Green IT

Rob Bristow - Joint Information Systems Committee
Outline

• Top tips
• The problem
• The opportunity
• Areas of activity
• Some examples
• JISC’s plans
• The way ahead
Top Tips to reduce your carbon footprint

1. Assess your carbon footprint

2. Enable PC Powerdown for devices not in use. Move to Thin-Client Devices or more efficient thick-client devices as appropriate

3. Extend life of equipment and procure to Energy Star 5

4. Consolidate and virtualise servers. Get servers out of departments and offices into properly designed data centres. Run them warmer

5. Implement Hot/Cold aisle separation and containment in your data centre. Look at the possibility of direct cooling of racks

6. Install more efficient power supply units (PSU) and uninterruptible power supply systems (UPS)

7. Consolidate printers and enable duplex and monochrome printing by default

8. Reduce travel by maximising the opportunities for remote working, flexible and home working

9. De-duplicate and rationalise data storage

10. Rationalise and simplify IT systems and architecture

Make this part of your strategic planning
The Problem

- Many devices
  - 760,000 PCs
  - 215,000 servers
  - 147,000 networked printers
  - 512,000 Mwh of electricity
  - 275,000 tonnes of CO2
- High costs
  - £116 million + in 2009 (HE & FE in UK)
The Drivers

• Rising energy costs and uncertainty of supply
• CRC Energy Efficiency Scheme - 2009
• Reputation
• Regulation
  • Waste Electrical and Electronic Equipment (WEEE)
  • Restriction on Hazardous Substances (RoHS) Directive and UK Regulations
  • Equipment and Energy Using Products (EUP) Directive
IT’s Environmental Footprint

• Worldwide IT accounts for ~2% Emissions (less that the airlines, in fact)
• UK IT accounts for 3% of electricity generated
• Embedded CO$_2$ of a PC is same as lifetime usage CO$_2$
• Typical PC & Monitor generates 66Kg waste and produces 1Tonne of CO$_2$ through its life
The Problem

- Data centres
- The desktop
- Printing
- Embedded carbon
- Disposal
- Demand!
The opportunity

- Smarter systems, buildings and processes
- De-materialisation and dis-aggregation
- HE as exemplar for low-carbon IT
- Green as driver for other efficiency gains
Data Centres

• “the physical reality of modern campus CyberInfrastructure (CI) is a complex network of ad hoc and sub-optimal energy environments in departmental facilities”
  • Green Light project - UC - San Diego
    [http://greenlight.calit2.net/](http://greenlight.calit2.net/)

• But demand is growing
  • Processing
  • Storage
Data Centres

- Data centres consume ~ 1% of global energy
- This consumption doubled between 2000 and 2006
- Huge wastage of energy on cooling and power supply
- What’s your PUE? - Up to 1.2 is achievable
- Should you even have one?
- EU Code of Conduct

Picture: Josie Fraser
Some rights reserved
Energy Efficiency Measures
Adapted from US EPA original
EU Code of Conduct for Data Centres

aims to: “inform and stimulate data centre managers to reduce energy consumption in a cost-effective manner without hampering the mission critical function of data centres”

• From comms cabinets to bespoke facilities
• Vendors & Participants (Data centre operators & end-users)
• Released November 2008
• Best practices and guidelines (not mandatory)
• Agreement to adopt recommended measures
• Commitment to report performance data
EU C of C for Data Centres - Expected Practices 1

- Group Involvement - Cross functional team
- Grid and Virtualisation - no new single use boxes
- Select efficient software - get the vendors to think about this
- Environmental
  - Raise operating temperature (up to 27°C)
  - Increase humidity range
  - Review temperature points for air or chilled water systems
EU C of C for Data Centres - Expected Practices 2

• New IT Equipment -
  • Include Performance per Watt of IT Devices in tendering process

• Power Provisioning
  • Provision for actual need - not PSU or nameplate rating

• Cooling
  • Containment, variable speed fans, rack air-flow management

• Utilisation
  • only provision for 18 months into the future
Data Centres - Changes

- Virtualise
- Hot and cold aisle separation and containment
- Run the Data Centre hotter - ASHRE limits have been increased
- More efficient PSUs and USPs
- Go multi-core and use the GPU
- DC power?
The Desktop

- Powerdown - This should have been done by now
- Extend it out to staff PCs
- Wake-on-LAN solutions available
- Extend life
- Procure to Energy Star 5 and EPEAT Gold if possible
- Examine case for Thin-Client
## Power Management States

<table>
<thead>
<tr>
<th>ACPI Global State</th>
<th>ACPI Sleep State</th>
<th>Energy Star Category</th>
<th>Common Terminology</th>
<th>Definition</th>
<th>Relative Energy Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>G0 – Active</td>
<td>Idle?</td>
<td></td>
<td></td>
<td>CPU executing tasks.</td>
<td>Baseline</td>
</tr>
<tr>
<td>G1 – Sleeping</td>
<td>S-1</td>
<td>Idle?</td>
<td>Seldom used in current devices</td>
<td>The CPU is not executing tasks but, as with all other components, remains powered.</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>Standby (but seldom used in current devices)</td>
<td>The CPU is not being powered, but RAM and other components are.</td>
<td>Negligible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>Sleep</td>
<td>Standby in Windows; Sleep in Mac; also Suspend to RAM</td>
<td>Similar to S2, but with fewer components powered.</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>S-4</td>
<td>Hibernation in Windows, Safe Sleep in Mac; also Suspend to Disk</td>
<td>No power to CPU or RAM, with all content saved to non-volatile memory such as a hard drive. (No operating system restart required.)</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>G2 – Soft Off</td>
<td>S-5</td>
<td>Standby</td>
<td>Shut Down</td>
<td>Power to only a very few components so that wake events can be triggered, e.g. from a LAN, followed by an operating system restart.</td>
<td>High</td>
</tr>
<tr>
<td>G3 – Mechanical Off</td>
<td></td>
<td></td>
<td></td>
<td>No components powered and device fully switched off. Can only be reawakened by restoring power and starting the operating system</td>
<td>Very high</td>
</tr>
</tbody>
</table>

ACPI Sleep States (adapted from NRDC 2005)
Thin Client

• Plus
  • Kit lasts longer
  • Easy to consolidate and virtualise
  • Lower Energy consumption in use and reduced need for cooling
  • Less weight and bulk to transport - less waste
  • Reduced support costs

• Minus
  • Load at server
  • Many devices on 24/7
  • Video/3-D Graphics not handled well
  • New thick-client solutions can match the thin-client claims
  • Important to match to users’ needs
## Cost and Carbon Comparison Tool: Thick vs Thin Clients - Thick Clients Vendors' Data

<table>
<thead>
<tr>
<th></th>
<th>Thick Clients</th>
<th>Very PC</th>
<th>Very PC</th>
<th>Very PC</th>
<th>Very PC</th>
<th>Very PC</th>
<th>Very PC</th>
<th>Own data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Replacement cycle</strong></td>
<td><strong>(years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Capital Costs (£)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client purchase price per client (incl. VAT)</td>
<td>595.73</td>
<td>484</td>
<td>920</td>
<td>553</td>
<td>586</td>
<td>494</td>
<td>386</td>
<td>1</td>
</tr>
<tr>
<td><strong>Energy Costs (£)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power of client in active/idle mode (Watts)</td>
<td>79</td>
<td>37.97</td>
<td>17.399</td>
<td>26.536</td>
<td>26.536</td>
<td>31.76</td>
<td>28.34</td>
<td>1</td>
</tr>
<tr>
<td>Power of client in standby mode (Watts)</td>
<td>4</td>
<td>1.502</td>
<td>0.876</td>
<td>2.532</td>
<td>2.532</td>
<td>2.051</td>
<td>2.016</td>
<td>1</td>
</tr>
<tr>
<td>Power of monitor in active/standby mode (Watts)</td>
<td>35</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Power of monitor in standby mode (Watts)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Space utilisation (m²)</strong></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
## Cost and Carbon Comparison Tool: Thick vs Thin Clients - Thin Clients Vendors' Data

<table>
<thead>
<tr>
<th></th>
<th>Sun</th>
<th>Wyse</th>
<th>Chip PC</th>
<th>Own data</th>
<th>Clever thing</th>
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</thead>
<tbody>
<tr>
<td><strong>Replacement Cycle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement cycle (years)</td>
<td>8</td>
<td>12</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Replacement cycle for thin client server</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Numbers of Devices (#)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated monitor?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>No. thin clients per Thin Client server</td>
<td>240</td>
<td>240</td>
<td>240</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Capital Costs (£)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client purchase price per client (incl. VAT)</td>
<td>265</td>
<td>227</td>
<td>105</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Thin client server purchase price</td>
<td>3,600</td>
<td>5,800</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Operational Costs (£)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Licence costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual client and server licence costs (per client)</td>
<td>19.00</td>
<td>15.00</td>
<td>3.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td><strong>Energy Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power of client in active/idle mode (Watts)</td>
<td>28</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Printing

- (Staff) printing is out of control
- HE Sector consumes over 21,000 tonnes of paper per year
- Accounts for 10-16% of ICT-related electricity use
- Most of the energy associated with printing comes from making the paper
- Form a cross functional team and get buy-in from users
- Consolidate printing to MFDs
- Enable “Pull” printing
- Enable duplex and monochrome printing by default
- Enable quick switch to low power mode
Procurement

- UK Government’s Quick Wins
- Centre of Excellence
- Standards
  - Energy Star
  - ECMA Eco-Declaration
  - EPEAT
- Sustainability not yet embedded in procurement practices
- Need for strategic view of procurement and estates involvement
The Cloud

Or

?
The Cloud

• “Not everything will move into the cloud, but the cloud will move into everything” - Nicholas Carr

• JISC - three studies
  • Cloud for Research
  • Technical Review of the Cloud
  • Environmental and Organisational Implications of the Cloud for HE and FE
  • Reports in May 2010
Queen Margaret University

• Thin clients everywhere

• New build

• Key driver was avoiding AC

• Good IT/Estates cooperation

• Reduced support overhead by 2 FTEs
Cardiff University

- Low power servers
- Chilled water cooling
- Efficient layout
- Efficient UPS
- 30% support overload
Imperial College

- IT as opportunity
- Move to e-Procurement
- Saved 240,000 pieces of paper a year
- £40,000 in postal costs
- Less paper to store
- Leveraged existing e-Business Suite (Oracle)
The JISC Greening ICT Programme - 1

• Suste-IT Study
  • Thorough examination of all aspects of Green ICT in the sector

• Institutional Innovation Projects
  • Wake-on-LAN
  • Location Independent Working
  • Server Virtualisation
  • Reduction of Energy use in computing intensive areas

• Studies looking at the Cloud and Information management
The JISC Greening ICT Programme - 2

• Building Capacity
  • Extend the SFC funded work to the rest of the UK

• Growing the Knowledge Base

• Developing Exemplars/Demonstrators
  • Small scale projects starting in 2010, bigger exemplars to follow. Maybe a rapid innovation call at some point

• Strengthening Sustainable Procurement
  • Working with procurement consortia
# Real life Carbon Footprint

## University of Sheffield

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Kwh/y</th>
<th>Proportion</th>
<th>Total CO₂ kg/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPC</td>
<td>1,208,617</td>
<td>14%</td>
<td>649,052</td>
</tr>
<tr>
<td>Servers</td>
<td>1,520,736</td>
<td>18%</td>
<td>816,666</td>
</tr>
<tr>
<td>PCs</td>
<td>4,164,477</td>
<td>48%</td>
<td>2,236,408</td>
</tr>
<tr>
<td>Networks</td>
<td>687,362</td>
<td>8%</td>
<td>369,127</td>
</tr>
<tr>
<td>Telephony</td>
<td>202,356</td>
<td>2%</td>
<td>108,669</td>
</tr>
<tr>
<td>Imaging/Printing</td>
<td>835,659</td>
<td>10%</td>
<td>448,765</td>
</tr>
<tr>
<td>AV</td>
<td>61,598</td>
<td>1%</td>
<td>33,080</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,680,805</strong></td>
<td></td>
<td><strong>4,661,767</strong></td>
</tr>
</tbody>
</table>

| Total FTE Students 2005/6 | 20,029     |

| ICT Energy & Carbon per student | 433         | 233         |
# Real Life Carbon Footprint

**Scottish FE Colleges (4)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Kwh/y</th>
<th>Proportion</th>
<th>Total CO₂ kg/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPC</td>
<td>15,768</td>
<td>1%</td>
<td>88,468</td>
</tr>
<tr>
<td>Servers</td>
<td>812,730</td>
<td>30%</td>
<td>436,452</td>
</tr>
<tr>
<td>PCs</td>
<td>1,147,862</td>
<td>42%</td>
<td>616,425</td>
</tr>
<tr>
<td>Networks</td>
<td>295,386</td>
<td>11%</td>
<td>158,634</td>
</tr>
<tr>
<td>Telephony</td>
<td>29,244</td>
<td>1%</td>
<td>15,705</td>
</tr>
<tr>
<td>Imaging/Printing</td>
<td>248,961</td>
<td>9%</td>
<td>133,697</td>
</tr>
<tr>
<td>AV</td>
<td>179,095</td>
<td>7%</td>
<td>96,178</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,729,046</strong></td>
<td></td>
<td><strong>1,545,559</strong></td>
</tr>
</tbody>
</table>
Angus College Sustainable ICT

- Experience with footprinting exercise
- What we got out of it
- Action plan
- Current progress

John Clayton
## Footprinting Results - ICT

<table>
<thead>
<tr>
<th></th>
<th>Lowestoft College</th>
<th>City College Norwich</th>
<th>Angus College</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Electricity (kWh)</strong></td>
<td>453,714 (100%)</td>
<td>1,241,700 (100%)</td>
<td>491,096 (100%)</td>
</tr>
<tr>
<td><strong>PCs and monitors</strong></td>
<td>197,402 (44%)</td>
<td>510,896 (41%)</td>
<td>239,069 (49%)</td>
</tr>
<tr>
<td><strong>Servers</strong></td>
<td>135,999 (30%)</td>
<td>226,665 (18%)</td>
<td>110,613 (23%)</td>
</tr>
<tr>
<td><strong>Imaging</strong></td>
<td>42,171 (9%)</td>
<td>236,901 (19%)</td>
<td>51,979 (11%)</td>
</tr>
<tr>
<td><strong>Networks</strong></td>
<td>68,538 (15%)</td>
<td>156,629 (13%)</td>
<td>49,485 (10%)</td>
</tr>
<tr>
<td><strong>AV/Telephony</strong></td>
<td>9,604 (2%)</td>
<td>110,609 (9%)</td>
<td>39,950 (17%)</td>
</tr>
</tbody>
</table>
## Footprinting Results - ICT

<table>
<thead>
<tr>
<th></th>
<th>Angus College</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWh/y</td>
<td>Cost</td>
<td>CO₂ kg/y</td>
</tr>
<tr>
<td>Total</td>
<td>491,096 (100%)</td>
<td>£54,021</td>
<td>263,728</td>
</tr>
<tr>
<td>PCs and monitors</td>
<td>239,069 (49%)</td>
<td>£26,298</td>
<td>128,395</td>
</tr>
<tr>
<td>Servers</td>
<td>110,613 (23%)</td>
<td>£12,167</td>
<td>59,401</td>
</tr>
<tr>
<td>Imaging</td>
<td>51,979 (11%)</td>
<td>£5,718</td>
<td>27,914</td>
</tr>
<tr>
<td>Networks</td>
<td>49,485 (10%)</td>
<td>£5,443</td>
<td>26,575</td>
</tr>
<tr>
<td>AV/Telephony</td>
<td>39,950 (17%)</td>
<td>£4,394</td>
<td>21,453</td>
</tr>
</tbody>
</table>

ICT represents 29% of total electricity
Salient Points

• Very useful exercise – tool easy to use
• Areas of priority – PCs and Servers, then Networks and Imaging
• Savings already made:
  • - power-efficient PCs/monitors - £1,400 p.a.
  • - automated switching off - £7,200 p.a.
  • - printing controls - £400
Provisional Action Plan

• Procurement decisions to include power use over lifetime
• Continue/speed up PC/monitor replacement
  - was 145W now 58W
• Refine and extend automatic shutdown for PCs
• Thin client?
Provisional Action Plan

- Purchase energy efficient servers
- Retire old servers
- Server virtualisation
- Review temperature control in server room
- Switch off lighting
Provisional Action Plan

- Disconnect old/unused network points
- Printing – variety of approaches
# Potential Savings

<table>
<thead>
<tr>
<th></th>
<th>kWh/y</th>
<th>Cost</th>
<th>CO₂ kg/y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>174,000</td>
<td>£19,140</td>
<td>93438</td>
</tr>
<tr>
<td>PCs and monitors</td>
<td>119,000</td>
<td>£13,090</td>
<td>63903</td>
</tr>
<tr>
<td>Servers</td>
<td>40,000</td>
<td>£4,400</td>
<td>21480</td>
</tr>
<tr>
<td>Imaging</td>
<td>10,000</td>
<td>£1,100</td>
<td>5370</td>
</tr>
<tr>
<td>Networks</td>
<td>5,000</td>
<td>£550</td>
<td>2685</td>
</tr>
</tbody>
</table>

This represents a saving of 35%
## Current progress

<table>
<thead>
<tr>
<th></th>
<th>kWh/y</th>
<th>Cost</th>
<th>CO₂ kg/y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>174,000</td>
<td>£19,140</td>
<td>93,438</td>
</tr>
<tr>
<td></td>
<td>31,000</td>
<td>£3,370</td>
<td>16,570</td>
</tr>
<tr>
<td><strong>PCs and monitors</strong></td>
<td>119,000</td>
<td>£13,090</td>
<td>63,903</td>
</tr>
<tr>
<td></td>
<td>24,000</td>
<td>£2,600</td>
<td>12,800</td>
</tr>
<tr>
<td><strong>Servers</strong></td>
<td>40,000</td>
<td>£4,400</td>
<td>21,480</td>
</tr>
<tr>
<td></td>
<td>7,000</td>
<td>£770</td>
<td>3,760</td>
</tr>
<tr>
<td><strong>Imaging</strong></td>
<td>10,000</td>
<td>£1,100</td>
<td>5,370</td>
</tr>
<tr>
<td><strong>Networks</strong></td>
<td>5,000</td>
<td>£550</td>
<td>2,685</td>
</tr>
</tbody>
</table>
The Green Gowns Awards

• Run by the Environmental Association of Universities and Colleges (EAUC)
• Posh dinner and kudos
• Make an entry
• Deadline for stage 1 applications - 19th Feb 2010
• See: http://www.eauc.org.uk/green_gown_awards
Getting stuck-in

• Carbon Footprinting and Reduction Project
• Follows on from SFC funded work in Scotland
• Will run in two regions initially
• Establish baseline CO₂ using Suste-IT tool
• Mutual support and some targeted consultancy
• Will focus on providing that
**INSTRUCTIONS**
Type in the blue areas below - nominal figures only have been entered.

Areas in yellow are default figures which can be altered if data specific to the institution is available.

**NOTES**
The letters in brackets correspond to explanations in the User Guide and the worksheet "Assumptions" on how the default assumptions were derived.

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### SusteIT ICT Footprinting Tool © SusteIT 2009

<table>
<thead>
<tr>
<th>Server Rooms</th>
<th>Number of 1U servers</th>
<th>Watts per server (c)</th>
<th>Overhead</th>
<th>Total kW hours per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central servers</td>
<td>1</td>
<td>300</td>
<td></td>
<td>2,628</td>
</tr>
<tr>
<td>Departmental servers</td>
<td>1</td>
<td>300</td>
<td></td>
<td>2,628</td>
</tr>
<tr>
<td>Storage &amp; other server equipment (d)</td>
<td></td>
<td></td>
<td>0.15</td>
<td>788</td>
</tr>
<tr>
<td>Server/equipment sub-total</td>
<td></td>
<td></td>
<td></td>
<td>6,044</td>
</tr>
<tr>
<td>Server cooling &amp; power supply overhead (e)</td>
<td></td>
<td></td>
<td>0.5</td>
<td>3,022</td>
</tr>
<tr>
<td>Server sub-total</td>
<td></td>
<td></td>
<td></td>
<td>9,067</td>
</tr>
</tbody>
</table>

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**TOTALS AND ANALYSIS**

- HPC
- PCs and monitors
- Networks
- Phones
- Imaging
- AV

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**Joint Information Systems Committee**

Supporting Education and Research
Links

- [http://www.jisc.ac.uk/whatwedo/programmes/greeningict.aspx](http://www.jisc.ac.uk/whatwedo/programmes/greeningict.aspx) - JISC’s Greening ICT Programme


  - Suste-IT main report and summaries
  - Best practice reviews for Data Centres, Personal Computing, Printing, Procurement
  - A number of papers written by Grid Computing Now! for the Suste-IT project. Subjects covered include the EU Code of Conduct for Data Centres, Data Centre Cooling and Virtualisation

- [http://www.susteit.org.uk/cases/index.php](http://www.susteit.org.uk/cases/index.php) - for 20 case studies drawn from UK HE and FE highlighting good practice and innovative solutions


- #greenict - Tag in use on Twitter et al

- [http://www.eauc.org.uk/home](http://www.eauc.org.uk/home) - The Environmental Association of Universities and Colleges (EAUC)

## Summary

1. Assess your carbon footprint
2. Enable PC Powerdown for devices not in use. Move to Thin-Client Devices or more efficient thick-client devices as appropriate
3. Extend life of equipment and procure to Energy Star 5.
4. Consolidate and virtualise servers. Get servers out of departments and offices into properly designed data centres. Run them warmer
5. Implement Hot/Cold aisle separation and containment in your data centre. Look at the possibility of direct cooling of racks
6. Install more efficient power supply units (PSU) and uninterruptible power supply systems (UPS)
7. Consolidate printers and enable duplex and monochrome printing by default
8. Reduce travel by maximising the opportunities for remote conferencing and flexible and home working
9. De-duplicate and rationalise data storage
10. Rationalise and simplify IT systems and architecture

*Make this part of your strategic planning*
Contact

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