The Impact of the Carbon Reduction Commitment in UK Data Centres

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On UK Data Centres

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Introduction

As part of the UK government's aim to reduce greenhouse gas emissions by at least 80% by 2050, the Department for Energy and Climate Change have implemented a scheme called the Carbon Reduction Commitment (CRC). The aim of this scheme is to reduce carbon emissions by reducing the consumption of both indirect energy e.g. electrical power and direct energy e.g. gas, coal and oil. The scheme is targeting the heaviest users in both the public and private sector and it is estimated it will affect 20,000 companies in the UK.

Due to their high electrical power consumption, data centres in the majority of cases will be affected and it will prove difficult over time to reduce emissions and at the same time sustain expansion and growth.

This paper is intended to provide a brief overview of the CRC, how it will affect businesses and how improvements to energy efficiency can be made with changes to the ICT infrastructure.

Brief Overview and Summary of the CRC

Organisations using half hourly meters will qualify for the scheme if HHM electricity consumption was greater than 6,000MWhr in 2008. The 6000MWhr is the combined electricity used from all sites using HHMs. All qualifying participants will need to register between April and September 2010 and measure and disclose their electricity consumption.

Participating organisations will have to buy allowances from the government for every tonne of CO2 they emit. The CRC will operate as a cap and trade scheme where participants can either buy or sell allowances through a mandatory auction based emissions trading scheme. The first sale of allowances will be April 2011 and will cover 2010 and 2011 emissions. The allowance price will be £12 per tonne of CO2 and is fixed for the first three years.

As a general guideline 1 kWh of electricity will produce 0.537kg of CO2 and the following table is a general estimate of typical consumption vs. allowance costs.

MWh	CO2(kg)	Cost
6,000	3,222,000	£38,000
10,000	5,370,000	£64,440
20,000	10,740,000	£128,880
30,000	16,110,000	£193,320
40,000	21,480,000	£257,760

A league table will be published based upon performance and made available to the public on the Carbon Trust's web-site. Penalties and bonuses will be administered depending upon the position in the league table.

Further information can be obtained from the first draft User Guide March 2009 through the following link www.defra.gov.uk/carbonreduction

The Impact on the Data Centre

This poses some major challenges for data centre owners and operators. Because of many factors e.g. cost, site location, availability of power and broadband access etc large scale data centres that fall into the CRC category are planned for a 10 to 20 year plus lifespan with expansion and growth in mind. It is inevitable therefore that as the business expands and more servers are deployed there will be an added penalty for extra power consumption.

Opportunities for Improvement

Server consolidation and virtualisation is the obvious route to reducing power consumption. Research has shown that a server will consume approx 70% of its fully rated power load when sitting idle, therefore significant savings can be made through consolidation. Microprocessors now have new power management features and run at lesser power for more computing power and will continue to advance. However, despite all the technical advances there will come a point when the CAPEX for continuous system upgrades to reduce energy consumption will outstrip the penalties imposed by the CRC, especially as new servers are deployed year on year. Therefore action needs to be taken to a least stem the acceleration of year on year power consumption.

Better Controls through Energy Efficiency

Although server consolidation and virtualisation can bring energy improvements they often create other energy problems, especially where blade servers and cluster computing is concerned. This can occur when servers need to be clustered closely together due to the short reach of the I/O interconnect, typically 7m – 15m. The net result can be poor power load balancing and cooling resulting in hotspots and power inefficiencies.

10GBase-T as a server to server interconnect is a potential solution to this problem. Recent advancements in transceiver chipsets and initiatives by the IEEE802.3az Energy Efficient Ethernet task group have brought about a significant reduction in transceiver power with more improvements underway. As a result OEMs are now launching 10GBase-T hardware. Coupled with the major advancements in I/O throughput and reduced latency through acceleration technologies, Ethernet is now a viable option for HPC cluster computing and storage applications with Fibre Channel over Ethernet.

The 100m reach of 10GBase-T enables servers used in cluster computing to be dispersed throughout the data centre, allowing system designers to optimise load balancing and cooling accordingly. This has the potential for reduced power at greater efficiency. Having the greater reach and design flexibility to increase the number of options in which the data centre can be laid out will greatly assist in reducing hot spots and subsequent equipment failures, balancing power loading and cooling and increasing the accuracy of CFD modelling.

Although tools such as CFD software can greatly assist in the design and planning process with the data centre layout, the ratings on the device nameplates are always overstated often by as much as 25% and therefore there will always be a gap between modelled and actual running conditions. To improve efficiency and get an accurate picture of what's happening it is imperative that power consumption is measured down to device level in order to ascertain what levels of power are being consumed by which devices and where this is happening. Nexans EMAC provides real time actual data of each device enabling a complete picture to be built.

Conclusion

Although significant progress has been made with microprocessors, server power management features, equipment fans, rack airflow, cooling systems, etc in relation to power management and efficiency, much of the gains can be lost through either poor infrastructure design or lack of flexibility causing power inefficiencies.

Future designs should take into account new or emerging technologies such as Energy Efficient Ethernet, which offers great potential for power and cost savings through lower powered and better managed devices as well as design flexibility of the network architecture.

By defining a roadmap and migration path which determine the most cost effective, power saving technologies and is based upon a design which is flexible and adaptable to change, data centre managers will be better able to control power wastage and usage.