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Opinion of the Institute

EPA Report Should Spur Industry-Wide Green Data Center Movement
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Report to Congress on Server and Data Center Energy Efficiency (pursuant to Public Law 109-431)
US Environmental Protection Agency (EPA) Energy Star Program

Editor's Note: To help further the conversation for the benefit of the industry, the Institute *welcomes feedback and comment on this* Opinion.

The just-published EPA report and recommendations deserve to be taken as a clarion call to all stakeholders involved in the server computing and data center industry to now take the greening of the data center seriously. This report will prove foundational to the evolution of the information economy. We in the enterprise IT industry need to give the EPA's efforts a high level of attention, begin planning, and take action.

Energy efficiency is an environmental and IT economic productivity imperative that can no longer be ignored. The EPA's charter in this matter is clear. Slowing the growth rate of electric power use for servers and data centers is a necessary part of slowing the rate of greenhouse gas emissions. Overall, power generation in the US remains solidly anchored in the use of fossil fuels (coal specifically) to drive steam turbines. That will remain so for the foreseeable future. CO_2 emissions from these coal-fired plants are an outsized contributor to global warming and climate change. Until cleaner plant technology or other alternatives become available, balancing electricity consumption with IT economic productivity is an important governmental and corporate policy issue.

The EPA report cites Dr. Jonathan Koomey's findings which indicate that servers alone consumed 1.2 percent of the nation's electricity in 2005, more than double the use over 2000. Actual data center power consumption used by disk and tape storage, network and communications, and other IT hardware is significantly higher. This level of consumption makes IT hardware and data centers a surprising leading national contributor to carbon emissions.

As argued in the *Institute's* newest white paper, titled *The Invisible Crisis in the Data Center: The Economic Meltdown of Moore's Law*, the power consumption trends cited in the EPA report are not momentary blips, but are long-term and systemic problems, showing no signs of abating. In this paper, we project, through year 2012, an ever-widening gap between the rapid rate of growth in computational performance and the slower rate of energy-efficiency improvement. We posit in this paper that historic IT economic productivity is significantly negatively impacted when total site operating and capital costs for today's high power (and heat) density data centers are accurately calculated as part of the true total cost of ownership (TCO) of IT hardware.

To effectively counter this trend and restore the economic benefits of Moore's Law at the whole-system level of the data center, the *Institute* focuses on the following four key concepts that we believe can make an early and quantitatively substantial difference in the industry's energy-consumption future:

Reset R&D Priorities to Include Energy Efficiency

Chip, server, and storage hardware developers and manufacturers are now called upon to reset long-term developmental roadmaps to ensure that the future rate of improvement in energy efficiency exceeds the corresponding rate of increase in computational performance. Facilities infrastructure manufacturers (primarily power and cooling) are called upon to look at design alternatives that may dramatically reduce the power requirement of the site infrastructure. Along with this, all vendors are called upon to make energy efficiency improvements a key component of the customer information and education. Because of their influence, IT equipment buyers are now called upon to make energy efficiency a key component of their procurement specifications; if customers demand efficiency improvement, vendors will provide it.

Benchmark Current Data Center Energy Consumption

All data center operators are now called upon to begin measuring and benchmarking their data center energy consumption. Under the old Peter Drucker maxim, *It is not possible to manage what you cannot control and you cannot control what you cannot measure*, IT managers and data center operators must begin measuring and benchmarking their power use. The *Institute* is now developing an integrated set of metrics, one of which was specifically referenced in the EPA report itself (Recent Industry Focus on Metrics, section 7.2.2.2), and analysis tools that will provide a standard way for the industry to understand and communicate its efforts in data center energy efficiency improvement.

Adopt New IT Governance Policies for Data Center Management

Regulation, social pressure, and/or rising energy costs will significantly motivate our industry to address energy efficiency issues. C-suite executives, principally the CIOs and the CFOs responsible for data centers, must drive new forward-thinking, top-down, enterprise-wide approaches to data center management. The economic ripple effect of IT investment on site infrastructure (power, cooling, and space) to date has largely been ignored. Boards are now called upon to take a whole-systems view of their IT investments to include the true costs of site infrastructure in the TCO calculations and cost justifications for IT hardware and business-line applications. This provides a more accurate view of IT's economic productivity.

Identify Key Characteristics of a Green Data Center

The criticality of IT is no longer in question for many businesses. Its IT function is entirely dependent on the availability and cost of its site infrastructure systems. It's a whole system—what the *Institute* refers to as the Integrated Critical Environment™ (ICE). In the overall scheme of things, data center energy consumption has been overlooked by most organizations, with IT performance trumping all other considerations. *Institute* research indicates that global enterprises that become early green adopters can have both high IT performance and energy efficiency while also creating a competitive advantage worth hundreds of millions of dollars over the next decade.

The four separate performance factors that define a green data center are:

- **IT hardware productivity** – IT managers should ask themselves, *How can I maximize the fraction of my IT equipment that is employed productively and fully utilized?*

- **Maximum computational performance per unit of internal power** – IT personnel who select platforms should ask themselves, *How can I select hardware that delivers the most effective computing performance per Watt of internal power used?*

- **Efficient delivery of power at the plug to internal IT hardware components** – IT procurement personnel should ask themselves, *How can I select IT equipment that delivers input power to its internal components most efficiently?*

- **Efficient site infrastructure** – Facilities managers should ask themselves, *How can I maximize the amount of useful power delivered to the IT equipment, for each unit of power consumed at the utility meter?*

Note that three of these factors are entirely within the IT side of an organization, while the fourth is mostly in facilities and corporate real estate, with a strong IT component. These key performance factors will allow respective stakeholder groups break down the daunting data center optimization problem into smaller components, enabling them to focus on developing independent but interrelated solutions. Some of these groups will be new cross-functional teams formed within IT and data center user organizations. Others will be in the IT hardware vendor community, the site infrastructure hardware vendor community, and the data center design and engineering community. Optimiza-

tion of each individual performance factor, in turn, will result in optimization of the whole system.

We believe that going green can result in massive, industry-wide savings. Based on our findings, we reasonably predict up to 60 percent energy savings in a new green data center with no loss of availability or performance. To underscore the magnitude of this point, for a large-scale enterprise data center, these savings can amount to annual operating cost savings of millions of dollars. Recovery of currently wasted site capacity (refer to *Institute* white paper, *High Density Computing: The Path Forward 2006* for details) can result in the potential postponement of long-term capital investments, which may save hundreds of millions of dollars.

To begin moving towards a truly green data center, the *Institute* is convening a design Charrette, *Data Center Energy Efficiency by Design: Engineering & Managing Site Infrastructure Systems of the Future*, in October, 2007. This initiative begins a rigorous technical inquiry into, and examination of, the IT hardware and site infrastructure design options that hold the promise of significant positive improvement in data center energy consumption. This first in an annual series of open-source knowledge-sharing events, the Charrette brings together all stakeholders to cut through the current industry and institutional barriers and perverse incentives to look at entire systems in unprecedented ways. As an integral extension of this roundtable, problem-solving exercise, the *Institute* and representatives from EPA Energy Star will examine the EPA report to see how its recommendations can be best employed to provide a consistent design and development roadmap for the industry.

We applaud and support the EPA's leadership with this report, as it underscores the need to raise awareness and calls for our industry's full engagement in seeking the right solutions to significantly shrink the carbon footprint of data centers. For the foreseeable future, the *Institute* is dedicating its resources to help guide the data center industry toward achieving transformational improvement in the energy efficiency of server computing and the data center. Through the establishment of user-based, widely accepted standardized metrics, specifications, design principles, management best practices, and governance policies, we believe the green data center will become a reality sooner rather than later. In addition, users who begin moving toward a green data center model will be benefit from an increasing economic advantage, not to mention exhibiting necessary corporate social responsibility and environmental sustainability.