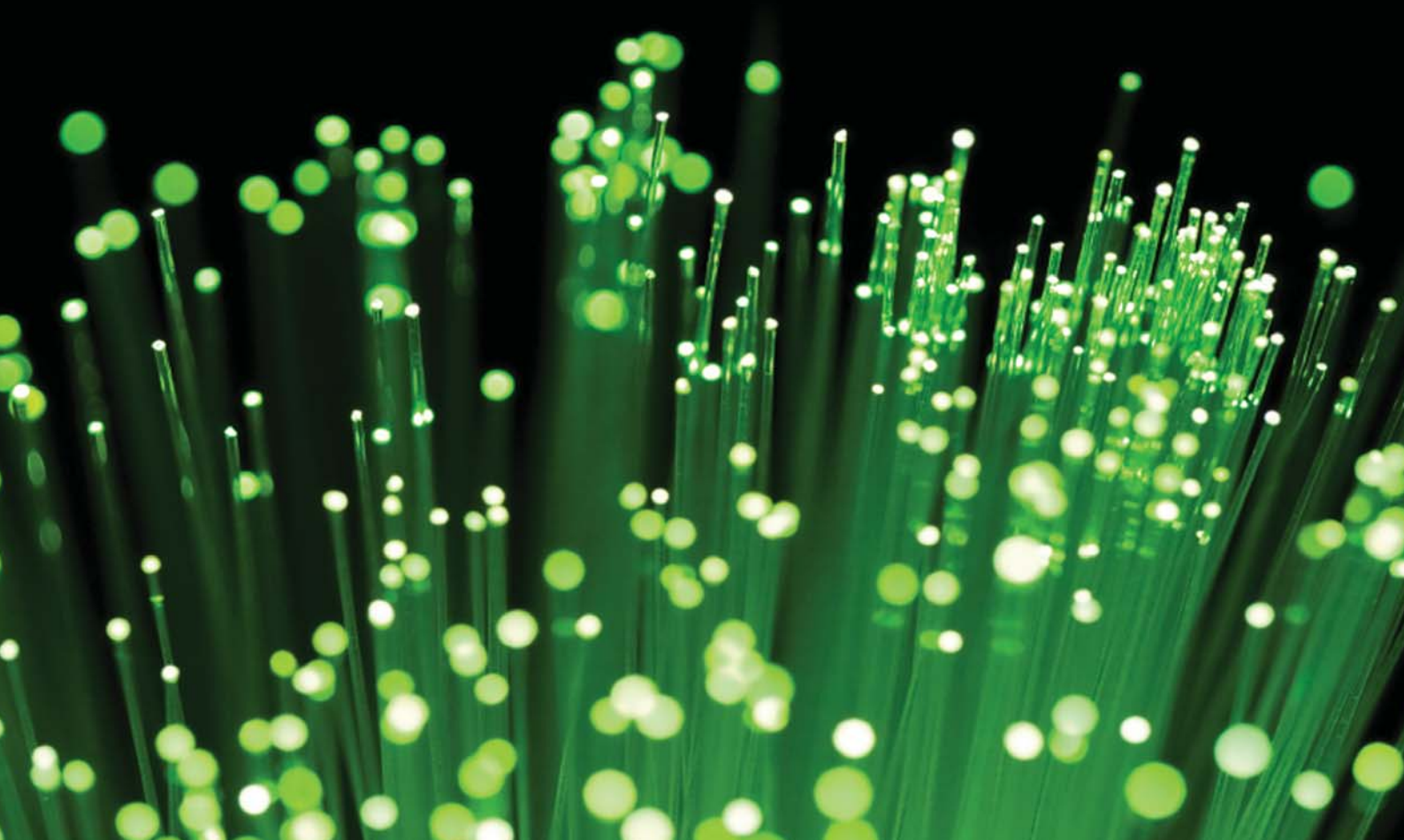
GlobalActionPlan
creating the climate for change

Green ICT Handbook

A Guide to Green ICT



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Environmental IT Leadership Team

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Introduction

Computer systems are a central part of our modern workplaces and increasingly our homes and communities. Technology continues to advance rapidly and the IT community needs to make sure this progression is focused on serving individuals, society and businesses in an efficient and sustainable manner.

IT has the potential to revolutionise the way we live and work, to integrate itself into our shared vision of a society based on environmentally sound infrastructure. As an industry, to earn the authority to take this leadership role, IT needs to get its own house in order.

Since our first ground breaking report “An Inefficient Truth”, Global Action Plan has consistently lead calls for the IT industry to play a role in the environmental challenges we face.

In support of this we run a range of flexible Green IT programmes for companies focused on reducing the environmental footprint of their computing infrastructure, whilst saving costs, improving process and maximizing efficiency.

We offer advice, tailored workshops, courses and support for greening small and medium enterprises in your supply chain.

Global Action Plan is a practical environmental charity that has 15 years experience in behaviour change and business advice. Our tried-and-tested workplace programmes deliver tangible and significant environmental and financial savings to businesses of all sizes. Green IT is one of our specialities, and we lead the Environmental IT Leadership Team (EILT) and drive improvements in the IT sector’s efficiency through research and business mentoring.

Trewin Restorick
CEO, Global Action Plan

2% of global carbon emissions come from the manufacture and use of Information and Communication Technology (ICT).

98% do not.

Is ICT part of the problem…

… or part of the solution?

The answer is both.

The 2% of global carbon emissions from ICT is growing.

However, the other 98% of global carbon emissions is crying out for solutions…

… and ICT is an important one.

For starters, progressive ICT staff can make serious improvements to energy efficiency, resource consumption and business travel.

But for ICT to be taken seriously as a solution to address the other 98%, it must clean up its own act first.

This handbook will explain how to curb your ICT department's carbon emissions and harness the positive power of ICT in making your organisation more sustainable.

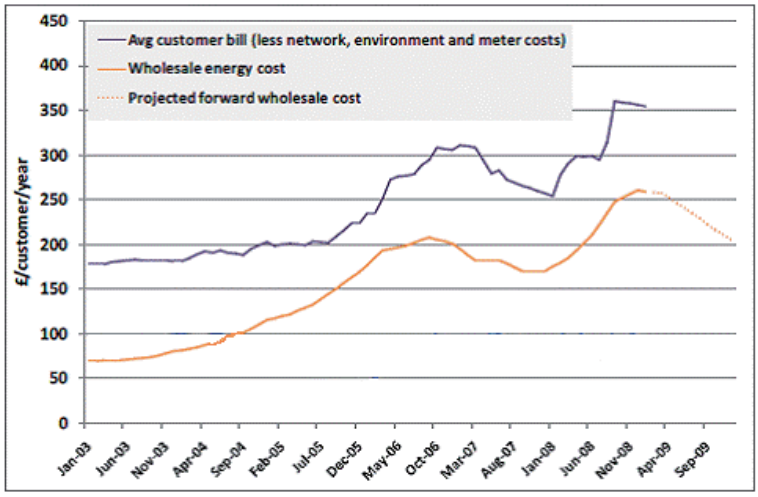
Why you should consider sustainability

From government policy to energy market economics and organisational dynamics, there are many reasons why ICT departments should consider and design sustainability into their actions. The most obvious is that being "green" simply means being efficient – not wasting money, resources or time.

BEING SUSTAINABLE SAVES MONEY (nothing is greener than the dollar!)

In 2008, wholesale energy prices increased by over 60% from the previous year[1]. Any change in the wholesale price can affect the price that energy suppliers charge their customers. Last year many businesses saw their energy bills increase significantly and some more than doubled.

Electricity customer bill and wholesale cost:



Source: Adapted from Ofgem Wholesale retail price link report – February 2009.

Individuals and organisations cannot easily control the price of energy, but the amount of energy that is used can be managed and reduced.

How much energy does ICT use?

ICT uses a great deal of energy and it is rising fast.

- ICT equipment accounts for 10% of the UK's electricity consumption[2].
- Non-domestic energy consumption from ICT equipment rose by 70% from 2000 – 2006[3] and is forecast to grow a further 40% by 2020[4].
- Data centres account for about a quarter of the ICT sector's emissions[5].

- In the USA electricity demand from data centres doubled in the five years up to 2006, meaning 1.5% of the total electricity demand in the US was from data centres and it is predicted to double again by 2011. This would result in an annual electricity cost of $7.4 billion[6].

However, there are real savings to be made and quick wins to be had.

- 30% of the overall energy consumed by PCs is wasted by being left on when not in use[7].
- 1,000 PCs running 24/7 cost around £70,000 in electricity over a year[8].
- A third of employees in the UK don't switch off their PCs when they leave the office at the end of the day, costing the UK £123 million a year in electricity[9].
- If all UK businesses shut down their computers when not in use, it would contribute 10% of the Government's Climate Change Levy target and 40% of the energy efficiency targets set by the Carbon Trust[10].

Did You Know?

More than six million PCs were left on over Christmas 2006, consuming nearly 40 million kWh of electricity – enough to cook 30 million Turkeys[11]. Together with the printers and other hardware this would have produced 19,000 tonnes of CO_2, at a cost of around £8.6m[12].

There are also significant inefficiencies in terms of servers and data retention:

- 60% of ICT departments are using less than half their available server storage space[13]
- Only 1/5 have a good working policy on data retention[14]

The Facts

ICT is responsible for 2% of global emissions of CO_2 which is on par with the aviation industry[15] and both are growing rapidly.

It is estimated that a medium-sized server has roughly the same annual carbon footprint as an SUV vehicle doing 15 miles per gallon, covering 15,000 km[16].

According to Forrester Research a data centre with 1000 servers will use enough electricity in a single month to power 16,800 homes for a year.

A significant proportion of lifetime carbon emission of ICT equipment is in its manufacture. The manufacture of one PC requires about 1.7 tonnes of raw materials and water, and consumes over ten times the computer's weight in fossil fuels.

Improve the external perception of ICT

ICT and sustainability in organisations have one very important factor in common – both are crucial to the core operation of the organisation.

When approached well, an organisation's sustainability strategy must address all operations, products, services and employee activities – making that strategy all encompassing. ICT is equally essential to the entire organisation.

Marrying the two business needs of ICT and Sustainability can help to raise the profile of both. It is very important to consider the capabilities of all departments, including ICT, when creating a sustainability strategy.

Currently this is largely a missed opportunity in most organisations. In a national Global Action Plan survey during 2007, 74% of ICT staff declared that their ICT departments are not integral to the CSR agenda set within their own organisations.

According to an MSN Environment survey completed in 2008 over 80% of employees want their workplaces to be more sustainable and they want to see positive steps taken by employers, including green ITC initiatives[17]. Sustainability can help employee retention and it can also help draw potential new employees to your organisation.

ICT is part of the solution

ICT could deliver a 15% reduction in global CO_2 by 2020, delivering a cost saving in fuel, energy and the cost of carbon of over a trillion dollars[18]. According to the Climate Group, the carbon footprint of the ICT sector is predicted to increase by 75% by 2020. However, smart use of ICT could contribute a reduction in carbon emissions in other sectors that is five times greater than the carbon emitted by the ICT sector.

What constitutes this ICT enabled reduction in CO_2 emissions? The Climate Group has identified opportunities it categorises as

"Dematerialisation" – swapping high carbon activities with low carbon alternatives such as e-billing instead of paper billing, teleconferencing instead of travelling to meetings and e-media instead of producing CDs or newspapers.

"Smart motors" – introducing ICT to the manufacturing sector to vary the amount of energy used by production lines, rather than motors either being on or off.

"Smart logistics" – ICT can facilitate better communication and planning, whether this is for haulage networks or customer delivery rounds. Many return journeys of vehicles carry no product and with 80% of fleets having less than 5 vehicles, better coordination, communication and cooperation is crucial to cutting carbon.

“Smart buildings” – our buildings and how we use them could be far more efficient. From occupancy based lighting and heating solutions to automatic systems to capture sunlight or provide shade from unwanted warmth, ICT has a role to play.

“Smart grids” – India’s power generation accounted for over half the country’s carbon footprint in 2007, but a third of this was lost in transmission making it a complete waste. Demand management and smart meters will help those supplying energy run a more efficient systems, whilst interactive real-time energy displays prompt users to consider their energy consumption.

Work with, not against, legislation

Legislation around sustainability is tightening up and increasingly requiring companies to act.

The European Community WEEE (Waste Electrical and Electronic Equipment) directive sets guidelines for disposal with an emphasis on re-using redundant equipment above recycling[19]. Obeying the producer pays principle, the WEEE directive puts the responsibility on the manufacturers and vendors of electrical equipment to collect and reuse or recycle equipment.

The WEEE directive has a clear impact on the ICT department whilst the Government policy on renewable energy tariffs, carbon reporting requirements and the new Carbon Reduction Commitment will force people to examine energy consumption in organisations, inevitably reaching the ICT department.

The Cost of Carbon

In 2008 DEFRA (Department for Environment, Food and Rural Affairs) set out the reporting guidelines on Greenhouse Gas emissions[20], with serious implications for renewable energy tariffs and those organisations that claim Carbon Neutrality. Previously, if organisations purchased their electricity from a renewable energy or green tariff they could report zero carbon emissions from the use of that electricity. Defra has now announced that renewable energy tariffs should be no different to standard electricity purchased from the electricity grid and carbon emissions are now attributable to this electricity use. The reasoning for this is two fold. Firstly, zero-rating electricity does not incentivise users to reduce electricity consumption. Secondly, renewable energy tariffs do not bring about additional carbon reductions as Utilities have a legal requirement, set by Government, to produce a certain quota of renewable energy.

Those companies that have been buying renewable electricity and claiming zero carbon will now have to report much higher carbon emissions from electricity consumption. For example, a company that was spending £1,000,000 per annum on electricity from a renewable energy tariff (and previously reporting zero carbon emissions) will now report 6,500 tonnes of carbon from this electricity. At an average of £20 per tonne of carbon, the company will now have to pay a further £130,000 to offset that carbon if they wish to claim carbon neutrality.

“Claiming carbon neutrality could add 13% to your electricity cost”

This renewable energy stance, coupled with the Carbon Reduction Commitment, gives organisations more incentive to focus on cutting energy consumption and those departments that contribute most to the bills – ICT being one of those.

The UK Government's new Carbon Reduction Commitment is scheduled to be introduced in April 2010[21]

- If your organisation (private or public sector) has one site that uses over 6 million kWh per year, or spends over £500,000 on electricity each year across all sites, the whole of your organisation will be included in the scheme. This includes businesses, local authorities and schools and could be extended to include the NHS.
- If qualifying for the CRC your organisation will be required to self audit and report energy consumption to the government.
- Based on the energy consumed by your organisation, carbon allowances will need to be purchased and submitted to cover electricity related carbon in annual cycles.
- The government will also publish league tables based on energy consumption. Penalties and rewards will be linked to the position of organisations on the league table.
- If an organisation reduces its electricity consumption over time, they will financially benefit from the CRC.

So become involved. ICT can no longer ignore issues labelled "green", "environment" or "sustainability".

And sustainability cannot be achieved without commitment and a contribution from ICT.

How do I start?

To understand how to change something, it is essential to assess it first. For this reason, it is now commonplace for organisations to measure their carbon footprint before taking steps to reduce it.

Research carried out by Global Action Plan found that a large majority of ICT departments are not responsible for or even have knowledge of the amount of energy that their departments currently consume and therefore the subsequent CO_2 emissions. The research found that:

- 86% of ICT professionals do not know the carbon footprint of their activities. Only 15% are planning to calculate this. However a further 38% would like to but do not know how to determine this figure.
- Although ICT is a significant consumer of energy, the majority of ICT departments are not directly responsible for this cost. More than half of the ICT departments surveyed do not see their organisation's energy bills and two-thirds do not directly pay their share of the energy bills.

Carbon Measurement

Measuring carbon is a straightforward process, but many people feel mystified by the concept. Within three steps an organisation can quantify their carbon emissions from ICT and establish a baseline measurement.

Carbon emissions can be calculated from the energy consumption of your ICT department's infrastructure, which is then useful in planning and prioritising projects.

Step 1 – Establish a measurement team. Creating a team to measure the carbon footprint is important. Asking each team member to carry out the measurement activity relevant to their responsibilities is key to measure correctly and to spark sustainable thinking.

Step 2 – Define a measurement timeline. It sounds basic, but putting a timeline in place will ensure that this activity, which may not be viewed as business critical, is completed in a timely fashion.

Step 3 – Undertake and collate measurement activities. The rest of this chapter explains what and how to measure and how to convert energy consumption in to a carbon footprint.

This process will calculate a carbon footprint for the energy consumed by ICT and its supporting equipment. The environmental impact of manufacturing and shipping ICT equipment is a much more complicated issue and more difficult to assess, due to complicated and opaque supply chains. See the Beyond the Energy ICT Consumes section of this handbook.

What to Measure

Take an inventory of all equipment. Below is a guide to the equipment you should look to measure - the list is not exhaustive and should be tailored to your organisation.

Desktop end user environment

- Desktops
- Laptops
- Monitors
- Thin Clients
- Printers
- Multi-Functional Devices

Telecommunication and networking

- Routers
- Wireless devices
- Boosters

Data Centre

- Servers
- Storage Drives
- Any telecoms equipment housed within the data centre
- Switch gears
- Cooling, lighting and other facilities
- Backup power supplies

You should note the total numbers, the make, model, specification and capacity (where appropriate) for each equipment type.

For some equipment types it may not be practical or cost effective to measure actual energy consumption, in which case a theoretical measurement can be used. Ensure that the source of the data is documented for future reference, for example supplier or equipment specification information. Use of theoretical data should be kept to a minimum to improve overall accuracy.

When the detailed inventory is complete, the next stage is to measure the energy consumption for each equipment type while in its various states – for example in use, standby and off.

How to measure

Using the inventory, initiate a data collection exercise to capture the required consumption data.

- Source any necessary energy meters. There are many types of devices available from sophisticated energy management systems that log electricity consumption over time to a central web console, plug in devices that display the current energy usage of equipment and clamp on meters that can measure the usage without having to unplug critical equipment e.g. servers. Select the most appropriate type of energy meter / monitoring tools for your organisation according to organisation size, your budget and type of ICT equipment.
- Involve facilities personnel who should be able to provide information on the organisation's total energy consumption and may have breakdowns by site, floor, department etc.
- Measure the rate of electricity consumption of equipment in its various modes of operation and calculate how long those types of equipment are in each operational mode during a year. Using this information you can calculate the amount of electricity that will be consumed in a year.
- When the total electricity consumption has been established, the CO_2 it is responsible for can be calculated by multiplying kWh by 0.537 to give kg of CO_2 per kWh of energy[22].

Please note that this multiplying factor is the 08/09 figure and it will change each year. Please check the Defra guidelines[23] for subsequent years.

This exercise will take time to complete, but it is worth doing it as accurately as possible to establish your baseline.

Is Your Data Centre Efficient?

The data centre energy consumption is complex to measure accurately, because a number of different servers are often present and many data centres are housed in multi use buildings without separate data centre energy metering.

The data centre manager must obtain the total baseline consumption for the data centre and then divide it into the various components within the data centre, such as servers, cooling and lighting. If possible, load variations during the day should also be measured to obtain peak load versus average load. An assessment can then be made on where to focus efforts and prioritise areas for improvement.

> A useful thing to do to understand the scale of potential benefit is to take the total measured energy consumption and cost it. Then set the bar high and assume (if you are starting from scratch) that you could save up to 50% – what financial saving does that equate to?
>
> Bear in mind that some organisations such as BT have committed to 60% savings on ICT energy usage!

The industry has also adopted a number of metrics which may add some value in assessing your position.

Power Usage Effectiveness (PUE)

PUE is used to assess data centre efficiency. It is a ratio that shows how much of the total energy consumed by a data centre is directly used to power the servers and other ICT infrastructure within it – i.e. a PUE of 2 means that for every watt your ICT equipment uses, the infrastructure to support it needs 2 watts. The average data centre has a PUE of 2.5[24] and best practice PUE has been quoted as 1.3[25], but whatever the starting point the aim is to continually reduce the PUE through data centre initiatives and energy efficiency improvements. If using PUE to assess data centre efficiency do not lose sight of the ultimate aim by focusing entirely on PUE to the detriment of the overall energy consumption.

Data Centre Infrastructure Efficiency (DCiE)

DCiE is the direct ICT equipment power expressed as a percentage of the power consumed by the data centre, which can be shown to be improving over time as it increases towards 100%.

DCiE = (ICT Equipment Power / Total Facility Power) x 100%

For an average data centre with a PUE of 2.5, the DCiE is 40% and a PUE of 1.3 would mean a DCiE of 77%.

What are the solutions?

Once measurement has taken place and a baseline established, the next steps are prioritising, planning and implementation. This should factor in the time and resources required for implementation of each project, the potential benefits and any existing or future regulations that will need to be met.

Recommended Approach

1. Measure the energy usage of all ICT assets and the associated facilities such as the data centre or machine room
2. Identify the quick wins for your organisation
3. Assess the value of longer term projects for your organisation
4. Develop a Green ICT Strategic Plan

At the end of each project or phase of projects we recommend that you measure the energy, carbon and cost savings achieved so far. By reporting financial savings made to date and projected savings, it will be easier to obtain backing and secure budget for further initiatives to green the ICT in your organisation.

Project Management Templates

Here are two links to management tools for Green ICT strategies which you could use to help manage your Green ICT initiatives.

The Cabinet Office has produced the CIO Roadmap for Green ICT:
http://www.cabinetoffice.gov.uk/cio/greening_government_ict.aspx

John Lewis Partnership uses an acorn diagram to manage their Green ICT initiatives:
http://www.greenict.org.uk/upload/documentstore/GreenAcorn.pdf

Below is a guide for each solution outlined in the following sections on the level of money and time that will need to be invested, and how much your employees will be affected by the solution.

	Low	Medium	High
Cost	£	££	£££
Time			
User Impact			

Greening the ICT (addressing the 2%)

Server Consolidation and Virtualisation


Server consolidation and virtualisation reduces the amount of physical servers that are required in the data centre, so as well as reducing the support and maintenance costs going forward, the energy consumed directly by servers and the indirect energy for cooling is reduced and the utilisation and efficiency of the remaining servers is increased.

Server virtualisation should be approached with the same planning and structure as any other ICT project, but there are some important considerations and approach guidelines:

- Are your candidate applications supported on virtualisation software such as VMWare for Windows and Solaris Containers for Unix? Many applications are now supported on a virtualised environment but there are some that will not be formally supported. You will have to discuss with the vendor for each application. With this information you will be able to compile a list of candidate applications for virtualisation.
- What are the licensing costs for virtualised servers/slices? Applications can be licensed per CPU, per seat, per server etc. which may increase your licensing costs.
- Produce a feasibility report on potential cost savings, support benefits and reduced data centre footprint on candidate applications and servers for approval from management.
- Determine how the current support arrangements may have to change including backup schedules and scheduled maintenance downtimes, how support costs may change (normally the cost would decrease), whether any retraining will be required and any other impacts of having virtualised servers in your organisation.
- Run a pilot of candidate applications and servers in scope for virtualisation to identify measurable benefits and risks i.e. power consumption, CPU utilisation, rack space saved, support costs reduced etc. Apply the benefits that are realised to the overall scale of the total number of servers in scope. This information will be essential to secure further budget and gain commitment from senior management.
- Identify the skills required for migrating applications to a virtualised environment and whether these skills exist in house. If the skills don't exist, what is the cost for external resources or new internal resources to support the migration?
- Determine the business disruption of migrating applications to a virtualised environment and the options available to minimise disruption in your organisation. If business impact e.g. at £500,000 outweighs benefits of virtualisation at £100,000 it will be difficult to get business support to implement.
- The outcome of the feasibility study and virtualisation pilot will provide input to the organisation's future ICT strategy and direction on virtualisation.

Case study: John Lewis Partnership

After an initial pilot of 20 virtual servers, JLP has rapidly increased to an estate of nearly 150 virtual servers. In 2008 more than half of JLP's computing power will be virtualised. This project has saved over £100,000 in new server purchases, 120 units of rack space, 1.5 tonnes in weight of equipment, numerous network and SAN connections, £8,000 in consumed power over five months, additional air conditioning costs and 250 tonnes of CO_2 annually.

Data Centre Optimisation

Optimising data centre operations can include repairs to air conditioning units and floor tiles, increasing the temperature setting by a degree or two and periodic cleaning of the data centre to reduce dust and debris which can impede airflow and therefore reduce cooling efficiency.

Any improvements to the operation of the data centre facilities will help increase the energy efficiency.

The EU Code of Conduct for Data Centres was launched in November 2008 and outlines the best practices that should be implemented in any data centre whether a purpose built large facility or a small server room. It took two years to develop with involvement from many data centre experts and is the key source for information on how to run an energy efficient data centre. The Code of Conduct is a voluntary initiative that organisations can sign up to. The Best Practice Guidelines and the Reporting Form are excellent tools to help any Data Centre Manager to identify and apply the changes that are required to their data centres.

The Uptime Institute estimates that the three-year operating cost of powering and cooling servers is currently one and a half times the capital expense of purchasing the server hardware[26]. This means that £500 spent on purchasing a server is actually £1250 in the total cost of ownership over a typical three year lifecycle. The Uptime Institute projects that by 2012 the cost multiplier will rise to three times the cost of purchase.

"The bottom line is that the cost of power on this scale would be difficult to manage simply as a budget increase and most CIOs would struggle to justify the situation to company board members" Rakesh Kumar, Gartner.

Thin Client Computing

Thin client computing provides users with the same interface, applications, and performance as a desktop based computer but through a slim lined desktop device. Because the thin client's performance is driven by a server instead of a local processor, there can be significant power savings when used in a large environment.

But thin clients are not always an appropriate solution – although they lead to cheaper clients with less energy consumption, they also lead to more communications and data centre applications and potentially higher energy consumption in the data centre. This balance needs to be assessed for your own particular circumstance.

Furthermore, because there is no hard drive and limited micro processing and memory requirements, there is less ecologically damaging waste, hardware upgrade cycles are extended to 10 years or more and support and maintenance costs are much lower than with traditional desktop PCs. Thin clients can help reduce energy consumption further because they produce less heat than a PC due to having few or no moving parts meaning less energy is needed for cooling the office space; they are also quieter when in operation making them ideal for classroom, library or call centre environments. With limited components, the price per thin client is significantly less, although a more powerful server will be required to run the thin clients.

Case study: Reed Managed Services

Reed replaced all of its 4,500 PCs with thin clients. To maximise their investment, they also introduced blade servers and server virtualisation technology in the data centre, and decommissioned servers in remote offices.

In one year, Reed has reduced energy consumption by 5.4 million kWh, cut CO_2 emissions by 2,800 tonnes a year, halved the number of storage drives, reduced the number of servers by a factor of 20, and cut the annual ICT budget by a fifth.

If implementing thin clients across the organisation to reduce energy consumption and realise the additional benefits, ensure that the PCs that are being replaced are reused where possible or disposed of in accordance with the WEEE directive. See Equipment Recycling and Reuse section.

Tailored Storage Solutions

In a typical data centre nearly 38% of the ICT equipment energy is consumed by storage[27]. Energy consumption for storage depends on the speed of the disks i.e. high performance disks require faster drives which consume more energy. Therefore, infrequently accessed data should be moved to low performance disk or tapes. This is an example of ensuring that the equipment used meets requirements without exceeding requirements or providing over capacity.

According to a survey by IDC the global data storage capacity requirement is growing year on year by nearly 60% and currently there is an estimated 281 billion gigabytes of data stored globally.

Some more ways to fight the war on terabytes that may be appropriate for your organisation include[28]:

- Reducing data volume and eliminating redundant data through de-duplication and compression
- Switching to fewer higher-capacity disks
- Increasing disk utilisation
- Moving rarely accessed data to tape
- Backing up to tape rather than to disk
- Virtualising and consolidating storage

Case study: John Lewis Partnership

John Lewis Partnership implemented SMSWakeup and Nightwatchman software products, both from 1E, and immediately saw savings that would amount to £100,000 a year in reduced energy bills.

By introducing NightWatchman® software, Peterborough City Council has saved £50,000 per annum on electricity and 250 tonnes of CO_2 – making a return on investment in under three months.

By introducing Surveyor® (Verdiem) software, Irwin Mitchell reduced PC energy consumption by 34%, which equates to around 107 tonnes of CO_2 per year.

Automated Power Management

There are many power management software solutions available today. Automated shutdown software will power down PCs automatically after a set time of inactivity and 'Wake-on-LAN' software will turn on equipment automatically to enable patching and software upgrades to be installed at night. Used together these tools can achieve considerable savings, as demonstrated by the case studies below.

To implement a power management solution, you may not have to purchase new software. By correctly setting the MS Windows power management settings on each PC, significant savings can be made.

To improve the power efficiency of a PC, the Climate Savers Computing Initiative recommends the following power management settings:

- **Monitor/display sleep:** Turn off after 15 minutes or less
- **Turn off hard drives/hard disk sleep:** 15 minutes or less
- **System standby/sleep:** After 30 minutes or less

Device Consolidation

Over time, it is easy for offices to become cluttered with IT equipment much of which can be underutilised, but all of which is using power. Many organisations do not have policies controlling or clear records of the number of personal devices that are issued to employees, such as laptops, mobiles and PDA's. To gain control of the number of devices and establish whether a device consolidation strategy is required in your organisation you need to work out the current equipment to employee ratios and then put a strategy in place to reduce them.

When considering imaging equipment such as printers, scanners, faxes, copiers a ratio of 10:1 is considered best practice i.e. ten employees to 1 device. To improve the ratio in your organisation replace individual printers, scanners etc. with multi-functional devices and also review the location of equipment. By placing printers in shared areas, rather than in team areas it is possible to reduce the number of printers that are required. This also has the added benefit of discouraging wasteful printing if employees have to walk a bit further to collect the printing.

For PCs and laptops the ratio to aim for is 1: 1. If your organisation has employees that have a desktop machine and a laptop, or multiple laptops then the ratio will be much higher. To reduce the ratio you will need to review the reasons for the excess equipment and overcome any operational issues that prevent taking equipment away.

People Power

Technical solutions are useful but user behaviour is a crucial piece of the jigsaw that should not be forgotten. Embedded as ICT is in people's working life, few people have been taught about the way that they use it. Much of the population has been using ICT systems for such a significant part of their life that these actions have become unconscious and habitual behaviours. By ensuring that users use the ICT equipment and software applications as efficiently as possible, energy and cost savings can be achieved.

Switching off – Encourage all employees to turn off their computers and monitors and unplug laptop and phone chargers when not in use.

87% of employees have never been asked to shut down their PC at night by their employers. It's estimated that at least 1.7 million PCs are habitually left on overnight and at weekends, wasting 1.5 billion KWh of electricity[29].

Screensavers – Discourage the use of screensavers, which do not save energy, they often use the same or sometimes more power as when the PC is active. It is much more energy efficient to set the monitor to turn off after a period of inactivity (See Power Management Section).

Printing – Set printers to duplex and greyscale print by default. If printers have a 'locked print' feature ensure that this is enabled. Locked printing discourages wasteful printing because the user has to be at the printer to physically start the print job after sending it to the print queue and lets users delete unwanted print jobs from the queue.

Email Use – As outlined in the Storage Solutions section the energy consumed by the storage of data is significant. By ensuring that users complete regular housekeeping of their email folders such as deleting unwanted emails, removing attachments from emails and emptying out the deleted items folder the storage required for email will be reduced.

Globally, 210 billion emails get sent every day which is more than 2 million emails per second[30]. The bigger the email, the bigger the impact so start by asking people to share files efficiently, rather than reducing the number of emails.

File Housekeeping – The technical solutions for reducing the amount of data stored have already been outlined, but this does not replace the requirement for employees to review the files they have stored on a regular basis and deleting unwanted or duplicated files.

How Do I Change Employee Behaviour?

The main principles behind any successful behaviour change programme apply to changing behaviours around ICT.

Information - Enabling people to make informed decisions.

- Deliver information in an engaging and positive way.
- Maximise the message conveyed with interactivity and discussion.
- Link individual actions to the bigger picture to personalise the issue and help people to recognise the power of collective will.

Measurement and feedback – Monitor the before and after picture. It demonstrates to people that real changes are taking place as the result of their actions. By rewarding and reinforcing positive behaviours, real gains can be made.

Social Interaction - When behaviours are habitual, they are so deep in our consciousness that we are barely aware of them and thus they are not open to change. Through discussion with others these actions are brought to our attention, can be challenged and potentially changed. Behavioural change is much more effective if it is approached on a group level as it doesn't threaten to exclude individuals but rather encourages change from within.

Global Action Plan specialises in leading behaviour change programmes within corporate businesses, SMEs, communities and schools. By running effective campaigns, Global Action Plan help organisations find behaviour-led solutions that centre on energy efficient usage, switching off equipment and more informed purchasing decisions. Global Action Plan believes that through a combined effort of incorporating new technologies with clear guidelines for employees relating to energy and resource usage, significant savings can result for the organisation along with reductions in energy consumption and carbon emissions.

Beyond the Energy ICT consumes

Reducing the energy that ICT directly consumes is important, but this is not the only factor to consider when thinking about the environmental impact of ICT. The entire lifecycle of ICT equipment must be considered from production to disposal.

Did You Know?

75 per cent of the total environmental impact of a PC occurs during the production process[31].

Green ICT Procurement

By reviewing your ICT procurement policy and checking suppliers' green credentials you can make an informed decision on suppliers to use and equipment to buy, with the aim of limiting the environmental impact of purchases. Remember to take into account the energy consumption of equipment that is being purchased and ask potential suppliers to explain how their products are less toxic, conserve natural resources, are designed to encourage recycling and reduce waste. Ensure that your supplier is taking action to minimise packaging and shipping and ask for evidence on how they do it. Where packaging is necessary insist that suppliers take it back and recycle it.

There are a number of initiatives to be aware of designed to assist organisations to make more informed choices when purchasing new equipment:-

The Green Electronics Council launched the Electronic Product Environmental Assessment Tool (EPEAT), a certification programme to help institutions buy the greenest computers and monitors possible. Within its first six months, nearly 600 products had been certified and consumers bought up 36 million EPEAT–certified computers[32].

Energy Star is a label which can be found on many computers, monitors, printers and other consumer electronic (CE) products to rate their energy efficiency. It is a move towards a uniform set of standards in the ICT and CE industries, but it is still only a voluntary scheme. Revisions become increasingly more stringent with improvements in technology and requirements become increasingly more demanding[33].

Office of Government Commerce
The Office of Government Commerce (OGC) is an independent office of HM Treasury, established to help Government deliver best value from its spending. Guidance on the procurement of ICT commodities and services is available from their website:
http://www.ogc.gov.uk/policy_and_standards_framework_ict_goods_and_services.asp

EU Codes of Conduct
The EU has issued a number of ICT related codes of conduct which to guide vendors and ICT users on the energy efficiency of ICT equipment and systems. Data Centres, Digital TV, Broadband Communication Equipment, External Power Supplies, Uninterruptable Power Supplies and Standby Functions all have EU Codes of Conduct related to them which can be found at this web address:
http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm

EuP is a framework that targets inefficient technology by setting eco-design requirements for Energy Using Products. It aims to improve regulation by identifying the environmental impact of the product throughout the product's lifecycle - manufacturing, in use and disposal. There is a current focus on making changes to the wasteful standby mode[35].

The RoHS_Directive (restriction of the use of certain hazardous substances in electrical and electronic equipment) is an EU directive which bans new electrical and electronic equipment containing more than agreed levels of certain hazardous substances such as lead, cadmium, and mercury[36].

Extending Equipment Lifecycle

By simply extending the refresh cycle of PCs in your organisation you reduce your organisation's environmental impact. Some manufacturers are now making efforts to find out the level of embedded carbon that is in their equipment, but it is not an easy task because ICT equipment is made of many components that are sourced from many different suppliers.

During the EILT 'Answer Time for Green ICT' event in October 2008, the clear message from the panel of ICT suppliers and industry experts was to 'sweat the assets' and get the most out of equipment before replacing, until it is known for sure exactly what level of embedded carbon is in equipment. By stretching the life of PCs by 2 years or more, the cost savings from not buying PCs can be given to fund other Green ICT projects that otherwise may not be affordable.

Aside from PCs, reconditioning or repair of equipment is often overlooked as inconvenient or costly. Why not just get a new blackberry or laptop instead of investing the time in repairing the broken parts? Environmentally this just does not make sense (the old equipment can be recycled but why recycle all the parts of a machine when only one is broken?) and financially repairing can pay dividends. Finally, people take time to get familiar with their ICT equipment and to get it working to meet their needs. A senior manager will waste hours configuring a laptop or blackberry back to the settings they previously had if the whole thing is replaced. Just repairing a part saves all of this trouble.

Equipment Recycling and Reuse

When equipment reaches the end of its useful life within your organisation, it does not necessarily mean that it can not be reused for another purpose or by someone else. There are many electronics recycling organisations which will recycle or re-use unwanted equipment where possible, in accordance with the WEEE directive, the Environmental Protection Act and the Data Protection Act. Also, look at how consumables can be reused or recycled. For example, talk to your printer cartridge supplier about arranging regular collection of used cartridges for refill and reuse.

Computer Aid International is a charity that will collect unwanted PC's, refurbish them and distribute them to schools and community organisations in developing countries. They will also supply free recycling boxes to place in your office for printer cartridges and mobile phones.

Equipment Disposal

According to Gartner research in 2007 over 51 million PCs ended up in landfill worldwide.

The WEEE (Waste Electrical and Electronic Equipment) directive means that the disposal of electronic equipment is no longer the responsibility of the user organisation. The responsibility falls to the manufacturers and sellers who should pay for the collection of equipment when it has reached end of life and either recycle or responsibly dispose of it.

Remember, when buying new equipment - ensure you are given the details of who to contact when you no longer require the equipment to arrange collection.

ICT greening the organisation (addressing the 98%)

There are numerous ways that ICT can help to green the organisation. Below are just a few ideas of how you could use ICT to ensure you still achieve your organisational aims, while following a low-carbon path.

Reducing Travel

There are several ICT tools that enable people to meet and work together without physically being in the same office or country, therefore reducing the need for business travel.

- Audio conferencing
- Video conferencing
- On-line meeting / web conferencing
- Telepresence - where attendees from different remote locations can meet and feel like they are in the same room together and can interact eye to eye and without sound or vision delay.

If your organisation does have such tools available already, to ensure you are realising measureable benefit:

- Make sure people know how to use the equipment through training and demonstration sessions and offer a good support service.
- Include in the meeting and resource booking system a survey to capture the number of attendees, approximate business miles that have been saved and the modes of transport that would have been used.
- Consider implementing a 'Green Miles' reward scheme for employees, based on the data collected at the time of booking.
- Ensure that when booking a meeting in a room with audio/video conferencing facilities priority is given to those that are using the equipment.
- Circulate a survey to employees asking if they use the conference facilities and on-line tools available to them, and if not what would need to happen to make them use these.

If your organisation has not yet introduced any of the tools outlined above then you should consider implementing such solutions. The recommended approach would be to run pilots of the various types of tools available with different teams and then ask for their feedback to learn what combination would work for your organisation.

Did You Know?

Cutting out 1 in 5 of Europe's business flights would save the equivalent CO_2 emissions of Croatia, or Kenya and Zimbabwe combined.
Source: WWF

Case study: Pearson plc

Through the utilisation of telepresence technology, Pearson has reduced time wasted by senior executives when travelling, improved the speed and flexibility of their decision-making and enhanced the work/life balance for employees through reduced travel.

Pearson has also significantly reduced transport costs and avoided over 800 tonnes of CO_2 emissions worth of air travel, equivalent to 1,185 flights from London to New York.

Home Working

Many organisations operate a successful flexible working policy and some large global organisations now claim to have over 50% of their employees working from home on a regular basis. For a flexible working policy to be successful an organisation will rely heavily on a number of technologies similar to those in the Reducing Travel section plus a robust method of remote system and network access to enable people to complete their normal work activities away from the office.

SUSTEL is a teleworking research project that was financed by the European Commission's IST initiative. It aimed to enhance understanding of the economic, environmental and social impacts of teleworking and develop tools and guidance materials to enable organisations to evaluate and optimise the sustainability of teleworking initiatives.

SUSTEL concluded that flexible working or 'teleworking' can be successful for any organisation if it is planned and implemented with full consultation of all staff and the appropriate communication tools are available to minimise the feel of isolation that teleworkers can experience. The full SUSTEL report can be read at http://www.sustel.org/documents/D16_brochure.pdf

The benefits include a better work/life balance for those able to work from home, reduced travel requirements and reduced office space requirements for the organisation. However, if offices are not adapted to use less energy when your employees work from home, the extra energy your employees use to heat their homes could make this less environmentally friendly.

Reduce Resource Consumption

As outlined previously, ICT could play a big part in de-materialising many everyday activities and processes to reduce their impact on the environment, but for your organisation what does this mean? Very simply it means looking at your existing processes, to identify where changes can be made to streamline and reduce the resources that are used. Examples of processes or activities that could be streamlined include:

- Invoicing – for small organisations this could be sending invoices by email as PDF's rather than sending a paper bill in the post, and for larger businesses implementing an ICT system that automatically sends electronic invoices for payment.
- Payslip generation and distribution – reduce paper use and printing, by sending out payslips electronically to employees email accounts.
- Faxing – moving from a traditional fax machine to a 'Fax to Email' service will also reduce paper and energy use. A Fax to Email service is where faxes are sent and received as attachments via email using existing email accounts. There are many fax to email services available and most offer a 30 day free trial for evaluation, and free to receive faxes but with a cost per page for every fax sent. With others a monthly charge is paid with an inclusive amount of fax pages that can be sent.

There will be many other processes and activities within your organisation that could potentially be streamlined by using ICT. These might not be apparent to you or the Operations Team, but put your heads together and see what you can come up with.

Building Facilities Automation

There are technologies available that can be installed into premises to automate building facilities. By using ICT to ensure that energy is only used where and when required rather than heating and lighting offices which are empty, cost and energy savings can be realised. Systems include sensors in rooms to turn on lights and heating/cooling systems that enable individual offices and spaces of a building to be controlled separately.

Measuring and Monitoring

The very act of measuring energy use and calculating your organisation's carbon footprint will require the use of ICT. This could be a straightforward spreadsheet created on a computer collating data from various parts of the organisation or one of the sophisticated carbon management and monitoring systems that are available.

Conclusion

For any business to declare its intention to become carbon-neutral it must have an environmentally friendly or 'green' ICT policy. Failure to respond in this area could damage the reputation of the ICT department within the organisation and in the wider business community.

Although there is much work to be done to reduce the ICT industry's 2% contribution to carbon emissions, ICT also holds the key to assisting other industries reduce their total emissions through the implementation of ICT solutions. The ICT Industry has the opportunity to drive efficiency across the economy and "deliver savings of 15% - 7.8 GtCO2e of global BAU emissions in 2020", which will be approximately equivalent to €600 billion of cost saving[37]. There is huge potential for ICT to become the pivotal piece in the sustainability jigsaw of every organisation, large or small. ICT staff already have the skills and knowledge and given the opportunity, will be able to cut costs, improve operational efficiency and ensure your organisation's sustainability strategy is a success.

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