ENERGY STAR® ICT Product Roadmapping Workshop Organizing Document

TRACK 3: DATA CENTER ENERGY EFFICIENCY BEST PRACTICES

INFORMING DOCUMENT PURPOSE.
Recognizing the unique nature of Information and Communication Technology (ICT) products −their complexity, their rapid evolution, their global applicability, their connectivity with many other products types − EPA and ITI see value in hosting an informal brainstorming dialog regarding the near term future of ENERGY STAR for ICT products and ICT-enabled solutions. This informing document is intended to assist participants in preparing for the Track 3 breakout, enabling the richest and most productive discussion possible on July 10 and beyond.

DESIRED OUTCOME FROM TRACK.
Outline the considerations and recommendations for the approaches and opportunities available to encourage the adoption of best practices to make data centers more resource efficient, via ENERGY STAR or otherwise, with a focus on the next 3-5 years. EPA and ITI anticipate that these considerations will be more fully discussed and documented through a limited set of conference calls hosted through the second half of the 2012 calendar year.

FRAMING DISCUSSION.
The data center has changed considerably as the evolution of information technology has enabled it to become the economic engine and critical nerve center of today's enterprise. As business demands increase, so do the demands on energy-efficient IT and data center facilities housing a rising amount of powerful IT equipment. Data center managers around the world are running into resource limitations related to power, cooling, and space, making the resource efficiency of data centers an important topic of discussion. At the same time, innovations in ICT hardware and software design enable these systems to greatly increase the quantity of work delivered per each unit of energy and space consumed but only if these systems are properly configured and utilized. How you scale your power and cooling to the IT demand at a given time can mean the difference between a highly effective and energy-efficient data center versus an operation of over-sized, poorly utilized, stand-alone resources.

Our task is to evaluate methods and means by which we can encourage/incent/recognize efforts by companies to transition from the common “cold is better” and “one server, one application” way of thinking to broader, systematic thinking wherein the data center dynamically manages cooling and workload. While many companies are at different points in evaluating and implementing greater system efficiencies, there are logical steps to take in the transition, including the recognition that new data centers should be designed and constructed with this objective in mind.

All of the opportunities below, for the most part, are independent of the energy efficiency of the ICT equipment: the strategy is how does one integrate the ICT and facilities systems to optimize the workload delivered per unit of energy consumed by the datacenter.

1. Best Practices to Reduce Facilities Energy Use: This includes ICT equipment layout to improve energy management and physical hot/cold separation; blanking plate and cutout block installations, power and thermal management (manual or real time with dashboards); and infrastructure improvements such as use of free cooling and upgrades and the integration of systems level power and cooling equipment. Execution of these practices in a data center can take 5 to 15% of the total data center energy load out of the system (improve PUE and utilization). Existing programs & resources include:
    a. LBNL Resource Page

b. EU Code of Conduct Requirements
c. DOE DC Pro and the Data Center Energy Practitioner Programs
d. ENERGY STAR data center rating program
e. Energy Efficiency Incentive Programs (Utility programs – partnership with ENERGY STAR & ACEEE)
f. Green Grid briefing papers

2. Promotion of the ASHRAE A2 Data Center Temperature Standard: Current ICT equipment on the market, and many legacy systems, are designed to operate at 27-30^{o}C, but many data centers are typically operated at lower temperatures to ensure reliability and provide more cushion for system upsets. With the installation of a thermal management system, data center operators can expand the data center temperature and humidity operating ranges with the ability to detect and correct potential over-temperature situations. This work/discussion item could also include the use of free cooling in the context of higher data center temperatures.
3. Implementation of Virtualization and Consolidation Technologies: New hardware systems, both server and storage, are capable of supporting many applications through various virtualization technologies. In an equipment refresh cycle, many current systems can be consolidated onto a single new system reducing energy use by 20 to 80% and delivering more workload using less energy and space. The extent of the consolidation that can be achieved depends on the type and age of the application, and the operational mechanisms being utilized, such as dynamic workload migration.
4. Development of the Dynamic Data Center: The ultimate objective, from an energy efficiency standpoint, is a data center that could dynamically schedule workload in a way which minimizes the quantity of equipment needed to perform the current workload, and adjusts the cooling delivery to the data center to match the current heat load. If no other work can be found, idle servers can be shut off or deep idled under demand increases. This system would be informed by integrated, connected, intelligent systems controlling and directing the IT workload, monitoring the data center power and temperature profile, and managing the power and cooling system to optimize hardware and free power and cooling utilization. Roadmapping work would include a logical progression of demonstration projects − demonstration of deep idle or shutdown/start-up strategies for ICT equipment; demonstration of a working system for each intelligent system (some systems are further along than others); simple integration of two or three systems; complex integration of two or three systems; and full integration. This is a long-term strategic objective, with pieces available today, but full integration is several to many years down the road.

KEY FRAMING QUESTIONS.

- How can we best build on and combine the learning and resources available from existing programs to encourage and enable the adoption of best practices? Is there a role for ENERGY STAR?
- How can we incent every layer (silicon, operating system, application, hardware package, management infrastructure, the building itself) in the data center system to engage in energy-efficient behavior? What policies would best internalize true energy savings and costs? Who would be in the best position to provide various types of incentive programs, and what would be an appropriate role for ENERGY STAR?
- Are sufficient mechanisms in place to encourage international convergence in energy efficiency voluntary programs and regulation pertinent to the data center, or are new mechanisms needed?