Green ICT in Schools

Introduction

Information and Communication Technology (ICT) is recognised as a significant user of energy and natural resources.

The Carbon Reduction Commitment (CRC) places a statutory duty on Public Authorities to reduce CO2 emissions through what is effectively a carbon tax. Kent's largest CO2 emitters are schools at 56%, followed by street-lighting at 28%.

Replacement of hardware and systems with low-energy technology may reduce ICT related CO2 emissions for CRC purposes, but a significant proportion of lifetime carbon emission of ICT equipment is in its manufacture and delivery. The manufacture of one PC requires approximately 1.7 tonnes of raw materials and water, and consumes over ten times the computer's weight in fossil fuels[i]. There is therefore no sustainable case for early replacement of computers.

Early replacement is also unlikely to be recovered through energy cost savings over the typical life-cycle of ICT hardware. In other words the equipment would need replacing before providing a return on the investment. CRC does not consider the wider environmental impact and carbon footprint of manufacturing, transport and disposal. Climate change is real, and energy prices volatile and likely to rise over time, so it is important to have plans in place to save energy in the short run and reduce carbon footprint at refresh or new purchase.

This document offers advice to schools on reducing ICT related energy use and consequently reducing your carbon emissions[ii].

Principles to adopt:

1. **Reduce now** - review and reduce the energy use of your current ICT.
2. **Change behaviours** – ensure staff, children and young people are aware of the issues.
3. **Plan for a sustainable future** – choose low energy options at each refresh and for new purchases.
4. **Disposal** – Ensure you dispose of hardware ethically and safely.

1. **Reduce now**

   a. General

   i. Understand your current ICT electricity consumption with an ICT Energy Audit and develop an Action Plan. Most ICT professionals are unaware of the carbon footprint of the systems they manage. "Progressive ICT staff can make serious improvements to energy efficiency, resource consumption and business travel." *Source: Green ICT Handbook (2009)*[iii]: There are 3 steps to quantifying your ICT energy consumption, which can then be used to prioritise actions.

      Step 1. Create an inventory of ICT assets by category: e.g. Desktop and user environment (including air-conditioning in ICT rooms); Telecom's and networking; server room (including cooling systems).

      Step 2. Set a timeline for reporting back.

      Step 3. Undertake the measurement activities, rank the issues and produce an action plan to address them.

   ii. Unnecessary data retention wastes money spent on storage hardware and the energy required to run it. Develop a data retention policy to define which data should be kept, for how long and how it should be deleted or transferred. Communicate your policy to users and enforce.

b. Server rooms.

i. Technicians should avoid working in server rooms where possible. Movement in and out of a room with environmental controls significantly increases energy use. Technicians should be able to access systems from a remote computer.

ii. Air conditioning needs to be fit for purpose. Typical equipment racks are designed to intake cool air at the bottom and vent at the top. Blowing cold air down on to rising hot air increases energy consumption.

iii. Layout and design of server rooms is crucial to energy efficiency. Equipment should be arranged into hot and cold aisles so that rack air intakes do not draw hot air from other equipment. This also allows more targeted extraction.

iv. Ensure blanking panels are in fitted in empty cabinets so you're not wasting energy to cool nothing.

v. Decommission, switch off or remove services and hardware that is no longer used. Servers which cannot be decommissioned for compliance or other reasons but which are not used on a regular basis should be virtualised and the disk images archived to a low power media. These can then be brought online if and when required.

vi. Services that do not achieve high utilisation of their hardware should be consolidated to improve the use of physical resources. This applies to servers, storage and networking devices.

vii. Most school technicians fight a continuous war on storage. A data retention strategy is essential to reduce data volume, and this should consider eliminating redundant data through de-duplication and compression, switching to fewer high capacity disks and moving rarely accessed data to tape or CD/DVD.

c. Network.

i. Consider freeing up unnecessary adjacent switches by consolidating patch leads on to one. (Care should be taken to ensure this does not compromise circuit redundancy).

ii. Unplug unused or unnecessary equipment in communications cabinets.

iii. Ensure power-saving settings are used on wireless networks where available. Modern managed wireless networks use Power-Over-Ethernet (POE) to power the wireless access points, and with some systems this allows them to standby when not in use.

d. User devices.

i. A power-managed computer consumes less than half the energy of a computer without power management. This needs to be sensitive to the unique environment in schools, as teachers do not appreciate their computer going into standby during a presentation. Similarly, a whole classroom of computers going to standby during a lesson is distracting, especially if they have to re-enter passwords etc. to restore. There are no hard and fast rules that can be applied, and each school needs to determine the appropriate policy, although our recommendation is to set power management to 30 minutes before standby.

ii. Use auto-shut down software to ensure computers are not left on outside of school hours. Unfortunately this leave monitors on standby, so it is still necessary to walk round and switch these off manually. The days of monitors being powered from the computer are mourned!

iii. Disable screensavers.

iv. Consider replacing CRT monitors with LCD types. LCD monitors use 60% less energy and last longer than CRT monitors. Older CRT monitors generate considerable heat that needs to be dispersed or force cooled.

v. Avoid leaving power chargers connected to the mains. This is particularly important where laptop trolleys are used. Laptops fully charge in no more than 3 hours, so install a timer that either cuts the power at a set time after school, or switches power on the early hours. Also avoid leaving them continuously charging over weekends and during school breaks.

e. Printing.

i. Avoid printing by switching to email and by communicating with parents electronically where appropriate.

ii. Purchase low melting point toner where suitable for your printer / photocopier.

iii. Use economy or draft mode for majority of printing as this saves toner as well as energy.

iv. Reduce the number of printers by consolidating into multi-function printer/photocopiers in departments and follow-me printing.

2. Change behaviours

The energy used by computers and monitors is partly dependent on their design, but mostly on the way they are used. Using energy saving computers will have a modest impact; however the biggest savings come from changing how they are used.

Educating and reinforcing users to turn off their computers often achieves good results, and there are a number of software products available to manage power and auto shutdown at specified times, such as the end of the working day.

a. Measurement and feedback

Use energy monitoring technology to demonstrate before and after outcomes of any behaviour change. Behaviour change is more effective if it involves people.

b. Dematerialisation

Swap high carbon activities with low carbon alternatives, such as email replacing paper communications, and e-media instead of printed magazines or newsletters.

c. Smart Admin

Re-engineer processes to remove paper based systems and forms.

d. Switch off

- Computers when not in use.
- Projectors, interactive whiteboards and other audio-visual displays and digital signage when schools are closed.
- Monitors when not in use or when you are away from the computer. This can save up to 60% of energy.
- Printers at the end of lessons, end of school day, over weekends and during school breaks. Don’t switch them on unless they are needed.

e. Know your ICT energy use

The IT department needs to know its energy consumption rather than being a facilities responsibility. One way is to link the IT budget to energy savings, i.e. the more energy used the less available to spend.

f. Interactive Audio-Visual

i. Ensure projectors are switched off when not in use. Care is needed when switching projectors on and off as this can damage expensive bulbs.

ii. Use dark backgrounds where possible, and when you don't want pupils distracted whilst you are talking, project a 'dark page' or slide.

3. Plan for a sustainable future

a. General

i. Refresh hardware only when unreliable or no longer fit for purpose unless there is a clear business case for early replacement.

ii. Use EU Energy Star [link] and EPEAT [link] standards and ratings when considering new hardware purchases.

b. Server Room

i. Include the Energy efficiency performance of equipment as a high priority decision factor in any tender process. This may be through the use of EU Energy Star[iv] or SPECPower[v] metrics. Power consumption of equipment at its expected utilisation or applied workload should be considered in addition to peak performance per Watt figures to avoid over-specifying power systems.

ii. Include the operating temperature and humidity ranges of new equipment as high priority decision factors in any tender process. The higher the operating temperature, the lower the cooling required. Starting 2012 new equipment should be able to withstand the extended air inlet temperature and relative humidity ranges of 5 to 40°C, and under exceptional conditions up to +45°C.

iii. Select equipment which offers external control of its energy use. An example of this would be the ability to externally restrict clock speed in a server to restrict maximum energy use.

iv. Consider management software capable of analysing and optimising where, when and how workloads are executed and their consequent energy use.

v. When selecting equipment ensure there is a master plan for air flow design. Equipment with non standard air intake, outlet or flow direction should be carefully assessed before putting into service.

vi. When selecting storage hardware evaluate the energy efficiency in terms of service delivered per Watt. Evaluate both the in use power draw and the peak power of the storage device(s) as configured. Implement a data management policy that reduces the number of copies of data, including logical and physical (mirrors).

c. Network and System choices.

i. Consider using cloud or web hosted services such as email and portals or learning platforms. This can considerably reduce energy use in server rooms and are often much cheaper than maintaining servers and technical supporting infrastructure.

ii. Thin Client computing moves applications to the network server instead of processing on each computer. This significantly reduces the power consumption of the end device, extends device life-cycle by several years and makes management easier. It does however restrict the use of rich media such as video and audio.

iii. Server consolidation and virtualisation reduces the number of physical servers, and ensures servers are operating at maximum efficiency, reducing support and maintenance costs in the longer run. Such a move needs to

consider whether the virtualisation software supports your applications and the cost of licensing.

iv. Energy Efficient Ethernet (IEEE 802.3az) is a series of enhancements to cable and switch infrastructure to allow less power consumption during periods of low utilisation. The goal is to reduce power usage by 50% while remaining compatible with legacy networks.

v. Consider a managed wireless system. These are more efficient as they often use lower power and fewer access points. There are many good systems on the market such as Aruba™, Meru™, Extricom™ etc.

d. User devices.

Computers and monitors continuously improve over time, and the emphasis has moved from increasing performance regardless of energy usage, to a focus on improving energy efficiency. This means that when new computers are purchased they will almost certainly use less energy than their predecessors.

i. Purchase energy efficient models when buying new PC's.

ii. Change the build and deployment process to enable power management features. This should include BIOS, operating system and driver settings.

iii. Don't buy multimedia options unless they are needed. Sound cards increase energy use.

iv. Consider laptops as they use less energy.

e. Printing.

i. Laser printers use less energy than inkjet printers and have energy saving features built in.

ii. Use shared and networked printers to reduce the number in operation.

iii. Buy printers that have energy saving features built-in.

iv. Operate a reduced number of centrally managed combined copier/printers within departments in a large school, or as a central resource. This reduces the number of printers around a school.

v. Introduce card based follow-me printing to reduce waste and improve accountability.

vi. Reduce paper consumption;

f. Interactive Audio-Visual (iAV)

i. When choosing large screen monitors, choose LCD over plasma.

ii. Consider large screen LCD in preference to interactive whiteboards.

iii. Choose networked projectors that allow auto-shutdown.

4. Disposal

Waste Electrical and Electronic Equipment Directive (WEEE) loosely describes discarded, surplus, obsolete or broken electrical and electronic equipment.

i. Do not pass unwanted computers to others without ensuring that personal data is completely wiped. This includes photocopiers and some printers that store documents on an internal hard disk drive.

ii. Consider donating unwanted computers to Computers 4 Africa[vi] or another charity that can provide a certificated guarantee of wipe-down.

iii. Only scrap computers and monitors through a registered recycler or contractor with suitable quality control processes to ensure traceability.

[i] Green ICT Handbook, Global Action Plan (2009)
[ii] **Carbon footprint** is most commonly defined as the **total set of GHG (greenhouse gas) emissions** caused directly and indirectly by an individual, organisation, event or product (Carbon Trust 2008). It is labelled a carbon footprint as commonly the total GHG emissions are converted to **CO_2 equivalent (CO_2e) emissions**. All figures are expressed as tonnes of CO_2 equivalent.
[iii] Green ICT Handbook, Green ICT (2009)
[iv] www.eu-energystar.org
[v] www.spec.org
[vi] http://computers4africa.org.uk/

Useful References

Green ICT
www.greenict.org.uk

Green ICT Handbook
http://www.greenict.org.uk/handbook

Data Centre Code of Conduct Introductory Guide
http://www.on365.co.uk/files//DataCenter_CodeOfConduct_Introductory_Guide.pdf

Final European Code of Conduct on data Centres Energy Efficiency, v1
http://www.on365.co.uk/files//CoC%20DC%20v%201.0%20FINAL.pdf

Best Practice Guidelines v1
http://www.on365.co.uk/files//Best%20Practices%20v1.0.0%20-%20Release.pdf

Green Electronics Council
http://www.greenelectronicscouncil.org/

EPEAT
http://www.epeat.net/

SMART 2020
http://www.smart2020.org/

Energy Efficient Ethernet IEEE 802.3az
http://en.wikipedia.org/wiki/P802.3az

EU Energy Star
www.eu-energystar.org

Global Action Plan
http://www.globalactionplan.org.uk/