

# Better controls save university \$173,000 in first year



Porsche enthusiast Robin Dunmall aims to get the best energy performance from the University of Waikato by running it like a well-tuned engine. An energy performance contract with Honeywell has proven a cost-effective tool.

UNIVERSITY OF WAIKATO  
TECHNICAL SERVICES MANAGER  
**ROBIN DUNMALL:** KEEPS PUSHING FOR  
IMPROVEMENTS. ▶

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## About the University of Waikato

The University of Waikato, on 68 hectares of rural land on the outskirts of Hamilton, has 1788 full-time-equivalent staff and 14,405 students.

Its total revenue in 2003 was \$175.7 million, with research income of \$17.9 million and a financial surplus of \$8.2 million.

From 2002 to 2004 the university increased its campus building area by 13,400 square metres to 137,400 square metres.

In the same period the energy consumption fell from almost 208 to 200 kilowatt hours per square in spite of

Good systems and advice are the backbone of the University of Waikato's energy management practices.

Running a multi-million dollar enterprise demands a strategic approach to make the best use of the time and money available.

Although the university spends around \$1.7 million a year on electricity and gas, energy management is officially less than 10% of technical services manager Robin Dunmall's job.

But because of his enthusiasm and perseverance, energy efficiency initiatives are saving the university hundreds of thousands of dollars of running costs each year.

"If it weren't for him pushing things into my face we wouldn't have achieved half what we've done – well, it would be happening, but a lot more slowly," says Dunmall's boss, facilities manager John Cameron.

**ROBIN DUNMALL**  
**"GOT AMBITIOUS"**  
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 PUSHED FOR  
**ENERGY-  
 EFFICIENT  
 LIGHTING,  
 AIR-CONDIT-  
 IONING  
 AND SOLAR  
 WATER  
 HEATING.**

Luckily, Cameron has a sympathetic ear and an excellent grasp of energy issues, but other matters constantly vie for attention on his list of priorities.

### Energy performance contract

Large-scale energy management initiatives must be approved by the university's board. One project they would have found it difficult to refuse was an energy performance contract with international building services and controls supplier Honeywell.

Honeywell promised to tune up key facilities with upgraded controls and monitoring. An EECA Crown Energy Efficiency Loan would cover the upfront capital cost.

Honeywell guaranteed savings of \$96,000 a year for six years. This would repay the loan within five years. After that, the university could keep the ongoing savings. If the savings didn't meet expectations, Honeywell would make up the difference.

Honeywell has completed the upgrades and the university has seen a sharp improvement in energy efficiency. In the contract's first year, savings of \$173,000 pleasantly exceeded expectations.

Dunmall has also overseen the refurbishment of a four-storey 1960s administration block, where he pushed for energy-efficient heating and lighting, solar water heating, insulation and sun-shading.

Next he is planning a major energy efficiency upgrade of the library lighting that will improve conditions for users.

He's particularly enthusiastic about the proposed new School of Management building, which promises to be a showcase for low-energy design.

### Good advice

During these initiatives, he has sought advice from experts such as environmental engineers Tricia Love and Dave Fullbrook. Fullbrook prepared an energy efficient design brief that's used for all new facilities.

Dunmall has used EECA-administered Crown energy efficiency loans to get work done.

With a background in health facilities, Dunmall has been at Waikato University for 12 years – long enough to build up useful institutional knowledge and to follow-through his energy management initiatives.

Dunmall keeps in touch with energy managers at other large Waikato facilities such as Hamilton City Council, Waikeria Prison and Waikato Hospital. He and Cameron catch up with their peers at twice-yearly workshops and annual conferences of the Tertiary Education Facilities Management Association for Australia and New Zealand (TEFMA).

Each year, TEFMA publishes a collection of data that allows each institution to benchmark itself against its peers. Cameron and Dunmall pay close attention to where Waikato University sits in the league tables of energy consumption.

The university annually consumes 0.68 GJ per square metre of floor space and 6.5 GJ per full-time-equivalent student, placing it in the lower half of the 72 Australasian tertiary institutions involved. This translates to \$12.46 in energy charges, including line charges, per square metre and \$120 per full-time-equivalent student.

Cameron and Dunmall find the TEFMA information reliable and relevant. ▶

cooler temperatures that increased the need for heating.

The university's Facilities Management Division pushes strongly to raise awareness of energy management.

Campus gathering-places sport energy efficiency posters.

The division's website includes a handbook for staff and students. It explains why it's not a good idea to have individual heaters and asks people to switch off lights to support energy conservation.

The website also shows graphs of the university's electricity and gas consumption from 1994 to 2004.

The website states the policy:

"We have an energy management programme to:

Ensure resources are made available for energy saving activities and that these resources are targeted to provide the best return on our investment.

Encourage the university community at large to assist in saving energy.

Ensure the energy we purchase is obtained at least cost, and when it is recharged this is conducted fairly and in good time.

Ensure utility records are maintained to provide accurate information for future developments, for budgeting and in full support of a well targeted energy management programme."

## 1960s building gets 21st century makeover



1

- 1 THE B BLOCK.
- 2 SOLAR WATER HEATING SYSTEM.
- 3 AFTER-HOURS CONTROLLER FOR AIR CONDITIONING ON DEMAND.
- 4 A VARIABLE-REFRIGERANT-VOLUME AIR CONDITIONING UNIT IN THE CEILING.



2



3



4

In June 2005, Waikato had almost completed updating one of its earliest buildings, the 1967 Administration Building (B Block), which houses the Vice-Chancellor's office, human resources and other administration functions on four levels with a total floor area of 2600 square metres.

The energy aspects of the \$1 million refurbishment project began modestly with a heating upgrade, but Dunmall "got ambitious" and pushed for energy efficient lighting, building controls and solar water heating for domestic hot water. A gas booster supplements the heating when sunshine is limited.

On the sunny day EnergyWise News visited, the temperature of the solar-heated water was 68°C.

The light switching is set up to encourage maximum use of the natural light that floods through the office windows.

"There's just about a switch for every light!" says Dunmall.

The lighting is all energy-efficient T5 lamps, which Dunmall says is superb. The improvements have reduced the lighting energy consumption from 22 to 11 watts per square metre.

Lighting and ventilation in the restrooms are controlled by occupancy sensors.

The B Block has heating throughout but has on-demand cooling in only selected areas, such as the conference room and executive meeting rooms.

During the upgrade, the heating system was rebuilt. It has a new efficient burner and high standards of pipe insulation.

Individual areas have thermostats to control temperatures, and the amount of fresh air can be adjusted for optimal energy efficiency.

Extra wall insulation has been added and sunshading is being installed on the exterior.

New lowered ceilings improve light distribution and reduce the volume of air to be conditioned.

The air conditioning is based on energy-efficient VRV (variable refrigerant volume) technology programmed from the building management system. After-hours run-on buttons give an hour of extra use when required.

Automatic metering captures data and sends it to the building management system.

### Energy performance contract guarantees savings

An energy performance contract is a way for an organisation to reduce the financial risks associated with energy consumption.

The contractor – in this case, Honeywell – designs and carries out a programme to improve the organisation’s energy efficiency.

The parties agree the terms, which are based on an energy audit to establish a baseline and find out how much money can be saved on energy and operating costs. The savings are leveraged to pay for building improvements.

If the new energy system fails to reap the agreed savings, Honeywell makes up the difference.

If the savings exceed the guarantee, the organisation keeps them.

### The Honeywell contract

In the University of Waikato’s energy performance contract, Honeywell installed modern control gear that saved energy by making the buildings more efficient.

To pay Honeywell the upfront capital cost, the University obtained a Crown Energy Efficiency Loan administered by EECA.

Honeywell guaranteed energy savings of \$96,000 a year for six years. In the contract’s first year, from 1 February 2004 to 31 January 2005, the university saved nearly twice as much – \$173,000.

### The Honeywell system

Honeywell’s strategy was to upgrade the existing Honeywell building management system (BMS) to an Enterprise Buildings Integrator model and upgrade the controls for six key facilities (see opposite).

The central controller of the BMS is an Excel 500 model. It is networked to Excel 50 controllers in the various facilities.

The Excel 500’s built-in functions include self-adapting heating curves (the heating system learns from experience), optimisation of air conditioning plant switch-on and switch-off times, and automated adjustment of thermostat setpoints based on outside air temperatures.

The Excel 50 controllers can be used to control air handling, heating and district heating, depending on their software. At the university they also monitor energy meters.

An Excel 50 next to the main switch room has the software to monitor total site power consumption and allows automatic switching off (shedding) and restoring of selected loads\*.

This limits the maximum energy demand during the network company’s measuring period, a 30-minute interval.

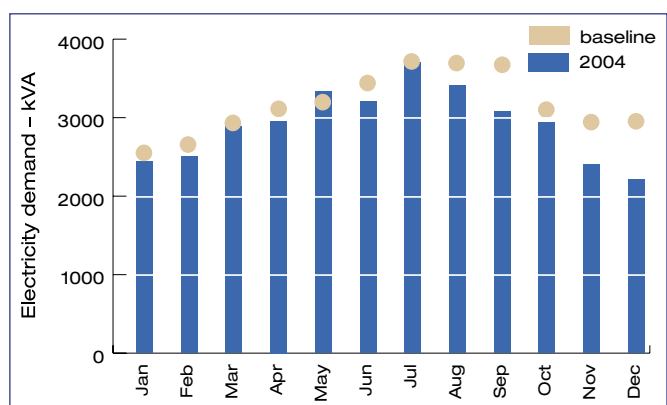
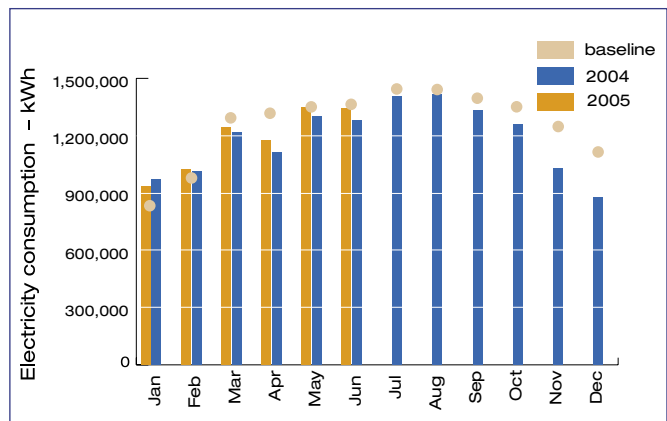
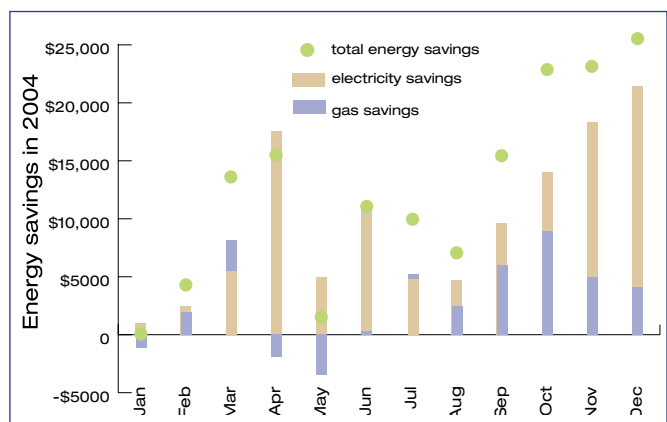
The new system can be operated through a remote modem. Both Honeywell and university facilities staff can dial in to view and adjust it. It’s now easier to detect faults.

Honeywell worked with the university to identify and rationalise the number of alarm points and computers on the system’s network, and to modify the graphics of the building management system. Says Honeywell account manager Pushkar Kulkarni: “It’s the biggest single installation in the southern hemisphere. With the number of points and controllers, it’s complicated.”

### Energy management strategies

Honeywell’s energy management strategies included optimising start and stop times for air conditioning plant, resetting boiler and chiller temperatures according to the need for heating or cooling and using fresh air for cooling.

THE GRAPHS SHOW SAVINGS IN ENERGY COSTS DURING 2004, ELECTRICITY CONSUMPTION IN 2004 AND 2005 AGAINST HONEYWELL’S BASELINE AND ELECTRICITY DEMAND IN 2004 AGAINST HONEYWELL’S BASELINE.



Dunmall says Honeywell's proposal was hard to turn down. "It was a no-brainer. We got the EECA money. It would have taken us five years to do it otherwise. But Honeywell saved us money by trimming off the top of the maximum demand and [installing] smarter controls than we could afford on our own."

Initially, Honeywell conducted an energy audit and wrote a preliminary report.

It requested a letter of intent and calculated whether the work would have a payback that would qualify it for Crown Energy Efficiency Loan funding.

For customers who go ahead with a performance contract, Honeywell's preparatory work is included in the contract price. Says Honeywell account manager Pushkar Kulkarni: "If they don't sign [a contract] they pay for our services up to that point and walk away."

When the university decided to go ahead, international Honeywell consultants verified the savings, using software called Metrix to work out the baseline energy consumption month by month.

The baseline agreed between Honeywell and

the university changed during the contract's first year, for various reasons. Some of the original meter readings had been inaccurate, and Honeywell was dealing with a moving target – the university added and changed buildings, bought computers, adjusted air conditioning equipment and enrolled more students.

The price of natural gas and electricity increased during the year.

The adjusted baseline cost is the cost that is estimated to have been incurred without the energy management programme.

## HONEYWELL ENERGY PERFORMANCE CONTRACT

The campus's Honeywell Building Management System, which communicates through a local area computer network, was upgraded to an Enterprise Buildings Integrator version. It included software for controlling peak demand\*. New field controllers were installed, and various energy management strategies were carried out to improve comfort conditions while reducing energy costs.

### A. Academy of Performing Arts

Occupancy sensors were installed in the concert, dance and playhouse areas to enable better control of air conditioning and lighting. Daylight sensors are being used to detect how much natural light is coming in and adjust electrical lighting levels accordingly.

The building is integrated with the peak demand control system\*.



### F. Chapel and Student Services

A new controller interfaces with existing floor and skirting panel heating. This enables increased automation of building controls.

Three electricity meters in the building are now monitored electronically. The building is integrated with the peak demand control system\*.



### E. Information Technology Services

A new controller was installed in each electrical distribution board.

This increases automation of building controls and integrates with the peak demand control system.\*



### B. College Hall

The controls for the central boilers and accommodation plant rooms were upgraded, for better control of hot water and heating. The cafeteria ventilation plant was refurbished for improved efficiency and operation.

### C. Waikato Management School

The existing control gear was expanded to enable greater use of occupancy sensors at main entry points.

It gives a greater degree of air conditioning and heating control. The building is integrated with the peak demand control system\*.



### D. Computing & Mathematical Sciences

An economy cycle has been installed to the air conditioning units.

\*The **peak demand control system** manages campus electrical demand so it never exceeds a pre-determined maximum. Otherwise, the network company's "maximum demand charge" can become hefty. Integrating many buildings gives more options for switching off loads, such as water heating, to reduce demand.



## School of Management – environmental showcase

The Management School project is an exciting building scheme that will supplement a group of small old buildings with a model energy efficient building intended as a showcase for environmental design.

The plans for the medium-rise building with lecture theatres, atriums and water features are still on the drawing board, but the university has received advice from low-energy buildings experts Brenda and Robert Vale of Auckland University and engineers Tricia Love and Dave Fullbrook, previously of Ove Arup in Auckland.

Fullbrook previously developed a design brief for new buildings for Waikato University, that sets out conditions for energy efficiency and other environmental aspects.

Dunmall says he is using it as a standard procedure for contractors: "This is our Bible, our standard brief."

## Library lighting upgrade to cut running costs



An upgrade of the library's lighting will reduce energy consumption, improve lighting quality and make maintenance easier.

Robin Dunmall demonstrated modern energy-efficient T5 lamps and electronic ballasts, with Dynalite motion sensors and dimmers, along one aisle in the library to show the staff how effective a total upgrade would be.

The light levels at the bottom of the book stacks rose from 30 lux to 95 lux.

Previously, it was hard to see the books at the bottom of the stacks.

Wrote facilities manager John Cameron: "I must say it was a totally different experience going into the new lighting area as the light was both cleaner and clearer and was shed right down to the bottom of the stack."

The library is open 15 hours a day for around 350 days a year.

At present, when any of the 723 T8 tubes need replacing it's awkward for the contractors to manoeuvre their ladders around the library shelves.

The new long-life Trilux 5051 T5 lamps last around 7.5 years.

They will be attached to rails on top of the book stacks instead of the ceiling.

the installation on three floors is expected to reduce power consumption by 570,000 kWh a year and reduce maximum power demand by 67 kW.

Because the lamps produce less heat, the air-conditioning chillers will save around \$9500 of power a year.

Re-tubing costs including material and labour will average \$8 per tube.

The university has been awarded a \$400,000 Crown Energy Efficiency Loan towards the \$500,000 cost of the upgrade.

## Future projects

The science laboratories are being fitted with a heat recovery system.

Dunmall aims to get an enthusiastic volunteer to act as energy manager for each school. Being on the spot, they'll be able to remind people to switch off lights and computers.

Cameron says the university has already picked up most of the obvious opportunities for energy savings. "I suspect the best bang for our buck is going to be the management of how people use energy – switching off computers and lights."

The university has held two sessions with EECA to use Energy Achiever diagnostic software to assess its current energy management status and pinpoint areas that need attention.

With the key facilities running sweetly, other buildings being refurbished and good systems in place, the university is well set up for the future.

### CREDITS

**Client** University of Waikato

**Energy performance contractor**  
Honeywell New Zealand Ltd

**EECA account manager** Russell Baillie

**EECA Crown Energy Efficiency Loans advisor** Dan Coffey

**University of Waikato Facilities Management Division** [www.waikato.ac.nz/fmd/energy\\_management.shtml](http://www.waikato.ac.nz/fmd/energy_management.shtml)

**Case study text and photos**  
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