Industry Trends and Technology Perspective White Paper

Analysis of EPA Report to Congress (Law 109-431)

A perspective on the EPA Report to Congress addressing public law 109-431 pertaining to IT datacenter electrical power consumption

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On August 1, 2007 the United States environmental protection agency (EPA) responding to public law 109-431 presented a 130 page report (plus 14 pages of executive summary and 67 pages of appendices and other supporting documents) to the U.S. congress addressing IT datacenter electrical energy consumption and associated issue. The EPA conducted a series of webcasts on August 9th 2007 covering the report, its findings, recommendations and plans for moving forward. This is a synopsis of the EPA report to congress with comments by the StorageIO group as to what the EPA report findings mean.

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Introduction and Background

Information Technology (IT) is an increasingly important factor in the growth of business which leads to increased demand for electricity. In December 2006, the United States congress passed a bill, public law 109-431 that was signed by the President instructing the EPA to report to congress the status of IT datacenter energy consumption along with recommendations to improve on energy efficiency including for federal datacenters. The EPA via ENERGY STAR® delivered to congress on August 1, 2007 the report[1] on energy consumption by IT datacenters along with recommendations. Subsequently on August 9th 2007 the EPA conducted two webcasts (USEPA Initiatives to Reduce Energy Use in Datacenters) presented by Andrew Fanara and Peter Oh of the EPA ENERGY STAR® product specification group to summarize and address various questions pertaining to the report.

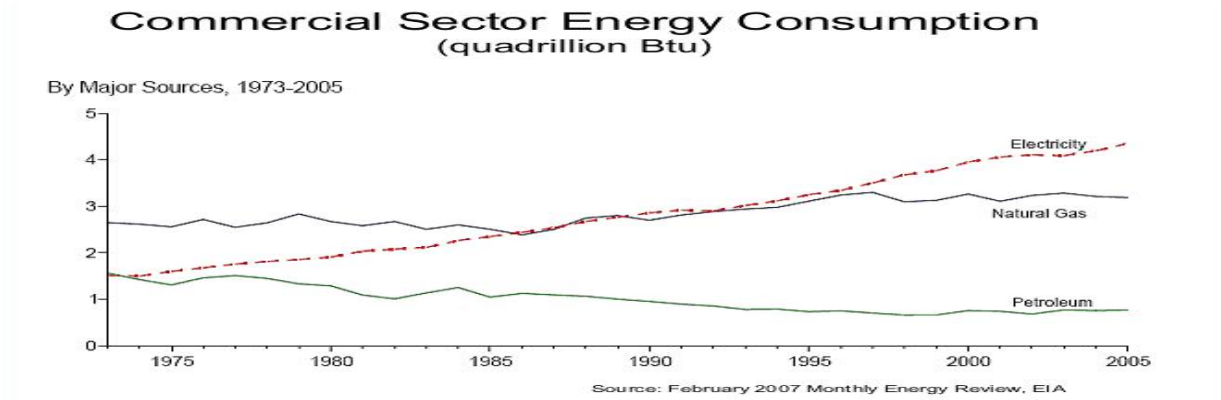

Figure-1: Chart from EPA webcasts showing commercial sector energy (in quadrillion BTUs)

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Figure-1 shows total energy consumption by the commercial sector in the US in quadrillion[2] BTUs including electricity, natural gas and petroleum. Demand for electricity is going up with time due to population growth and overall demand growth from new appliances and technology evolution in what is being referred to as a digital age that are all reliant upon energy. Energy supply has grown however demand continues to grow in the U.S. and on a world wide basis resulting in spot shortages and supply instability along with spikes in demand. For IT datacenters, electricity is the lifeblood, however with electricity consumption in IT datacenters not effectively being used, wasted energy needs to be dealt with in the form of cooling and ventilation of heat, resulting in more energy to power IT datacenter cooling and ventilation equipment.

From the EPA - The Energy Straightjacket

- Deliverability limitations in all markets for all fuels
  - Processing and generation
  - Transportation, transmission
- Oil market restrained by refining capacity
- Coal market restrained by rail and mining capacity
- Electricity constrained by available fuel and transmission
  - High demand taxes existing electricity grid infrastructure
- Renewable energy limited by equipment manufacturing
- Fuel switching limited by tight markets

[1] http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency#epa
[2] Quadrillion is 10^{15} or 1,000,000,000,000,000 where a billion is 10^{9} or 1,000,000,000

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Demand continues to increase for electricity to power IT datacenters to provide information services of all types for essential services to entertainment purposes nationwide and worldwide. A combination of supply and demand factors are clashing resulting in the so called "Energy Straight Jacket". In addition, the general availability of and cost of fuels, production generation capacity, transportation or transmission facilities and associated infrastructure continue to be a concern. Hidden in this message is that the aging infrastructure for energy production and transmission is being stressed requiring constant, costly and time consuming maintenance as well as long lead time to upgrade or replace.

From the EPA - Climate Concerns Gaining Momentum

- Beyond energy supply and demand issues…
- There are also climate sensitive concerns…
- Various news stories, reports, studies, opinions
- Energy efficiency is easiest and cheapest ways to reduce subsequent emissions

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Environmental and "Green" related topics are garnering headline news coverage; consequently organizations have a sensitivity to appeal to the green nature or risk being as perceived as not being green. Green issues extend beyond carbon dioxide ($CO_{2)}$ green house gas emissions to include environmental health and safety (EHS), asset disposal including restrictions of hazardous substances (RoHS) among others. The EPA report to congress is focused on energy availability and consumption by IT datacenters however there are concerns of subsequent CO_2 emissions. Of note, while there is a rush of "Green wash" stories linking all aspects of IT energy consumption to being green, IT datacenters only account for approximately 1.5% of all U.S. electrical power consumption and subsequent CO_2 emissions.

EPA - What are the risks to Business?

- Energy supply, security and climate (environment) change risk
  - Physical risk to property from extreme weather
  - Financial risk to the health and competitiveness of firms
  - Reputation risk due to poor public and investor community perception
- There is a growing demand for energy management strategies designed to mitigate risks while seeking a competitive advantage

StorageIO Group Perspective - What This Means

The risks to businesses are the continued stable supply of electricity at an affordable price in an era where climate and environment concerns are becoming more pronounced. The health risks to business are financial impacts due to disruptions in services should IT resources and information not be available causing a loss of revenue, possibilities of penalty fees or fines, increased competitive pressure, sagging investor confidence and negative public perception tarnishing company's reputation.

Business and governments are seeing the strategic importance of energy to reduce negative issues of supply and production or processing volatility, availability, price and distribution risks to power IT datacenters of all size. The initial impact and focus given their size are the ultra-large datacenters where due to their size and scale, simple changes and improvements and have a significant multiplier effect. Energy efficiency is thus the first resource to protect against uncertainty and risks associated with energy supply in the face of rising demands and market instabilities.

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From the EPA - Where do Datacenters Fit In?

- Datacenters are energy intensive facilities
  - Server racks now designed to carry 25 kilo-watts (kW) loads
  - Typical facility draws about 1 mega-watt (mW) and some can be 20mW
  - Nationally, 1.5% of US Electrical consumption in 2006 – could double in 5 years
- Critical national and global infrastructure
  - Few technology barriers to increased efficiency
  - Good candidates for efficiency investments by utilities to reduce peak loads

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Electrical generation and transmission capacity in the U.S. continues to age with demand exceeding supply at various times and geographic locations due to surge from weather, business seasonality or generating and transmissions off-line for planned preventive or un-planned maintenance resulting in an increase in demand side management (DSM). DSM is not a new approach for electrical power generating and transmission (G&T) companies to manage their supply and demand. Power G&Ts regularly buy and sell to each other surplus energy balancing their own generating capacity and costs vs. buying lower cost energy from other sources to meet demand and maximize their production capabilities.

The electrical power G&T industry has long optimized generating and transmission capacities by managing and encourage optimization and effective use given the cost, complexity and time required to maintain as well as develop new production and transmission facilities. The EPA report to congresses focuses on a model based upon server shipments (sales) to primary datacenter facilities in the U.S. looking at data from 2000 through 2006.

The usage and forecast model used in the report builds on previous resource and studies by Stanford, Lawrence Berkeley National Laboratory (LBNL) and others looking at energy intensive IT and compute environments. The nature and diversity of IT datacenters results in a complex eco-system of environments of various size, some of which are compute intensive (less storage ratio to servers) while others are data and storage intensive (more data storage capacity than CPU compute power).

Datacenters are now being thought of in terms of "Information Factories" that are powered by electricity to produce information services similar to traditional factories that produce other goods. IT datacenters are energy intensive and electricity dependent to power the IT equipment (servers, storage and networks) along with heating, ventilation and cooling (HVAC) systems to remove waste heat. Demand is expected to continue to grow moving forward even with improvements of IT equipment energy efficiency and effectiveness given the continued growth of IT services and functionality.

IT datacenters are being seen as vital national assets, vital to business, vital to essential services providing on-line services, services to support logistics and other services we take for granted not to mention enabling research, essential civil services, government needs and so forth as well as entertainment and convenience services. Thus datacenters in general are seen as very important and expected to consume more power with continued growth and increased capabilities enabled by IT evolution and adoption.

What is not factored into this model and the IT datacenter equation is non traditional datacenters including telecom related switching and similar facilities. Likewise desktop, mobile and virtual offices are not included. There is also a great deal of energy efficient technology currently in the market place however more best practices for their use and deployment are needed to achieve energy efficiency to sustain IT growth. Technology by itself does not solve the problem, nor do best practices by themselves

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address energy efficiency and effectiveness, rather, a combination of energy efficiency and effective technologies and best practices.

The current EPA models reflected in the August 1, 2007 report to congress are server centric based on the underlying premise and urgency of the available data and initial focus. External storage energy consumption may be underestimated in this initial EPA report and could be several times higher than currently being reported particularly for data and storage centric environments as opposed to compute intensive datacenters. Regardless of the actual energy consumption tied to data storage, there is general consensus that data storage is accounting for an increased usage of electrical power and being looked at as a second phase of this current IT datacenter energy push.

From the EPA - Energy Issues Abound

- Over the next five years, power failures and limits on power availability will halt datacenter operations at more than 90% of all companies
- By 2008, 50% of current datacenters will have insufficient power and cooling capacity to meet the demands of high-density equipment
- Survey of 100 datacenter operators: 40% reported running out of space, power, cooling capacity without sufficient notice

StorageIO Group Perspective - What This Means

In general, there are numerous citations that can be found in the Internet from a variety of sources, studies and findings pertaining to the issues and awareness around energy issues for IT datacenters. Concerns tend to focus around volatility and exposure to "Information factories" due to insufficient or predicable power. Most people are seeing the importance of IT datacenters, their dependence on electricity to power equipment and remove waste heat via cooling as well as see the real issues of energy supply and demand along with other issues of corporate citizenship, environmental health and safety and climate impact.

While there is a general "Green" awareness growing and "Greening" of IT from an environment and climate perspective, IT datacenters are beginning to rally around to defend against energy shortages including addressing energy and effectiveness to sustain and support future growth and service delivery.

From the EPA - The Rising Cost of Ownership

- From 2000-2006, computing performance increased 25x however energy efficiency only 8x
- Amount of power consumed per $1,000 of server spending has increased 4x
- Cost of electricity and supporting infrastructure now surpass capital cost of IT equipment
- Perverse incentives – IT and facilities cost separate - - Source: The uptime institute

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Computing performance along with data storage capacity have increased several times over the past six years and can be expected to grow at similar rate moving forward, however with improvements to energy consumption, demand continues to pressure the supply chain (fuel, production, distribution or transmission) associated with powering IT datacenters. For example, over the past several years commoditization has reduced the size, energy consumption and price of servers while boosting performance however this has lead to a proliferation of so called "Volume Servers" deployment.

The relative low cost to entry and ease of deployment has lead to mass deployment of "Volume" as well as midrange and high-end servers to enable more IT services. The complexity of the IT ecosystem results in more copies of data being made to support the various servers and applications they enable further

compounding the demand for electrical power. Similarly more powerful computers are having difficulty staying cool resulting in higher energy costs and resorting to time tested techniques including water cooling along with new cabinet based cooling and power diction techniques.

There is a myth that it costs more to power and cool IT equipment than to actually acquire the hardware and in some cases that can be true however with a caveat. The caveat is an example given by the EPA where a site acquired approximately $20 Million in technology however had to spend $100 Million for a new facility to house, power and cool the equipment. More typically and generally speaking, the case is that hardware acquisition costs still outweigh energy costs, however it should be noted that when IT total cost of ownership are looked at, costs for new facilities or enhancements need to be kept in perspective since IT staff may not see actual energy bills, they may not be aware of actual electricity usage and costs.

From the EPA - IT Industry Taking Action

- Trade groups - Climate Savers, Green Grid, SNIA and others
- News reports, portals and blogs
- Vendor initiatives – HP, IBM, Dell and Sun among others

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There are many examples of industry taking action including industry trade associations such as Thegreengrid.org, Climate Savers, SNIA, Specmark and others. Most activity is centered on "Green", climate and general environmental issues including emissions, disposal, RoHS and other items, however there is a growing awareness of the real and immediate issues of sufficient and stable supply (available power) to meet demands of IT datacenters now and into the near term and long term future.

In addition, most vendors have either launched formal and comprehensive "Green" related initiatives focusing on internal as well as external aspects of their business including Dell, HP, IBM and Sun among others with other vendors are leveraging and jumping on the "Green IT" bandwagon leveraging "Green" as a marketing opportunity. You can learn more about various "Green" and power / cooling related news, initiatives, topics, approaches, articles, announcements and various links at www.greendatastorage.com or www.greendatamanagement.com.

From the EPA - What's the Governments Role?

- EPA & Department of Energy (DoE) can be catalyst
  - Stimulate competition on energy efficiency
  - Foster discussions between key stakeholders
  - Provide key recommendations (EPA report to congress – e.g. Public law 109-431)
  - Developing standardize test procedures and metrics to measure energy consumption (e.g. ENERGY STAR®) - - - Note that for now, the report and scenarios are based on model vs. actual measure per say
- Take the lead on best practice and metering federal datacenters
- Promote initiatives globally (Canada, European Union, UK, China, India)

StorageIO Group Perspective - What This Means

The role as seen by the EPA is that to serve as a strategic facilitator and to tread lightly to foster efforts and promote initiatives in the U.S. and on a global basis. The role of government and EPA is to generate awareness about best practice, however leaving definitions and implementation of specific best practices to industry. Another role beyond awareness is to promote development of measurements and metrics that can be used to gauge actual energy usage as well as gauge or establish benchmarks to determine the

effectiveness of energy consumption and IT datacenter efficiency's. This activity can be seen as an extension of the existing ENERGY STAR® program already in place for lower-end and consumer oriented electronics and appliances to extend coverage of datacenter IT equipment to assist in purchasing decisions as well as datacenter IT infrastructure resource management (IRM).

From the EPA - Public Law 109-431: EPA Report

- Purpose: assess energy impacts on and from datacenters, identify energy efficiency opportunities, and recommend strategies to drive the market for efficiency
- Goals:
  - Inform congress and other policy markers of important market trends, forecasts and opportunities
  - Identify and recommend potential short and long term efficiency opportunities and match them with the right polices
  - Identify areas for additional strategic research outside the scope of the report

StorageIO Group Perspective - What This Means

The EPA report enables congress as well as other government agencies and industry at large to better understand energy usage patterns, issues and impacts in relation to the national energy picture. While the focus of public law 109-431 has centered on this initial EPA report to congress, it serves as a wake up and take notice to the industry that IT datacenters are now being looked at as much more of a strategic importance to commerce and the nation similar to how traditional factories have been in the past.

Several initial opportunities to improve power efficiency's are cited including implementing best practices combined with deployment of more efficient and energy effective technologies. The EPA report and subsequent discussions should help drive industry to support IT datacenters to cope with their future growth and continued demand for electricity while optimizing their energy footprint in a stable manner.

From the EPA - Findings from EPAs Report to Congress

Trends in Datacenter energy use

- Sector consumed about 61 billion kWh in 2006
  - Equates to about 1.5% total U.S. electricity consumption and about $4.5B in costs
  - Federal sector consumed about 6 billion kWh at a cost of about $450M
- Projected to increase to 100 billion kWh in 2011
  - Equates to about 2.5% of total U.S. electricity consumption and $7.4B in spending

StorageIO Group Perspective - What This Means

By way of comparison, U.S. household's ranges from 20-28% of electricity consumption in the U.S. which makes the IT datacenter numbers seem rather small by comparison. Given that in the EPA report, external data storage accounts for about 5% of the total power consumed by IT datacenters, which equates to about .075% of the total U.S. electricity consumption, a question that might be asked is why spend time and money addressing energy and environmental or "Green" topics on such a relatively small piece of a bigger global environmental issue.

What may not be as obvious is that IT datacenters tend to be concentrated or dense area of energy use and have a requirement for 7x24x365 continues operations coping with limited disruptions via alternate power supply or battery backup UPS systems. The answer is a bit more involved however can be summarized as the current issue with and for IT datacenters is not as much about reducing CO2 and associated greenhouse gases from energy emissions, those are collateral benefits and issues. Rather, the real and

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current issue is tied more to energy supply (fuel, production, distribution) availability and demand for concentrated users of electrical power. This is not to say that "Green" topics including technology disposal, EHS and other issues are not important or relevant, rather, energy supply and demand are real issues that if not currently, within 9-18 months will be encountered by most data centers of all shape and size in the U.S.

Identify Key Barriers to Energy Efficiency

- Lack of efficiency definitions for equipment and datacenters
  - Service output difficult to measure, varies among applications
  - Need for metrics and more data as well as how to account for performance
- Split incentives
  - Disconnect between IT and facilities managers
- Risk aversion
  - Fear of change and potential downtime in that energy efficiency is perceived as a change with uncertain value and risk

StorageIO Group Perspective - What This Means

There are several key barriers to energy efficiency identified in the EPA report including lack of consistent and comprehensive energy efficiency definitions for equipment or datacenter power usage. The useful effectiveness of power consumed in terms of effective work output is also difficult to measure or estimate. Thus there is a need for more measurement, metrics and data to account for performance and energy consumption as a form of energy effectiveness in addition to making equipment more energy efficient.

Moving forward, it will not be enough to make a piece of IT equipment consume less watts or produce less btus, IT equipment also needs to enable more useful work to be performed per unit of energy consumed in a given time interval to be more effective. There also needs to be more awareness by IT professionals of issues and impacts of facilities and vise versa so that facilities people understand the demands of IT equipment and levels of delivered service requirements.

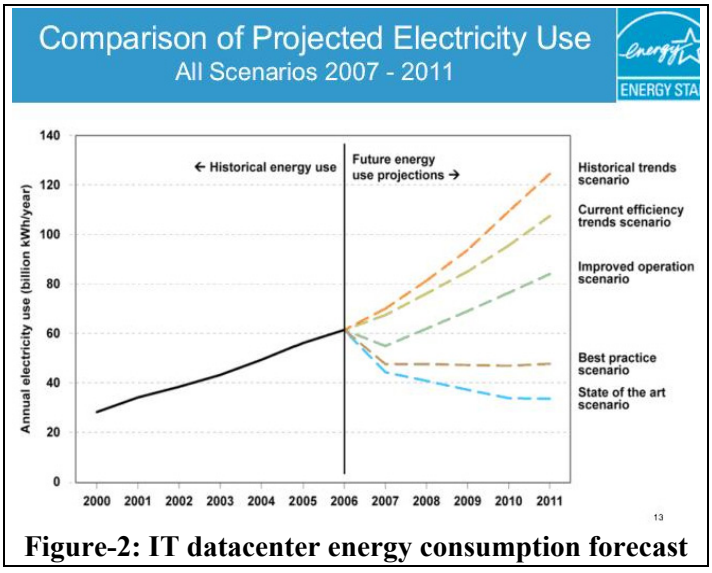

Figure-2: IT datacenter energy consumption forecast

Figure-2 shows electrical consumption for IT datacenters based on usage models from 2000 through 2006 with five potential future consumption scenarios. Note that while some combination of the above scenarios could result in reduced energy consumption, it can also be expected that what ever energy savings achieved may be consumed by growth and expansion of IT equipment and related cooling or infrastructure overhead. In essence, IT datacenters need to secure their future power footprints via optimizing and leveraging what energy resources they have available in addition to whatever new net energy capacity may enter the energy supply picture. For IT datacenters, energy management becomes a self-managed proposition of maximizing energy consumption to insure future availability.

Figure-3 shows a breakdown chart from the EPA report of how power is allocated in the typical datacenter used in the report mode. In the EPA report mode, approximately 50% of energy on average is being consumed for heating ventilation air conditioning (HVAC), power conditioning and distribution

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with the balance consumed by IT equipment. There is a need to gather more reflective metrics from a wide range of datacenters representing different workloads to paint a more representative IT datacenter picture in the future. With better metrics, models and reporting, subsequent reports and forecast models should show more about actual energy usage patterns in the datacenter including by different IT equipment categories.

The initial focus of the EPA report is around servers with subsequent investigations to look at storage among other topics. Your actual energy consumption will and should vary from those shown in the EPA report based on your ratio or mix of servers, storage and networking equipment along with the overall age and affiance of the technology in our IT datacenter. In the EPA report model, volume servers are servers with high volumes of sales, low cost, commodity used for large scale deployment. Likewise the model may not include special or customer servers used in ultra-large-scale corner case scenarios.

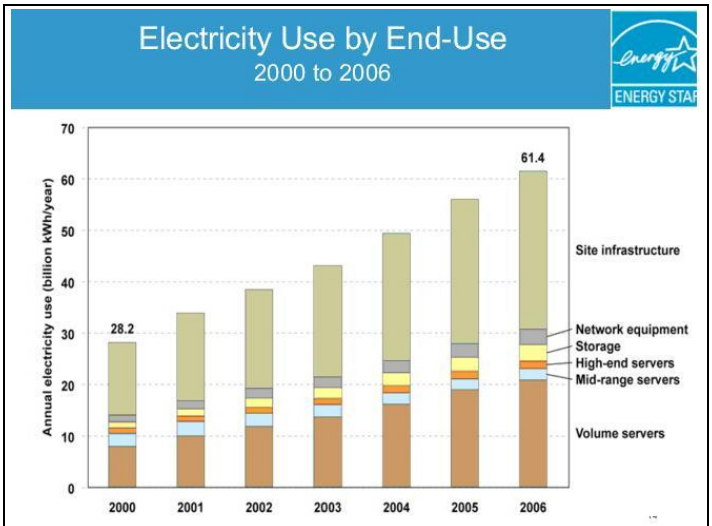

Figure-3: IT datacenter energy use by component

For storage professionals the energy consumption allocated to storage in the EPA report looks small and for some environments, particular those that are compute or server bound with less storage that can be reality. However, for environments that are data and storage intensive, the percentage of power allocated to storage can be several times higher than what is reported in the EPA report.

The report assumes based on IDC server shipment and price point data that a hard disk drives (HDD) consumes 12 watts of power. 12 watts of power may be reflective of HDD's that are used in servers, however may not be reflective the power consumed in external storage arrays. An overhead for energy consumption by external storage array controllers and mounting enclosures should also be added to each HDD deployed in enterprise external storage arrays of six (6) to eight (8) watts or higher depending on age, make, model and configuration to more accurately reflect external storage energy consumption.

The report model also assumes that approximately 10,100,000 HDD for external enterprise class storage were shipped in 2004 and based on a compound annual growth rate (CAGR) of 20% in 2010 that number will reach 37,800,000 HDD. The annual electrical consumption for enterprise storage devices is estimated to be 3.22 billion kWh for 2006 or about 4-5% of total power consumed, or 8-10% of power consumed by IT equipment (without cooling or infrastructure overhead). The bottom line is that your specific energy consumption and efficiencies should vary from those listed in the EPA report findings depending on your environment, applications and IT equipment configuration.

From the EPA - Report Recommendations

- Standard performance measurements for IT equipment and datacenters
  - Development of benchmark/metric for datacenters
  - ENERGY STAR® label for servers, possible for storage in the future
- Leadership by federal government
  - Publicly report energy performance of datacenters

  - Conduct energy efficiency assessments in all datacenters in 2-3 years
  - Architect of the capital, implement server-related recommendations in Green of the Capital report
- Private Sector Challenge
  - CEOs conduct DOE Save Energy Now energy efficiency assessments, implement measures and report performance
- Information on best practices
  - Raise awareness and reduce perceived risk of energy efficiency improvements in datacenters
  - Government partner with private industry: case studies, best practices
- Research and development
  - Develop technologies and practices for datacenter energy efficiency (e.g. hardware, software, power conversion)

StorageIO Group Perspective - What This Means

Some IT organizations have begun to instrument and enable rack monitoring or metering of power consumption as well as enabling monitoring of specific servers and IT equipment to better gauge actual power consumed in datacenters. EPA and other stake holders in industry are working on metrics as well as addressing other recommendations of the EPA report. Organizations of all size need to become energy consumption aware of their IT equipment along with facilities cooling and related usage costs. Research continues into new energy efficient and effective technologies to enable more work to be done using less energy for a net overall improvement with regards to IT equipment and cooling impact.

From the EPA - Benchmark for Datacenters

- Core recommendation of the EPA report
- Benchmark provides opportunity to compare and measure impacts of changes made to facility
  - Users can measure total facility energy consumption over time by adding sub meters to monitor specific loads within the datacenter
  - Building owners and operators can track datacenter energy use alongside their other facilities
- Role of the government
  - Forge consensus to get industry accepted benchmarks
  - DOE Save Energy Now Program, metering datacenters
  - EPA considering an ENERGY STAR® benchmarking tool

StorageIO Group Perspective - What This Means

A core theme of the EPA report to congress is to establish a measured view of electrical energy consumption for IT datacenters to gain better insight into actual energy consumption and potential impacts for supply and demand. The first step is to put basic measurements in place with more advanced measurements to reflect actual useful work performed per kW of power to follow.

The StorageIO Group feels that metrics will arrive from multiple groups across different technology domains in the IT industry addressing different needs over different periods of time cumulating in some defacto industry standards that become part of future ENERGY STAR® programs. Industry trade groups including have groups currently looking at and defining metrics that could be used to help influence and shape ENERGY STAR® initiatives pertaining to energy consumption in the IT datacenter.

From the EPA - ENERGY STAR® for Servers

- Server energy demand drives DC power and cooling needs
- Goal: Create protocol to measure server energy efficiency to allow fair competition
- Technical specification would have several key elements:

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  - Definitions of product types eligible for ENERGY STAR®
  - Test procedure for energy efficiency and computing performance
  - Proposed levels to set the bar: near term (i.e. Tier 1) may include power supply efficiency; longer term (i.e. Tier 2, replacing Tier 1) would be a more holistic metric (system efficiency)
- Draft framework discussion document available for stakeholder review

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When the EPA mentions Tier 1 and Tier 2, this is not referring to tiers or types of servers or storage. Instead Tier refers to of the EPA ENERGY STAR® specification and evolution to include measuring and reporting on energy usage including efficiency and effectiveness to support various workloads and applications. EPA report recommendations for energy efficiency improvements center on low lying fruit specifically enhanced power supply efficiency, cooling and best practices. The EPA favors more efficient technology however they are not making any mandates on what to do, or how to do it. Federal IT datacenters are however mandated under law to improve their energy efficiency and effectiveness.

From the EPA - Take Aways

- Rising energy supply (availability), security (stability) and climate change concerns
  - Emergence of green economy but standard metrics and energy transparency needed
- Financial and reputation risk associated with doing nothing
  - Boardrooms, investors and customers taking notice
  - Energy efficiency should be a first resource in an action plan
- Datacenters a key economic and CO_2 reduction opportunity
- Stay tuned for EPA & DOE plan to implement recommendations
- Track progress at www.energystar.gov/datacenters and http://hightech.lbl.gov/datacenters.html
- The EPA URL http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency#epa

StorageIO Group Perspective - What This Means

Low hanging fruit for datacenters when it comes to power optimization involves improving efficiency of HVAC cooling resources, implementing best practices, server consolidation and increasing effectiveness of energy consumption. Secondary activities include addressing energy effectiveness and efficiency of storage related energy consumption for data storage intensive environments. Energy providers such as PG&E in California and other regional utilities are providing energy incentives for customers who replace existing servers and IT equipment with more energy efficient models. Best practices include consolidating under utilized IT equipment, server virtualization and powering down un-used or dead servers.

Energy costs and CO_2 emissions vary by location and type of fuel used for electrical power generation, thus costs and emissions mentioned in this EPA report are relative averages. Specific geographies including the New York northeast corridor, Washington DC metro and the West Coast particularly Los Angeles and San Francisco bay areas have been identified as locations with power constraint issues. Power constraints issues are a combination of concentrated demand and competition for energy, limitations on transmission and even distribution in specific neighborhoods or individual buildings.

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While IT datacenters account for about 1.5% of all electrical power consumed in 2006 in the U.S., that number may double by 2011, likewise, even though IT datacenters account for a relatively small overall CO_2 footprint, there are risks for business by not addressing their IT datacenter power and cooling issues as well as their broader energy and subsequent CO_2 emissions and "Green" footprints. Thus there is a the current "Greening of IT" phenomena currently taking place with the IT industry at large seeking ways to leverage and appeal to IT customers "Green" senses in order to compete in the market place. You can learn more in the article "Pace Yourself to Meet Storage Power and Cooling Needs" and "Keeping IT Green This Summer – Don't be "Green washed". Additional information is available at www.storageio.com including various reports, articles, tips and events pertaining to power, cooling, environmental, facilities and other topics for storage and IT data infrastructures. Other sites with reports, articles and useful links include www.greendatastorage.com and www.greendatamanagement.com.

Conclusion

Energy supply and demand issues for IT datacenters of all sizes will not be going away anytime soon, however improvements that can be made now and into the future can be used to support net incremental growth and expansion of IT datacenter provided services. Federal datacenters are under mandate to implement energy saving measures while supporting growth. Energy needs to be considered, managed and planned for similarly to other IT resources to support the delivery of information services including servers, storage, networks, people and facilities. With a growing awareness, IT datacenter professionals will gain tools and insight for more accurate reporting of energy consumption as well as cooling needs to remove heat from IT equipments inefficient use of energy.

Storage currently in the EPA reports represents a small percentage of total datacenter energy consumption which may vary by environment. Note that the energy cost to power servers to implement and support software for data as well as information lifecycle management tasks management may contribute to the overall energy consumption issue for some environments. Longer term, data footprint reduction, data management, best practices combined with more energy efficient technology that uses less or the same amount of power to do more useful work will help address energy consumption issues for IT datacenters.

Energy efficiency means reducing your energy consumption as well as reducing the amount of heat generated by inefficient use of power. Another approach combines improvements in energy efficiencies to reduce heat as a by product of wasted energy along with enhancing IT equipment to perform more work in a given unit of time per unit of power consumed. The net results is that the same or less power is consumed to do more useful work per time interval without having to consume additional energy for cooling results in an overall more effective solution and use of IT equipment. Thus IT organizations can deploy more energy efficient and effective technology along with best practices to achieve desired results to meet specific organizational or mandated energy requirements.

About the author

Greg Schulz, a 25 plus year industry veteran has worked in IT organizations at an electrical power generating & transmission company, a railroad as well as for storage and networking technology vendors in addition to being founder and senior consulting analyst of the StorageIO Group. Greg is extensively published on IT datacenter and data storage related topics as well as author of the SNIA endorsed book *Resilient Storage Networks — Designing Flexible Scalable Data Infrastructures* (Elsevier Digital Press).