S-Lab Briefing 2: Understanding Laboratory Energy Consumption

Energy Use in Laboratories

Laboratories consume large quantities of energy – often 3 to 4 times more than offices per square metre. They can therefore account for up to 60% of non-residential energy consumption of research - focussed universities, making it impossible for them to meet carbon targets without taking very major action to contain energy consumption.

To improve understanding of where energy is used – and to identify opportunities for improvement – S-Lab together with consultants Carbon & Energy Reduction Solutions and KJ Tait, undertook detailed pilot audits at five university labs: Biosciences Building (Liverpool); Edinburgh Cancer Research Centre (ECRC); Department of Biology (York); Department of Chemistry (Cambridge); Department of Chemistry (Manchester).

The table shows that main use is moving, heating or cooling air through laboratory spaces (especially in Chemistry), and that equipment use is high in Life Science. Audits also highlighted IT's importance in many labs such as Cambridge Chemistry, where server rooms mean that it accounts for 17% of total use.

Indicative Consumption Split	Chemistry	Life Science
Ventilation-related	60%	45%
Space heating	20%	20%
Equipment and small power	15%	25%
Lighting	5%	10%

A detailed analysis of equipment at two labs identified the main energy using types (number x rated power x hours of usage).

For chemistry these were, in order of total use, heaters/stirrers (particularly in teaching labs); mass spectrometers; gas chromatographers; rotary evaporators; NMR; ovens; fridges; pumps (diaphragm and pumps); and water baths.

In life science they were freezers (-20 and -80s) environmental growth chambers, water baths, incubators, ovens, ice makers, hybridisers, incubator-shakers and thermal cyclers.

A rule of thumb is anything that is heating or cooling, is on 24/7, or has a 3-phase power supply is likely to be a significant energy consumer. (See our report on sustainable purchasing of lab equipment on www.goodcampus.org for more discussion).

David Somervell, Sustainability Manager, University of Edinburgh

Views

"Auditing the ECRC has created a better understanding of energy consumption patterns, and demonstrated the benefits from the night switch off of most of the ventilation systems – which few people were aware of before. It's identified more improvement opportunities such as modifying ventilation setback times as well as highlighting the high energy consumption of steam autoclave and inefficiencies in the steam boiler as future priorities. Tom McGrath, an engineering student, did much of the work, showing the potential to use audits for learning purposes."
David Somervell

"Since the audit we have been much more aware of equipment energy consumption and put powerdown stickers on equipments that can easily be turned on and off. The Estates team have also put in presence detection for lighting."
Laura Nuttall

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Low Cost Actions Identified by the Audits

NB Adoption should always be subject to a safety assessment:

- Switching off individual fan coil units when the rooms they serve do not require special ventilation for prolonged periods
- Experimentally increasing cooling control range within fridge / freezer or cold room
- Regularly checking filter conditions and replace proactively (as clogged filters have a higher energy consumption)
- Reviewing HVAC sensors to ensure they're optimally positioned
- Turning off or powering down (selected) equipment when not in use, together with related devices, e.g. AC/DC converters
- Turning off lights when rooms / chambers are not in use
- Examining equipment consolidation / sharing opportunities
- Switching off (overnight or permanently) those fume cupboards which are little used
- Reduce heating demand by allowing reduced temperature out of hours – aligned to switching off
- Experimentally increase cooling control range in server rooms.

The Audit Process

An S-Lab audit guide – based on the pilot audit experiences – stresses the need to begin the exercise by establishing ownership (with senior management backing from both Estates and principal investigators being vital). It recommends starting with a quick first stage with the aims of building relationships; understanding the laboratory building and its operation; creating a broad picture of energy consumption; identifying improvement opportunities; recording key laboratory features; and building momentum for change. A key question is whether the design specifications of the ventilation system and fume cupboards are being achieved in practice – this is often not the case and unravelling the reasons why can be extremely revealing.

A second stage can then prioritise immediate improvement opportunities; scope medium-long term plans; and develop a monitoring strategy (e.g. new sub-meters, fume cupboard control data) to provide a more detailed understanding of target areas.

Laura Nuttall, Bioscience Building Manager, University of Liverpool

Audit Benefits

- Identifying, and developing the business case, for energy efficiency improvements
- Improving understanding of laboratory energy costs and carbon emissions
- Enabling benchmarking with other labs
- Enabling the creation of new incentives for energy minimisation, such as devolved energy budgets to, and within, laboratories and / or shared savings schemes
- Better understanding of the building and its operations (with non-energy benefits such as identification of broken or malfunctioning equipment or assisting the design of new or refurbished facilities)
- Strengthening relationships between Estates, laboratory staff and other key stakeholders
- Benchmarking with other labs
- Highlighting 'hidden' examples of good energy practice that can be replicated elsewhere.

Further Information, including the full lab audit report, process guide and guidance on sustainable equipment procurement are at www.goodcampus.org.uk. Version 1.0 June 2011.

Disclaimer – Every effort has been made to ensure accuracy, but readers should verify all information.