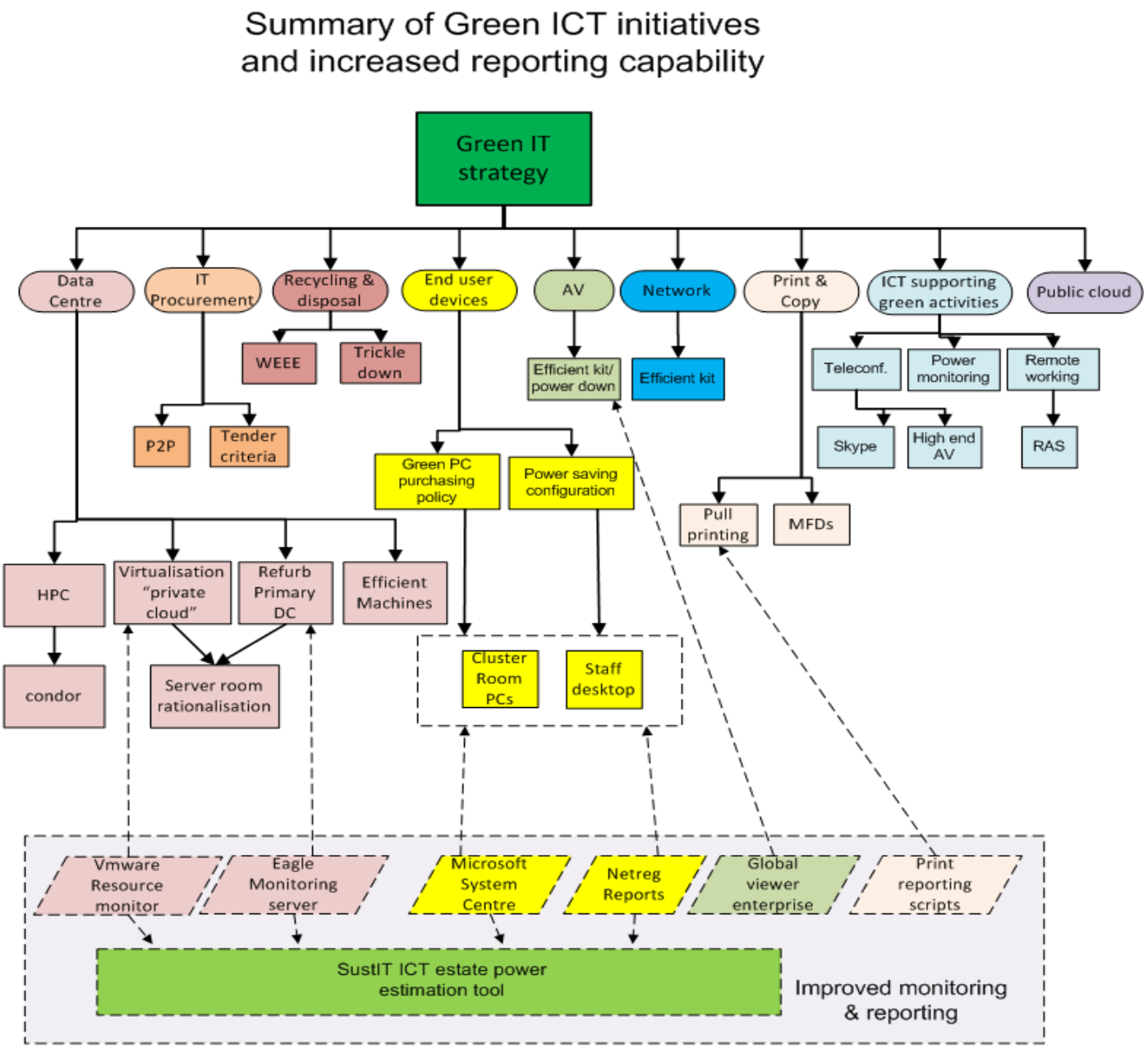
Summary of Green ICT Initiatives



The Network registration system (netreg) and print reporting scripts have been historically used for monitoring . Microsoft System Centre is being investigated for reporting capability. Eagle Monitoring Kit and VMware Resource Monitor are both tools that have just been purchase that will improve energy monitoring (they also fulfil other functions)

The following is a summary of Green ICT initiatives by area detailing the initiative in each area as well as the enhanced reporting capability where appropriate.

1. Data Centre

(a) "Private Cloud" Server Virtualisation: The University has invested in the provision of a general virtualisation platform based on VMware, which is available to server/service owners across the University. This means that IT managers can move from a per-project hardware acquisition model to a model relying on the hosting platform capacity. Projects now only consume the computing resources they need rather than that of a server that was specified for the worst case loading scenario and leads to significant power consumption savings (estimated to be in the 70-80% per service range). Consolidation of resource onto a pool of servers also means that techniques such as dynamic load reassignment and power down of unused resource can be deployed.

(b) Refurbishment of Claremont Data Centre: The refurbishment of the Claremont Data Centre has introduced more efficient air conditioning utilising both passive cooling (use of ambient air) and active free-cooling. The room layout, ceiling height, positioning of server racks and deployment of blanking plates have all been adjusted to improve airflow and create hot and cold aisles. This has created a more energy efficient data centre and has created the space and spare capacity to host servers for academic/service units from around the University (and possibly elsewhere if a shared-services/reciprocal approach to our off-site hosting needs can be achieved).

(c) Efficient machines: Energy efficient IT equipment is a key factor assessed in the purchase of new equipment. This has lead to a 30% reduction in the power consumption of equipment whilst doubling the computing resource available.

(d) HPC: High Performance Computing. The refurbishment of the Claremont Data Centre has freed up capacity to host more high performance computing for academic units. Hosting high performance computing in the more energy efficient data centre will lead to a drop in energy consumption. The refurbishment has seen HPC from the Schools of Computing Science, Electrical, Electronic and Computer Engineering, Civil Engineering and Geosciences, Mechanical and Systems Engineering, Geography, Politics and Sociology as well as the CISBAN and CENGEO research groups move into the Claremont Data Centre.

(e) Condor is a high throughput computing solution used to harness spare CPU power from desktop workstations to form a distributed computing cluster, making efficient use of deployed resources. The implementation at Newcastle University is configured so that it does not have an undue impact on power saving initiatives. It represents a more energy efficient and cost effective solution than deploying resource on servers or procuring cloud resources in that it leverages existing capital expenditure.

(f) Server Room Rationalisation: The combination of the Claremont Data Centre refurbishment and deployment of virtualisation has allowed greater sharing of computer resources around the University. By moving resources from inefficient server hosting sites and from “under desks” to an efficient centralised platform the power consumption associated with the consolidated services will decrease. A project has been jointly commissioned between ISS and School of Computing Science to decommission one of their server hosting rooms and greatly reduce the capacity in the other. ISS continues to engage with academic units to consolidate server hosting provision into the Claremont Data Centre (preferably through the use of ISS services, but via physical hosting of equipment in the Claremont Data Centre if necessary).

The data centre strategy is also underpinned by a strategic drive towards increased monitoring of the power consumption related to the data centre and the resources deployed in it. Improved ability to report on energy consumption is a cornerstone to enabling informed green ICT initiatives in the future. Rack level “Eagle” temperature and power monitoring probes and the VMware Resource monitor tool have been purchased to bolster the monitoring capability for the Claremont date centre.

2. IT Procurement

(a) P2P: The new procure to pay (P2P) system offers an opportunity to ensure that green suppliers and green products are preferred vendors via the catalogue. Collaboration between Procurement and ISS will help shape the P2P system so that it supports green purchasing. Care should be taken however that the increased deployment of credit cards may lead to more “off-catalogue” purchasing of “non green” ICT equipment.

(b) Tender Specifications: ‘Green IT Strategy’ considerations already included in IT tender specifications, awareness raising and collaboration between Procurement and ISS will ensure that green considerations remain embedded in and are more deeply integrated into ICT related tenders .

3. End User Equipment

(a) Green PC purchasing policy: The University has a well established green purchasing policy[1] which describes a standard configuration for new desktop equipment. The policy is updated on a regular basis and has seen the average energy use of a desktop PC drop from 100 watts to 32 watts for compliant PCs.

(b) Power saving configuration: The default configuration of common desktop PCs promotes power saving behaviour. Enhanced power saving behaviour is being investigated to improve power management. In addition an outreach campaign to academic/service unit Computing Officers and end-users is being formulated to drive behavioural change in those areas with measured poor power management. Monitoring of the desktop estate shows a 3 year trend towards better power management, but highlights that further gains could be achieved. Tools to support machine power off and Wake on LAN technology have been deployed and this enables machines to be remotely switched on should a user want to remotely connect and access files on their machine. It also enables machines to be powered on for automated patch management removing one of the perceived barriers for wider machine power off.

Other factors: The switch from CRT to flat screen monitors has seen a 70% drop in power consumption from monitors (average 100 watts to 30 watts) though the (in many cases unjustifiable) trend towards multiple monitors is eroding the green benefits of this. Historic records show a year on year growth in the number of PCs with a 50% growth in the last three years. This growth in volume is undermining the gains made in power efficiency and power saving of individual devices.

New tools are being investigated to bolster monitoring and reporting of green ICT across the desktop estate. Microsoft System Centre is being setup to improve power reporting for actual power usage and behaviour of desktops across the campus desktop estate. Deployment of the tool will be backed up by a drive to engage with and educate academic/service unit Computing Officers and environmental coordinators as to appropriate power saving behaviour for their section.

ISS maintains a watching brief on Thin Client technologies for provision of desktop computing and periodically re-examines thin client as a desktop solution, power usage forms part of this considerations.

4. AV

(a) With the rise in centrally managed teaching rooms (currently some 160 venues) the procurement of energy efficient machines is an embedded part of the room commissioning and maintenance processes. The audio visual equipment within teaching rooms is aggressively power managed and monitored by the ISS Learning Spaces team.

5. Recycling & Disposal

The University has a well established procedure for managing disposal of IT equipment:

(a) Waste Electrical and Electronic Equipment (WEEE). The new WEEE ensures that disposal and recycling is now free at the point of use across the University. This leads to efficient disposal of defunct IT equipment and older power hungry equipment is more likely to be disposed of rather than redeployed, thus reducing power consumption of the ICT estate.

(b) Trickle Down: Serviceable equipment being replaced in ISS managed cluster rooms is made available for redeployment across the University in a process called “Trickle Down”. This process avoids the additional capital cost and expended energy of purchasing new equipment and replaces old PCs with more power efficient version. For academic/service units to receive trickle down they must commit to disposing of old equipment on a numerically like-for-like basis.

6. Network

While selection of networking equipment is primarily driven by delivering the required functional capability, power consumption is one of the factors considered in choosing new network equipment. This ensures that the network

[1] http://www.ncl.ac.uk/iss/green/

equipment supports the green ICT drive of the University. Network capability is also an enabler of many other green activities. E.g. Cloud computing (private or public) is dependent on pervasive reliable high quality data networking. Distance working applications like Remote Application Service (RAS) and Video Conferencing are dependent upon networking.

A change in provisioning model from data-points being connected upon request to one based upon "flood connecting" i.e. all network points are live, has meant that there has been an increase in the amount of network equipment deployed across the estate. This provisioning model was adopted due to its benefit for customer experience (data points "just work"), it has also freed up staff resource to address other workloads.

Power consumption of networking equipment is now a key criterion in the procurement process. The power consumption of the network estate has been reviewed and replacement of less efficient equipment is being prioritised as part of the usual replacement cycle. A bid for Salix funding to speed this replacement process, particularly in halls of residence is being considered in conjunction with the Energy Manager.

7. Print & Copy

(a) Multi Function Devices (MFDS) are the preferred printing/imaging solution in the University. Driving the deployment of MFDs over a suite of printers, copiers and faxes will reduce the energy consumption both in capital and recurrent terms. We also seek to mandate the use of duplex printing by default in order to reduce the amount of paper used across the University.

(b) Pull Printing has been deployed in King's Gate. Pull printing offers the potential to reduce the number of printing devices deployed within a building and also to reduce the volume of printing. However deploying pull printing is non-trivial, requiring significant setup resource and behaviour change on the part of users.

Current strategy regarding printing is to build capacity and knowledge around large scale solutions with a series of point deployments (King's Gate, NUMed Malaysia, Business School, ISS) before contemplating any campus wide solution. Pull printing across ISS managed student clusters is to be considered as part of the Project 2012 programme. Green centralised/pull printing will be supported by a series of scripts to report on printing usage across the pull printing estate. Experience has shown that reporting is critical to successful roll out of pull printing to support sustainable/green ICT to enable managers to manage printing behaviours.

8. ICT to support green activities

a) Teleconferencing: Teleconferencing facilities are an integral part of any strategy to reduce the amount of travel undertaken by University staff, and hence reduce the travel related carbon emissions. By enabling effective teleconferencing the need for some face to face meetings and the related travel will be avoided. The University provides a variety of platforms to meet teleconferencing requirements in certain rooms. Skype is deployed for simple ad hoc teleconferencing needs, advice and support for Skype use is being reviewed to ensure its use grows. For those that require high quality conferencing there are a series of dedicated teleconferencing rooms with high end teleconferencing equipment and suitably configured networking.

b) Power monitoring: As well as monitoring the power usage of the ICT estate IT can be used to provide improved monitoring and reporting of the power usage and related carbon emissions of the University as a whole. Improved networked sub metering allows statistics to be gathered and analysed in real time. The improved statistical reporting then allows for targeted drives to be made to reduce energy consumption in particular areas and for the outcomes of those drive to be measured.

c) Remote working: Applications that support remote working help to lower travel related carbon emissions by removing the need for staff travel. The University has a mature remote application service (RAS) that enables users in remote locations to access applications as if they were on a common desktop machine, and hence perform many of their work functions.

9. Public Cloud

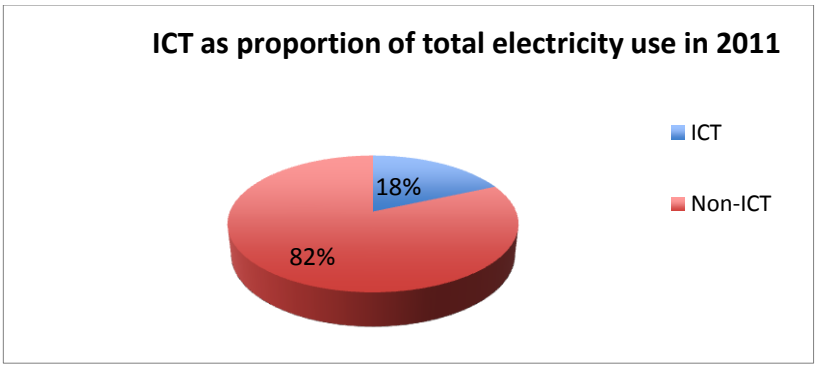
Public cloud services are an emergent area which could potentially reduce energy usage. Cloud based solutions will be examined on a case by case basis with green considerations being a key criteria in service selection. E.g. It is likely that student email will be migrated to cloud hosted services by summer 2012, resulting in a significant energy saving and capital expenditure avoidance. Procurement of cloud based services is in its infancy and cloud providers have not yet adjusted their route to market to take into account the needs of public sector bodies and EU procurement directives: in particular reliance on credit cards and a direct to consumer model is problematic. The availability of brokering that makes cloud services procurable by the sector is critical to successful deployment and uptake. The brokering service in development by JANET(UK) is being tracked and discussion with Procurement Services and academics about manageable cloud procurement are ongoing. The University Modernisation Fund (UMF) work of Eduserve and JANET(UK) in setting up cloud based hosting for academia is also being monitored.

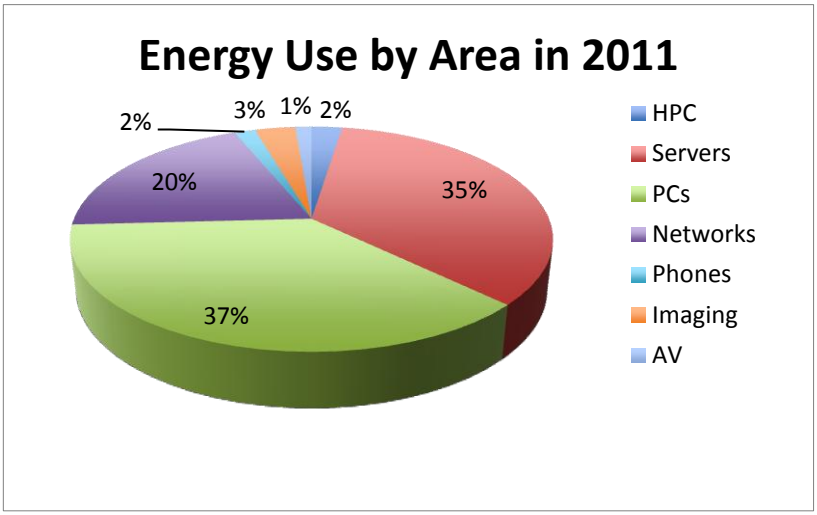
10. Management Information

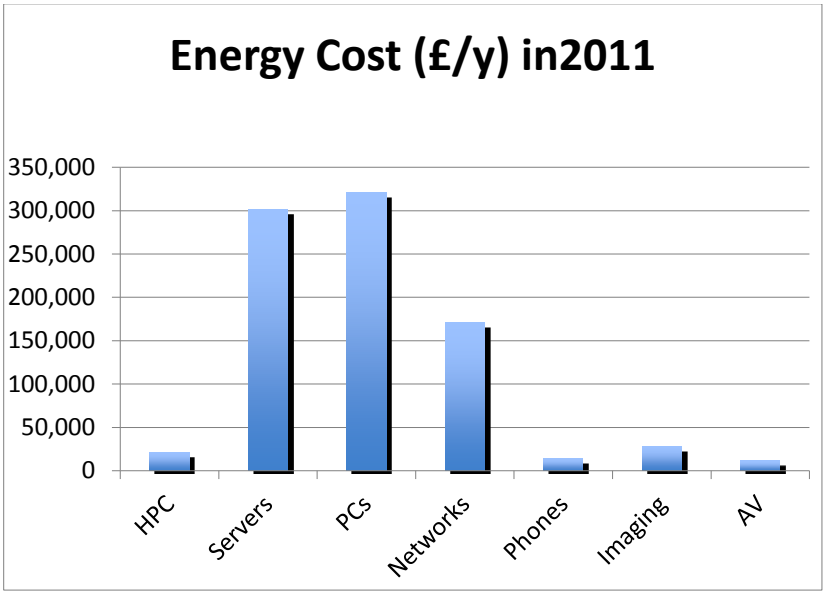
Underpinning the strategy is a drive to acquire better management information with which to measure the benefits of green initiatives and to shape future green ICT strategies. To assist in meeting this objective a variety of tools and approaches have been deployed to strengthen the green ICT metrics available. Major initiatives in this area are:

1. The refurbishment of the Claremont Data Centre improved power consumption monitoring ability.
2. VMware resource monitor will enable usage of virtualised infrastructure to be reported.
3. A campaign of surveying the end user devices (e.g. PCs) estate is giving a clearer picture of energy consumption and power saving measures taken.
4. Microsoft System Centre configuration manager is being deployed as an automated tool to provide reports on power consumption across the desktop estate. The tool will be trailed in ISS first, then across student cluster PCs, before final role out across the estate. Deployment of the tool to be supported by an outreach campaign with academic/service unit Computing Officers and environmental coordinators to ensure that it delivers improved power saving. Outreach to be targeted at the worst areas of the desktop estate.
5. Reporting tools and procedures will be developed to enable management of the volume of PCs deployed within schools. Combine with an outreach campaign with computing officers and environmental coordinators to ensure that the PC estate within a school is appropriately sized.

Data from these systems has been fed into the JISC SusteIT power estimation tool to give an overview of how much the overall ICT estate consumes and how much of that consumption is contributed by various categories e.g. PCs, server, network, printers. The SusteIT tool is already providing valuable information as to priority areas to address. The tool will be continually refined so that energy consumption from the ICT estate can be mapped over time. Examples of the improved management information made available by the SusteIT tool are presented below:



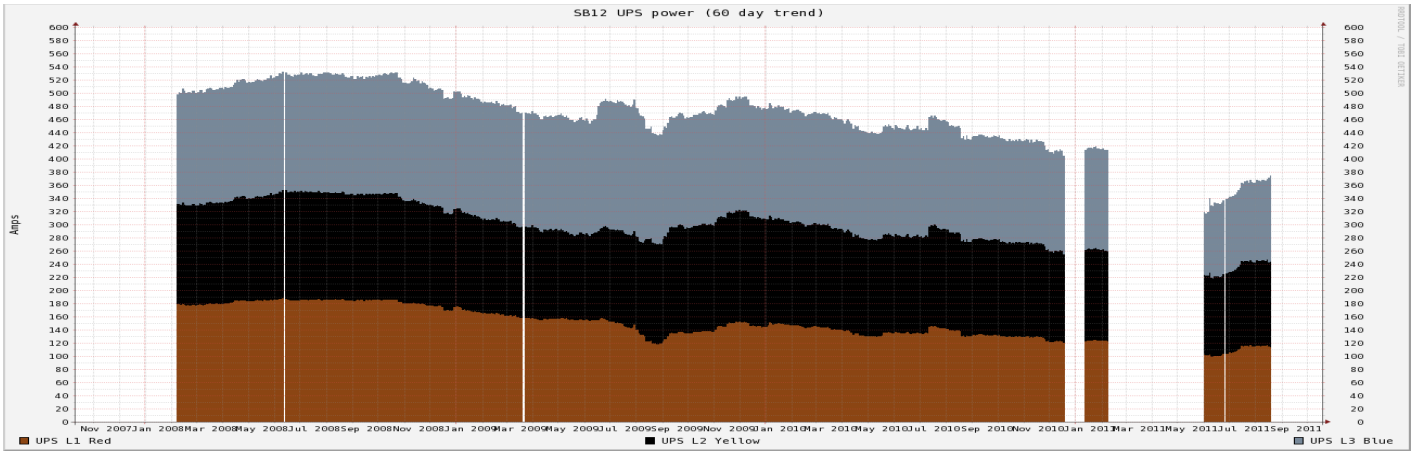




The above graphs have been used to focus strategic green initiatives onto the big 3 areas of Servers, PCs and Networks.

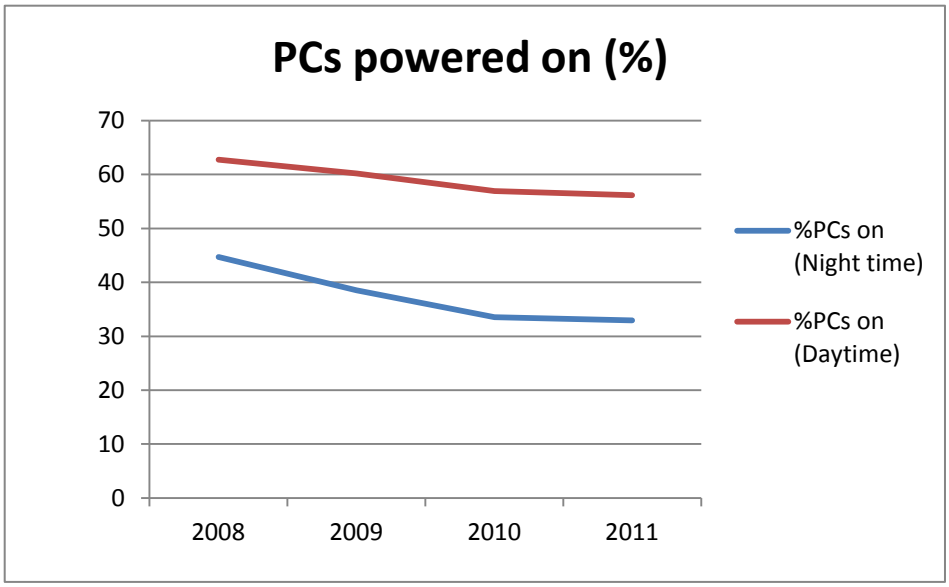
Examples of monitoring enabling measurement of savings below:

Power usage in Claremont Data Centre



The graph above shows the power measured at the UPS in the Claremont Data Centre. This measures power to servers and related equipment but does not include air-conditioning. There is a drop from a peak load of 530 amps in summer 2008 to a current load of 370 amps. This is a 30% drop in energy usage and a saving of £66K pa (once an overhead of 80% air-conditioning is added). The reporting gap is due to the recent refurbishment works.

Power saving behaviour of the PC estate



The figure above shows the energy saving trend for PCs (both in terms of powering off during the night as well as during the day). The improvement is due to a combination of improved default power saving configuration and user education. This improved power saving behaviour is worth £58K pa compared to the 2008 behaviour.

Known Gaps

- Green and Mobile computing.
- Governance of green i.e. appropriate charging for electricity at school, academic/service unit level.
- ICT to support green behaviours e.g. car pooling.
- Lack of a comprehensive/consistent IT asset register across the University hampers estimating the power consumption of the ICT estate (even though Financial Regulations state that *all* items of ICT equipment, irrespective of value, should be listed on the University's asset register).

Engagement Plan for Draft Strategy and Initiatives Summary Papers

- IT Review Green ICT second discussion with KPMG: 9th September 2011;
- ESS Energy Manager: 9th September 2011;
- ISS Directorate: 3rd October 2011;
- PVC Planning and Resources: 12th October 2011;
- Registrar: 19th October 2011;
- University Carbon Management Group: 20th October 2011 (postponed, to be rescheduled)
- Environment & Sustainability Committee: 25th October 2011
- Strategic Information Systems Group: 17th November 2011;
- Academic/Service Unit Computing Officers: TBD;
- Academic/Service Unit Environmental Coordinators: TBD.

Cal Racey,
20th October 2011