

Implement Data Center Energy Saving Management with Green Data Center Environment and Energy Performance Indicators



Awareness of environmental protection issues, has many industry types focusing and pursuing energy saving and carbon reduction. New green industry standards and verifications are gaining acceptance including green IT, data center, products and energy management systems, and ISO50001. Everything green is bringing a wave of green opportunities.

A ranking report on domestic energy users' energy usage index (EUI) indicates that the top three energy users are telecomm data centers, network data centers, and telecomm carriers. Their average annual unit area power consumption doubles that of a department store, the number four power user. It is clear that an information data center consumes a large amount of power per floor space and with rising cloud applications, green data centers' requirements are expected to grow as well.

Recent surveys show that IT/telecomm relevant carbon emissions have topped the global sources of GHG emissions rankings. Emissions are currently at 860 million tons per year, rapid growth is expected along with rising global demands for computing, data storage and telecomm technologies. Despite heavy investments in designing better data centers, improving equipment and data center energy efficiency,

it is estimated that global IT related carbon emission may rise to 1.54 billion tons by 2020. This shifts more and more attention toward the construction of green data centers.

Aiming at optimizing equipment energy efficiency within data centers, ATEN has developed a green data center equipment and energy performance benchmarking system to improve performance on power usage. Combining a dynamic rack cooling index (RCI) and return temperature index (RTI) with its energy saving sensor, eco-PDU devices, the system's eco-sensor software provides energy usage data accessing, diagnosis and forecasting tools to optimize energy usage, based on the system's recommendations, without dampening the reliability of the IT equipment.

A data center's IT equipment and infrastructure consume the lion's share of energy. In general, only one-third of electricity used by a typical data center goes to IT equipment, with the remaining two-thirds going to infrastructure. Reducing infrastructure power requirements, improving energy usage efficiency, and improving cooling efficiency of HVAC system has become the key of large scale data center construction projects. A data center's greening and energy saving process is a long term and continuous process that require a multi-dimensional approach instead of piecemeal equipment considerations. The first step is to identify the ingredients of a data center's infrastructure power consumption, power usage status and potential of power usage cut to shape a comprehensive solution. A strategy aimed at a single layer and isolated problem does not work. Suppliers who have skills in limited tiers gain little results in data center's green and energy saving markets.

Better data center energy saving comes from improved energy usage efficiency. That is, to apply every watt of power to its maximum benefit. You have to manage a data center's power consumption before you can talk about power efficiency. This, in turn, means to take good power consumption measurements, as you cannot manage anything without it being measured and quantified. The very first job in improving a data center's power efficiency is to take accurate measurements of the power consumed.

The intelligent rack PDU (IRP) is by far the most accurate tool in measuring power consumed by information equipment. Located within individual cabinets, the rack PDU is the last device distributing power to information equipment, and so is the best

point for taking their power consumption measurements let alone the remote on/off and ambient parameter measurement function possessed by some high end IRPs.

By working together with the most advanced software eco-sensors, ATEN's eco-PDU ensures the green data center's environment and energy performance benchmark system come true. The free-of-charge eco-sensors are critical to your energy saving goal and improve ATEN products' competitiveness. The basic features are:

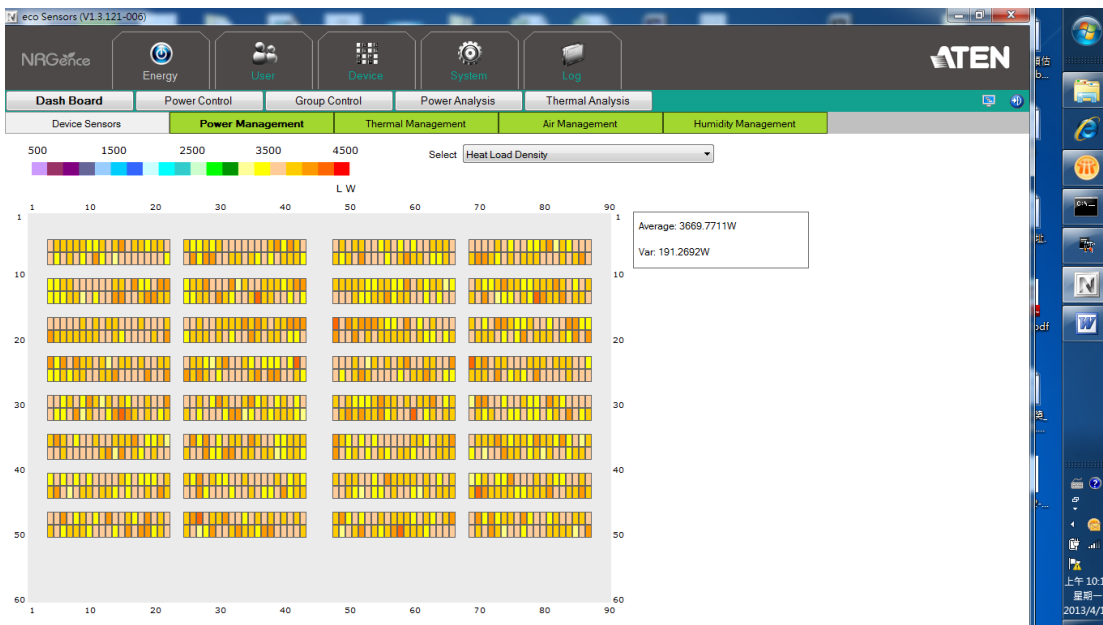
1. Graphical display of racks in data center for easy control by data center administrator

- Fundamental data center monitoring: Comprehensive monitoring display



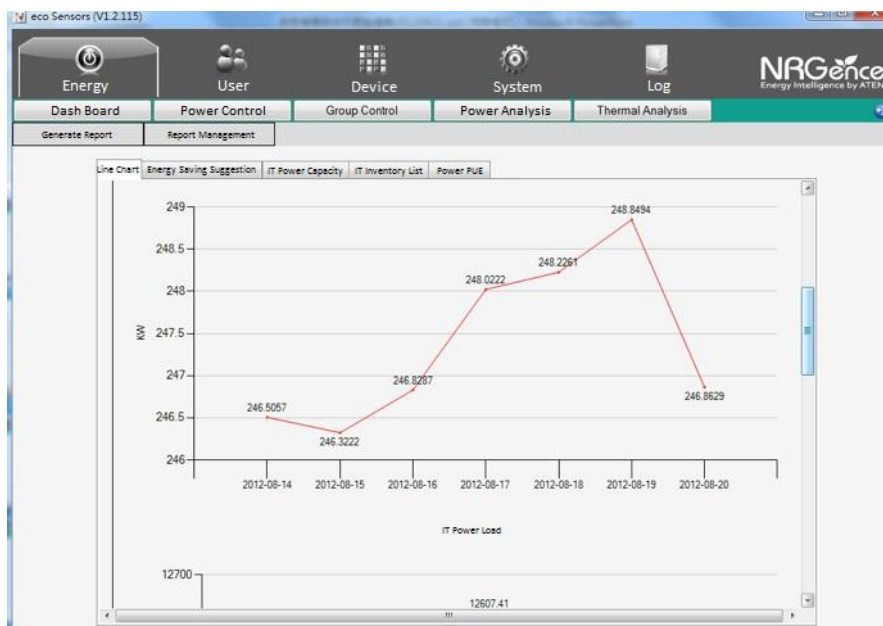
- Instant data display to enable data center administrators' direct control at their office or control center

Fundamental data center instant monitoring: Instant power status (KW)



- Historical data analysis

Fundamental data center electricity monitoring: Historical power usage report (KW)

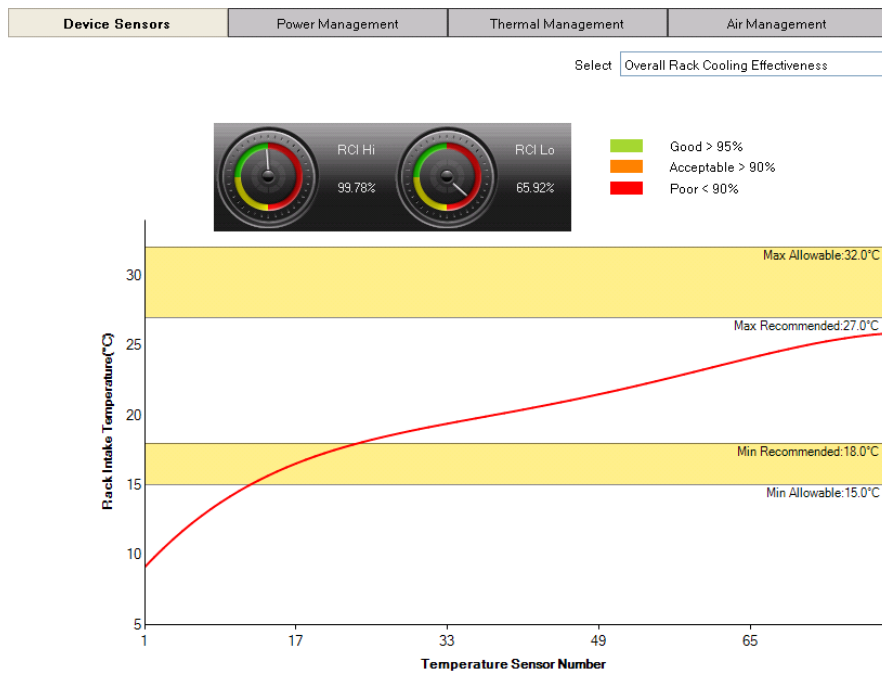


4. Ambient situation and benchmarking analysis

Fundamental data center instant monitoring: Rack Cooling Index (RCI)

$$RCI_{HI} = \left[1 - \frac{\text{Total Over-Temp}}{\text{Max Allowable Over-Temp}} \right] 100 \%$$

$$RCI_{LO} = \left[1 - \frac{\text{Total Under-Temp}}{\text{Max Allowable Under-Temp}} \right] 100 \%$$



Rack Cooling Index (RCI) and Return Temperature Index (RTI) measuring temperature, humidity and differential pressure are common features of intelligent environment protection PDUs. The RCI is the air-conditioning safety performance indicator of any data center. Defined by the ASHRAE (American Association of Refrigeration and Air Conditioning) as the main air-conditioning improvement indicator and the parameter for rack cooling efficiency measurement and appraisal, this RCI was invented by air-conditioning expert Dr. Magnus Herrlin, who is also a senior ASHRAE member and host of the DOE's data center energy expert training and certification program. ASHRAE suggests to keep data center temperature between 18~27°C. The higher the temperature is, the more energy is saved. Temperature safety and air-conditioning performance should be benchmarked with RCI and RTI parameters.

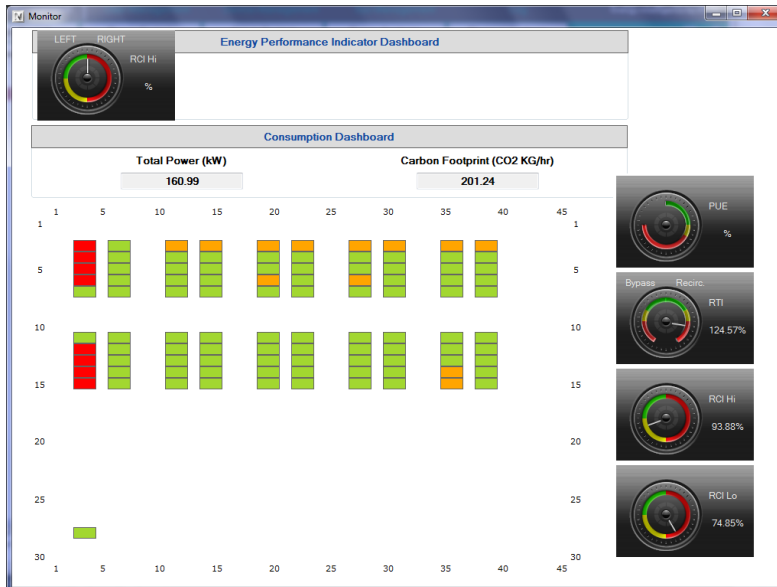
The ISO50001 directive launched in June 2011 mandates every ISO50001 unit must set its critical energy use area as its prioritized management item. A data center, for its high electricity density, is definitely a critical energy use area and so must be the top goal in ISO50001 implementation. To be certified with ISO50001, the data center must look into its Power Usage Effectiveness (PUE) indicator, the ratio of total data center power consumption VS. information equipments power consumption. This index indicates the ratios of power used and wasted by a data center, which in turn, indicates the proportions of total power input used by IT equipments. The larger the data center's PUE value is, the bigger amount of power is consumed by the motor and environment protection infrastructure for secure IT equipment operation including PDU, UPS, air-conditioning system, input/output power supply and distribution system, and lighting system. In essence, a lower PUE value always represents better energy saving in data center. Most domestic data centers' PUE value is around 2.5 while their western counterparts' average 1.8 or even lower. The PUE value is a good indicator to the level of a data center's "green". ATEN eco-sensor software's comprehensive measurement function can accurately measure data center's PUE, RCI, and RTI value, identify existing cold and hot spots, as well as racks with improvement potential.

$$\mathbf{RTI = (\Delta TAHU / \Delta TEquip) 100\%}$$

$\Delta TAHU$ = Temperature drop across the air-handler units (airflow weighted average)

$\Delta TEquip$ = Temperature rise across the IT-equipment (airflow weighted average)

$$PUE = \frac{\text{Total facility power}}{\text{IT equipment power}}$$



The American Association of Refrigeration and Air-conditioning suggests that air-conditioning power consumption should be around 1/3 of that consumed by the information equipment. Most data centers set their temperature lower level to avoid shortened server life span caused by overheating. This is indicated by a relatively low RCI. If the air-conditioning is not set too low and the RCI remains normal, then some hot air that should be removed from the data center is returned into the air-conditioning's cooling passage to cool hot air rather than IT equipment, including the server, switch and router. This means more power is consumed by air-conditioning to reach the same cooling effects. ATEN's green data center environment and energy performance benchmarking system helps data center administrators acquire PUE, RCI, and RTI energy performance index to manage green data center's power usage, identify cold and hot spots for energy usage efficiency improvement for enhanced green energy saving results. This article highlights ATEN's green data center environment and energy performance benchmarking system eco-sensors, ATEN intelligent environment protection power distribution unit (eco PDU) and the applications of couple of important energy performance indicators. As mentioned at the beginning, the key to data center's energy saving management endeavor is a software system together with intelligent environment protection power distribution unit for energy performance indicator

measurement and appraisal. We hope this helps data center administrators in selecting appropriate data center energy saving management system.