Level 1 Energy Audit of Ōtaki College, Mill Road, Ōtaki.

Auditor
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Site visit
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Energy use
Electricity
228,892 kWh per year, equal to $43,789 per year cost excl GST

Note, only one bill based on actual meter readings was provided (Feb to March 2013). School holidays and other seasonal factors such as increased demand for electricity for heating in winter have not been taken into account in this estimate, but to a certain extent they should cancel each other out (i.e less use in summer holidays and more use in winter compared to the late summer/autumn bill used).

Natural Gas
857,166 kWh per year, equal to $59,364 per year cost excl GST

Two bills were provided. These carried a graph of the previous 12 months. This was used to estimate full year usage (Feb 2012 – Jan 2013) with reasonable accuracy.

Tariff analysis
Electricity
The retailer is Contact Energy. Like all electricity retailers, they pass through transmission and distribution charges from the local lines company Electra, and put their own charges for the actual electricity and their own services on top of these. The combined charges are shown on your bill. The School is on the 'Triple Saver' tariff.

Peak	25.615 c/kWh
Off peak	15.313 c/kWh
Night	11.193 c/kWh
Supply charge	$1.32/day

These prices are excluding GST. There is no prompt payment discount.

Comparison of these prices to Council's suggests that savings could be made via a competitive tender. Furthermore, the school would qualify for Electra's new 'Standard Industrial' rates, which has been offered to large users of electricity from 1 April 2013. If it is not already on this tariff, the school could save approximately $830 per year by switching.

To get this rate simply ask your retailer (currently Contact Energy) to switch you to it. The saving will appear via a change in the prices charged by your retailer.

Natural Gas
The retailer is Genesis Energy.

Variable rate	6.37 c/kWh
Supply charge	$13.00 /day

These prices are excluding GST. There is no prompt payment discount. Comparison of these prices to Council's suggests that savings could be made via a competitive tender.

Energy use indicators (EUIs)
The energy use indicators for the College are below.

Floor area gross: 7,461 m^2
Floor area teaching: 5,424 m^2
Number of pupils: 437

	Floor area gross	Floor area teaching	Per pupil
Unit	kWh/m^2	kWh/m^2	kWh/pupil
Electricity	31	42	524
Fossil fuel (gas)	115	158	1,962

There is no historic data with which to calculate EUIs for past years at the College (internal comparison). Some other EUIs are provided below for external comparison for the *EECA Energy Efficient Schools Guide*[1].

UK BRECSU 1996 for Primary Schools

	Typical	Good Practice
Unit	kWh/m^2	kWh/m^2
Electricity	28	20
Fossil fuel	173	126

Forbury Primary, Dunedin

	Floor area	Per pupil
Unit	kWh/m^2	kWh/pupil
Electricity	64	404
Fossil fuel (coal)	254	1,614

Northcote College, Auckland

	Northcote College	'Reasonable' NZ
Unit	kWh/m^2	kWh/m^2
Electricity	52	40

Analysis
There is not a lot of information available with which to make external comparisons. However, based on the information here it would seem the College has good EUIs by floor area, but poor on a per pupil basis, compared to Forbury Primary at least. The College has two unused class rooms, but as their combined area is less than 100m^2 of space, this will not make a significant difference to the EUI values.

[1] www.eecabusiness.govt.nz/resource/energy-efficient-schools-guide

It is suggested the staff at Ōtaki College encourage the other colleges and schools in the area to calculate their EUIs, which will form a much better basis for comparison.

Description of site and services

Buildings

The buildings are typical of Ministry of Education buildings built in the middle of the 20th Century, being timber framed weatherboard and fibre cement board with shallow pitched corrugated iron roofs and having wooden framed windows. Some buildings such as the administration block have flat roofs. It is not known what insulation the buildings have, or what condition it is in.

The College is planning a rationalisation programme to remove or demolish two relocatable class rooms, the music room and the old library, and relocate the library to a space presently occupied by two classrooms in the Nelson Block.

The College also has plans to refurbish the administration block to create a clear entranceway to the school buildings. It is likely a pitched roof will be built over the existing flat roof, and an internal refurbishment will be carried out. The admin block currently suffers from overheating in summer and its refurbishment is an opportunity to address this.

There is a swimming pool at the College but it is unheated.

Heating

The primary heating for the site is an Ygnis natural gas boiler that circulates hot water to radiators, providing heating to around 75% of the site. The boiler has no controls other than a timer, which turns the boiler on for around 3 hours in the morning. Staff manually turn the boiler on for extra heating and out of hours heating. There are no separate heating zones or thermostatic radiator valves. The boiler plate says the output of the boiler is 814kW, for an input of 899kW. It is around 20 years old. Valves and elbows in the pipework in the boiler room are not insulated.

In addition there are direct-fired radiant gas heaters in the school hall which are used manually on demand. They have a one-hour timer to avoid being left on unnecessarily.

There are also nine heat pumps and six non-portable electric heaters.

Hot water

Hot water is not currently provided in the student toilet blocks, although this may need to be provided in the near future to meet Ministry of Education standards. Instantaneous water heaters are used in the staff room and for showers. There is no hot water storage at the College.

Lighting

The school is primarily lit by 5ft T8 Fluorescent tubes (Philips Alto, 58W). The lights have simple manual on-off control. They are covered with prismatic diffusers.

Computers and equipment

There are computers throughout the school. During the audit several were observed to be on (including the screen) and idle.

Opportunities

Energy measurement and comparison
Tracking the energy use of the school and comparing present performance to past performance is a good way to detect wastage when it occurs. This can be done from data on energy bills, but this can be improved upon with web-based data collection and display systems, which can give faster, more detailed and therefore more useful feedback to staff and students.

As previously mentioned, comparison to other schools (particularly secondary schools) would be useful. The College could encourage neighbouring schools to produce EUIs regularly and share them, which will give further insights into how they are all performing, where improvements can be made and which energy saving approaches work best.

Involving students and staff
Students and staff can all play a role in saving energy by turning off lights, heating and equipment when not needed, suggesting ideas for improvements and reporting energy waste when they see it. There is a wide range of methods that could be used to communicate energy saving messages throughout the school including at assemblies, on posters, newsletters and via the curriculum. A 'green team' could be formed to look at energy and other environmental actions around the school like reducing waste and saving water. Critical to the success of any such campaign is timely and relevant feedback on actual energy use so students and staff can tell if and how their actions are having an effect. This is why measurement is important.

Automation
Presence sensors can be used in occasionally-used spaces like toilets to turn off lights when unneeded. Software can be installed to switch off or standby computers and screens when not in use. Timer switches can sometimes be used on printers and other pieces of communal equipment that tend to get left on. Such approaches take the responsibility for managing energy away from staff and students, so careful thought needs to be given to how such measures fit with an education and encouragement campaign.

Boiler
There are several opportunities related to the boiler which would make its operation more efficient. However, these need to be assessed not just with respect to energy savings (reductions in consumption) but also increases in service levels – e.g. the amount of time the rooms are at an acceptable temperature. The current system of control, which does not have a thermostat, may equally result in underheating as well as overheating of the school. Savings from improved, automatic control will only eventuate if the school is typically overheated at present. However, improved service levels (consistent heating to an acceptable level, fewer incidents of both under heating and over heating) are likely to result in either case. Therefore achieving improved service levels is a key consideration of any business case for improvements to the boiler controls.

The low EUIs suggest it is likely the school is being underheated at present. A baseline of the present 'service levels' could be more accurately determined by logging indoor temperatures around the school over an extended period.

Possible boiler heating control improvements include installation of thermostatic radiator valves, introducing separate thermostatic and schedule-controlled heating zones and/or the inclusion of an ‘optimiser’ control that calculates when the boiler should start each day to achieve the target temperature by the required time.

Other improvements include upgrading pipe insulation in the plant room and between classrooms, and replacing the existing boiler with a modulating, condensing gas boiler.

Hot water
The most efficient way to provide hot water in student toilet blocks are likely to be with small electric water heaters. Generally they have no water storage or small vessels (e.g. around 20 litres) where several outlets are served by one device. As a general rule the amount of hot water stored should be minimised, given the low utilisation rates of these facilities.

Rationalisation programme
When the library is moved into the Nelson block, the internal reorganisation will be a good opportunity to reduce the amount of lighting power needed by going to T5 fluorescent or LED tubes. Controls could also be considered to dim the lights when daylight is abundant. Depending on the extent of the works to the linings of external walls and the ceiling, insulation levels could also be increased.

Administration block upgrade
Insulation could be increased in the admin block when it is upgraded. Natural shade in the form of a veranda or some other form of deep overhangs above the North and West facing windows could be part of the design, which along with the insulation would also help reduce overheating.

Given the way that the main boiler is presently controlled, and that the admin block has longer and more regular hours of usage than the rest of the school, a separate heating and cooling system in the form of heat pumps is likely to be the most effective and efficient approach to conditioning this space.

As with the relocation of the library, lighting in the admin block could also be upgraded to T5 fluorescent or LED tubes as part of the upgrade.

Summary
It would appear that Ōtaki College’s energy consumption is reasonably low compared to other schools on a per metre squared basis. Given the building fabric, lighting and heating are not the most efficient technology available, this may be related to the relatively frugal practices employed to manage energy, with the downside that this may be at the expense of service levels (e.g. space temperature levels, hot water provision in student toilets). Also in certain areas, technologies have been chosen that use energy efficiently and effectively: for example instantaneous water heating for showers, the radiant gas heating in the assembly hall.

Ongoing measurement of energy use and comparison to other schools is recommended. There are good energy saving opportunities which warrant further investigation, especially those related to other capital works upgrades. Some of these measures are more likely to result in improved service levels rather than reductions in energy consumption.

The school should check with its electricity retailer Contact Energy to see if it is currently on the ‘Standard Industrial’ tariff offered by Electra and switch to it if not.

Further reading: EECA fact sheets for schools

Heating and cooling
www.eecabusiness.govt.nz/resource/saving-energy-schools-heating-and-cooling

Lighting
www.eecabusiness.govt.nz/resource/saving-energy-schools-lighting

Water heating
www.eecabusiness.govt.nz/resource/saving-energy-schools-water-heating

Equipment and appliances
www.eecabusiness.govt.nz/resource/saving-energy-schools-equipment-and-appliances

New buildings
www.eecabusiness.govt.nz/resource/saving-energy-schools-new-building-projects

Renewable energy
www.eecabusiness.govt.nz/resource/saving-energy-schools-renewable-energy