

**CIBSE**  
**The Low Carbon Performance Awards 2010**  
**Design Technical Innovation of Year**

**1.0 TITLE**

Operation and Enhancement Strategies for HVAC Systems for Carbon Reduction

**2.0 GENERAL INFORMATION**

Organisation & Address	Imperial College London Estates Office, Sherfield building, Imperial College Road, London SW7 2AZ
Contact name	Kevin Cope
Phone No	020 7594 9658
E-mail	k.cope@imperial.ac.uk
Category being entered	<i>Design / technical innovation of the year</i>

Imperial College London Facilities Management department has demonstrated a continued commitment to reducing carbon emissions and energy consumption, against a steady increase in student numbers (2003 = 11,771 to 2008 = 14,013), together with a growing demand for controlled environments.

ABS Consulting has worked in partnership with Imperial College London since 2003 on carbon, energy and cost reduction initiatives. The outcome of work to-date has resulted in:-

- CO2 emissions reduction of 2,900 tonnes
- Energy savings of 6.3M kWh
- Energy cost savings of £490,000
- Improved occupant comfort

ABS identified an opportunity to make significant savings using enhanced control of HVAC systems serving the College's research laboratories. The enhancements have been implemented and the measured savings are significant and replicable.

**3.0 MAJOR ASSOCIATES**

Imperial College  
ABS consulting  
Powell Systems  
CJB commissioning

**4.0 WRITTEN SUBMISSION**

**Introduction**

A review of the South Kensington campus by ABS in 2005 identified that technical and operational enhancement to the HVAC systems in two major laboratory facilities would result in substantial carbon savings and improved internal conditions. The laboratories require rigorous ventilation control and pressure differential between adjacent spaces while operating to challenging health and safety standards. Prior to the enhancements these systems were not energy efficient and would

regularly go out of balance, causing occupant concern and discomfort. It was therefore essential that users and H&S team were fully involved with the development of the enhancement strategies.

### **Methodology**

ABS collaborated with the IC Facilities Management department and its service partners developing an enhancement strategy that met the primary objective of the project: to limit HVAC energy consumption, carbon emissions and operating to those necessary to meet the occupier's business needs and provide a safe, productive and comfortable environment for the occupants.

### **The HVAC System**

A description of the system that was selected for detailed analysis is outlined below:

- Two supply air handling units (AHUs) with variable speed fan drives; maximum air handling capacity of 11.48 m<sup>3</sup>/s and fan motor rating of 55kW.
- Two extract AHUs with variable speed fan drive; maximum air handling capacity of 11.6m<sup>3</sup>/s and fan motor rating of 22kW.
- The system was designed to operate continuously at full capacity to provide an adequate air supply to laboratories and fume cupboards while maintaining the differential air pressures required between rooms.

### **Enhancement Programme**

The system was recommissioned to determine whether or not it could operate in accordance with the original design intent and to determine if all components were functional. This identified that some of the balancing dampers had ceased and that the system required rebalancing. It also identified large pressure differentials between rooms which were causing annoyance to users. This was becoming a growing concern in many other laboratory buildings on the campus.

The HVAC requirement for each type of space was determined from discussion with the users and H&S officers. This included:

- air volumes
- cooling requirements
- occupancy times
- requirements for silent hours
- set-back opportunities
- pressure differential between adjacent spaces

### **Night setback**

Although the equipment rooms required 24 hour ventilation for cooling purposes, the main laboratories only required cooling and ventilation during working hours. As a result the equipment rooms were imposing 24 hour operation of the on the systems for the both areas.

In order to implement a night setback, it was necessary to separate the ventilation to the equipment rooms from the main laboratories during silent hours by converting the existing balancing dampers to motorised dampers.

### **Differential pressure Control**

The new motorised dampers provided an opportunity to resolve the balancing and pressure

differential problems by linking them to pressure transducers across the doors of the laboratories.

From the above together with results from the commissioning programme, a strategy for enhancement and optimised operation was prepared by ABS and presented to the stakeholders. The new control strategy included:

- differential pressure sensing between rooms
- motorising the existing balancing dampers
- commissioning the system to provide reduced air flow during silent hours and in accordance with the heat gains of the rooms while maintaining the required pressure differentials between rooms.

The above strategy uses the differential pressure controls and the motorised dampers to provide automatic dynamic commissioning of the HVAC system in accordance with individual room requirements and occupancy.

The strategy supported by all stakeholders was implemented between May and August 2009. Monitoring has shown savings pa will be:

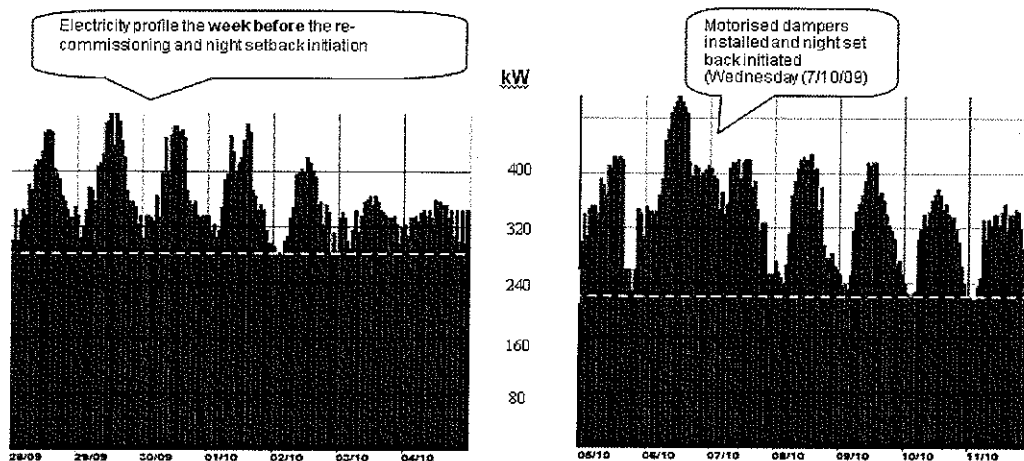
Annual Savings	kWh	Cost £	CO2 Tonnes
Flowers building (Demo project)	565,215	48,326	302

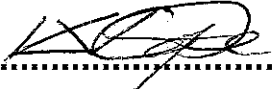
### Replication

The annual savings from roll-out across the estate are estimated to be:

Annual Savings	kWh	Cost £	CO2 Tonnes
Imperial College - Roll Out	3,145,915	267,403	1,689

The carbon reduction potential from roll-out throughout the UK in similar highly serviced laboratories and air conditioned facilities is substantial.



Signed.....  .....

Print Name..... *K V Cope* .....

Date..... *30<sup>th</sup> October 2009* .....

**Please e-mail completed entry to:**

**[rcafferty@cibse.org](mailto:rcafferty@cibse.org)**