

While IT's pervasive expansion has facilitated many positive environmental and societal gains, there are also unexpectedly severe and growing impacts from the global electronics boom. Rachel Sullivan asks whether emerging thinking on greener IT can help make industries across the board more sustainable.

# Greening IT

Information technology promised – and has delivered – us a lot, from more free time to mountains of information at our fingertips, and the idea of working from home. We use technology in many different ways, whether it be laying out documents in detail, doing our banking or shopping online or by phone, or performing dozens of internet searches daily. And all without most of us giving a thought to the real costs of using information and communication technology (ICT).

But whether it's your home PC or a search engine provider's enormous server farms, any ICT component is part of a supply chain that begins with raw materials and ends with the disposal of what is mostly toxic waste. Along the way, the chain increasingly consumes energy and emits greenhouse gases, and given the scale of global IT infrastructure now, that is a considerable impact to consider.

But so-called 'green IT' promises

to do much better on both cost and environmental fronts.

Tom Worthington is an Adjunct Senior Lecturer in the Department of Computer Science, Faculty of Engineering and Information Technology at the Australian National University and a Fellow of the Australian Computer Society (ACS), where he was the founding chair of the ACS Green ICT Group. He says IT alluded to many things, of which the 'paperless office' is probably the best known.

'Thanks to the availability of huge volumes of information, we are printing more than ever, because it seems to be human nature to do so,' he says. 'IT also promised us a more relaxed lifestyle where we could work from home, and more free time. In fact we tend to use up that free time checking on e-mail, or responding to messages from the boss at all hours.'

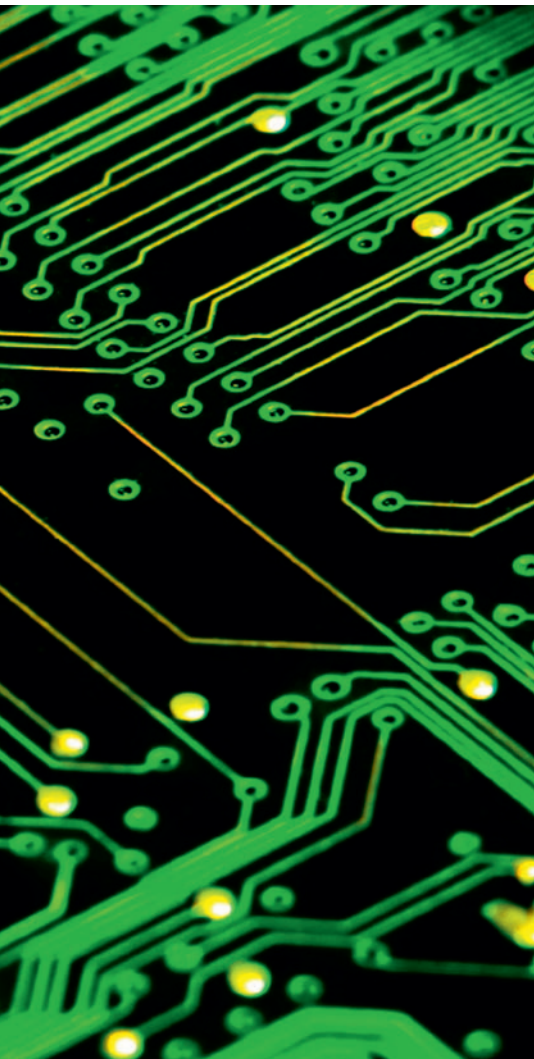
'Unfortunately this "always connected" lifestyle means that people are often not

connecting with family and what's going on in their homes.

'Meanwhile on the environmental front, computers promised to be a clean alternative to traditional dirty manufacturing industries, and while computer plants look sterile and clean, their pollution is hidden,' he adds.

This is thanks to greenhouse gases (GHG) emitted over a computer's lifecycle, the chemicals and minerals used in their construction – such as coltan and iridium, the demand for which is impacting communities and the environment in the developing world – and the mountains of e-waste they create when they are rapidly superseded, thanks to built-in obsolescence (see *Ecos* 149 for more discussion on the topic of e-waste).

It is generally accepted that IT now contributes about 1 to 2 per cent of a developed country's total emissions. In 2007 an ACS survey found that IT



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Recent computer networking technology such as 'thin client' systems can reduce energy consumption by up to 80 per cent.

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**ICT infrastructure typically accounts for more than 20 per cent of the energy used in an office building, with up to 70 per cent attributed to ICT in some offices.**

was responsible for 1.52 per cent of Australia's total national emissions, figures Worthington believes are 'very rubbery', as it is very difficult to access consumption data by government organisations. 'If anything that figure was an understatement,' he says.

Information on what the Australian Government is doing in the field of greener computing is also lacking, although many media commentators feel that an opportunity has been missed to take a leadership position on the issue.<sup>1</sup> Recent COAG meetings have encouragingly firmed up new national approaches to the complex e-waste challenge, but the final shape of these is still being decided.

**From basics to corporate server farms**  
ICT infrastructure typically accounts for more than 20 per cent of the energy used

in an office building, with up to 70 per cent attributed to ICT in some offices. As the costs of energy – and carbon – rise, there is obvious incentive to reduce these figures.

Tom Worthington says studies have shown that IT-related emissions can be easily cut by around 15 per cent, just by doing simple things like switching off computers at the end of the day. It's about basic improvements to efficiency. By using the information supply chain more efficiently overall – from the desktop computer to printers and to server farms – and employing new, more energy-efficient systems, cuts of up to 50 per cent are possible. But this undoubtedly has knock-on implications for e-waste management.

The move towards more sustainable or 'green IT' began in 1992 with the US

Government's Energy Star initiative, a voluntary labelling system that recognised energy-efficient monitors, cooling equipment and other technologies, and led to the adoption of 'sleep mode' and other energy saving practices. Today most large organisations, concerned about environmental impacts and cost-cutting, are looking to green-up their IT as part of wider moves to reduce carbon emissions and waste. According to a survey of the IDC<sup>2</sup> Green IT Forum in April 2009, 85 per cent of registrants believe greener IT will play a significant role in helping an organisation to reduce its environmental impact, with 68 per cent rating energy efficiency top-of-mind.<sup>3</sup>

Charlie Hargroves, Director of The Natural Edge Project and co-author of *Factor Five*, a new book examining how

<sup>1</sup> Green IT will hit Australian govt 'like a ton of bricks', Liam Zung ZD Net Australia. <http://www.zdnet.com.au/news/hardware/soa/Green-IT-will-hit-Australian-govt-like-a-ton-of-bricks-/0,130061702,339282527,00.htm>

<sup>2</sup> IDC is a global provider of market intelligence, advisory services and events for the information technology, telecommunications and consumer technology markets.

<sup>3</sup> IDC, 'Saving money through green IT becomes more appealing in troubled economic times, IDC says,' <http://www.idc.com/getdoc.jsp?containerId=prUS21779309>



## FOCUS

the global economy can be transformed through 80 per cent improvements in resource productivity, agrees that big changes are possible, but cautions: 'Greening a computer by making it smaller, more energy-efficient and less polluting, with equal or better functionality, does not yet spell much ecological improvement. This is because the efficiency gains made per unit can be quickly overcome by the increase in the use of such units, resulting in an overall increase in environmental pressures.'

Data centre energy savings offer huge opportunities for change, he says. 'Data centres consume more energy per square metre than any other part of an office building, and by 2020 their consumption of energy – and output of associated GHGs – is expected to be higher than air travel.'

Data centres not only consume energy by being switched on 24/7, they also put out a lot of heat and need massive cooling systems to keep them operational. The good news is that world-leading work on data centre efficiency by the Rocky Mountain Institute shows significant opportunities for improvement, and Hargroves points to Google, owner of the largest data centres in the world, as currently being engaged in an industry-leading project to reduce their energy consumption.

Although the company has traditionally been secretive about its energy consumption, recent industry estimates suggest that once its Dalles plant in Oregon, USA, is running at full capacity by 2011, it will require 103 MW of power to run – enough to supply every home in a city of 250 000 people.

The plant, one of five the search engine giant owns around the world, features four towering air-conditioned warehouses packed with tens of thousands of internet servers, and functions as a clearing house for the millions of pieces of data that stream from Google's servers each day.

Initiatives by Google to reduce the footprint of its data centres include continuous measurement of power usage by servers, storage and networking equipment to reduce greenhouse loads,



Server centres and data warehouses are huge consumers of power, but concerted efforts by companies such as Google are improving their performance. iStockphoto

and sensors to optimise the efficiency of its large data centres. The company says these efforts have cut electricity consumption and significantly reduced both its operating costs and environmental footprint, and now believes its data centres are the world's most efficient.<sup>4</sup>

A slightly different approach to making server farms more sustainable comes from i/o Data Centers, a US-based IT infrastructure provider. Rather than taking energy from the grid as Google does (its Dalles plant consumes the equivalent of a small nuclear power plant's entire output), i/o is in the process of deploying a massive array of solar panels on the 11-acre roof of its data centre that will generate up to 4.5 MW of electricity to help power its thousands of servers.<sup>5</sup> Smaller providers are expected to follow its lead.

#### Help at the desktop

In Australia, larger ICT organisations such as Hewlett-Packard and Telstra are behind moves to make IT greener at the office level, with advanced videoconferencing and telepresence services being made available to corporate customers. These, they say, are designed to reduce the high environmental impacts associated with

travel, although they have been slower to catch on than early estimates expected.

According to Tom Worthington, this is again due to human nature. 'Teleconferences don't come with Frequent Flyer miles,' he says, adding that he has been invited to teleconferences where 'lunch was provided as a bribe for attendees.' With the global economic downturn and increased environmental concerns, however, uptake of videoconferencing services are expected to increase.

Building on these concerns, Hewlett-Packard (HP) Australia recently announced a collaboration with the WWF to promote the environmental and business benefits of energy-efficient computing. Although it does involve replacing existing desktop computers with a new energy-efficient, 80 per cent recyclable HP model, the company will donate US\$10 from every sale to WWF's Coral Triangle Program to further the WWF's climate adaptation and resilience initiatives in the Coral Triangle region.

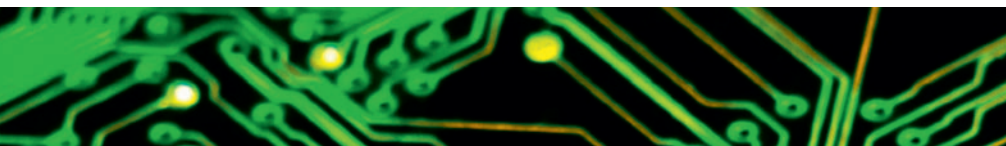
As well as encouraging individuals and organisations to invest in more energy-efficient computers, HP's 'Power to Change'<sup>6</sup> initiative is also prompting behavioural change, by getting people to switch off their computers at the end of each work day. A freely downloadable widget tracks the cumulative energy savings associated with participants turning off idle PCs when they are not in use, and allows them to follow the energy savings generated by the campaign.

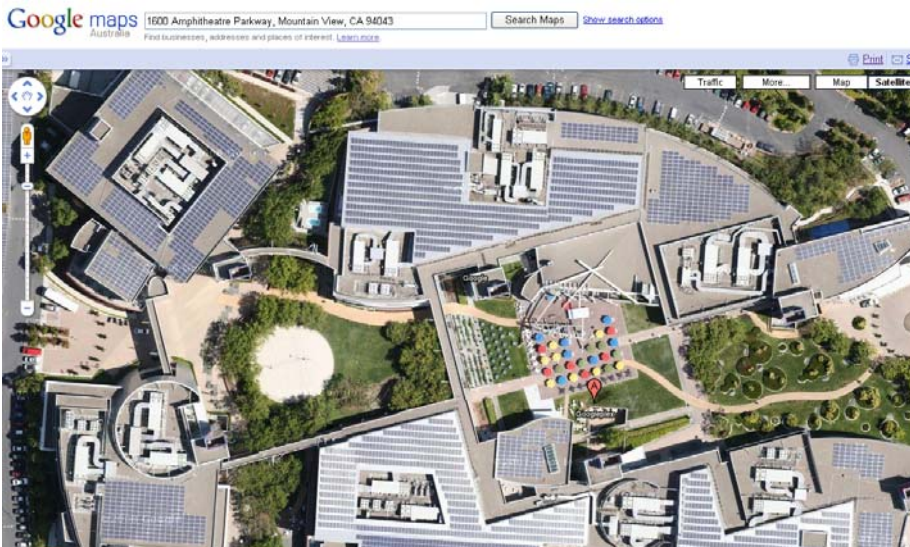
'HP's Power to Change is about people making a small environmental

<sup>4</sup> <http://www.google.com/corporate/green/datacenters/measuring.html>

<sup>5</sup> <http://www.datacenterknowledge.com/archives/2009/06/16/solar-power-at-data-center-scale/>

<sup>6</sup> [https://h30470.www3.hp.com/en\\_index.aspx](https://h30470.www3.hp.com/en_index.aspx)





The Googleplex, Google's Headquarters in Mountain View, California, recorded in the now globally popular Google Maps program. Google Maps Data

commitment each day that has the potential to have a much greater impact on the environment in the long term,' said Peter Ekstedt, Global Citizenship Manager, HP Asia Pacific and Japan. The company estimates that if 100 000 people did this every day, energy savings could total more than 2680 kilowatt-hours and carbon emission reductions could total more than 1500 kg daily. This is the equivalent of taking more than 105 cars off the road each day.<sup>7</sup>

'Rather than just jumping on the bandwagon, we believe it is important to be leaders when it comes to reducing emissions and other environmental impacts,' he adds. HP has been recycling components since 1980.

Ekstedt says the company has sought to reduce lifecycle impacts of the products it manufactures, from designing energy-efficient products, to reducing hazardous materials in their manufacture and recycling more components. 'We then help customers further reduce their environmental footprint through optimised print operations.'

Many IT companies are taking similar approaches – one initiative is integrated print services, where one centrally located printer serves around 20 people, rather than one being run at each workstation. The central printer only operates when the person comes to pick up their documents. The user selects their document from a list at the printer,

which helps to cut down on the printing of extraneous copies by mistake.

### An IT-led environmental transformation

Charlie Hargroves believes that in order to deliver an overall positive effect, the modes of use of computers in our society – not just the technology – need to be redesigned and optimised to be much more resource efficient. He is optimistic this will be achieved.

Dr Paul Campbell, Principal Consultant of Cogentia, a consulting company that looks at the commercial impacts of climate change, sees a hugely positive and facilitating role for IT, which extends the enormous contribution it has made to accelerating humans' understanding of our world, and more rapidly meeting the challenges around us.

'Reports indicate that by 2020 IT's positive impact on reducing GHGs in other industries will be five times greater than its own industry impact,' he comments.

'We also need to consider the consequences of not reducing GHGs fast enough, or far enough, and the consequences of living in a high carbon world. This will move the rhetoric forward from mitigation to adaptation issues,' he says, 'and to undergo a complete paradigm shift when it comes to inventions and innovations that involve IT supporting reduced impacts in other industries.'

'The internet of connected technologies

will become increasingly prominent, where sensors, meters, tags and actuators are connected on, for example, an intelligent power grid that manages electricity demand, ensuring there's not too much current flowing down any line, and reducing peak loads during critical periods.

'Smart water, sewerage and agricultural systems would work similarly to minimise waste by ensuring the correct level of resources are delivered when and where they are needed. Each of these smart grids will employ the intelligent use of IT, and although each element will use only a tiny sliver of bandwidth, the millions of devices in use will require fast broadband systems to be effective.'

Campbell says that while there are lots of exciting projects in Australia, they are mostly happening on a small scale. 'The rollout of the National Broadband Network will help in the creation of a true digital economy and accelerate the rate at which ICT can help other industries to reduce their footprint.'

By government working together with business, he believes Australia can be brought to the forefront of the greener IT movement. CSIRO, for example, recently developed the world's first six gigabit per second (Gbps) wireless communications link,<sup>8</sup> technology that will further revolutionise the speed at which problems can be solved.

'However,' Campbell argues, 'we need to start alerting business now on how a fast broadband network can facilitate innovative uses of IT to create new commercial "green" industries.'

'We must also move our thinking from small projects that deal with individual buildings and organisations to a larger community, city and national focus where IT can contribute on a scale large enough to make an immediate difference.'

'The Europeans are up to five years ahead of us when it comes to public policy. We need to catch up quickly so that we can reap the economic and environmental dividends.'

#### More information:

Australian Computer Society (ACS)  
Green IT Special Interest Group,  
<http://www.acs.org.au/greenit/>

See [www.factorfiveonline.com](http://www.factorfiveonline.com) for a detailed case study on 80 per cent energy efficiency improvements in a large data centre.

ACS will be running a professional development course on Green ICT, commencing at the end of August. See [www.acs.org.au](http://www.acs.org.au).

<sup>7</sup> The energy savings are estimated based on a benchmark study conducted by Lawrence Berkeley National Laboratories in 2004 and UK Energy Saving Trust in 2007; equivalency determined by EPA calculations. [https://h30470.www3.hp.com/html/faq/faq\\_WidgetCalculations.html](https://h30470.www3.hp.com/html/faq/faq_WidgetCalculations.html)

<sup>8</sup> See <http://www.csiro.au/news/MedalWinners2007.html>