

Discover

Ross Island



meridian



The world's coolest wind farm

New Zealanders have built **the world's coolest wind farm**

Meridian has built the world's southernmost wind farm, with Antarctica New Zealand. It's located on Crater Hill, Ross Island, Antarctica. The construction and development of this wind farm were unique and challenging.

Three wind turbines on Crater Hill now supply renewable energy to power New Zealand's Scott Base and its neighbour, the American base, at McMurdo Station. The wind farm links the electrical grids of both bases and reduces the carbon footprint of the Antarctic operations, as well as the environmental risks associated with transporting diesel fuel to Antarctica.

The project demonstrates Meridian's and Antarctica New Zealand's environmental leadership in accordance with the Antarctica Treaty principles.

Antarctica New Zealand represents New Zealand's interests in Antarctic and strongly supports the Antarctic Treaty principles of environmental protection. It is committed to reducing the environmental impacts of its operations.



*The three turbines supplying renewable energy
to McMurdo Station and Ross Island.*

Sub-zero conditions

The conditions in Antarctica meant that work could only be carried out during summer months when there was daylight and 'slightly' warmer conditions.

Site works were performed during the short summer season (beginning of November to end of February), when there was 24-hour daylight.

The Ross Island wind farm has been built in one of the most environmentally sensitive areas of the world, with extreme climatic conditions.

It required world-leading expertise in project development and the development of innovative technical solutions – and that's where Meridian's expertise came in.

Did you know?

Site temperatures range from -37°C to 7°C (average temperature -20°C) in the summer period, down to -57°C in winter.



Preparation

Owing to the remoteness of Ross Island and the short time-frame for construction, all equipment necessary to build the wind farm was planned right down to the last nut and bolt.

The success of the project relied on logistic and operations support from Antarctica New Zealand and the United States Antarctic Program (USAP).

All large equipment was transported by sea on the one annual supply ship, the *MV American Tern*, which arrives at McMurdo each February.

The project team and any minor equipment were flown down in a US C-17 Globemaster III aircraft and housed at Scott Base with scientists and base support staff.



Departing C-17 at McMurdo.



McMurdo Ice Pier—MV American Tern unloading.

Laying the foundations

In November 2008, the work began at Ross Island. Firstly, the turbine foundations were laid – these are unlike the majority of wind turbine installations, which use gravity pad foundations.

These more common gravity foundations comprise a reinforced concrete slab set in the ground and the turbine tower base attached to the centre. The weight of the turbine and foundation, in conjunction with the diameter of the foundation, provides resistance against overturning forces. But this design was hard to achieve in Antarctica because the concrete had to be mixed on site, and the lack of water and the sub-zero temperatures made this difficult. Instead, an anchored structural steel foundation was designed.

The main advantage of this was that it was pre-made in New Zealand then assembled on site. This significantly reduced on site project risks.

Each turbine foundation comprises eight 13-tonne pre-cast concrete foundation blocks arranged in a circle in a pit, then backfilled and frozen in, so the tops of the blocks are nearly flush with the ground. An eight-legged steel spider is bolted to the concrete blocks. The wind turbine tower is attached to the top of the steel foundation. This ensures that the turbine can withstand some really tough conditions.

Once the foundations were laid, engineers then installed the electrical link to both bases, ready to continue work when conditions allowed the following summer.

Did you know?

The pre-cast concrete blocks used for the foundations weigh 13 tonnes each.



Installing the turbines

The second stage of the project was to install the turbines and commission them for operation.

Electricity from the wind farm feeds into McMurdo Station and a new installed interconnector 4160 volts feeder cable allows Scott Base to receive electricity supplied from the wind system and from the McMurdo diesel generating plant. The McMurdo Station power plant generator load controllers manage the

existing diesel generator energy output and balance the load with the generation from the wind turbines.

Effectively, wind energy does in the first instance meet the Scott Base electrical load, and then the McMurdo electrical demand. As the installed capacity is considerably in excess of the Scott Base electrical load, wind-generated energy supplies a portion of the McMurdo load demand most of the time.

Did you know?

The turbines were designed for low-temperature operation, so they have no gearboxes, unlike most wind turbines. Instead the shaft is directly connected to the generator, meaning there is less wear and lower stress on the equipment. Not having a gearbox removes problems associated with the oils inside the gearbox operating in low temperatures. This means the turbines only require maintenance once a year – which will happen during the slightly less chilly summer season.

Wind turbines

Number of turbines: Three

Manufacturer: Enercon GmbH, Germany

Model: E33 WEC (Wind Energy Converter)

Rated power: 330kW

Hub height: 37 metres

Rotor diameter: 33.4 metres

Rotor: Three blades upwind with active pitch control

Rotational speed: 18 – 45 revolutions per minute

Wind class: IEC/NVN 1A

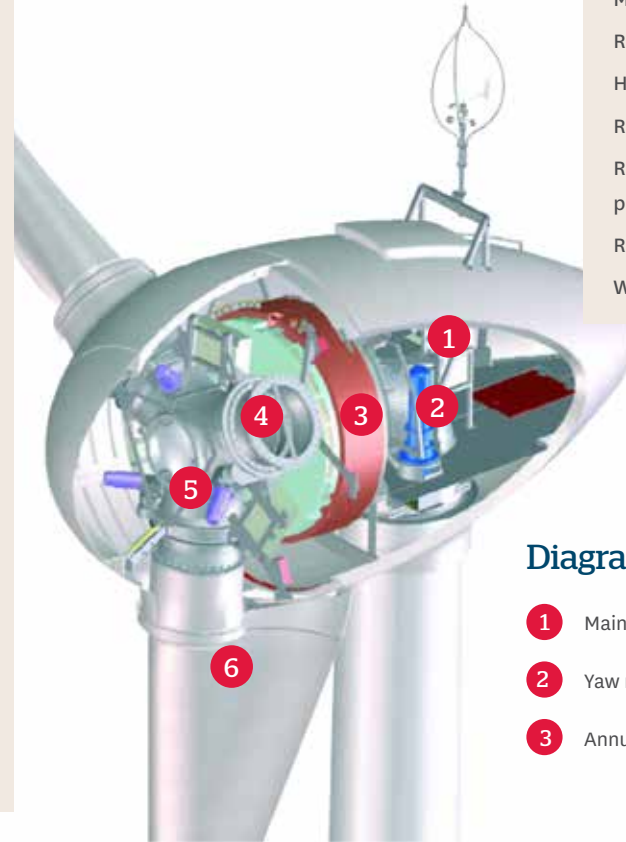


Diagram key

- | | |
|---------------------|-----------------|
| 1 Main carrier | 4 Blade adaptor |
| 2 Yaw motor | 5 Rotor hub |
| 3 Annular generator | 6 Rotor blade |

Why build a wind farm in Antarctica?

Substituting renewable energy for existing fossil fuel use is a way of reducing environmental emissions and the environmental risks associated with getting the fuel to the bases.

The wind farm continues to cut consumption by approximately 463,000 litres of fuel every year between the two bases – initially reducing fuel consumption by 11 percent. It will also result in a reduction of greenhouse gas production from both bases of 1242 tonnes of CO₂ annually.

Not only does the Ross Island wind farm reduce environmental impacts with reductions in greenhouse gas emissions

from the current diesel-powered electricity generation, it also helps to reduce the costs of running the site.

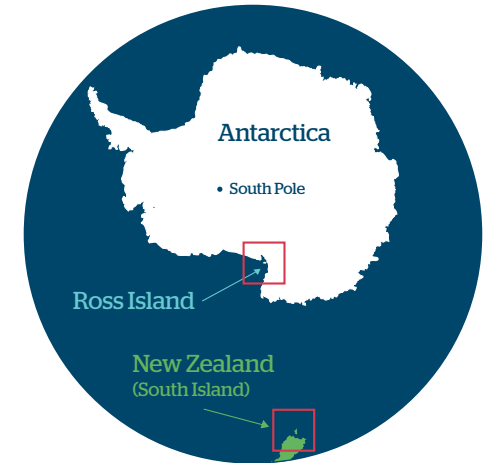
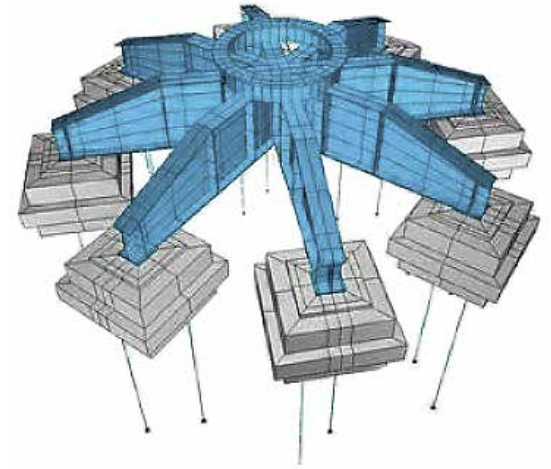
The experience of the first two years of operation has been extremely valuable. All parties have learned a great deal about what it takes to run an integrated power system in one of the coldest and most remote places on the planet.

The first year did not quite meet its production target, but the second exceeded it. Some additional improvements have been made to enhance performance, including changing the oil in the yaw gear and blade pitching motors.

Foundation diagram.

Did you know?

The turbine foundations for Ross Island were designed and made in New Zealand. This is because without a large-scale concrete plant on Ross Island, and with the challenges of mixing concrete in sub-zero conditions, it would have been difficult to produce the large quantities of high-quality concrete for the foundations on site.





Views from Scott Base at midnight in summer.

About Meridian Energy

Meridian Energy is an integrated renewable energy company. We are the largest electricity generator in New Zealand, generating power from 100% renewable resources. We retail electricity to homes, farms and businesses across the country, through our Meridian and Powershop brands.

Meridian is creating a better energy future by leading the way in harnessing the power of renewable energy sources – water, wind and sun. In New Zealand, the company owns and operates seven hydro stations, six within the Waitaki hydro scheme, and wind farms throughout New Zealand.

We also own and operate wind farms in Australia and have a strong pipeline of new generation options in both countries. We've built solar facilities in California and Tonga, and see future opportunities for solar in Australia.

Sustainability is fundamental to our operational approach, reflecting our long-term focus. We work with organisations to preserve the natural environment and protect native plant and animal life, and support local communities through our award-winning Community Fund Programme and national and local sponsorships.

To help our customers manage their energy use, we offer a range of innovative, energy-efficient products and services.

WANT TO BE A CUSTOMER?

Please feel free to contact our Energy Centre Team.

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