

Energy measurement use in data centre evolves

With the world running out of energy and the concomitant need to conserve energy, measuring the amount of energy used in data centres and the whole enterprise is critical. Merri Mack looks at proposed ways energy is to be measured and some of the small steps being made to implement a standard metric.

Connections Research's Graeme Philipson reported from his survey of 262 organisations that represented the big end of town and small to medium businesses (SMBs) that less than 10% of respondents are using any sort of software tool to measure or monitor the organisation's total energy consumption or carbon footprint.

Power usage efficiency (PUE), and the new data centre infrastructure efficiency (DCiE) which has evolved from data centre efficiency (DCE), and compute units per second (CUPS) are some of the eight proxy metrics being considered by the Green Grid. But the question is, which data centre energy efficiency measurement will become the standard?

The Green Grid is proposing eight proxies for evaluation and will solicit feedback from its members and the larger community of data centre and information technology professionals. Feedback will be evaluated and the final choices for a proxy or proxies will then be the subject of additional research work by The Green Grid.

Power and energy mean different things but are often used interchangeably and incorrectly. It is important to understand the difference and adhere to the correct meaning the Green Grid says.

Power is a rate. For our purposes, it is the rate at which IT equipment or data centre infrastructure consumes electricity. It is measured at an instant in time as joules per second, or watts. In a data centre, it is typically reported in kilowatts (kW).

Energy, on the other hand, is a total quantity, or an amount. It is power integrated over time and is typically measured in kilowatt-hours (kWh).

Additional confusion can occur when one realises that power is typically measured not by taking an instantaneous measurement of power, but by measuring energy use over a period of time and then dividing by that time period to compute an average power. This is done because instantaneous power at a data centre varies over time in a cyclic fashion 50 to 60 times a second. Thus, average power becomes the most meaningful measurement.

Macquarie Telecom's Aidan Tudehope, Managing Director, Hosting, comments on the need for a standard that goes beyond PUE and DCiE: "Generically, efficiency is defined as the relationship between the output derived from a specific input — in this case, electricity.

"However, a data centre and the equipment housed within it is a complex ecosystem. Measuring the energy efficiency of a data centre is

a challenge due to the many different forms of output there are from the multitude of equipment that consumes power in a data centre.

"Because the industry is yet to agree on a standardised energy-efficiency measurement for data centres, efficiency is currently only being measured at a basic utilisation level. Both PUE and DCiE only measure how much power is consumed by productive equipment such as IT equipment and hardware, as opposed to also calculating the power consumed by supporting infrastructure like cooling or lighting.

"Although there is still much progress to be made in agreeing a common benchmark, PUE and DCiE give an overall picture of energy efficiency and provide a step in the right direction towards a universally agreed standard.

"As the owner of one of the most highly certified data centres in Australia and member of The Green Grid consortium, Macquarie Hosting supports initiatives which promote transparency for data centre energy-efficiency measurements.

"However, only a clear and, most importantly, standardised approach to measuring data centre green credentials will bring an end to the current spate of 'green cloaking' by certain players in our industry."

According to Tudehope, the Australian Government Information Management Office (AGIMO) data centre strategy should consider an energy rating system similar to the star rating system used in the consumer electronics industry to ensure government data centres meet minimum criteria for energy efficiency. In addition, such systems should mandate continual improvement to foster ongoing investment in the most energy-efficient equipment and operational practices.

"There are strict security standards and operational standards demanded by government agencies such as ISO27001 that ensure vendor claims are matched by reality. Why should energy-efficiency standards be any different?" Tudehope said.

So where is the energy in the data centre used by Macquarie Hosting? Analysis conducted by Macquarie Hosting in its data centre, The

Intellicentre, showed that a large corporate data centre can consume as much as 40 times the energy of a typical Australian office housing 100 staff. The analysis identified that in some areas, 80% of power consumption in the data centre came from 20% of users. Also, storage accounted for as much as 30–40% of power consumption in the entire data centre.

Macquarie Telecom measures its energy use and calculates savings using metering and monitoring technology from its investment in new server rack technology. This enables the measurement of power right down to the rack level to understand exactly which servers are drawing the most power. The new racks are rated to various heat loads and include a sealed front door, in-built directional air-flow and intelligent power strips to enable Macquarie to effectively cool the rack and monitor power usage at the customer and socket level.

Customer education using online management tools and portals allow customers to track, analyse and adjust the IT infrastructure components that consume the most energy within their IT environment to reach optimum settings for their business.

According to the US Environmental Protection Agency, 1.8% of all global power is consumed in data centres. This is a corporate cost of almost US\$8 billion. In Australia, the cost of power and cooling is now higher than the actual hardware costs in the data centre.

The Macquarie Hosting green IT strategy is a combination of hardware, software and managed services optimised to the highest levels of energy efficiency and delivered to customers as part of their managed hosting contracts.

Improving energy efficiency in data centres can accommodate extra demand without the predicted adverse effect on the environment or rising energy costs (passed on to the customer).

Audits of data centre performance figures six months after Macquarie Hosting's implementation of the green IT strategy showed that although the number of customer-managed servers in the data centre had increased by 30%, the company had:

"Importantly, we can not look at the data centre in isolation from the services it provides. Measuring how much energy they use is crucial. It leads to visibility, which enables intelligent decisions and improvements to be made and assessed."

- Reduced the overall energy consumption by more than 10%;
- Reduced the data centre cooling power load by 26%;
- Reduced the environmental impact of the data centre by more than 600 tonnes of CO₂ emissions according to Energy Australia calculations.

All Macquarie Telecom analysis of improvements in data centre performance and energy consumption were audited by technology services specialists The Frame Group.

Not all data centres are green, but they can be CSC (Computer Sciences Corporation) says. It varies dramatically on how proactive the operators of the centres are and the physical constraints of the premises.

Object Consulting's Practice and Productivity Manager, Kevin Francis said, "One reason for concern over power usage in data centres is, of course, because of the direct relationship between power usage and cost. This concern will no doubt increase as carbon becomes more directly priced — whereupon the need to effectively measure, report on and reduce power usage will also become more and more important."

Danny Willmott, Director, Managed Computing Services at CSC, comments on their new branch circuit monitoring pilot program on power, "Importantly, we can not look at the data centre in isolation from the services it provides. Measuring how much energy they use is crucial. It leads to visibility, which enables intelligent decisions and improvements to be made and assessed."

This program will enable CSC to present a client with their energy consumption mapped to high-level business applications. For example, payroll consumed 'x' kilowatts of power and produced 'y' tonnes of greenhouse gas emissions.

The pilot program began in late 2008 and it currently doesn't have a name because it is still in the pilot stage, but can be referred to as the branch circuit monitoring program. It is expected to be completed this year. The branch circuit monitoring pilot program is a system where CSC can measure the usage on each circuit within the data centre. At the moment, most data centres can only measure overall consumption, but this will enable them to measure each different circuit (or each different client). It is a current measure that physically clips on to each circuit in a distribution board, collects consumption information, and is passed back to the main data collection centre and recorded. One of the key criteria for CSC for this program was that it would be implemented without interrupting their power and current data centre. It is simple but effective technology that allows them to measure the current on existing currents without causing any interruption.

"Enabling clients to be aware of how much power they consume is the first step to being more sustainable," said Willmott.