

## Three Steps to Energy Sustainability in the Data Center White Paper

by Joe Polastre, PhD

### Introduction

Growing political, environmental and financial concerns have put the spotlight squarely on data center energy consumption recently. The enormous amount of energy consumed by data centers has gone from being a concern to a potential power crisis. Energy consumption within data centers in the U.S. is doubling every five years.<sup>1</sup> By 2010, three percent of all power consumed in the U.S. will be located directly in data centers.<sup>2</sup>

In addition, the demand for data center capacity has led to a sharp rise in IT costs. Even as the economy slows, demand for computing, storage and networking capacity increases. More demand means more power. Soon the cost to power and cool data center equipment is likely to exceed the cost of the hardware itself. Gartner predicts that power costs will be nearly 50 percent of the overall IT budget by the end of 2009.<sup>3</sup> Power is undoubtedly the dominant operating expense in the data center. So the pressure is on organizations to quickly investigate data center power consumption and develop strategies to manage it.

Despite these warning signs, many data center managers don't have the knowledge or capacity to make these crucial changes. They lack sufficient visibility into the details of energy costs and inefficiencies within a facility. Without knowledge of where power offenders live, it's virtually impossible to take the steps needed to lower consumption, streamline operations and make better use of existing assets. It's one thing to know there's a problem; it's another to know how to go about fixing it. In other words: You can't manage what you can't measure.

### Image 1



According to Gartner, by the end of 2009 nearly 50% of IT budgets will be spent on energy.

So what's the answer? It is not an easy solution. It takes micro and macro views throughout the entire organization. To reduce the cost of your IT, you have to look at what it costs to run your data center on a daily basis. Power, of course, is the primary cost, and requires cost management just like running any other part of your business. Through better management of assets, more accountable management and setting clear goals for reducing energy costs and carbon emissions, most companies can double IT efficiency and halt the growth of greenhouse gas emissions.<sup>4</sup>

1.U.S. Environmental Protection Agency Report to Congress on Server and Data Center Energy Efficiency – August 2007 (HYPERLINK: [http://www.energystar.gov/ia/partners/prod\\_development/downloads/EPA\\_Data-center\\_Report\\_Congress\\_Final1.pdf](http://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Data-center_Report_Congress_Final1.pdf))

2."Why Invest in Data Center Efficiency? Risk," by Martin LaMonica / News Blog for CNET News – August 2007 (HYPERLINK: [http://news.cnet.com/8301-10784\\_3-9759557-7.html](http://news.cnet.com/8301-10784_3-9759557-7.html))

3.Gartner, Inc (HYPERLINK: <http://www.gartner.com/it/page.jsp?id=496819>)

4."Data centers: How to cut emissions and costs," McKinsey & Company – 2008 (HYPERLINK: [http://www.mckinsey.com/client-service/ccsi/pdf/Data\\_Centers.pdf](http://www.mckinsey.com/client-service/ccsi/pdf/Data_Centers.pdf))

**Three Steps to Data Center Energy Sustainability: Measure - Analyze - Act**

Energy efficiency in the data center depends on being able to clearly measure, analyze and ultimately act on strategic implementations for reducing power consumption. Once you proceed through these three steps, you must repeat them on a regular basis. Repeating these steps is truly the process of sustainability--ensuring that your operations continually adapt to the changing needs of your data center.

**Measure**

It's amazing how much power is inefficiently managed in the data center. A recent McKinsey report shows that the average data center only utilizes six percent of its servers and only 50 percent of its facilities.<sup>5</sup>

**Table 1** Steps to Energy Sustainability in the Data Center

<b>Measure</b>	Arm yourself with as much information as is practical and set a baseline for your consumption
<b>Analyze</b>	Identify offenders, waste, unknowns and uncover trends
<b>Act</b>	Adjust operations, schedules and cooling, replace, repair, turn off offending equipment, and adopt automation solutions

So first and foremost, you must figure out exactly how much energy you're currently using and where you're using it. Arm yourself with as much information as possible. Measure where and when you're consuming power to set a baseline whereby you can evaluate your progress. Also, keep in mind that the power coming into a data center is not the same as the power being used by the equipment. By measuring every step that the power takes along the way to the equipment, whether it's through the uninterruptible power supply (UPS) or the power distribution system, you can get an accurate read on what needs to be fixed. This process is true for any industry that consumes power—data centers, commercial buildings, industrial facilities, and so on.

Make sure your measurements are thorough and detailed. Don't take any shortcuts. If you want to reduce power operating costs, you have to know exactly how much you're using and how it's being used.

**Analyze**

In the Analyze Phase, you dive into the details to find precise power saving remedies. Analyze the power savings you unearthed in the measurement phase. Determine what areas are consuming the most power. There are potential energy leaks and losses throughout the data center. It has been reported that less than half of the electrical power feeding a data center is actually delivered to the IT loads to perform useful computing functions.<sup>6</sup>

What are the costs associated with those areas? Are there any significant trends you've found? In the Analyze Phase, the goal is to take the massive amount of data you've gathered and put it into a succinct and understandable context.

5."Data centers: How to cut emissions and costs," McKinsey & Company – 2008 (HYPERLINK: [http://www.mckinsey.com/client-service/ccsi/pdf/Data\\_Centers.pdf](http://www.mckinsey.com/client-service/ccsi/pdf/Data_Centers.pdf))

6 [http://www.apcmmedia.com/salestools/NRAN-66CK3D\\_R1\\_EN.pdf](http://www.apcmmedia.com/salestools/NRAN-66CK3D_R1_EN.pdf)

By looking at all these points across the data center, you can identify where your power losses are specifically located. Once you identify this wasted energy, you can take the steps to mitigate those power efficiency losses as they travel on their way to the IT equipment.

Analysis is not just about the power distribution and flow, but also how power is used by IT equipment. Continuous, real time measurements provide insight into when your IT equipment is in use, and how much of its capacity is utilized. Tracking idle periods and usage patterns identifies candidates for virtualization, improperly configured equipment, and gross offenders of power relative to their peers.

These types of suggestions enable you to put in place an IT reduction strategy, complete with actual data to predict future power consumption.

### **Act**

Once you've done your measurements and have analyzed and identified your exact energy inefficiencies, you're ready to put together a strategy on which you can act.

By putting policies and strategies in place, you can measure every tier of the data center—servers, storage, racks, cooling systems—and analyze and identify equipment that's not being used in an efficient manner. Once you've identified the things that aren't performing up to your specifications, you can act by employing new policies, by consolidating equipment using new techniques such as virtualization, and by rescheduling jobs to run more efficiently. Saving one watt at the server component level can save up to another 1.84 Watts without doing anything else—a total saving of 2.84 Watts.<sup>7</sup>

It's not just about optimizing the facility and equipment. You can adjust how people perform their jobs in ways that could result in energy reduction as well. Day-to-day operations management determines what applications run where. You can adjust where applications run to take advantage of the most efficient servers for that task. You can also incorporate new software, replace faulty equipment, and turn off equipment that isn't being used.

Here's another reason to act. According to the EPA, enterprises can save up to \$4 billion annually in their data centers by becoming more efficient.<sup>8</sup> Furthermore, many utilities are offering incentives for every kilowatt-hour saved, as long as you can prove the reductions.

### **Repeat Measure – Analyze – Act Over and Over and Over:**

This isn't a "one and done" process. Not even close. If you do this process just once, you might reduce your energy usage initially, but eventually entropy will set in and you'll go back to the same old problem—energy consumption that you can't sustain.

The Measure – Analyze – Act process of energy conservation in the data center is truly an act of sustainability. By continually measuring, analyzing and acting by putting the right strategies and processes in place, on a day-by-day basis, you'll be able to sustain optimized energy usage, reduce carbon emissions and lower costs in the data center.

8. "Emerson Shows Data Centers How to Take the Heat Out of Energy Costs" (HYPERLINK: [http://www.emerson.com/EN-US/INNOVATION\\_LEADERSHIP/Pages/EnergyLogic.aspx](http://www.emerson.com/EN-US/INNOVATION_LEADERSHIP/Pages/EnergyLogic.aspx))

9. U.S. Environmental Protection Agency Report to Congress on Server and Data Center Energy Efficiency – August 2007 (HYPERLINK: [http://www.energystar.gov/ia/partners/prod\\_development/downloads/EPA\\_Data\\_center\\_Report\\_Congress\\_Final1.pdf](http://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Data_center_Report_Congress_Final1.pdf))

### About the Author

Joe Polastre is co-founder and chief technology officer at Sentilla. Joe is responsible for defining and implementing the company's global technology and product strategy.

Winner of the 2009 Silicon Valley/San Jose Business Journal 40 Under 40 award and named one of BusinessWeek's Best Young Tech Entrepreneurs, Joe often speaks about energy management and the role of physical computing -- where information from the physical world is used to make energy efficiency decisions. Before joining Sentilla, Joe held software development and product manager positions with IBM, Microsoft, and Intel. Joe is active in numerous organizations, including The Green Grid, US Green Building Council, ACM, and IEEE.

Joe holds M.S. and Ph.D. degrees in Computer Science from University of California, Berkeley, and a B.S. in Computer Science from Cornell University.

### About Sentilla

Sentilla provides demand-side energy management solutions for data center and commercial facilities. Sentilla's platform is the only solution that analyzes energy use and waste at the equipment level to create actionable profiles of an organization's energy footprint. The resulting intelligence enables companies to reduce energy consumption and carbon emissions thereby dramatically lowering operating costs. For more information, please visit the Sentilla website at [www.sentilla.com](http://www.sentilla.com).

Sentilla Corporation

California ■ London ■ Worldwide

For more information: Americas +1.650.241.0220 EMEA +44 (0) 118 963 7780

[www.sentilla.com](http://www.sentilla.com)