The real deal

case studies of environmental design and construction

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Auckland School of Architecture

Environmental design and construction is fully cost effective

The following examples are all in the public sector, with low fixed budgets
Three UK National Health Service medical centres

All these buildings were built for the budget allowed by the NHS to construct a conventional building

Heeley Green Surgery, Sheffield (1985)
The building used superinsulation to reduce energy demand by 80% at no extra cost

Simple materials included timber lintels and double-glazed low-emissivity timber windows
Woodhouse Medical Centre, Sheffield, UK (1987)
Winner of 1992 “Green Building of the Year Award”

The building contains two separate medical practices and a dentist
Superinsulated construction, daylighting, long-life sustainable materials, gas condensing boilers, All at no extra cost.

The building works as predicted, and also showed very high productivity gains in UK government tests.
Birley Health Centre, Sheffield (1992)

Passive solar design, triple-glazed argon-filled glazing, 400 mm thick roof insulation, 150 mm wall insulation and under floor slab. All at no extra cost.

The Health Centre is deliberately located close to public transport
The landscaping was designed with medicinal herbs, in case the health service cuts got really severe…

Two social housing schemes

These three bedroom houses were within the budget allowed by the Housing Corporation to construct a conventional house.
Industry Road houses, Sheffield (1992)

Superinsulated, triple glazed, full gas central heating, mechanical heat recovery ventilation system. Heating costs $3.50 per week.

The weekly heating bill is about the price of a bottle of beer.
Very low heating bills mean that low-income tenants have more money to spend on other living costs.

The Cresswell Road houses (1992)

- 400 mm roof insulation (R 10)
- 150 mm wall insulation (R 5)
- Triple low-e glazing (R 1.2)
- Passive stack ventilation
- Low-energy lights
- Condensing gas-fired combi boiler
- And full central heating
- Water-saving toilets
- Rainwater collection system
- Non-allergenic flooring

All for $10,000 LESS than the permitted budget.
New construction details were designed to minimise thermal bridging

Measured **delivered** energy consumption

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<table>
<thead>
<tr>
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<tr>
<td>Space heating</td>
<td>2,800 kWh per year</td>
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<td>Lights and appliances</td>
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<td>Cooking</td>
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This is about as much energy as is used in a New Zealand house, but Sheffield is three times colder, and these houses are heated to a constant 22°C all winter.
but how do we know if a building is sustainable?

This is the Queen’s Building at de Montfort University, Leicester. It houses the Engineering School.
It is designed to use natural ventilation rather than air conditioning.

The computer lab is designed to have good daylight without glare.
The Queen’s Building works well in terms of energy/CO$_2$

But what is its overall impact on the environment?

Is it possible to measure environmental impact, so that we can compare buildings in a non-subjective way?
BREEAM from the UK was the first environmental rating system for buildings.

The LEED system from the United States is another attempt to rate the environmental impact of buildings so that one can be compared with another.
With LEED you tick the boxes and add up the scores for the building. The final outcome is a score plus a Silver, Gold or Platinum award for the best buildings.

BUT...real buildings do not necessarily perform as they are designed to do. LEED, BREEAM and other rating systems measure the intention of designers, not what actually happens when the building is in use.
Designers often get it wrong. Portcullis House in London uses four times as much energy as the designers intended.

http://www.myk.mcmail.com/london/south_bank/london_eye/

The National Australian Buildings

NABERS

Environmental Rating System
NABERS provides a quick basic rating of a building’s environmental impact

• NABERS does not...
  • Provide detailed design advice
  • Use simulated results
  • Replace existing design tools

A reporting system

• No argument about results
• Non-prescriptive
• No need for expert assessors
• Allows all types and ages of buildings
NABERS: Headings

- Land 5 stars
- Materials 5 stars
- Energy 5 stars
- Water 5 stars
- Interior 5 stars
- Resources 5 stars
- Transport 5 stars
- Waste 5 stars

NABERS looks at all aspects of a building’s construction, location and operation to determine its rating.

The new Landcare Research building at Tamaki will be New Zealand’s greenest commercial building.
The building includes offices, laboratories and glasshouses, and is shared by Landcare Research and MAF.

A key element is the national collection of five million beetles, needing very stable temperature and humidity conditions.
Climate control is used selectively, in areas that really need it, rather than as a blanket solution.

The north-facing facade collects solar heat, a 2000-year-old design principle...

image from Chow Hill Architects
Energy Targets

Typical Lab 300 kWh/m².year
Typical Office 150 kWh/m².year
Landcare Building target 100 kWh/m².year

Energy simulation model is under target

Composting Toilets

- No Water Use
- Use On Site
- Ground Floor Conventional
Rainwater collection

- Syphonic Drainage
- Typical Storm 67 m³
- Storage 75 m³
- Detention 75 m³
- Metrowater $4.00/m³
- Annual Collection 3000 m³
- Soak Hole For Raingarden
- Flushing – Groundfloor
  - Urinals

slide from Landcare Research

Hot & Cold Water

- Solar Hot Water
- Resuse Of Water For Urinals & Ground Floor Toilets
- Windmill To Pump Water
- Heat Recovery For Hot Water

slide from Landcare Research

Green Building 2003
Materials are chosen for their minimal environmental impact

image from Chow Hill Architects

The use of timber is a major component in its design, both visually...

image from Chow Hill Architects
...throughout the interiors...

...and in the technical details

**Building Fabric**
- R-4 Walls, 150mm insulation
- R-5 Roof, 200mm insulation
- Mass Inside
- Double Glazing Windows
- External Shade To North Facade
- Fins To East And West Facades
- Heating load 32 kW
The Landcare Research building has been tested with NABERS

<table>
<thead>
<tr>
<th>NABERS CRITERIA</th>
<th>UNIVERSITY OF TASMANIA BLDG</th>
<th>WOODHOUSE MEDICAL CENTRE</th>
<th>MURDOCH ET CENTRE</th>
<th>LANDCARE BLDG CURRENT ASSESSMENT</th>
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Case Study 1
Student Association Building, University of Tasmania
Rating carried out by Roger Fay
Case study 2
Woodhouse Medical Centre, Sheffield, UK
Rating carried out by Robert Vale

Case study 3
Environmental Technology Centre, Murdoch University, WA
Rating carried out by David Beyer, postgraduate student at Murdoch University

Photographs from Murdoch University website
http://www.ies.murdoch.edu.au/etc/news/welcometoetc.htm#advanced
Preliminary NABERS scores for Case Studies

The University of Tasmania building scores
**NABERS Basic 43%**

The Woodhouse Medical Centre scores
**NABERS Green 47%**

The Murdoch E T Centre scores
**NABERS Green 60%**

It is extremely hard to get a high score in NABERS

To score highly, a building must be exceptional in every way.

The highest score so far recorded is for the new Landcare Research headquarters building

**NABERS Bronze 61%**