

# CASE STUDY ZOO TRUMPETS ELEPHANT HOUSE ENERGY SAVINGS

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There has been a dramatic fall in the energy consumed by the heating and ventilation plant serving Chester Zoo's elephant house. The installation by JBC Controls of a variable speed drive and Trend IQ3xcite controller on the building's air handler has produced annual electricity and gas savings of over £25,000 – for an outlay of just £9,500. Fan power consumption has dropped by an average of 80% and – owing to the demand-led controller strategy implemented by the IQ3xcite – the plant hardly runs at all at certain times of year. The combination of Trend controls and variable speed drives has also yielded savings in other parts of the zoo.

Opened four years ago, Chester Zoo's 'Elephants of the Asian Forest' exhibit comprises a large paddock area with a waterfall, pool and feeding wall and a 2900m<sup>2</sup> steel-framed building with a clear, polycarbonate roof. This structure provides a home not only to an 11-strong herd of elephants but also to a variety of Asian birds, reptiles, fish and smaller mammals, and many plants.

The elephant house is served by a gas-fired, ducted warm air heating system equipped with a 35kW fan. This is also used for ventilation and in the summer months can provide cooling – by blowing un-tempered fresh air into the space. Previously, the plant's controls were very basic with the result that it ran continuously, 24hrs a day, seven days a week – and was only stopped for maintenance.

In August 2008, a variable speed drive was fitted on the fan motor and the latter's speed reset to 80% its former rate. This compensated for the fact that the fan motor was oversized for the application, which is very often the case on air handling plant. Crucially, the 20% reduction in speed meant a 50% saving on electricity usage (owing to the cube law relationship between

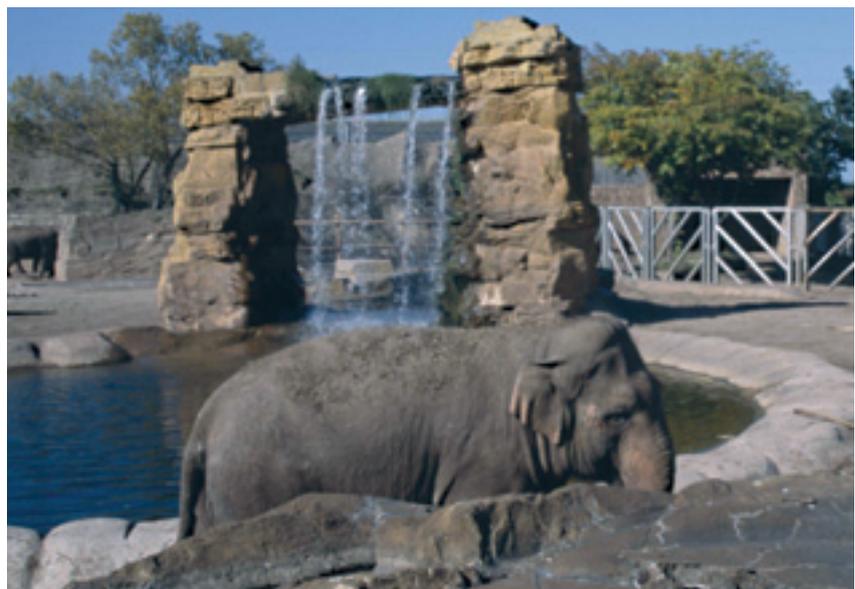
motor speed and power consumption). But with the subsequent installation of the Trend IQ3 intelligent controller, even greater savings have resulted.

Some of these extra savings are due to the much more stable control of the heating that is now being achieved. In addition, the IQ3xcite has made it possible to reduce the temperature setpoint at night – from its daytime level of 23°C +/- 1°C.

But by far the biggest additional saving has come from the demand-led control strategy programmed into the IQ3xcite. This matches the operation of the plant, including fan

speed, to actual demand. It has had a particular impact in the temperate months. Indeed, during June, July and August of last year there was little or no demand for heating, while cooling and air quality requirements were largely met by passive ventilation, which is promoted by the building's design. Fresh air infiltration and flow are encouraged by the numerous openings in the elephant house and its massive main doors – which are left open during the day to allow the herd to wander in and out.

When environmental conditions are satisfied, the controller switches the





plant off completely. Last summer it remained off for hours or even days on end. As a consequence, electricity consumption in June was only 904 kWh and in July a mere 597 kWh – which was just 2.5% of the level a year previously. In August 09 it was 602kWh. In the first 12 months that both the VSD and controller were operational (Dec 08 – Nov 09) the power consumed by the air handler fan was 46,937 kWh, a fall of 80.5% compared with the year before the equipment was installed. This represented a cut in CO<sub>2</sub> emissions of 84 tonnes and a financial saving of £21,300. Added to this there was an annual reduction in gas usage worth approximately £5,000. There has even been a £500 saving on replacing air handler filters, the service life of which has increased 60%.

Previously, when there was no means of measuring the build up of stale air inside the elephant house, the air handler fan was always kept running to ensure sufficient air changes, though as has now been discovered

this was unnecessary. The zoo has found that passive ventilation is so great that the plant rarely needs to operate just to maintain air quality at the desired level, for both animals and the public. And even when it is run for this purpose, the fan is typically working at 50% speed. The controller determines whether there is a need for mechanical ventilation based on the readings from a Trend sensor that monitors the level of a range of gases and impurities. Before being installed in the elephant house, this was first fitted in the zoo's main administration building, which allowed an acceptable air quality threshold to be established.

The zoo's Maintenance and Site Services Manager, Ray Morrison, is understandably pleased with the results of the elephant house scheme: "We have carried out a number of projects aimed at improving energy efficiency and reducing our carbon footprint. This has undoubtedly been the most successful, which is largely due to us being able to maximise savings by means of the demand-

matched control strategy. After all, there is nothing more energy efficient than plant that is turned off. The financial savings are especially important to us as they will help to fund future refurbishment projects at the zoo and our animal conservation work abroad."

An important spin-off benefit of running the air handler fan at a slower speed is that background noise levels in the building are much reduced – since air travels through the ducting at a lower velocity. This is most noticeable in the plant room, where carrying out a conversation used to be well-nigh impossible. Also, because fan speed is now ramped down gradually prior to stopping, there is no longer a loud boom that could potentially alarm the elephants when the plant is shut-off.

There are Trend IQ controllers in five other buildings at the site, all of them supplied and engineered by JBC Controls. In two of these – one of which provides the living quarters for the zoo's jaguars and the other the home of its komodo dragons – the IQs perform a similar function to the one in the elephant house. Though the savings have been smaller, they are still significant – amounting to an estimated £22,000/yr on power consumption. Chester Zoo has now adopted a policy of only specifying Trend building controls.

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