The Meridian Building
@ Wellington Waterfront, New Zealand
5 Green Star: Office Design V1

Jared Rodio
Eddie Allen
## The Meridian
33 Customhouse Quay, Wellington, NZ

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Rating</td>
<td>5 Green Star, 5.5 out of 6 NABERSNZ</td>
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<tr>
<td>Location</td>
<td>33 Customhouse Quay, Wellington</td>
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<tr>
<td>Developer</td>
<td>DNZ Property Group</td>
</tr>
<tr>
<td>Property Owner</td>
<td>DNZ Property Group</td>
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<tr>
<td>Landowner</td>
<td>Wellington Waterfront Ltd</td>
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<tr>
<td>Tenant</td>
<td>Meridian Energy Ltd</td>
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<tr>
<td>Architect Design</td>
<td>Studio Pacific Architecture Joint Venture with Peddle Thorp Aitken</td>
</tr>
<tr>
<td>Engineering</td>
<td>Dunning Thornton (Structural)</td>
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<tr>
<td>Total NLA</td>
<td>5,246 m² (17,207 square feet)</td>
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</table>
DNZ Property Group

- Owns, manages and develops office, industrial and retail properties in main urban areas of New Zealand
- Founding member of both the New Zealand Green Building Council and NABERS-NZ
- Actively involved in aiding one of the NZGBC’s first major goals – a rating tool for new office buildings.
- NABERSNZ measures energy performance in office buildings across a one to six star scale – one being poor, three average, and six stars aspirational.

NABERSNZ - National Australian Built Environment Rating System
Meridian Energy - Powering New Zealand

State-owned enterprise committed to renewable energy

Offshore projects in Australia, Antarctica, United States and Tonga

Operates seven hydro stations and five wind farms

New Zealand’s largest electricity generator

Generates all electricity from renewable sources and provides electricity to more than 270,000 customers
BECA – Engineering Consulting Services

Core expertise in six key markets: buildings, industrial, power, public sector, transport and water.

Engineering and consultancy services, planning, architecture, project and cost management, software technology and valuation services.

Provides a comprehensive range of environmentally sustainable design (ESD) consultancy services that delivers innovative sustainable solutions and displays environmental best practice within their own operations.

Significant percentage of the company’s overall revenues are already derived from sustainable service offerings.

Sustainability-focused services include development and implementation of corporate sustainability strategies, environmental management systems and internal audit systems; carbon footprinting and management, waste management and minimization advice, green procurement, supply chain management as well as general high level strategic business sustainability advice.

“BECA took the Aorangi House, the worst performing building in Wellington and turned it into a five-green-star building.”
Member of the Climate Change and Environmental Sustainability Council

Focused sustainability efforts primarily on waste reduction and recycling

Up to date Environmental Policy

7 awards for Environmental Sustainability from 2009-2010
The Meridian Honors

Architectural design is articulated as two separate forms
- Glass Pavilion
- Curved Annex

Social sustainability
- Enhanced by an urban square with ground floor retail
- New Zealand 1st green lease
- Lease is tied to the building performance
- Supported by Wellington City Council for the request of no parking in the building

Leader in Environmental Performance
- New Zealand’s first 5 Green Star rated building
- Concrete3 Sustainability Award of Excellence, 2009
- NZIA New Zealand Architecture Award, 2009
- NZIA New Zealand Architecture Medal Finalist, 2009
- NZIA Local Award, 2008
- ACENZ – Gold Award of Excellence, 2008
- Winner of two Property Council New Zealand Awards, 2008
- SBN - Local and National Design and Innovation Award, 2008
- New Zealand Engineering Excellence Awards for Sustainability and Clean Technology, 2009
The Waterfront Framework requires that the ground floor is predominantly publicly accessible to ensure the attractions or services will complement the waterfront's holiday atmosphere and attract people to the newly redeveloped Kumutoto Precinct.

The Seaward section is the largest at 658 square meters and will **features six-meter high glass exterior walls**. These walls make the building transparent at ground floor level, allowing views through to the harbor and beyond from the Kumutoto Plaza public space, that is also under construction. The footprint may be divided according to the floor space needs of the successful tenant or tenants. A priority is to ensure internal walls do not compromise the view through the building.

The Annex (120 square meters) and Kiosk (7 square meters) sections would suit individual tenancies such as cafés, light food and refreshment outlets.

**The four-story (18 meter high)** Meridian building’s L-shaped configuration is specifically intended to create a sheltered north-west facing Kumutoto plaza that will seamlessly connect to the Kumutoto Precinct via an enclosed thoroughfare.

The lower floor (5.3 meters high) designed as a retail space, is dominated by glass walls that provide uninterrupted views through the building to the harbor, or back towards the Kumutoto Plaza.
Green Features

- Integrated building management system
- Climate responsive façades
- Exposed structure assists passive temperature control
- Daylight harvesting and automated light control
- ‘Mixed mode’ natural ventilation and mechanical ventilation
- 100% outdoor air supply with energy recovery (75% efficiency)
- Heat pump heating and cooling
- Solar hot water heating
- Rainwater collection, recycling, waterless urinals
- Reduced embodied energy
- Photovoltaic system
- Photovoltaic system
# LEED vs. Green Star

<table>
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<tr>
<th>Assessment Criteria</th>
<th>United States</th>
<th>Australia/New Zealand</th>
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<tbody>
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<td>Rating Agency</td>
<td>LEED (2009)</td>
<td>Green Star</td>
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<tr>
<td>Energy</td>
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<td>X</td>
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<tr>
<td>CO2</td>
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<td>X</td>
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<td>Ecology</td>
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<tr>
<td>Economy</td>
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<td>Health &amp; Wellbeing</td>
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<td>Indoor Environmental Quality</td>
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<td>X</td>
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<tr>
<td>Innovation</td>
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<td>X</td>
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<tr>
<td>Land Use</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Management (Integrative Process)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Materials</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Pollution</td>
<td>X</td>
<td>X</td>
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<td>Renewable Technologies</td>
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<td>Transport</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Waste</td>
<td>X</td>
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<tr>
<td>Water</td>
<td>X</td>
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</table>
The initial focus of Green Star is on office buildings. Within the ‘Office’ category there are four tools, each reflecting a different phase in the building lifecycle; Design, As Built, In Use/Performance, Fit Out.
LEED versus Green Star

**Similarities**

- Rating systems have minimum eligibility criteria as well as prerequisites for certification (buildings or communities that do not meet certain minimum points, cannot get certification).
- Take an approach of bundling up credits under a category
- Have qualifications in place that identify the active involvement of professionals in their respective rating systems

**Differences**

- For LEED the process of certification is two staged. The first stage is design review and the second is construction review. The projects only receive certification at the end of construction review.
- Under Green Star it is possible to be certified at the design stage and then build something completely different.
- The LEED rating system is easily adaptable to a wide range of project types. Green Star requires the development of a custom rating system for project types not covered by their current tools.
Energy Use Target

Design Annual Energy Benchmark for Site 7 Kumutoto Base Build

Data Source: Constructing Excellence in New Zealand Website
Energy, Water & Material Savings

**Operations** (savings compared to typical Wellington CBD office buildings)

- **Energy** – 45%
  - Light – 78%
- **Water** – 77%
- Reduced temperature moderation - 60%

**Construction**

- Waste management best practices - $14,000
- Waste diversion from landfill - $20,000
- 65% recycled materials used for core, columns, walls are mixture of new

**Project Cost (2007)** - $19,000,000 ($3,800/m²)

**Project Value (2013)** - $36,000,000 ($7,200/m²)
Ventilation and Heat Reduction

Stack Effect
- Performs key function in buildings air and ventilation control
- Heat travels up through central stair well and filters out via wind driven vents in the ceiling.
- Central accessible stairwell discourages elevator use → reduction in operating costs
Indoor Air Quality

- HVAC system uses 100% outdoor air with an energy recovery wheel to reduce heating and cooling requirements
- HVAC system supplies filtered air to ceiling-mounted active chilled beam terminal units

Chilled Beams - Halton CBC Active Chilled Beam

- Combined cooling, heating, and supply with a flush installation within a suspended ceiling
- Functions like a basic radiator by pumping hot or cold water through radiator -> then pumping fresh air from outside across them and into working environment.
- Enhanced life-cycle performance with low air and water flow rates
- Highly efficient temperature control
- High standard of air quality
Energy – *Materials & Temperature Regulation*

**Concrete – Thermal Mass Advantage**
- Core, columns, walls are mixture of new and 65% recycled materials
- Heat generated by people and electronics circulates into the floor slabs and is absorbed by the thermal mass of the concrete
- Regulates internal environment by reducing and **delaying the onset of peak temperatures** → reduces energy consumption costs for building tenants and owners.
- Minimal fluctuations in temperature create an indoor environment more comfortable and healthier to work in, both in winter and summer
- Power savings from reduced temperature moderation requirements = 60%

**Night Purge**
- Overnight thermal mass releases heat back into the building
- Heat expelled by opening the windows.
- Leaves building cool for the next day
Ventilation Continued

- **Winter Mode**: Mechanically operable window closed, inner windows closed, blinds open to allow passive solar gain, low level vent open.
- **Natural Ventilation Mode**: Outer window closed, inner windows open for natural ventilation, blinds partially closed, low level vent open for ventilation.
- **Summer Mode**: Outer window open to vent warm air, inner windows closed, blinds closed to block solar gain, low level vent open to ventilate cavity.
Annualized Total Building Energy Use

Meridian Energy Use
55% of Typical Wellington CBD Building

Planned = 75 kWh/m²  Actual = 110 kWh/m²

Data Source: Constructing Excellence in New Zealand Website
Indicated Water Use

Typical Wellington Office uses 1,170 liters/m² per year

The Meridian Building on average uses 276 liters/m² per year

Indicated savings of 3.95 million liters per year of main water supply

One and half Olympic size swimming pools of water

5 Star NABERS Rating is 350 liters/m² per year

Data Source: Constructing Excellence in New Zealand Website
Water Efficiency

- **Rainwater collection** – 16,000 liter tank
- **80%** of toilet flushing uses harvested rainwater
- Low flow sensor taps and showers (50% less water than traditional shower heads)
- Recycling system for toilet flushing
- Timer controlled showers
- Waterless urinals

- **Solar Powered Hot Water**
- One of the most effective ways to reduce energy use is to use solar energy water heating.
- Eight solar hot water collection panels placed on the roof supply hot water for 80% of the building’s domestic needs

Meridian Water Use

23% of Typical Wellington CBD Office Building

Supplies hot water for 80% of the building’s domestic needs
Benchmarked Water Use

Data Source: Constructing Excellence in New Zealand Website
Building Management System

- The electronic brain of the Meridian Building.
- A collection of hardware and software,
- Controls all the building’s moving parts including
  1. Integrated with DALI Lighting System
  2. Mechanical louvres, the Venetian blinds, windows and lights
  3. Adjusts temperature and light to optimal levels for the occupants.
  4. Communicates with HVAC to ramp down A/C after rooms are vacated
  5. Constantly monitors the interior and exterior temperature and natural light illumination

- Accesses the NIWA National Institute of Water and Air in conjunction with a weather station satellite on the roof to predict optimal temperature for the building
- Automatic Blinds help manage solar gain → maintain optimal temperature range
- Louvres adjust to the sun
The heart of the Building Management System is the innovative **Helvar Digidim 910 Router**.

There are three to four units per floor with all floors linked by an Ethernet backbone with remote access by a dedicated stand-alone computer.

When the routers are networked together they act as one controller, with one designated router being the master, and the balance then become slaves.

In the event of a failure each router then acts independently from the group with distributed intelligence allowing the lighting to function seamlessly.

Occupancy sensors communicate with the Building Management System (BMS) to ramp down the air-conditioning after rooms have been vacated.

Lights are also programmed to rapidly switch off once a room is empty, maximizing energy savings, particularly in meeting rooms.

This functionality ensures that the rooms only have air-conditioning and lighting when required.
Multi-sensors control luminaire output: Calculate the amount of natural light entering the building against the electrical light provided and automatically creates a balance between the two.

• Sensors incorporate infrared receivers, occupancy PIR (passive infrared) and light level management.
• Lighting control within meeting rooms is enabled from a telephone keypad.
• Occupancy sensors communicate with BMS.
• Minimum Energy Performance Standards (MEPS) targeted = $62\text{ kWh/m}^2\text{ per annum}$.
• Lighting consumption forecast = $13\text{ kWh/m}^2\text{ per annum}$.
• 78% reduction.
Double Skinned Façade

- Façade performance is one of the most important elements in the Environmental Sustainability Design (ESD)
- Extensive glazing
- Sun shading blinds/louvres
- Windows that open for natural ventilation
- Automatically controlled for prevailing weather conditions
- **East** and **west** sides of the building incorporate ‘double skin’ façade.
- The outer skin protects blinds from high winds
- Automatic solar sensor controls motorized venetian blinds.
- **Winter**- Cavity of double façade is sealed to capture solar gains and limit heat loss
- Air is drawn in from the bottom and filtered before let into the building to heat or cool as required
- Air can be trapped inside to provide insulation.
North Facing Louvres

- Designed to minimize solar gain into the building.
- Certain louvres are hydraulically controlled by the building management system and automatically change their angle depending on the sun’s position.
- The fixed louvres have been positioned to minimize solar gain while also allowing optimal outlook for the building occupants.
Annex Façades

North
- Fixed Louvres
West
- Fixed and Motorised Louvres
Day Lighting

Window Glazing

- Reduces glare, while allowing high levels of daylight into the offices
- Provides insulation → increased energy efficiency
- Floor to ceiling glass allows large amounts of light for majority of the building
- 90% of office area is within 8 meters of an external view
Day lighting

Distance to the center of building
Width = 12.5 meters (E/W)
Length = 22.5 meters (N/S)

Window Height = 4.5 meters

Optimal ratio of window height : distance to center = 1 to 2.5 (11.25 meters E/W)

Meridian
East – West Direction Ratio = 1 to 3.13
Meridian Energy Headquarters - Interior
Interior Office 2nd, 3rd & 4th Floors
Energy Efficiency & Collaborative Space

The Meridian Building uses energy efficient electronic equipment to help meet the energy savings set out in the building’s performance specification.

- Refrigerators
- Dishwashers
- Low energy computer screens
- Low energy photocopiers and printers

Meeting rooms with electronic whiteboards copy and transmit information using building’s wireless network.

Information can be shared organization-wide, including Meridian’s other locations.
Reasons for Success – People factors

**Meridian Energy** – a tenant that desired a green building

**Fletcher Construction** – implemented waste minimization systems in their own headquarters

**Wellington City Council** – support through free of charge recycling services for timber and plasterboard

**Ministry for the Environment** – sponsored a support consultant that provided guidance and advice for Fletcher Construction during the project

**Waste Champions** – Site Administrator, Supervisor and Project Manager all ensured the systems in place for recycling and minimizing waste did not regress as new workers arrived on site

**Waste contractors** – worked closely with project managers and Full Circle (a major recycling company in New Zealand) provided various recycling solutions for various types of plastic packaging
Reasons for Success – *Technical Factors*

**Focus on Volume Waste** – large volumes of a specific waste were prepared for by having a specific system developed to deal with it.

**Mobile Bins** – small wheelie bins and cages could easily be lifted to loading bays encouraged recycling close to work stations. With general waste bins located only on ground floor recycling on upper floors was only option.

**Small capacity for general waste** – single small waste bin available for the site and use was strongly discouraged.

**Site advantages** – site had extra space available for the placement of waste bins. Ample crane capacity allowed for waste movements.

Waste management - $14,000
Waste diversion from landfill - $20,000

<table>
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<tr>
<th>Waste material type</th>
<th>Destination</th>
<th>Approx. volume</th>
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<tbody>
<tr>
<td>Timber</td>
<td>Composted</td>
<td>444 m³</td>
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<tr>
<td>Plasterboard</td>
<td>Composted</td>
<td>184 m³</td>
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<tr>
<td>Paper</td>
<td>Recycled</td>
<td>26 m³</td>
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<tr>
<td>Plastic</td>
<td>Recycled</td>
<td>4 m³</td>
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<tr>
<td>Mixed</td>
<td>Recycled</td>
<td>8 m³</td>
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<tr>
<td>Metal</td>
<td>Recycled</td>
<td>22 m³</td>
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<tr>
<td>Landfill</td>
<td>To landfill</td>
<td>463 m³</td>
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</tbody>
</table>
Meridian Building Eastern Face - Night
Meridian Building Eastern Face
Design & Construction
Questions?

Thank You!
References

1. Sustainable Design - ‘Smart’ Building for Wellington Waterfront
2. The Wellington Waterfront Limited website
4. DNZ Property Fund
5. SustainableConcrete.org
7. Wellington City Council – Meridian Energy Head Office
8. BRANZ-REBRI Reducing Building Material Wastes
10. Enlighten NZ Limited – Lighting a Sustainable Future
11. Fletcher Construction
12. http://www.branz.co.nz/cms_show_download.php?id=199ac18282436bc3b9b57a4c2c4f6d753a788b62
13. Constructing Excellence website
14. https://blogisthmus.wordpress.com/2012/02/
15. Sustainability Matters.net.au – Solutions for Industry & Government
16. TheFifthState.com.au – Wellington’s Meridian building achieves 5.5 star for NABERSNZ
17. New Zealand Green Building Council
18. Ravenscroft – Wellington Meridian Building, May 1st 2014
Appendix to follow
## Comparison – Pre & Post Occupation

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Temperature in Winter Overall</td>
<td>4.54</td>
<td>5</td>
<td>4.21</td>
<td>4.72</td>
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<td>Temperature in Summer Overall</td>
<td>3.84</td>
<td>4.92</td>
<td>4.03</td>
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<tr>
<td>Noise Overall</td>
<td>3.72</td>
<td>5.11</td>
<td>4.24</td>
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<tr>
<td>Lighting Overall</td>
<td>4.7</td>
<td>5.1</td>
<td>5.1</td>
<td>5.02</td>
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<tr>
<td>Comfort</td>
<td>4.32</td>
<td>5.67</td>
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<td>Health</td>
<td>3.69</td>
<td>5.03</td>
<td>3.55</td>
<td>3.97</td>
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<td>Forgiveness (-1 to +1 Scale)</td>
<td>1.04</td>
<td>1.12</td>
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<tr>
<td>Rating (Selected Variable Method)</td>
<td>66/100</td>
<td>100/100</td>
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<tr>
<td>Perceived Productivity (-40% to 40% Scale)</td>
<td>-6.37</td>
<td>8.96</td>
<td>-2.69</td>
<td>3.45</td>
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Data Source: *Constructing Excellence in New Zealand Website*
September 9th 2013 - The NABERSNZ Certified Rating found that the building uses a tiny 34 kWh/m² per year.

Base Building Certified Rating = includes elevators, air conditioning and common areas

NABERSNZ rates the energy performance of existing buildings by using 12 months of in-use energy data

Green Star rates the environmental performance of new buildings from a design and build perspective.

NABERSNZ Lighting consumption in this landmark building was forecast at approximately 13kWh/m² per annum, a 78% reduction. (with less than a full years data)

“The 5 Green Star rating shows its potential, while the NABERSNZ rating of 5.5 out of 6 certifies its day-to-day performance”. - DNZ Property Fund Chief Executive Paul Duffy

“Good commissioning, tuning and attention to energy management can help all buildings improve their energy use. But certainly a great design gives you a massive head start.” –NZGBC Chief Executive Alex Cutler
Floor Plan & Birds Eye View
Meridian Building Exterior Architectural Design

North Face

West Face

South Face

East Face

University of San Diego