

Minimising Energy Use for Ventilation

Oxford's Chemistry Research Laboratory (CRL) has a striking design, with a central atrium space encouraging interaction between its researchers. In 2009/10 it used 6,398MWh of electricity, 6,133MWh of gas, and 59,596m³ of water, and spent £605,440 on energy. Around 25% of this is related to ventilation, especially of 332 Variable Air Volume (VAV) fume cupboards. Consumption since the first year's operation in 2004/5 has changed by only +9.6% for electricity, -6.6% for gas, and +5% for water, despite a 30% increase in the number of bench scientists. The actions that have minimised usage in this period include:

- Energy efficiency induction for new lab users, focusing on the financial and safety benefits of sash closure.
- Sash closure reminders, through labelling, publicity and inspections by the Chair of the Department of Chemistry.
- Pro-active maintenance, including cleaning fume cupboard baffles and strainers in the Air Handling Units.
- Using annual servicing (especially of air balance controls) and validation (of fume cupboard face velocity) as an opportunity for engineers to advise users on efficient fume cupboard operation (e.g. not impeding air flow through rear baffles by storing items against them).
- Daily tuning of the Building Management System in response to changes in occupancy, weather and load.

Further action is planned to lower face velocities from 0.5 to 0.45m/s or lower – provided that independent testing shows this to be safe – and to establish an internal incentive scheme. This will involve a fine of £1 for open sashes when cupboards are not in use, with the annual proceeds going to the research group with the best record.

These actions have been enabled by the University's Estates function, through its devolved energy budgeting scheme; practical assistance, especially from the Energy Manager, Philip Pike; and delegation of daily building control to the Chemistry Department, in the form of its Buildings and Facilities Manager, Richard Jones.



Richard Jones

Key Points

- Dedicated Building and Facilities Manager provides clear point of responsibility and contact for energy measures
- Devolved energy budgeting provides incentive for Department to minimise consumption
- All laboratory users have induction on energy efficiency and on-going reminders about fume cupboard sash closure and efficiency
- Sash closure increases safety as well as energy efficiency
- Building Management System adjusted on daily basis to optimise energy use
- Annual air balancing and fume cupboard testing used to provide expert guidance to lab users
- Oxford is planning the 'world's greenest Chemistry Research Building' with a target of BREEAM Outstanding

S-Lab Case 7 – Energy Efficient Chemistry

Key Benefits

Carbon and Cost Reduction – as these relate primarily to moderating rates of increase they are difficult to calculate. However, consumption at most other laboratories in Oxford (and elsewhere) tends to rise in line with occupancy. Hence, a conservative estimate is that the actions have avoided a 10% increase in energy consumption, which translates into an extra £65,000 for the Department of Chemistry's budget.

Improved Safety and Well Being – closing fume cupboard sashes improves safety (see below) and reduces the university's risk exposure. The annual balancing of airflows also ensures effective ventilation and minimises the existence of annoying hot spots or cold spots.

Creating Engagement and Momentum – a special focus group chaired by the University Head of Sustainability has identified further improvement opportunities, e.g. a change in the practice of water jacketing reflux reactions, timers on glass drying ovens and even a stair core to negate lift use. The Department of Chemistry Chair, Professor Steve Davies, has set a goal that a planned new building will be the "greenest chemistry research facility in the world" and achieve the BREEAM Outstanding category. Possible initiatives include ground source heat pumps, heat recovery, LED lighting, 'state of the art' BMS, natural ventilation, rainwater harvest and automatic sash closure systems.

VAV Sash Closure has Energy and Safety Benefits

Fume cupboard sashes contain hazardous substances or events, such as explosion or fire. Hence, the lower they are, the safer are working conditions. Variable air volume (VAV) fume cupboards vary the amount of ventilation in accordance with sash height. Hence, the lower the sash, the lower the air movement - and associated energy consumption and cost. (NB Shutting sashes in constant air volume (CAV) cupboards makes no difference to air flow as more 'make up air' is drawn in through side or overhead vents to compensate).



The CRL's central atria

Views

"Richard has brought energy management to the top of the agenda so that all of the CRL team, from the Chair of Chemistry down, think energy all of the time. This excellent example shows that energy demand can be reduced even in highly research intensive buildings. We are now extending it to other University lab managers to further reduce our - rather large - energy use."

Jennifer Wood, Estates Director

"Understanding how the building operates, and tweaking controls accordingly, is vital. For example, the annual barbeque is a time when I can reduce diversity and make the building set back earlier as students take a well earned afternoon off. Devolved budgeting and awareness raising also motivates everyone, from the Departmental Chair and his regular inspections to cleaners turning lights off."

Richard Jones

Further Information – www.goodcampus.org; Richard Jones: richard.jones@chem.ox.ac.uk.

Disclaimer – This case reports information provided by the University. Every effort has been made to ensure accuracy, but readers should verify it as it does not constitute professional advice.