Energy Efficiency in Data Centres

The IT industry in recent years has been very focused on cost cutting, which given the inclement economic period we've been through is unsurprising. However, this has had a mixed impact on the drive for greater energy efficiency in the data centre. On the one hand, with the cost of powering these facilities being so high, it has made energy efficiency a very valuable objective. On the other hand, with responsibility for energy bills falling outside of the IT function, it has made data centre managers cautious about making investments in power efficient technologies when they won't have visibility of the return on investment (ROI). As we head further into the second half of 2010 however, the more favourable economy leaves us better positioned to consider a more proactive and dynamic approach to energy efficiency, and hence to the environmental footprint of data centres.

Bernard Geoghegan, Senior Vice President of International Operations at Digital Realty Trust, discusses how these steps forward can be made.

Why Energy Efficiency?

The growing momentum towards a digital economy and society makes data centres a critical and necessary part of the national infrastructure. These facilities provide high value to business, and our economy could not run without them. But they are large consumers of energy – a factor that requires careful consideration in their design, construction and operation. This has several implications, two of the most important of which are the power bill that data centres incur, and the impact they have on a business' environmental credibility.

The challenge of managing these huge energy requirements is increasingly set in the context of a regulatory/ political environment which seeks to minimise data centre carbon footprints – for

example the EU Code of Conduct for Data Centres (which is voluntary) or the Carbon Reduction Commitment (CRC) in the UK (which is mandatory).

The signs are good however that organisations are thinking green. Gartner[1] has revealed that Green IT is one of its top ten strategic technologies for 2010, while Forrester[2] has revealed that well over half (59%) of companies now include 'green' within their IT purchasing criteria. The data centre industry itself is also rapidly evolving to meet the demand for more green facilities. One of the clearest examples of this is power usage effectiveness (PUE), a metric created by members of the Green Grid, which can be used to determine the energy efficiency of a data centre. It is calculated by dividing the amount of power which is used in a data centre by the power used to actually run the computer infrastructure within it – in essence PUE is the mechanical load in relation to the IT load. The figure a company presents as its PUE is therefore a representation of how effectively its data centre uses the power put into it, with efficiency improving as the ratio moves closer towards 1.

Uptake of PUE

As of April this year, a number of significant organisations and legislative programmes have officially adopted PUE as their standard metric of choice for measuring and reporting data centre efficiency. In the US, the Environmental Protection Agency's (EPA) ENERGY STAR programme and several federal energy management programmes are making use of the metric. The Department of Energy has also introduced PUE to its 'Save Now' programme. In Europe, PUE has been adopted into the European Code of Conduct for Data Centres, and Japan's Ministry of Economy, Trade and Industry (METI) has introduced the metric into its green IT initiative and Green IT Promotion Council (GIPC).

Unsurprisingly when dealing with such a complex issue as data centre energy supply, there are some important considerations to keep in mind when using PUE. Although it has provided the industry with a 'common language' on data centre energy efficiency, there is currently little consistency in its calculation, and PUE can be used in several ways. The Green Grid provides specific and useful guidance, although some organisations are still debating smaller details, such as whether to include lighting in PUE calculations. Businesses understandably want to advertise the most favourable measurement available, but problems can arise when a "mine is better than yours" scenario occurs. If a common reference frame is not used, these comparisons between organisations will be misleading.

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The flipside to the success of the metric, therefore, is the risk that the core value of PUE (as a tool for internal measurement and improvement) is lost.

Making PUE Work

One of the resoundingly positive outcomes of PUE is therefore the provision of tangible results which show how a facility is delivering on its energy efficiency objectives.

Without this, it becomes difficult to justify investments made, or to monitor progress. Measurement is also a key component in respond-ing to the regulatory requirements that many data centres are increas-ingly subject to. Traditionally, mon-itoring and recording software hasn't been a standard part of the data centre toolkit. This needs to change. Digital Realty Trust has recently developed PowerVU, which provides real-time data on power utilisation and PUE. It helps organisations understand the ener-gy savings they make through green technologies, and hence cre-ates tangible value for environmen-tal decision making.

The point of this PUE discussion is to underline that the best way to take big steps forward in energy management in the data centre is to create a solution which works for the specific facility and the organi-sation which runs it. This may be different from what's being done elsewhere. An end-user I spoke to provided an example which high-lights the value of PUE in meeting a company's 'personal' efficiency aspirations. As part of a cam-paign to reduce their data centre's PUE, they planned to clean the facility's roof, because the reflectivity of the roof sur-face had been reduced by the amount of dirt that had built up in the past few years. By clean-ing the roof and increasing its reflectivity, they reduced the so-lar loading and in turn reduced the cooling requirement within the data centre. A slight reduc-tion in PUE was seen as a result, highlighting that what appear to be small and insignificant ac-tions can make a real difference in reducing energy wastage.

Use Best Practice and the Best Technology

The big question for many organ-isations will be how they get to the point where they have a data centre which is geared towards a good PUE score. Much of this

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can be achieved during the build, and so following best practices can make the difference between a facility which is optimised for energy efficiency, and one which is not. Digital Realty Trust has been a principal advisor to BRE Global in their development of the BREEAM bespoke standard for assessing the environmental performance of data centres. This voluntary scheme gives organisations the assurance that environmental best practices are incorporated into their facility, and this is confirmed by certification to a benchmark that is higher than regulation. By participating in a standard such as BREEAM Data centres, organisations can expect to build a data centre which is more energy efficient, and which has market recognition for the achievement. The sharing of expertise in this way can help ensure that within the data centre industry, we're all getting inspiration as to how to best approach the power management challenges.

A growing range of innovative technology solutions are also help- ing move data centres towards their efficiency goals. Often these are the product of a combination of an apparently simple insight, and a clever technological response. For example, the considerable energy requirements demanded by air conditioning units can be reduced through the introduction of 'variable frequency drives', which only spin when they are required to lower the temperature, as opposed to regular cooling systems which spin continually. Cooling is clearly a significant barrier to constructing environmentally-friendly data centres. The next major innovation to address this is 'air-side economisation' technology, which uses outside air to chill water used in cooling systems. This reduces the need for traditional, energy-intensive cooling systems, and is being deployed across the company's portfolio. At one Digital Realty Trust facility, this innovation should save an estimated 3.5 million kilowatt hours of energy annually.

A further notable energy challenge is the uninterruptable power supply (UPS) – a secure back-up which ensures IT hardware is never without power. In existing systems, 1 kW of energy channelled into the UPS will reap only 0.8 kW output – a loss of 20%. Working with industry providers, we're now using 0.9 rating UPSs, eliminating 50% of that wastage. As was made apparent with the roof cleaning example, both the small and the large changes such as these can have a significant impact on the overall efficiency of a data centre. It's difficult to use the term 'easy wins' when building a data centre, as it is an inherently complex process, particularly when financing and ROI come into play.

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However, an increasing range of solutions and approaches are available in the market, which lead to great power efficiency, and we have a duty to at least consider all of these.

We All Have a Role to Play

Data centres underpin significant elements of our economic and social lives, but their environmental footprint requires careful consideration. Despite the multiple challenges inherent in the industry, there are many trends which favour 'green data centre' construction and operation. From best practices and metrics, through to specific energy-saving technologies, we are seeing genuine progress within both awareness of the issues, and realised efficiency. The need for data centres is constantly growing, and all participants within the industry now have a role to play in meeting this demand in an environmentally responsible manner.

References:

[1]*http://www.gartner.com/it/page.jsp?id=1210613*

[2]*www.channelweb.co.uk/crn/news/2266454/firms-aware-green-issues*