TREND CASE STUDY

Trend goes to the top of the class at the University of Leeds

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The University of Leeds is one of the UK's most prestigious higher education institutions and is renowned for the quality of its teaching and research. When its School of Chemistry needed to reconfigure and optimise its ventilation and controls strategy, a Building Energy Management System (BEMS) from Trend Control Systems provided the perfect formula.

Founded in 1904, the University of Leeds is part of The Russell Group, an association of 24 leading UK universities. The University of Leeds has a longstanding commitment to reducing its carbon footprint by the efficient use of energy.

Robert Douglass is one of the energy officers at the University of Leeds and explains, 'As the estate expands, it places an ever-increasing demand on our consumption and, with utility bills in 2016-2017 of almost £12m, it is important that we deliver meaningful interventions in order to use energy wisely.'

All about chemistry

Part of the Faculty of Mathematics and Physical Sciences, the School of Chemistry houses a wide range of laboratories. Ensuring health and safety compliance through appropriate ventilation is vital.

The previous ventilation system was showing signs of wear and was becoming increasingly costly to operate and maintain. Robert Douglass comments, 'We felt that it was time to redesign the whole system. I was aware of the great strides that have been made in ventilation based technology in recent years, and after seeking advice from a US based consultancy, I contacted our longstanding BEMS partner, Westminster Controls, to get some further advice about what we could do.'

For the last 25 years a Trend BEMS has been installed across the entire campus which is supported by Westminster Controls. Westminster is a Leeds based controls system specialist and Trend Technology Centre (TTC) that works closely with the estates team to manage and operate the system. The company's operations director, Adrian Hall, says, 'Our aim is to provide complete integrated control systems and we are proud to be one of a select group of TTCs. We've worked closely with the University of Leeds for over 15 years.

Air apparent

Modern laboratories are often equipped with variable air volume (VAV) heating, ventilation and air conditioning (HVAC) systems. These systems control the level of fresh air that is brought into a laboratory and conditioned. However, on the extract side, buildings are sometimes designed with constant volume fans that are either completely off or running at 100 per cent flow.

'The difference between the building interior airflow and the flow out of the extract stack is controlled with bleed dampers that feed additional air into the extract fans,' states Adrian Hall 'For large laboratory extract systems, it is often possible to operate the fans at reduced volume rates using VAV, and still maintain adequate air quality at all nearby air intakes and other sensitive locations. With a VAV extract system, the volume flow rate out of the extract stack may more closely match the airflow into the building, possibly eliminating the need for bleed air, resulting in the potential for significant energy savings.'

Westminster Controls was subsequently asked to assist in the development of a control strategy design for an existing VAV laboratory extract system. Five laboratory extract systems were previously operating as VAV on the supply side, but as a constant air volume (CAV) system on the extract side.

Solution provider

Through the implementation of this project, the extract system has been converted to operate as VAV, which now minimises the amount of air flowing through the bleed dampers. By doing this, significant energy savings are being realised by reducing the operating volumetric flow rates of the extract fans. All extract fan systems are now safely operating at less than 100 per cent of design flow at all times and the combined energy consumption from two fans operating at reduced volume flow rates is less than the energy consumption from one fan serving both systems.

'The new system also determines exactly where the fans are operating along their fan curves, dictates the minimum fan speeds at which duct static pressure can be maintained, verifies the functionality and response rates for the bleed dampers, and allows the sequence of operations to be developed,' adds Adrian Hall. 'Once we had got to a point where fan energy use was minimised as much as possible, we needed to ensure that we could optimise the control of the new system – that's where the BEMS came in.'

Command and control

A Trend BEMS has been installed at the University of Leeds for many years and, while it was working well, as part of the work at the School of Chemistry, Robert Douglass decided that it would be a good

time to upgrade some of the controllers to enhance operational effectiveness and lower energy consumption.

'Much of the previous BEMS comprised IQ®1 devices and although these were working well we felt that replacing them with a range of state-of-the-art IQ®4 products would complement the work on the ventilation system,' says Adrian Hall. 'They incorporate features that simplify installation, engineering and commissioning, making them particularly suitable for energy efficient, highly distributed local control of services. As with all Trend devices, backwards compatibility is designed in from the outset, so the entire IQ®4 range can communicate with any IQ®1, IQ®2 or IQ®3 controllers already in-situ.' All of the information collected by the controllers is presented via a centrally managed Trend 963 Supervisor.

As well as monitoring the status of the ventilation system and the levels of fumes and noxious gasses in and around the building, the BEMS also carries out a weekly damper test to ensure that everything operates correctly. This allows the effectiveness of the system to be maintained and identifies whether the dampers are able to moderate the fan speed as per the controls strategy. Alarms are also configured to alert designated personnel if defined setpoint and sensor parameters are exceeded.

Money matters

After completion of the VAV extract system, the analysis of BEMS data from 1st December 2016 to 1st June 2017 indicated annual energy savings of £43,672 (587MWh), based on power meter readings.

Asked about the outcome, Adrian Hall replies, 'Given that the project cost around £100,000 to complete, it provides an excellent return on investment.'

Mission accomplished

What has been achieved is testament to the determination of all parties to get the very best out of the BEMS. The final word goes to the University of Leeds' Robert Douglass, who concludes, 'After working with Adrian and his team for many years and enjoying the benefits of having a Trend BEMS, I had high hopes for significant energy savings as a result of this project. However, all my expectations have been exceeded and I'm looking forward to generating further savings across the campus.'

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