Program for the National Data Center Strategy Workshop, July 8, 2008. Do not cite or quote this document without the written permission of CEE.

CEE is a consortium that brings together efficiency program administrators from across the United States and Canada to discover, through conversation, credible, unbiased solutions to issues in the efficiency program industry. As a collective entity, the individual efficiency programs of CEE are able to partner with other industries, trade associations, and government agencies. By working together at CEE, administrators multiply the effect of their funding dollars and at the same time, achieve greater energy efficiency for the public good. Both our process and our integrity enable our work. The Consortium currently supports over 100 members.

CEE began its broad Data Centers and Servers Initiative in 2007 and has an active committee with over 25 member organizations to support the work area. To encourage more energy efficient and high performance data centers and help members address energy savings opportunities, CEE:
- Facilitates our industry's collective understanding of the market players and industry motivations;
- Develops and supports consensus-based definitions and performance specifications; and
- Identifies recommended program strategies to help increase the energy efficiency of data centers over and above that of the industry itself.

CEE understands there to be a number of challenges to improving data center energy efficiency including: limited consistent and consensus-based definitions, data center and IT equipment performance metrics and test procedures; inconsistent information about energy performance available to end-users and efficiency programs; organizational and budgetary challenges to improving IT system efficiency; risk aversion to disrupting data center uptime and reliability; and the dynamic nature of the IT industry.

The table in this section provides an initial structure for the CEE data centers work area, some current activities with which the data centers committee is involved and some key questions raised in the past year.

Broad Engagements	Activities	Key Questions
Development of customer engagement strategies	• Working to understand data center owner needs, unique program value add propositions • Monitoring initial program offerings and uptake and focus group research results	• What are key roles for efficiency programs in helping customers in this work area? • Who are the key target audiences for program outreach and what are the messages that resonate? • Is there a central information resource for data center locations in the USA and Canada?
Server energy performance definitions and specifications	• Engaging EPA ENERGY STAR on server specification development • Understanding	• What are the broad classes of servers? Among these classes what are differentials in "standard" energy performance

	applications of server virtualization, efficiency potential and risks to informing program needs and development	and "efficient" performance? Cost differentials (1-to-1 replacement)? • Are there common customer risks in migrating to virtual server environment? What are those risks? How might efficiency program mitigate them? • What are different applications of virtualization and market penetration? To what extent are different businesses virtualizing and what are the key challenges to broader deployment?
Data storage systems	• Conducting initial research on feasibility of performance specification • Reaching out to gov't and storage industry understand technological potential, market dynamics	• What are the various types of datastorage systems and areas for efficiency enhancements? • Is a common performance metric and specification feasible and desirable for these systems? • What are software/ hardware applications (e.g., MAID) that achieve greater system energy savings? What is occurring in the market across different businesses? What are the key challenges to broader deployment?
Engaging U.S. DOE and EPA on ENERGY STAR and other data center program activities	• Piloting U.S. DOE's DC Pro Software tool suite to identify program benefits and inform planning • Monitoring EPA and DOE efforts to develop data center energy performance metrics and benchmarks	N/A
Tracking member program efforts	• Performing annual program summary of member programs – will capture data center program information	N/A

For further information about CEE's Data Centers and Servers effort, please visit www.cee1.org or contact Jason Erwin at jerwin@cee1.org.

Standard Performance Evaluation Corporation (SPEC)
<u>Point of Contact</u>: Klaus-Dieter Lange

Description of Program:
The Standard Performance Evaluation Corporation (SPEC) is a non-profit corporation formed to establish, maintain and endorse a standardized set of relevant benchmarks that can be applied to the newest generation of high-performance computers.

SPEC is acknowledged worldwide as a leading authority on standardized performance measurement for computing systems and has been providing benchmark suites for twenty years to the industry.
The SPEC web site publishes hundreds of different performance results quarterly, spanning dozens of system performance disciplines.

How to participate in SPEC: SPEC's membership comprises more than 80 leading computer hardware and software vendors, educational institutions, research organizations, and government agencies worldwide.
Membership in SPEC allows for access to existing benchmarks (this includes company-wide licenses for current benchmark products) and full participation in development of new benchmarks with unlimited result publication on SPEC's website. Membership is open to all, from vendors to academia.

SPEC currently comprises three groups: the Graphics and Workstation Performance Group, the High Performance Group and the Open Systems Group.
- **Graphics and Workstation Performance Group (GWPG):** Develops consistent and repeatable graphics and workstation performance benchmarks in a way that reflects user experiences with popular applications.
- **High Performance Group (HPG):** Develops benchmarks that represent high-performance computing applications for standardized, cross-platform performance evaluation.
- **Open Systems Group (OSG):** Develops component- and systems-level benchmarks for desktop systems, workstations and servers.

For more information about membership in any of SPEC's groups, please contact SPEC at info@spec.org. A complete list of SPEC's benchmark products is available at www.spec.org.

SPEC Benchmarks
SPEC offers a wide range of server and workstation benchmarks, including its popular SPEC CPU2006 suite.
> **Newly released suites:**
> - SPEC CPU2006 V1.1
> - SPECjvm2008
> - SPECpower_ssj2008
> - SPEC SFS 2008
> - SPEC Viewperf 10 for Linux/Unix
>
> **Future Suites:**
> - SPECmail2008 - benchmark to test a server's ability to process e-mail requests, based on the Internet standard protocols SMTP and IMAP4.
>
> **In development:**
> - Virtualization performance for data center servers
> - Session Initiation Protocol (SIP) workload for server performance
> - Incorporating power measurement into other SPEC benchmarks suites.

Point of Contact: Bob Cassiliano

Description of Program:
The 7x24 Exchange is on the forefront of the mission critical industry with a membership that is comprised of professionals from all areas of the business. The organization hosts semi-annual national conferences which attract the industry's best and brightest. In addition, the organization has 13 recognized/chartered chapters and 21 active organizations throughout the Americas and Europe and is actively engaged in establishing new chapters around the globe. Record breaking attendance at recent conferences is a testament to the need for current and relevant information that users, professional services firms, and equipment manufacturers can take back to their respective organizations.

Observed Trends
While the complexity of the mission critical business drives an increasingly challenging agenda, a number of key trends continue to resonate throughout our membership base. We've summarized some repeating themes below.

- **End User processing requirements continue to grow!** Despite tough economic times our users tell us that the need for more processing capacity continues to grow at record levels. In many instances we're hearing of double digit year-on-year growth. Drivers of growth are industry specific with financial institutions needing capacity to support ever increasing market volumes, application service providers gearing up for SaaS (software as a service) delivery models, and of course the ever increasing demands of internet service delivery for both general public and business uses.
- **Increased processing capacity in smaller footprints yield higher overall operational efficiencies but challenge cooling infrastructure.** Equipment device manufactures continue to develop device footprints that provide increased processing capacity in smaller and smaller packages. A welcome benefit of this trend has been increased overall energy efficiency however the increased footprint densities have challenged many of our users as they struggle to deploy these devices in their legacy data centers. This trend has had positive impact in the new construction market as it encourages "out of the box" thinking as engineers and manufactures introduce solutions that meet the challenges of increased density and are also significantly more energy efficient.
- **Operational expense, environmental impact, and efficiency mandates increasingly drive buy/build decisions.** Expense relating to the design, build and operation of data center facilities is driving increased scrutiny at the most senior levels of even the largest corporations. Ratios of technology spend to general infrastructure spend are shifting dramatically. Costs associated with land, construction and the complex MEP infrastructure required to support increased technology capacity and density account for an increasingly large portion of a firm's technology capital spend. Data center operational budgets are also rising with energy consumption accounting for an increasingly larger share of operating expense.
- **Industry-wide need for standardized metrics to measure performance.** The historical focus of the mission critical world has been on delivering data center facilities that could support the broad range of technology requirements while meeting increasingly stringent availability and reliability requirements. While the industry has done a great job at addressing the above attributes it has, until recently, not done nearly as good a job driving standardization in the means to measure performance efficiency. Rising energy expense and environmental responsibility has focused the industry on this issue and a number of organizations have made significant progress in this area. Driving education in this area has been a major focus of the 7x24 Exchange with recent conferences bringing together leaders from the DOE, EPA, and many of the leading organizations that are on the forefront of this issue.

- **Virtualization is becoming standard operating procedure for firms with large data centers. Impact has ranged from minimal to dramatic depending on application.** Everyone is talking about virtualization and the impact it can have on energy efficiency by reducing the number of servers in the environment. However results vary significantly from firm to firm. We have seen one financial services firm monitor their servers every 10 milliseconds for 1 year to clearly understand where to relocate applications. This firm achieved a 70% reduction in servers with the applications that they virtualized.
- **As a result of the current economic climate budget pressure has caused some to delay/defer infrastructure refresh yielding short –term expense reduction but slowing migration to more efficient platforms.** The current economic climate has put increasing pressure on corporate budgets. Many firms have delayed or deferred expenditures on refresh of technology and support infrastructure. While the short-term effect is one of capital cost savings, the longer-term view is that delaying the deployment of higher efficiency infrastructure will have the unintended effect of higher energy consumption and increased operational expense. Educating users in best practice for increasing energy efficiency by identifying and implementing no/low cost efficiency initiatives in existing facilities is a high priority of the 7x24 Exchange.
- **Shortage of qualified personnel to operate and manage increasingly complex infrastructure efficiently - <u>Increased need for training and educational programs!</u>** The rapid pace of growth and innovation in our industry is making it increasingly difficult to find qualified personnel who can bridge the communication gap that often develops between technology and facilities organizations. Rapid expansion, increasing operational risk associated with higher density environments, and increased focus on bottom line and environmental performance are all areas that drive the need for highly trained professionals.

Activities and Achievements

- 7x24 Exchange Conferences are 3-1/2 day industry events conducted biannually (Spring & Fall). The conferences are designed for information exchange among those who design, build, operate and maintain mission critical facilities and infrastructure. Information exchange occurs through formal presentations, tutorial sessions, case studies, interactive panels, Q&A sessions and formal and informal networking opportunities.
- The 7x24 Exchange promotes awareness of energy efficiency topics & issues of the day by providing a forum for education where users, consultants, vendors, and media can learn from and exchange ideas with industry experts. At our recent Spring conference there were 12 presentations on energy efficiency including a session with a panel of experts from IBM, HP, Pacific Gas & Electric, and the Green Grid which was moderated by the EPA. Our diverse and vocal audience provides information on practical application and real world issues and solutions. This facilitates valuable cross-sector input to stakeholders. The conference draws mission critical industry leaders as speakers, sponsors, and attendees allowing for significant networking opportunities at breaks, lunches, nightly hospitality suites and vendor sponsored events.
- The 7x24 Exchange Magazine (Newslink) prints articles providing in-depth coverage on energy efficiency, reliability and industry trends relevant to the mission critical world.
- The 7x24 Exchange website posts information relevant to the mission critical world. The website offers current information on the activities of the organization. Back issues of Newslink can also be downloaded. As a non-profit organization with an independent view, the website acts as a clearinghouse that provides links to industry websites which are of interest to mission critical professionals.

Key Areas for Collaboration
- 7x24 Exchange semi-annual conferences and regional chapter events provide a forum for information exchange and offer opportunities for education, networking, meeting with industry leaders and an ability to poll a user/consultant /vendor base to get feedback on key issues.
- The 7x24 Exchange offers training opportunities achieved through end-user case studies that highlight best practices to measure and improve energy efficiency. Together we can develop a training program to ensure that data center operators clearly understand how to take advantage of current and future opportunities
- The 7x24 Exchange is reviewing opportunities to collaborate with other organizations to develop recognition programs that highlight achievements in driving energy efficiency. This type of recognition would be an additional incentive for companies to strive to be energy efficient.

More Information:
Additional information about the 7x24 Exchange and its activities and conferences can be found at www.7x24Exchange.org or by calling (646) 486-3818.

APPENDIX C: SPONSORS

The U.S. DOE and EPA would like to thank Microsoft Corporation for providing the meeting space and meals during the workshop, and the following companies for hosting the evening reception: OsiSoft, PSMA, Sabey Corporation, 7x24 Exchange, Green IT Alliance, the Telecommunications Industry Association's ICT Green Initiative, and Seattle City Light. The following pages feature the organizational descriptions submitted by the sponsors prior to the publication of this report.

Energy Smart Services™ from Seattle City Light

Energy Smart Services™ (ESS) pays cash to help businesses, institutions and government facilities buy and install advanced energy conservation technologies. ESS can pay up to 70% of the cost of qualifying energy efficiency improvements for your information technology systems:

ESS can pay $8.00 per controlled personal computer to help install network server software that:
- Maintains power management settings on connected PCs and can shut down computers remotely according to a schedule
- ESS can pay $25.00 per connected workstation for software and hardware that enables the operation of multiple workstations from a single central processing unit.
- Numerous other incentives for the use of energy-efficient technologies are available, including incentives to help pay for efficient equipment you might use in your data facilities, such as:
    - Lighting systems & lighting controls
    - HVAC systems & HVAC controls

Custom incentives can be developed for other hardware and software solutions that can be shown to save energy in your facility–call your Seattle City Light Energy Management Analyst for further details.

For details on the requirements to receive an ESS incentive payment, including further information on the conservation measures mentioned above, call 206-684-3254 or visit www.energysmartservices.com. To be eligible for Seattle City Light funding, a contract with Seattle City Light must be in place before any energy conservation measures are installed. The above incentive levels are subject to change without notice.

Since 1977, Seattle City Light has been committed to conservation as its highest-priority, most cost-effective, environmentally-friendly energy resource. Encouraging conservation avoids the need to build new power plants, helping to keep rates low and to preserve the environment.

Energy Smart Services™ (ESS) provides financial incentives and technical assistance to businesses served by Seattle City Light to encourage the use of advanced energy conservation technologies. The program may change without notice and is subject to the availability of funds.

Energy Smart Services
700 Fifth Avenue, Suite 3200
SMT 3436
Seattle, WA 98124-4023

Green IT Alliance (GITA)

The Green IT Alliance (GITA) is a non-profit Research Center of Excellence located in the Pacific Northwest. GITA is devoted to accelerating the integration of green, energy efficient IT technologies into sustainable building architecture. While many organizations have recently formed that focus on either Green Building, or Green IT, GITA is unique in that it focuses on the integration of technologies in both sectors. Rather than just industry advocacy, GITA is primarily focused on implementing its mission through real-world pilot implementation projects and test laboratory research. The organization integrates the resources and talents of Private Industry, Government, and University researchers. Joint, interdisciplinary, interagency projects will provide the basis for the next generation of thought leadership in this field, and GITA will work to formulate new curriculum for education and conduct job training programs needed to propagate technology adoption.

Member Benefits:
The primary benefit of becoming a GITA member is to become actively engaged in GITA research and pilot projects. All members will receive all research and project RFP's, and be eligible for project participation. Specific Benefits for General and Charter Memberships are delineated below.

General Membership Benefits
- Participation in GITA projects
- Quarterly Newsletters
- Free or Discounted Consulting, Training &
- Technical Support
- Free or Discounted Events
- Basic Marketing and PR Benefits

Charter Membership Benefits:
Charter Members receive all of the benefits of the General Membership as well as:
- Voting Rights for Board of Directors Elections
- Eligibility for Board Seats (Nominate one candidate per Member)
- Steering Committee Seat (one seat per member)
- Enhanced Marketing and PR Benefits

GITA Founding Sponsors

SILVER: Greater than $50K	GOLD: Greater than $100K	Platinum: Greater than $250K

GITA Annual Membership Dues

	Individual* (not business)	Universities, State or Federal Government Agencies / National Labs (per agency or division)	Universities, State or Federal Government Agencies / National Labs (per agency or division)	Medium Business ($5 - $100M revenue)	Large Business ($100M + revenue)
General Member	$100	$500	$350	$750	$1,500
Charter Member	$500	$3,500	$1,500	$5,000	$10,000

*Individual memberships for students $25

Organization Financing:
GITA is financed through a combination of research or pilot project contracts and grants, fees for testing, consulting and training services, founding sponsor donations, in-kind contributions, and annual membership fees. GITA has an innovative approach in allowing members and donors to decide exactly where their contributions are going. Our 4321 process allows members to allocate contributions to specific projects or technical emphasis areas, specific university or educational programs, and related non-profit organizations as they see fit.

40% GITA Project or Technical Emphasis Areas*:* GITA conducts and organizes research, test programs and pilot projects in three primary technical emphasis areas, including:
1) Energy Efficient IT Hardware/Software/Network Architecture, 2) Advanced Power and Cooling, and 3) Integration into Sustainable Building and Landscape Architecture. For all Contributions, Donations and Membership fees, 40% goes directly to the project budgets in these areas as designated by the Member or Donor.

30% University, Training & Educational Programs*:* The next 30% of your membership fees, donations or contributions are applied to fund and execute a range of balanced educational programs that are geared towards engaging students. GITA will apply their contributions towards Scholarships, Internships, Entrepreneurship Programs, or Job Training Programs. This program will encourage students to pursue careers that support the GITA mission by supporting the funding of student participation in research in the primary technical emphasis areas, leveraging the 40% Project Funding.

20% GITA Organizational Operating Expenses: The next 20% of membership fees are applied directly to support GITA operating expenses, including Organization and Project management, State-of-the-Art research facilities and test laboratories, and related operating expenses.

10% Related Non-Profit Organizations: GITA is establishing affiliation and relationships with other like-minded non-profit organizations in an effort to advance GITA's mission and outreach. 10% of the membership fees and donations will be applied to create budgets for inter-organization collaboration.

4321 Contributions

GITA Projects or Technical Emphasis Areas • **Energy Efficient Hardware, Software, Network Architecture** • **Advanced Power & Cooling** • **Integration into Sustainable Building & Landscape Architecture**	40%
University Training & Educational Programs	30%
GITA Organizational Operating Expenses	20%
Related Non-Profit Organizations	10%

OSIsoft, Inc.

OSIsoft delivers the PI System, the industry standard in enterprise historians, as the core of its real-time infrastructure platform. A global base of more than 11,000 installations across manufacturing, energy, utilities, life sciences and other process industries relies upon the OSIsoft PI System to safeguard data and deliver enterprise-wide visibility into operational health in order to manage assets, mitigate risks, and identify new market opportunities. The company provides worldwide technical support for customers in more than 70 countries. OSIsoft is privately held and headquartered in San Leandro, California.

OSIsoft has specialized in delivering real-time innovations that help optimize operational performance and, for more than 25 years, the PI System has proved itself to be the platform of choice for extending operational insights to all levels of the organization. Led by engineers and industry experts and joined by an ecosystem of qualified partners, OSIsoft remains committed to our customers and their expectations for return on investment through:

- Pervasive Connectivity - Weaving an event-driven data fabric is easy and cost-effective with the PI System's extensive library of interfaces to all data sources.
- Scalable Architecture - From its inception, the PI System was designed to store, manage and retrieve information accurately and efficiently, and to overcome the limitations common to a relational database.
- Fast Deployment - Unlike many IT investments and point solutions that are high risk and include long implementation cycles, the PI System is easy to deploy and use.
- Evergreen Platform - As our customers' businesses change, the PI System has faithfully evolved to meet these challenges.

OSIsoft customers have achieved significant business value from implementing their PI Systems, but businesses are changing and real-time infrastructure systems are becoming larger, and more complex; customers face more data, more users than ever are demanding data in real-time, while there are less people to manage this data. Enterprise Agreements have been introduced to account for this shift.

The goal of the Enterprise Agreement Program is to form closer partnerships with customers and focus on business practices that allow customers to achieve maximum value out of their PI investment across their entire enterprise.

The OSIsoft Mission
• Deliver on the promise of Real-time Performance Management
• Unlock the value of data across the enterprise
• Continue to develop and support technology in which customers and partners have already invested

How Do You Manage Your Data Center?
Customers trust the PI System to safeguard their data and to provide real-time, enterprise-wide visibility into operational events. The PI System proves itself time and again as the platform of choice for extending operational insights to all levels of an organization—helping our customers successfully manage their assets, mitigates risks, and identify new market opportunities.

With the PI System you can reliably monitor and better manage your data center. Support your strategic decisions with the PI System to converge your real-time operational and IT data to improve:
• Power Monitoring & Management   • Contractor Management (SLA)
• Capacity Planning   • Energy Management
• Deployment Optimization   • System Reliability
• Real-time Condition Based Maintenance   • Asset Management

Power Sources Manufacturers Association

The Power Sources Manufacturers Association (PSMA) is a not-for-profit organization incorporated in the state of California. As stated in the papers of incorporation – the purpose of the Association shall be to enhance the stature and reputation of its members and their products, improve their knowledge of technological and other developments related to power sources, and educate the entire electronics industry, plus academia, as well as government and industry agencies as to the importance of, and relevant applications for, all types of power sources and conversion devices.

PSMA Mission
The PSMA Mission is to integrate the resources of the power sources industry to more effectively and profitably serve the needs of the power sources users, providers and PSMA members.

For more information on the PSMA, its members, its committees, recent activities, other publications or to join the PSMA, visit our Web site or contact us:

PSMA
P.O. Box 418
Mendham, NJ 07945-0418
Tel: 973-543-9660
Fax: 973-543-6207
E-mail: power@psma.com
Web site: www.psma.com

Sabey Data Centers

Sabey Data Centers provide a fully conditioned critical environment to keep essential services cool, secure and flexible.

Sabey DataCenters' approximately 1.5 million square feet of mission critical space is occupied by some of the world's iconic names, as well as universities and branches of the U.S. government. Our data center specialists offer leased and build to suit facilities as well as operations management services in Seattle and in Eastern Washington, with extensive experience outside the state.

- **Abundant hydro-power at low, stable rates -** The Pacific Northwest's hydro-powered electricity provides rates that are both lower and more stable than those of fossil fuel utilities. Water is not only a sustainable power source – it's **GREEN** – with a carbon footprint much lighter than that of typical coal-fired power generation.
- **Efficient, energy-conscious economizer cooling -** Sabey DataCenters cooling systems are designed to take advantage of state-of-the-industry innovations as well as our mild Pacific Northwest climate. We work closely with the power utilities to ensure that both our tenants and the environment receive maximum benefit from energy conservation measures and incentives.
- **Secure, redundant systems -** Sabey DataCenters are designed and constructed with redundant mechanical/electrical systems, state-of-the-art controls and back-up systems for emergency and maintenance events.
- **Peak Performance - 24 x 7 x forever -** Sabey DataCenters mission critical facilities are designed to require zero server downtime during maintenance or renovation. Rigid processes safeguard uptime and reliability, ensuring that our tenants function at peak performance levels .
- **Fiber options abound -** Sabey DataCenters are supported by redundant fiber paths through and around the site.
- **Secure around the clock -** Sabey DataCenters security personnel are on site around the clock, 365 days of the year, making hourly rounds and performing regular fire, safety and security checks. We also maintain a full-time complement of building engineers, support staff and operations managers throughout the weekday and on call whenever you need us.

Our data centers are unmarked to avoid unwanted attention. Critical perimeter walls are constructed to provide Level V ballistic protection in addition to bullet resistant doors, frames and glass. Extensive closed circuit television systems monitor the exterior and interior of the building.

About Us
Sabey Corporation is a privately held real estate development, construction services and investment company. Over the past 40 years, we've constructed, renovated and managed more than 27 million square feet of technology, office, medical and mixed use space.

Today, we own and manage more than 4.5 million square feet of commercial and technology space in the state of Washington in addition to major projects in Alaska, Arizona, California, Colorado, Idaho, Montana, Oregon, Texas and Utah.

For more information, please visit www.sabey.com.

Telecommunications Industry Association (TIA)

The Telecommunications Industry Association (TIA) is the leading trade association representing the global information and communications technology (ICT) industry through standards development, government affairs, business opportunities, market intelligence, certification and worldwide environmental regulatory compliance. With support from its 600 members, TIA represents a large cross section of IT and communications manufacturers and is currently working to mobilize them to make gains in energy efficiency and other green initiatives. (www.tiaonline.org)

TIA'S ICT GREEN INITIATIVE: The purpose of the ICT Green initiative is to provide leadership and opportunities for TIA's member companies to participate in and contribute to global green initiatives. TIA is working in collaboration with EPA, DOE, LBNL, Green Grid, USGBC, ASHRAE and a large cross-section of companies to both support work already underway, and to address new areas not being addressed that are ideally suited to its membership and competencies.

Key components of the TIA's ICT Green Initiative are:
- **Energy Efficiency Metrics and Standards for Networking and Communications Manufacturers**: While much work has been accomplished with servers, a large-scale effort to help networking and communications manufacturers agree upon metrics and standards for energy efficient equipment has only just begin. TIA has the largest membership of these types of companies in the world and will be supplying leadership to make significant gains in this area.
- **Energy Efficiency Product Design and Regulations Tracking**: TIA currently owns and operates EIATRACK – one of the largest (more than 6,000 pieces of legislation) and most successful programs that supplies electronic product manufacturer's information regarding environmental product regulatory compliance laws and requirements in all major regions of Europe, Asia Pacific, North America and South America. Employing the top environmental legal firms in the world, regulatory information is tracked by country, translated when necessary, and broken out according to issue. Examples are energy-efficiency, toxic waste, hazardous substances, recycling, and prohibited product materials and components. (www.eiatrack.org)
- **Large Scale Internet and Events focused on Green Initiatives**: While considerable information on green initiatives can be found on the internet, it is time consuming to explore and understand. TIA is leveraging its ability to undertake large scale programs such as its NXTcomm tradeshow and its ANSI-accredited standards development to define one of the largest websites in the world on green initiatives for the ICT industry. This program is still under development and has received positive feedback.
- **Electronics Recycling Online Information Source**: TIA hosts and maintains ecyclingcentral.org, a comprehensive electronics recycling information website for companies and consumers. Featuring public information on more than 2,000 electronic recycling sites across the United States, the site is also used as a key piece of environmental regulatory requirements for electronics companies. (www.ecyclingcentral.org)

TO PARTICIPATE
To participate in one of the above initiatives, contact:

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Ellen Farmer
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www.eiatrack.org
(703) 907-7582

For more information on DOE and EPA data center initiatives:

Save Energy Now – Datacenters Web site:

www.eere.energy.gov/datacenters

ENERGY STAR Web site

www.energystar.gov/datacenters

To view presentations and other workshop materials visit the workshop web site:

www.energetics.com/datacenters08