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INSIGHT

HP Fine Tunes its Strategy Around Green Computing and Energy Efficiency

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IDC OPINION

In embedding corporate and social responsibility (CSR) across the organization, HP aims to take a leading position in the marketplace in terms of communicating both environmental considerations and energy efficiency. At the customer, level there remains a high-level of confusion and a number of open questions. Top of mind are the questions: What is my organization's carbon footprint? What influences my organization's carbon footprint? What does the legislative environment look like with respect to carbon? HP intends to bring the answer to some of these questions closer to the customer, with clear messaging and detailed life cycle assessment methodology affording customers the ability to understand the environmental impact associated with purchasing HP products.

- The association of HP with environmental responsibility is reinforced through future aggressive internal targets set for energy consumption, carbon, and efficiency. HP, like any vendor communicating on CSR "green" credentials, will be judged as much by its ability to meet internal goals as by its products and solutions.

- HP's focus on environmental responsibility has resulted in a drive towards more efficient products and IT operations from an energy perspective. At the customer level, IDC believes that this drive towards efficiency is a result of a necessity to reduce overall TCO and address hot issues such as power and cooling constraints within datacenter estates resulting from high-density computing.

There are numerous point solutions in the marketplace today to address such issues, but in most cases large investment is required without solving the root cause of the problem. In looking to develop metrics around datacenter efficiency, HP has correctly identified that the key issue is energy wastage in the datacenter, and significant savings could be achieved by following a methodology that identifies and then acts to reduce such wastage.

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IN THIS INSIGHT

This insight will discuss the recent announcements made by HP with regards to corporate and social responsibility (CSR), with particular emphasis on energy efficient computing. The document will focus on:

- HP's targets with regards to environmental responsibility and methodology for understanding and reducing global impact both through operations and end-to-end across the product life cycle.
- Other initiatives/activities that HP has undertaken in the area of environmental responsibility.
- New technologies/solutions that can reduce environmental impact.

SITUATION OVERVIEW

HP has for some time recognized its role and impact on the global environment. Since 2001 HP has published an annual Global Citizenship Report that lays out for the coming year HP's internal and external targets in terms of CSR. In formally launching a "Global Citizenship Strategy," steps have been taken to position HP as a leader in educating the world on how to reduce the overall negative environmental impact attributed to IT from manufacture through distribution and operations. HP has also put a lot of effort into demonstrating how IT can help address social and economic inequality around the world.

In March 2007, HP released the latest in this series of reports entitled FY06 Global Citizenship Report (GCR), a full copy of which can be accessed using the link http://www.hp.com/hpinfo/globalcitizenship/gcreport/index.html.

The FY05 GCR highlighted three priorities for the coming year focusing on:

- **Reducing product environmental impacts** through disposal by offering multiple end-of-life service options.
- **Raising standards in the HP supply chain**, leveraging HP's $53 billion annual spend on materials, manufacture, and logistics and setting out the standards that HP expects suppliers to meet in the production and distribution of components within HP's Supplier Code of Conduct.
- **Increasing access to ICT**, recognizing that working with governmental, non-governmental, and NFP groups to increase access to ICT will help in some way to rebalance global social and economic inequality.

HP has used the FY06 GCR to re-emphasize the organization's focus on the environment, both within the supply chain and at the operational level.

- **Supply chain responsibility —** HP's spend in the supply chain in 2006 was in the region of $50 billion spent on material, manufacturing, and transportation. This high spend affords HP heavy influence but also places a heavy reliance on the supply chain to adhere to the strict standards that are set out by HP to meet goals in terms of shareholder expectation, protecting reputation and mitigating compliance issues with regards to current and future environment regulations such as ROHS.

- **Energy efficiency** arising from issues of energy security, energy cost, and the impact of energy generation on the environment in terms of greenhouse gasses, the user community is placing pressure on suppliers to deliver products that are more energy efficient. In doing so HP demonstrates an understanding of what is needed to drive down emissions from within industry together with affording the organization and customers value based around reducing energy bills and the impact on the environment.

- **Product reuse and recycling** reducing the environmental impact of the disposal of IT equipment taking a holistic view from product design, materials used and the continuation of end-of-life service offerings.

Key to the priorities set out in the FY06 GCR is the ability of HP to meet its own internal goals based on energy demand and climate change, these being:

- To increase the purchase of renewable energy in the U.S. to 50 million KW/h in 2007 from the 2006 level of 11 million KW/h

- To reduce by 20% on 2005 levels the combined energy consumption of HP operations and products by 2010.

- To improve by 2010 the energy efficiency of high-volume server systems by 50% over 2005 figures.

- To improve by 2010 the energy efficiency of high-volume printer systems by 30% over 2005 figures.

- To reduce by 2010 energy consumption and the resulting carbon-dioxide emissions from HP-owned and HP-leased facilities worldwide by 15% over 2006 levels.

Life Cycle Environmental Impact Assessment

HP has implemented a detailed five-step methodology to understand and reduce the environmental impact of HP and HP products across the entire product life cycle. The methodology has two components — measurement and offsetting — demonstrating how environmental considerations are embedded within the organization across the life cycle of any product or solution.

Manufacture

HP's five-step methodology is outlined below:

1. **Design** — The stated aim is to use HP's position in the marketplace to innovate and develop products or solutions that reduce greenhouse gas emissions. Aiming to improve the product-specific attributes, considerations are given to energy efficiency, material use and design for recyclability. Embedded in the design process are stewards to identify, prioritize, and recommend environmental considerations. Considering datacenter technology, we have seen energy efficiency increased considerably through the innovation embedded within Proliant c-class blades such as Thermal Logic technology, new fan/ blower designs, and the introduction of the Modular Cooling System. At the solution level, HP takes a more holistic view of the datacenter, bringing to market Dynamic Smart Cooling to reduce power wastage in the datacenter.

2. **Manufacturing —** HP aims to reduce greenhouse gas emissions resulting from manufacturing operations by increasing consumption of renewable energy. Recognizing that HP must focus on areas where the organization has most control this will first concentrate on internal operations with stated aims as outlined above and then externally through partner/ supplier operations. That said it is not sufficient to simply reduce energy consumption during the manufacture process. HP has demonstrated that even after reducing energy consumption by 1% in 2006 the overall carbon footprint (CO_2 $KWhr^{-1}$) of manufacture processes increased by 4% as a result of purchasing cheaper energy in the U.S. with the mix of energy generation methods shifting towards coal, for example. Today renewable energy sources represent only a small fraction of the total energy consumed by HP although referring to the U.S. aims above, this percentage will increase rapidly. The key factor here is cost of energy, as the cost delta between conventional and renewable energy in the U.S. remains lower than in Europe, which also has an impact on HP's ability to offset carbon across the two regions. Naturally, HP needs to be run as a business.

3. **Distribution —** With the aim of reducing GHG emissions in HP's distribution network, HP has hired an executive with a defined role to look into and measure the impact of HP logistics end-to-end. To date there is no formal strategy, and previously this was affected primarily through intuition. An example here would be an impact analysis of shipping versus airfreight. Shipping may have a lower environmental impact, but is it more efficient to ship more boxes per shipping container if those systems will not be sold and have to be disposed of? In reality, HP is pushing towards more shipping freight and efficiencies will be gained through HP developing a better understanding of its logistics organization and cost implications. This distribution piece then extends beyond transport to better understand factors such as packaging, location of regional sourcing facilities, and even employee commuting and travel.

4. **Usage** — HP recognizes that this component will require a long process of education and is potentially the most difficult component of the methodology to implement due to the reliance on users to follow best practices. HP can take some proactive steps such as shipping all notebooks with powersave mode on (HP estimates 60%–70% of customers will keep this mode switched on) but in the wider picture HP takes the position of educating the user and partner. Utilizing HP's knowledge base, the organization is well positioned to advise on how to best operate HP products to reduce GHG emissions. On the customer side, education takes the form of online videos and a Web site dedicated to energy. Other outward facing activities include partnerships with NFP organizations such as WWF and Sustainable Energy Europe Campaign. Internally HP employees are given incentives to use IT in the most power-efficient way.

5. **End of life** — HP intends to better control GHG emissions by maximizing end-of-life treatment options. While this is the least understood component of the methodology, as such the hardest to measure, with the impact of recycling on GHG emissions should not be underestimated due to the power-hungry processes of raw material extraction and processing. While there is a lack of information here today HP will ask questions such as the energy/carbon cost of recycling plastics versus metals.

Carbon Offsetting

Carbon-offsetting or Carbon-neutral operations are topics that have been spoken about for some time. Carbon offsetting is the process of educing the net carbon emissions of an individual or organization, either by their own actions, or through arrangements with a carbon offset provider. There has been some commitment from verticals such as government, financial services, and retail together with some announcements from within the ICT sector. HP's perspective is that this conversation must be treated with caution and complementary to the energy efficiency story outlined above. Alone, carbon offsetting may be presented as a reason not to act at the product level — if we are able to offset carbon do we need to produce more efficient systems? This also does not address issues of TCO and energy wastage in the datacenter. No commitment at the product/end-user level has therefore been forthcoming from HP.

HP has sought to offset carbon internally; one example being offsetting carbon associated with travel to U.S. events. HP is also actively investigating "offset provider" options that could be leveraged in the future, although concerns remain over elasticity and control in this new market; for example, how do we measure the real money spent on offsetting and can we really measure the impact?

European Union Legislative Environment

In 1991 the EU issued its first community strategy to limit CO_2 production and improve energy efficiency and has since issued many climate-related initiatives. 2000 saw the launch of the European Climate Change Program (ECCP) aimed at identifying and developing EU strategy to meet Kyoto protocol commitments and revised in 2005 to form ECCP II. EU interest in energy efficiency was also influenced by a number of other factors, including energy security and trading-block competitiveness.

The ECCP has three targets:

- Deliver a true internal energy market within EU boundaries
- Promote a shift towards low-carbon energy
- Deliver an action place for energy efficiency

The action plan for energy efficiency will have a significant impact on the ICT sector. This impact will be felt primarily within the printing and PC markets through energy-efficiency legislation and through promotion of energy efficiency in other ICT markets with initiatives such as energy-star (or other labeling), education, and financial incentives. There are 75 measures in place to improve the energy efficiency of primary energy consumption by 20% by 2020. These aggressive targets are being pushed by major member states such as the U.K. and Germany but there is heavy pushback from some of the accession states where rapidly growing economies are underpinned by dirtier energy production methods. Should these states commit to a target of 20%, the wider EU community will put in place a higher target of 30% across the trading block.

Product consultants will be put in place by the EU to study each sector, with a view to first advising as to the viability of legislating the specific product sector and then developing regulations with a 12–18 month lag between adoption at EU level and then in the marketplace. Today, no attention is placed on the server market as the commission focuses on PCs (inc. screens) although it is not inconceivable that servers will be considered in the near future.

Labeling will play a significant role, as users need to be aware of what they are purchasing. Today, this is already compulsory on the white goods side (fridges, washers, etc.), but voluntary with respect to ICT, with labels such as energy star. Energy star is in fact a U.S. accreditation, but the EU has agreed to work jointly to promote the label in an attempt to create a true worldwide standard. Energy star has recently been reclassified, with only 25% of new systems being compliant, thereby driving up standards across the board.

In terms of procurement, both the U.S. and EU will take a lead. For U.S. governments it is already compulsory to purchase energy star-compliant products. The EU has lagged somewhat but will foster lead markets in Europe, attempting to make the EU more competitive through the acquisition of greener technologies. IT has played a major role in driving the projected 50% productivity growth over recent years. Both the EU and HP ask the question whether IT can be responsible for 50% of energy savings over the coming years. Looking forward IT can be used to drive developments in green-energy production such as modeling applications for more efficient wind-turbines or transport efficiency.

HP Future Developments

As you have seen in this document, HP has embedded the CSR program into the design process for all products. All future products should therefore be designed to be more environmentally efficient/friendly. For the purposes of this document, we will focus on new technologies that specifically affect the datacenter.

Power Efficiency in the Datacenter

Despite shrinking form factors, datacenters are not expected to shrink over time. Application growth and performance continues to increase and this links directly to a growth in server performance requirements. With no significant change to technology, it is inevitable that in the near future the cost of powering a server over its lifespan will exceed the purchase cost of that system. As increasing energy prices and more powerful systems may make this unavoidable, users must start to take a view of the ROI associated with energy costs. In other words, users must start to measure the efficiency of their servers by looking at metrics such as business value per watt. This can be extended to allow users to take a holistic view of the datacenter and in doing so identify where power is being wasted, whether through servers sitting idle or the over-provisioning of cooling capabilities, and will be covered below when looking at HP Dynamic Smart Cooling.

At the datacenter level, HP is looking to develop a standardized metric to measure datacenter efficiency under the banner Power Usage Effectiveness (PUE). The calculation for PUE is outlined below:

PUE = Total facility power/IT equipment power

Total facility power = Building load (UPS, battery back-up, chillers, CRACs, etc.)

IT equipment power = IT load (servers, storage, telco equip, etc.)

This equation can then be extended to consider datacenter efficiency (DCE) as follows:

DCE = 1/ PUE = IT equipment power/total facility power

* For a detailed explanation of the methodology HP has used to define this metric please refer to Malone, C., C. Belady, "*Metrics to characterize Data Center & IT Equipment Energy Use*," To be published in the Proceedings of 2006 Digital Power Forum, Richardson, TX (September 2006).

These equations in combination will enable benchmarking of enterprise datacenters, allow informed decision-making during the design and build of new datacenters, while also allowing for regulation to be put in place by the EC for datacenter efficiency targets. The Uptime Institute believes that the best possible PUE is 1.3; users should target a PUE of 1.6. A high proportion of today's datacenters run at a PUE in excess of 3.0.

We know that today most datacenters are facing constraints from a power and cooling perspective. In fact, in a large percentage of datacenters, power/cooling and not floor space is the limiting factor when considering capacity. We also know that traditional deployment models have seen utilization rates in the region of 17% for x86 servers and that servers continue to consume power/emit heat even when sitting idle. PUE can be positively affected by reducing these inefficiencies and the market is already taking action by deploying technologies such as virtualization. In fact, PUE can also be used as a tool to break down the traditional siloed operations of stakeholders such as facilities and IT managers. PUE can be used as a tool to afford a better understanding of how IT is being used to generate business value. In extreme cases it could be used to demonstrate that replacing the entire datacenter

infrastructure with more efficient systems could be more cost effective than building a new facility, a consideration in the minds of many enterprises today.

PUE has already been adopted by standards bodies such as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) of which HP is a founder member, together with the Green Grid. The Green Grid highlighted the issue of datacenter efficiency as the most important issue facing technology providers and their customers in February 2007. The Green Grid is the first consortium of vendors and customers chartered to take a holistic view of the computing ecosystem, with a focus on addressing the pressing issues facing datacenter users.

Server Power Efficiency

While power efficiency has been embedded into HP's design process, the degree to which it affects design is determined by the energy acquisition cost (EAC) ratio.

EAC = 3 year energy cost/acquisition cost

At the low end, EAC will be close to 1. In other words, the cost of powering a low-end server across three years will be close to the initial purchase cost of that server. High-end systems will have an EAC closer to 0. The higher the EAC the more power sensitive the system, therefore we will have an increased focus on cost from a power efficiency perspective across the product life cycle through the introduction of new power technologies such as HP Thermal Logic in c-class blades and HP Power Regulator built into HP servers. The cost metric for products such as Superdome will remain on efficiency through consolidation and utilization together with initial acquisition cost.

HP Dynamic Smart Cooling

Estimates assume that around 63% of total power into the datacenter is consumed by cooling. Cooling today is deployed in a manner akin to that of traditional server deployment scenarios, to meet peak demand. As a result in most cases power capacity is vastly over provisioned. Understanding better the thermodynamics of the facility can afford significant energy savings, estimated by HP to be in the region of 20%–45% with Dynamic Smart Cooling (DSC).

HP DSC is a solution that will dynamically provision cooling capacity across the datacenter according to real-time requirements. The goal of DSC is to drive down datacenter TCO through dynamic management of CRAC units, eliminating over-provisioning of cooling. DSC gives universal management over any variable capacity CRAC system or room. HP DSC works by correctly provisioning the existing cooling capacity across the datacenter, achieving significant savings this way.

The system measures air temperature entering the server through a distributed thermal sensing network across the datacenter, both at rack and zone levels. Once deployed the system works through an initial "commissioning phase," where the impact of each CRAC on overall datacenter thermals is measured by gradually reducing the power of each individual CRAC and identifying where the impact is felt. Through this process, the DSC software will automatically split the datacenter into optimal zones, which are understood to be affected by a single or combination of CRACs. A system management controller unit will then manage the sensor network, system status, and thermal system control of the datacenter to provision cooling where needed when required. Each zone can then be afforded a threshold temperature level that can be managed.

HP DSC can be an effective tool across any datacenter estate to achieve significant energy savings. However, the sales process, which includes a detailed datacenter thermodynamic assessment service often, highlights inefficiencies within the datacenter architecture that can be easily affected with minimal costs by aligning the facility with a template for datacenter best practice.

In essence there is much that can be done in most datacenters to extend the power/cooling capacity without investing in new technologies. However, DSC provides users with a tool that can afford energy savings at any level, together with providing valuable insight into the thermodynamic environment of their facilities. All such activities will extend the overall life cycle of datacenter facilities by reducing the pressures felt today on power/cooling capacity.

FUTURE OUTLOOK

IDC sees an increasing emphasis placed on power efficiency in relation to IT. This will be driven by a number of factors including:

- Energy security and the increasing purchase cost of energy per unit
- Reduction of IT TCO through increasing the efficiency of IT operations
- The future legislative environment, which will develop and enforce metrics for efficiency and purchasing, both at the product and datacenter levels, together with programs such as carbon trading

While environmental concerns today play second fiddle to economics, looking forward the emphasis on the environmental aspect of IT operations is expected to increase considerably. This will develop in line with maturing corporate and social responsibility teams that are arising in most major organizations. In doing so, organizations will increasingly look at differentiation and market based on environmental responsibility and the ability to reduce customers' impact on the environment.

In the short term, customers will look to develop strategies for increasing the life cycle of existing datacenters and in most cases this will be achieved through increasing the efficiency of existing operations, with the emphasis on wastage.

Product labeling will increase in importance. Already we see government purchasing influenced by the energy star label, and this can be expected to extend into other market segments.

ESSENTIAL GUIDANCE

Actions to Consider

For Customers

If not already the case, customers will have to carefully consider energy efficiency and environmental aspects of IT, embedding these considerations into the IT strategy for the company. Energy as a proportion of TCO will increase, as IT systems become more power hungry, and the unit cost of energy continues to rise. Compounding this are issues around power and cooling in the datacenter and the cost of construction for new datacenter facilities. For example, customers must ask if existing infrastructure will be able to support the power demand of high-density computing products such as blades if looking to extend the physical capacity of the facility. If the answer here is yes, further questions around thermodynamic impact and the ability to cool such systems need to be raised.

What is clear is that there remains a high degree of energy wastage in datacenters today. Customers should focus on these inefficiencies and in doing so will achieve significant energy and hence cost savings. For example, a server running at 15%–20% utilization continues to consume power when sitting idle and is being addressed through consolidation programs with virtualization technologies playing a key role. Cooling is a further example, constituting a significant proportion of the power consumed by the datacenter. In many cases, an incomplete understanding of datacenter thermodynamics has resulted in massive over provisioning of cooling capacity, representing a further opportunity for energy savings.

Before undertaking any activities, customers should first look to fully understand their current environment. Questions such as "does my facility conform to datacenter best practice?" should be asked, as considerable savings could be made through simple actions requiring little investment. A combination of metrics such as PUE and performance watt^{-1} should be considered as a benchmark, providing both a holistic view of datacenter efficiency and a more detailed analysis at the product level.

Looking forward it is highly likely that the European Commission will look to regulate datacenter efficiency through metrics such as PUE or equivalent metrics. PUE is important here as it distinguishes between energy wastage and that which is consumed to generate business value. Legislation will distinguish along these lines and there should therefore be no impact on productivity growth driven by IT, although we can assume that energy wastage will be heavily penalized. There are numerous solutions in the marketplace today that are designed to address the issue of hot spots, but these are point-solutions and few give consideration to the wider picture by taking efficiency into account. If your datacenter facility does conform to these guidelines further benefits can be achieved through the deployment of new technologies such as HP DSC.

Customers should give careful consideration to efficiency today to reduce TCO. IT/ facilities managers should keep in mind that efficient products are simply one piece of a very complex puzzle and a true "green IT" strategy requires a holistic view of the company's complete operations. In doing so IT/ facilities managers will position their organization well to accommodate any forthcoming legislation on efficiency or programs such as carbon trading.

For Vendors

Firstly, we must recognize that there remains today a subtle difference between efficient computing and CSR, although the two purchase drivers are closely related. IDC believes that datacenter TCO and capacity are now the two key drivers placing power efficiency considerations front of mind in purchasing decisions. However, in line with the legislative landscape, carbon could quickly eclipse TCO as a purchase driver.

Issues of efficiency, power, and cooling affect all vendors selling into the datacenter. Whether or not your product contributes to the issues is irrelevant. As long as your product is a consumer of power or emitter of heat, customer ability to deploy is affected by his or her own power/cooling constraints viewed holistically at the datacenter level. At the product level, power efficiency should be an integral component within the design-process, together with developing tools, within management applications, and solutions to allow customers to better understand their thermodynamic environment. Certainly, vendors will begin to differentiate based upon efficiency and we already see metrics such as performance watt^{-1} openly discussed but not yet published in specifications due to application specificity. We also see partnerships that involve rebates from energy providers for the purchase of energy-efficient servers.

From a services perspective, these issues represent a significant revenue opportunity. However, it is essential that the sales process should include a first-level datacenter assessment, which will identify low-hanging fruit in terms of architecture. This may negate the immediate necessity for large investment but would create an engagement model that could offer future revenue-rich opportunities at both product and service levels. Looking forward, the legislative environment will force customers to look closely at carbon footprint. Measuring this is difficult but we know that IT contributes both positively and negatively. As customers are forced to either purchase or offset carbon, insight into the carbon footprint of suppliers such as IT vendors will be crucial. The ability to provide a model that can answer many of the questions could act as a key differentiator at this point.

Labeling such as energy star could also play an important role in future tenders. Failure to meet labeling requirements could result in a company's name being removed from RFPs in segments such as government, and the wider market should programs such as carbon trading be fully implemented across the EU. In doing so, vendors should first focus internally and present themselves as a model for best practice, setting internal targets for energy efficiency and demonstrating awareness of the environmental impact of their own and other enterprise operations. From a marketing perspective it is insufficient to develop dedicated "green" products as for an outbound marketing message this would suggest that other products are environmentally unfriendly. IDC believes that if as a vendor CSR is to be taken seriously a company should present itself as a vendor of "green computing" and show awareness through demonstrable best practice together with aggressive but achievable internal targets. These targets must be met, as the ability to drive business based around green issues today is as much about credibility as it is about know how. If nothing else, using your own organization as a case study should assist in significantly reducing IT OpEx.

In General

- For both customers and vendors alike the ability to demonstrate and take actions based on environmental considerations can also act as a valuable marketing tool. While today economics drive efficiency needs, looking forward, marketing based on "greenness" is already gaining traction in the marketplace and could serve as a key differentiator in purchasing decisions. Already there are distinct differences across the EU, with Nordic countries taking a lead on environmental/ energy issues.

- With HP's approach to CSR methodology embedded through supply chain, product development, and end-of-life, HP is taking the correct steps towards the future development of green computing.

- Extending this to develop tools, service offerings, and innovative solutions to evaluate and act upon issues such as power/cooling and carbon HP meets a number of current market requirements.

- Through demonstrating internal goals and defined messaging HP, answers the environmental concerns across the complete chain, while keeping in mind business issues that customers are facing today and for the future.

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