

# Pre-constructive surgery



Waitemata District Health Board set up its new west Auckland hospital to snip energy costs before the first sod was turned.

IN AN **UNUSUAL APPROACH** FOR NEW ZEALAND BUILDING PROJECTS, THE DESIGN HAD AN **ENERGY AUDIT** SO **ENERGY EFFICIENCY IMPROVEMENTS** COULD BE MADE **BEFORE CONSTRUCTION BEGAN.** ▶

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## About Waitakere Hospital

The \$60 million 180-bed sub-district general hospital is part of Waitemata District Health Board's \$120 million five-year Orion redevelopment programme begun in early 2000.

A major two-level hospital block of 14,700 square metres is an extension to the main (Hughes) block.

More than 500 new staff positions have been created.

The population of the area the hospital serves is expected to grow from its current 178,000 to 254,000 by 2021.

### Facilities before redevelopment

Maternity, geriatric services, minor day surgery outpatients, mental health, community services.

### After

- Emergency department-acute assessment unit, designed to cope with 23,000 patient visits a year.
- Six-bed coronary care unit.
- Medical and surgical services including four operating theatres and two procedure rooms
- Child health – 24 hour paediatric assessment and treatment beds.
- Special care baby unit.
- Health services for older people.

Waitakere's new hospital sets the scene for future design partnerships with a goal of energy efficiency.

It's obvious that the best opportunity to set up an energy efficient facility comes early in the design stages, when it's not too late to angle it correctly for the sun, allow for natural ventilation and specify the ratio of windows and walls that will limit the amount of heating, cooling and electric lighting needed.

But the nature of the design and construction process often works against an integrated design where the building form, orientation and energy services are optimised for energy efficiency.

In the scrum there's the client who's trying to get the best building for the lowest upfront cost; the project manager who wants a smooth process with few

disruptions; the architect who's working within the constraints of the site, the budget and the timetable while trying to design a building that works beautifully and looks great; and various engineers, quantity surveyors and contractors, all with their own particular priorities.

If the client isn't determined to push for energy efficiency, it's unlikely anyone else will.

The partnership between Waitemata District Health Board, Waitakere City Council, EECA and the consultants on the design team for Waitakere Hospital offers an alternative way of running a project that is unusual in New Zealand.

Because energy efficiency was moved up the agenda, the hospital is a welcoming light-filled facility that promises to be economical to run.

## From the top

Waitemata District Health Board runs North Shore Hospital in Takapuna and the smaller Waitakere Hospital in Henderson.

When Waitemata was planning to upgrade Waitakere Hospital to a long-awaited 180-bed sub-district general hospital, sustainable building was important for North Shore and Waitakere hospitals general manager Rachel Haggerty.

After a period of working in health roles involving cost-cutting and rationalisation, she saw a chance to set up the new hospital on the right footing for years to come.

She wanted an eco-hospital, but the trouble was, nobody had designed an eco-hospital in New Zealand before. Comparable overseas examples were hard to find.

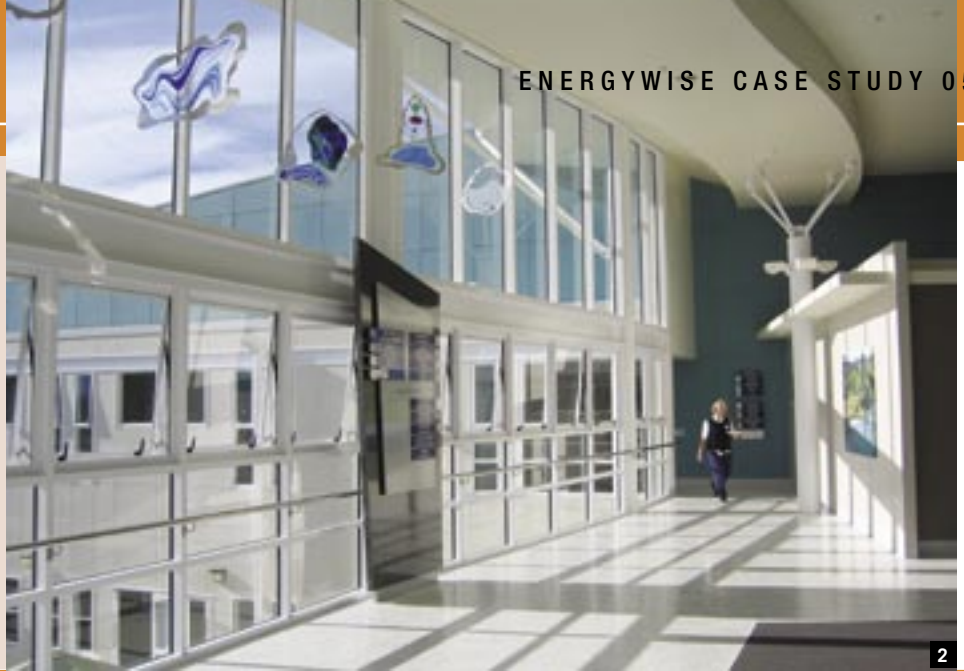
"I have a long-standing interest in things

### 1 HOSPITAL ENTRANCE.



- Expanded outpatients/day medical/day surgery.
- Diagnostic and therapy services, including laboratory and radiology.
- Clinical support services, including pharmacy, laboratory, kitchen, records, library and radiology.

**2** THE REAR OF THE LIGHT-FILLED FOYER FACES NORTH-EAST. IT HAS SUNSHADING TO AVOID OVERHEATING IN SUMMER. WINDOWS LET IN AIR AT A LOW LEVEL. AS IT WARMS IT RISES AND EXITS, DRAWING IN MORE FRESH AIR.



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environmental,” says Haggerty. “Because of that and because of my interest in working closely with the community I worked with Waitakere City Council to explore what it [an eco-hospital] was.”

Waitakere City Council helped her get the point across to the design team.

The council’s principal advisor for urban development, Janet Hannan, got involved. Her job is to promote Waitakere’s “Eco-City” aims to people developing infrastructure projects within the city.

Says Hannan: “Our council said it was going to be a significant facility in our city and they wanted someone to influence the environmental outcomes.” The council had been lobbying for a hospital for years and it was a key building to do well.

Usually a council has little to do with a development of this type until it receives

#### WAITAKERE HOSPITAL FACILITIES

##### HUGHES BLOCK

OUTPATIENTS AND MAIN ENTRANCE;  
CHILD HEALTH UNIT AND SPECIAL CARE  
BABY UNIT.

##### GROUND FLOOR

THREE MEDICAL/SURGICAL WARDS (70  
BEDS), INCLUDING SIX-BED CORONARY  
CARE UNIT; FOUR OPERATING THEATRES;  
NEW RADIOLOGY/IMAGING DEPARTMENT;  
EMERGENCY DEPARTMENT/ACUTE  
ASSESSMENT UNIT; CAFETERIA.

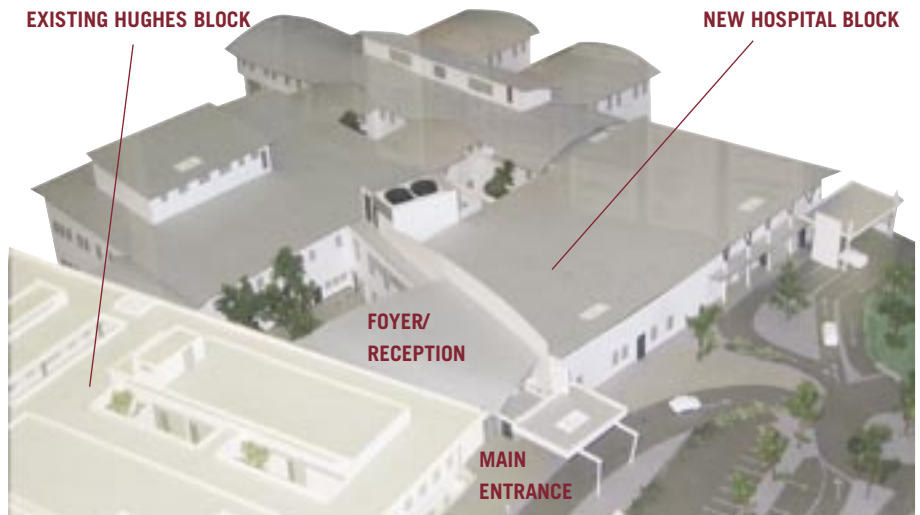
##### LOWER GROUND FLOOR

TWO ASSESSMENT, TREATMENT  
AND REHABILITATION WARDS (51  
BEDS); OCCUPATIONAL THERAPY/  
PHYSIOTHERAPY; KITCHEN FACILITIES;  
HOSPITAL SUPPORT SERVICES;  
CULTURAL HEALTH FACILITY; HOME  
HEALTH SERVICES.



##### EXISTING HUGHES BLOCK

##### NEW HOSPITAL BLOCK



## Design process

- Waitakere and North Shore hospitals general manager Rachel Haggerty developed a master plan with the hospital's Orion Programme management team, Di Carlo Potts Architects, project managers Carson Group, quantity surveyors Rider Hunt and Worley (now Maunsell) Consultants.
- Hospital staff developed briefs for their departments.
- The business plan was put to the government.
- More consultants appointed: services engineer Connell Wagner, civil engineer Harrison Grierson and structural engineer Buller George.
- Design consultant team selected: project management team, Waitakere City Council, EECA and Auckland Uniservices sustainable design consultant Robert Vale.
- Waitakere City Council co-ordinated co-operation between its staff and consultants in stormwater drainage, policy groups and the arts.



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## Timeline

### 1964

Waitakere Obstetric Hospital opens.

### 1999

Waitemata Health makes a business case for a \$60 million development on site.

### 2000

Government approves business case.

### 2000-2001

Orion Programme team set up, planning and designing take place.

### December 2001

Site works begin.

### July 2003

"Back of house" commissioned.

### September 2003

Stage One extension completed.

### 1 February 2005

First patients admitted.

### 12 February 2005

Official opening.

### April 2005

Emergency department opens.

### July 2005

Paediatric Assessment Unit and Special Care Baby Unit open.

## Lessons learned

Auckland Uniservices sustainable design consultant Robert Vale says that because a detailed design brief was incomplete at the start of the design process, it had no clear statement of objectives such as electricity use per square metre, so it will be difficult to gauge success in reducing energy use.

Vale recommends the following process:

- Key stakeholders should be consulted before the development of the brief to identify the necessary issues.
- Partnerships should be formed to provide avenues of funding for "extras".
- A brief should be developed by a select group of consultants then referred back to the stakeholders and their opinions incorporated.
- The brief is then referred to central government for budget scrutiny and analysis of issues raised by stakeholders.
- Revisions are made to the brief.
- Design consultants are engaged.
- Checkpoints are established to review whether objectives are being achieved in the design.



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**1 DAYLIGHT** IN THE WARD IS USUALLY SUFFICIENT FOR THE LIGHTS TO BE **SWITCHED OFF**.

**2 ONLY ONE** OF THE LAMPS IN THIS FITTING NEEDS TO BE SWITCHED ON BECAUSE LIGHT IS COMING THROUGH THE **NEARBY WINDOWS**.

**3 THE REAR** OF THE BLOCK HOUSES THE **EMERGENCY DEPARTMENT** ENTRANCE.

**4 NORTH-FACING** WARDS OVERLOOK A **COURTYARD**.

**1** FOYER/  
RECEPTION.  
**2** THE  
FOYER HAS  
AN AIR-  
LOCK ENTRY  
TO KEEP  
TEMPERATURES  
STABLE.  
THE HOSPITAL  
HAS  
ARTWORKS BY  
WAITAKERE  
ARTISTS.



► the application for a resource consent. By forming a partnership with the health board early, it got results that worked for both.

Says Haggerty: “At an early stage we developed five core principles,” to do with the environment and the community. “Well environments and well people go together.

“In a principles-driven development your decisions are guided by what you’re hoping to achieve.”

The project’s environmental goals were:

- to design an energy-efficient building;
- to design to avoid waste;
- to recycle as much material as possible;
- to maximise the use of natural lighting;
- to specify the use of sustainable and environmentally friendly materials;
- to reduce and control stormwater runoff and wastewater, provide quality stormwater treatment and reuse water.

Haggerty and Hannan soon ran up against the inevitable barriers of cost and what Hannan terms “off-the-shelf thinking”.

Taking more time on the design to optimise energy use, and buying more energy efficient equipment, would put the budget under pressure.

Hannan says while Waitakere City had a sustainable building philosophy, it did not at the time have the built examples such as its Massey and New Lynn community centres.

### Energy eye

Hannan invited EECA’s in-house architect John Goodchild to attend meetings. Goodchild had been studying a scheme in the UK where architects with specialist energy-efficient design skills would scrutinise building plans and recommend ways they

could be altered to make the building more energy-efficient. He was keen to do something similar in New Zealand.

EECA could see it was a great opportunity to influence the design of the hospital before it became an expensive energy hog throughout its lifetime.

Goodchild and colleague Russell Baillie attended several design team meetings, along with sustainable buildings expert Robert Vale, an associate professor in the University of Auckland School of Architecture.

Says Hannan: “Getting EECA on board was the turning point.”

The building design needed to be tested for thermal efficiency.

EECA approved a subsidy for the design to be modelled for thermal performance. This was done by the Melbourne office of services consultant Connell Mott McDonald, which used specialised software to work out the best way to orient the building to make use of the sun’s warmth and light, while keeping out unwanted heat and glare.

They experimented with various combinations of walls, windows and insulation, working out the best way to use the building’s thermal mass to even-out temperatures and reduce the need for heating and cooling.

The solution they found was to divide the building into zones. They would air-condition the upper floor that housed operating theatres and clinical equipment, while leaving the lower floor naturally ventilated, with opening windows and glazed doors so patients and visitors in the wards could feel connected with the outdoors.

Waitakere and North Shore hospitals general manager Rachel Haggerty is pleased the team was able to achieve so much for so little extra cost.

“There’s a level of investment you can make that moves you a long way forward without breaking the bank.

“We maximised our gain by working with EECA on energy efficiency stuff.”





“If I ever had the opportunity I would do it again – I’d recommend principles-based development.”  
– Waitakere and North Shore hospitals general manager Rachel Haggerty.

► Instead of making the building one solid block, the design scooped out chunks in the middle, creating courtyards to bring sun, light and air to the interior while providing green space to view and experience.

The savings on air conditioning pleased the hospital representatives. It helped that their surveys had found many of the patients would be older people who didn’t like air

conditioning. The wards would be heated in the winter but not mechanically cooled in the summer.

The computer modelling gave the team the confidence to build the lower floor without mechanical air conditioning.

Connell Mott MacDonald has since built up thermal modelling expertise and software in its Auckland office. Connell Mott MacDonald principal Neil Purdie says

it’s been a considerable investment but it’s worth it. “It’s amazing what you can do now, compared to even just five years ago.”

## Funding

In a variant of EECA’s Energy Audits Grants Scheme, a \$20,000 grant subsidised a \$40,000 energy efficiency review by sustainable buildings expert Dave Fullbrook, when he was still at Connell Mott MacDonald.

Waitakere Health used a \$293,000 EECA Crown Energy Efficiency Loan to finance the extra cost of the recommended energy efficiency measures.

The measures were calculated to save \$76,000 of electricity, gas and maximum electricity demand charges a year, which would repay the loan in four years.

The energy savings would also avoid 476 tonnes a year in CO<sub>2</sub> emissions.

Says Haggerty: “It all came together – there’s a moment and an opportunity. You can make a difference without it costing a lot of money.”

## Energy efficiency measures

The measures are:

- **High-efficiency lighting**, with more circuits to allow better localised switching, dimmable controls for daylight areas and presence detectors for areas that are used only occasionally.
- **Insulation** to a higher standard than the minimum code requirements.
- **High efficiency motors and low-pressure-loss duct systems for heating, ventilation and air conditioning.**

The electric motors are more efficient than standard models.

## Key energy efficiency points

- Experts from EECA and Auckland University helped evaluate different options.
- EECA provided funding to audit the initial design and suggested alterations that result in better energy efficiency.
- The intention was to create healthy and low-energy environments in tune with the outdoor environment.
- The building’s orientation was adjusted to improve natural ventilation and to reduce the risk of overheating.
- High levels of insulation further avoid over-heating in summer and save on heating costs in winter.
- Extensive use of natural light is supplemented by state of the art light fittings and switching, which can be adjusted to provide the right level of lighting.
- Shading and special glass on the northern windows of the wards avoid overheating.
- Natural ventilation through opening windows is expected to provide a healthy indoor environment.
- The building has been split into air conditioned zones (such as operating theatres) and naturally ventilated zones (such as public areas and wards for older adults).
- Re-circulation of some air and use of outside air for cooling in the air-conditioned zone further reduce energy use.
- High efficiency motors and low pressure loss systems are used throughout the water and air handling systems, reducing energy use further.
- A computerised building management system controls the systems in the new building, ensuring efficient operation.
- Solar hot water heating will be provided for the Cultural Health area.

## Further reading

### The Better Building Code

<http://www.waitakere.govt.nz/abtccit/ec/bldsus/betterbuilding.asp>

from Waitakere City Council

**Before the First Pour**, design guidelines and briefs from EECA's website, or ph 0800 358 676

**Tool for Urban Sustainability – Code of Practice** (TUSC), [www.tusc.org.nz](http://www.tusc.org.nz), a two-year project initiated by Waitakere

City Council, using the Ministry for the Environment Sustainable Management Fund, to produce a web-based analysis tool to assess and plan new urban developments against sustainability indices.

### UK Carbon Trust Design Advice Service

Professional, independent and objective advice on energy efficient and environmentally sound building design.

[www.thecarbontrust.co.uk/energy/pages/page\\_67.asp](http://www.thecarbontrust.co.uk/energy/pages/page_67.asp)

EECA contributes towards the cost of energy audits for existing and new facilities, through its Energy Audits Grants Scheme.

EECA can help with auditing building designs before construction.

Organisations that are publicly-funded, such as schools, hospitals, universities and government departments, can qualify for Crown Energy Efficiency Loans for energy efficiency measures.

The duct sizes have been modified to reduce drops in pressure. This allows the fans to be smaller and to not have to work so hard.

- **Variable-air-volume air conditioning** run from a central plant instead of using distributed constant-volume package units.

Other items, such as advanced glazing and highly reflective roofs, were analysed but were judged not to have enough effect to justify the extra cost.

Some of the measures found by the analysis either cost no more or cost less, so didn't need loan funding.

These included passive cooling of the ward areas and partial recirculation of air to operational areas.

Haggerty is pleased the team was able to achieve so much for so little extra cost.

"There's a level of investment you can make that moves you a long way forward without breaking the bank.

"We maximised our gain by working with EECA on energy efficiency stuff. Through engaging those resources, and enthusiastic, intelligent people wanting to make a difference, we got a good hospital.

"It's integrated with the wishes and desires of the community."

## Tracking progress

As a result of the process, Goodchild initiated EECA's series of design guides and energy-efficiency briefs, *Before the First Pour*.

Vale and Hannan were keen for the design process and its results to be documented and analysed.

But their plan for a detailed study of the

hospital's design process, partnerships and impact on the community folded when the proposed consultant, Uniservices, eventually declined to manage the research.

However, Vale has written a 20-page scoping study whose advice would be useful for people involved in a complex building project.

Waitemata Health facilities manager Peter Jaine and Waitakere Hospital engineer David Cray have been coming to grips with the plant and building management system while the hospital has been progressively brought into service.

The hospital began to be used in early 2005. By the middle of the year it was not yet fully occupied, so any initial measurements of energy consumption would not represent the hospital's ongoing energy performance.

But by mid-2006 it will be interesting to look at the hospital's energy consumption per square metre of space and per patient, and compare it with other hospitals.

Haggerty believes the environmentally-focused design process achieved good results.

Says Haggerty: "If I ever had the opportunity I would do it again – I'd recommend principles-based development.

"It's a missed opportunity in public projects that there's not more focus on those things."



**1** THE GREEN TANKS STORE STORMWATER. A DIESEL FUEL TANK IS IN FRONT OF TWO COOLING TOWERS THAT SERVE THE CHILLERS.

## CREDITS

**Client** Waitemata District Health Board  
**Environmental partner**  
Waitakere City Council

**Architect** Di Carlo Potts Architects  
(Sydney)

**Project manager** Carson Group

**Services engineers and energy modelling**  
Connell Mott MacDonald

**Civil engineer** Harrison Grierson

**Structural engineer** Buller George

**Quantity surveyor** Rider Hunt

**EECA advisors** John Goodchild and  
Russell Baillie

**Sustainable design consultant**  
Robert Vale, Uniservices

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

**Case study text and photos**  
Cathy Sheehan