EnergyManagement
Association of New Zealand

Auckland University does its homework and saves a fortune

Old 1970s gas fired heating boiler

New gas fired condensing boiler

Client: University of Auckland

EMANZ Member: Denis Agate, Energy Manager – University of Auckland

Challenge: Significantly reduce the University of Auckland's energy and water consumption and integrate energy and water efficiency into new build projects.

Solution: The University was one of the first organisations in New Zealand to appoint a designated energy manager, Denis Agate. Denis has led a number of energy management initiatives across the University campus, achieving savings of over $100 million in gas and water costs and reduced electricity consumption.

In brief: Following the oil crisis of the 1970s, the University commissioned a report which estimated energy use on-site could be reduced by 10 per cent. Energy Manager Denis Agate was asked to implement the recommendations. In doing this, he recognised the potential for significantly more energy saving. Denis went on to study for a diploma in energy management. Strategies he has been involved with include connecting the mechanical plant to a Building Management System (BMS) and decentralising the heating systems. A major challenge was convincing building designers to take a whole-of-life view of a building's consumption and costs. Today, the facilities management team is involved in design consultation for all building projects.

The project

Denis Agate joined the university in 1980 as a mechanical engineer in Property Services, ultimately becoming Energy Manager. One of the first initiatives was to start a programme of reading all electricity, gas and water meters serving the University.

"Prior to the 1970s 'oil shock', energy and water was so cheap and no one considered measuring their usage. There was so much wastage, and we quickly realised achieving a 10 per cent saving would be simple," said Denis.

One challenge was the many manual time clocks controlling plant, making it impossible to change them fast enough to respond to events like public holidays. Another was the fact that the huge central gas fired heating boilers were located in central positions, with heating distributed to remote buildings via underground piped hot water systems, leading to massive standing heat loss. Also, the operation of central boilers was determined by the first building in the day that required heating through to the last building being switched off in the evening. Underground heating pipes eventually suffered from a series of catastrophic failures.

The campus has grown rapidly. Since 1979 student numbers have increased from 9,800 equivalent full time students (EFTS) using a gross floor area of 242,000 square metres, to 34,000 EFTS and 574,000 square metres.

The solution

In 1983 one of Denis's colleagues had the first computer in Property Services and the skills to implement a BMS, a fairly new concept for New Zealand. Replacing time clocks with this meant they could place conditions of operation on each piece of plant.

In 2000, the University proposed installing a fibre optic ring main around the central city campus. Denis saw a cost-effective opportunity to decentralise heating plant and include water and gas pipes in the same trenches as fibre optic cable.

"I presented a business case proposing the distribution of fuel (natural gas) to individual buildings along with the installation of small self-contained, energy-efficient boilers at the point-of-use," said Denis.

"A lot of our central plant and underground heating pipes were at end-of-life, so we could build a strong case for senior management that this proposal was a viable alternative to replacing existing infrastructure. The bonus was it would make significant energy savings by eliminating standing heat losses at the central boiler station and the distribution of the heating water. We took a multi-stage approach to this large project, and at each phase demonstrated that we were achieving the calculated payback, which was three to four years."

Denis recognised the need for the Facilities Management (FM) team to become more involved in the development of new buildings. "Consultants were still designing buildings and plant the way they had done when energy was cheap," he said. "It's been a paradigm shift, to get people to see things differently, but results have proven this new approach over time."

In 2007 it was agreed the FM team would have input into the design of building projects, which has brought vital institutional knowledge to the design work. "I think that's pretty progressive. People from other organisations often tell me their FM people still aren't consulted during the design stage," said Denis.

Denis also introduced water efficiency initiatives. These included sensors to control flushing in urinals, and the installation of recirculating systems so that water used for cooling equipment – such as lasers in labs – could be recycled. Water meters are now installed on all plant and equipment consuming water, and monitored regularly for spikes in usage.

To improve lighting efficiency, T12 fluorescent fittings and incandescent lighting have gradually been replaced – mainly with T5 fluorescents. Occupancy sensors have been installed in common spaces. In the main Library, occupancy sensors control lights in the aisles between every book stack. Perimeter zone lighting on all floors switches off when external light is sufficient. LED lighting technology has been introduced cautiously, and external precinct lighting is currently being replaced with LED. This means lighting levels at ground level are increased, but with reduced light pollution and electricity usage.

A 'controls' contractor progressively checks the logic of the HVAC operation and proves that overall plant and lighting systems are responding correctly. After recently discovering and replacing a failed signal transmitter in a carbon monoxide sensor controlling the car park fans, the resulting drop in consumption was almost 1 million kWh/year. The person who made that discovery had just completed the *EMANZ Continuous Commissioning for Commercial Buildings Specialist* course.

Every building is benchmarked in terms of total energy (gas, steam and electricity) and water usage. "We know the annual kWh and water usage for each building, and categorise these by type (science, high rise, low rise, accommodation etc). Similar buildings have similar usage. By benchmarking, we are alerted if a building is using more than it should. We can then investigate the issue, and if necessary engage an energy auditor to undertake a detailed study," said Denis.

Denis has tracked the university's consumption alongside its growth from 1979. He measures 'normalised' savings by plotting consumption against student numbers and building area.

In real terms, consumption data collected since 1981 shows:

- despite the 3.5 fold growth in EFTS and greatly increased operating hours, total water and gas consumption is no higher
- total energy consumption per EFTS is 41% lower, despite electricity savings being harder to measure because of operational changes and the introduction of desktop computers and data centres
- 19 billion litres ($74 million) of water have been saved over the period
- 410 million kWh ($26 million) of gas has been saved.

That's a great result from some simple but effective strategies with a focus on continuous improvement!

"Sound evidence is very important when building a case for management, clearly showing the benefits and savings compared with the cost. Good communication is important in achieving buy-in. I work very closely with Dr Lesley Stone, the Manager of Sustainability and Environment. Lesley is the interface between our team and the academic and management team and is very good at communicating technical information."

Denis Agate, Energy Manager, University of Auckland.

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