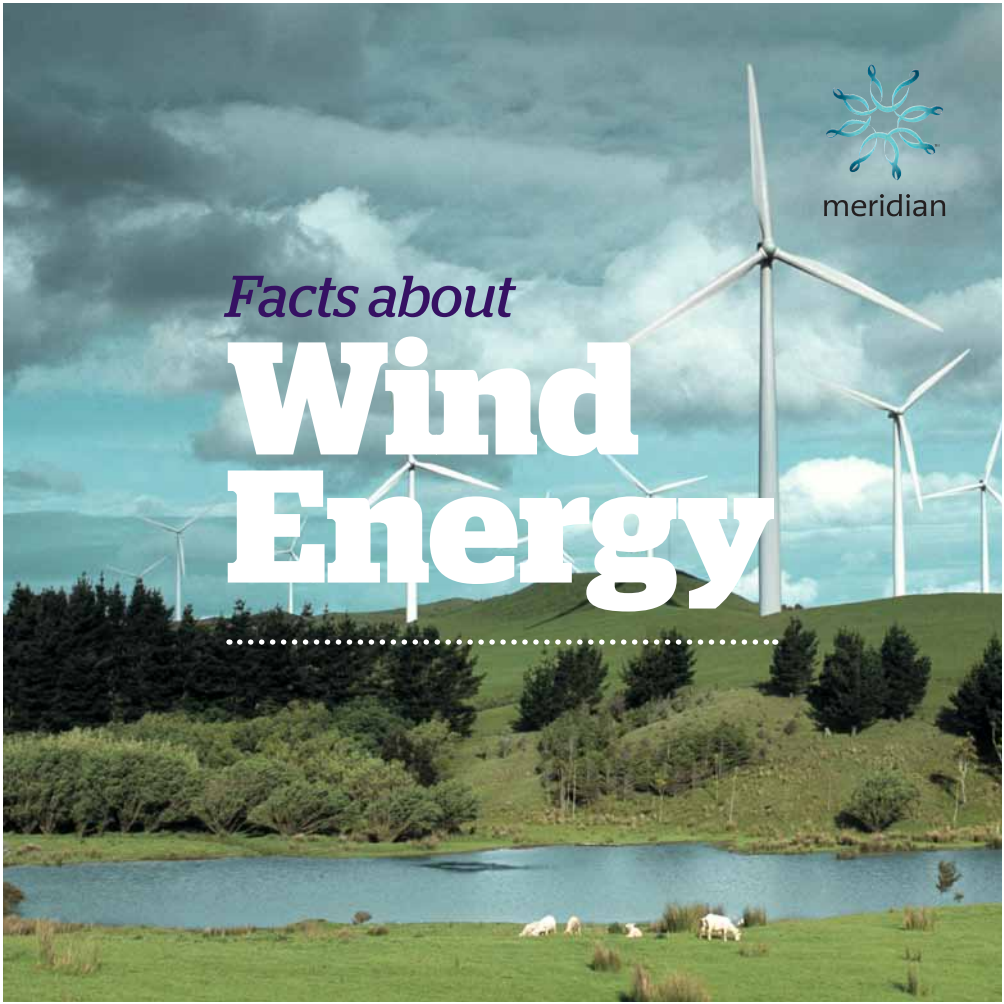

meridian
Facts about
Wind
Energy

New Zealand's wind resource

New Zealand has a world class wind resource being situated right in the path of the 'Roaring 40s' – wind at around 40 degrees latitude (South) unhindered by large land masses which can be extremely strong. With its narrow islands, New Zealand has a good exposure to coastal winds and its ranges and areas of elevated terrain give localised wind speed accelerations.

New Zealand has one of the most consistent wind energy resources in the world, and our wind farms operate at an average of 45% of maximum capacity, compared with an international average of only 24%.

Electricity is critical to New Zealand's economic growth. We need to generate enough electricity to meet the needs of our industries and houses, and our power supply has to be reliable.

Diversifying the way we generate electricity provides greater security for our power supply. Wind is an abundant local resource which can be harnessed to provide that electricity and provides a complementary generation to hydro.

White Hill wind farm.

Where can wind farms be built?

There are laws in place to ensure wind farms are only developed where they are appropriate. Anyone wishing to develop a wind farm must seek resource consents from the relevant authorities (the regional, district and/or city council) under the Resource Management Act (RMA). Wind farm developers must also prepare and submit Assessment of Environmental Effect (AEE) reports with their resource consent applications. AEE reports help ensure local authorities are aware of the full details of what is proposed and the potential effects including visual, noise, communications interference, ecological, archaeological impact and effects on culturally significant sites. Using this information, councils can consider applications for resource consents and make informed decisions as to whether to decline or grant the application with appropriate consent conditions.

How can I have a say about wind farm developments in my area?

Community and stakeholder consultation is an important part of Meridian's development process and the resource consent process because it is crucial that people have an opportunity to have their points of view considered on energy development projects. People are welcome to attend open days, request meetings with the consent applicant, or make submissions as part of the consent process for proposed wind farms.

Mossburn Primary.

Are there any health effects from wind turbines?

With the increasing use of wind energy world-wide to generate electricity, concerns have been raised regarding possible health effects. The main concerns relate to low frequency sound and infrasound, shadow flicker, blade glint and electromagnetic interference.

Some of the reported effects include anxiety, sleep disturbance and hearing loss. Over recent years, a number of international studies have been conducted, all of which have found no evidence to support any adverse health effects from wind turbines.

In 2009, an international panel of experts was established to review the vast literature available on the perceived health effects of wind turbines, with a specific focus on sound produced by the turbines. [1]

Following extensive review, analysis and discussion, the panel concluded:

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
- The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

The panel also gave consideration to 'wind turbine syndrome' and vibroacoustic disease (tissue inflammation and fibrosis associated with sound exposure), both of which have been claimed as causes of adverse health effects. 'The evidence indicates that 'wind turbine syndrome' is based on misinterpretation of physiologic data and that the features of the so-called syndrome are merely a subset of annoyance reactions. The evidence for vibroacoustic disease is extremely dubious at levels of sound associated with wind turbines.'

A similar review was undertaken in July 2010 by the National Health and Medical Research Council for the Australian Government. It too concluded that 'There is currently no published scientific evidence to positively link wind turbines with adverse health effects.' [2]

[1] *Wind Turbine Sound and Health Effects: An Expert Panel Review. View online at http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects.pdf*

[2] *Wind Turbines and Health. A Rapid Review of the Evidence, July 2010. http://www.nhmrc.gov.au/publications/synopses/new0048.htm*

How much wind is needed to generate electricity?

Wind turbines start generating electricity when wind speeds reach around 4 metres per second (m/s) or a little over 14 km/h. Full production is reached when wind speed reaches around 50 km/h, but at speeds greater than 90 km/h the turbines shut down until the wind speed drops. The amount of electricity generated by a wind turbine is very dependent on the wind speed.

Did you know?

When the wind speed doubles, the power available for generation increases eight times.

Why not use other methods to generate electricity?

New Zealand is fortunate to have excellent resources for producing hydro electricity. Meridian meets approximately one-third of New Zealand's electricity needs from its nine hydro power stations in the South Island. Hydro power is a key part of the New Zealand generation mix, but it is vulnerable to low rainfall and there are limited future development options.

Meridian can now complement its hydro stations with wind power. When it rains, the lakes fill and we can generate from hydro power. When the wind blows, we can generate electricity and the water in the hydro lakes can be conserved for times of peak demand.

Currently in New Zealand, only hydro power stations, geothermal power stations and wind farms are economically viable means of generating renewable energy on a sufficient scale.

Gas is another generation option, but there is no certainty as to whether gas can be supplied to power stations in the future. Oil, gas and coal generation emit greenhouse gases.

Other renewable energies such as solar electricity or wave/tidal power are currently very expensive or in the early stages of commercial development.

How much electricity can wind turbines generate?

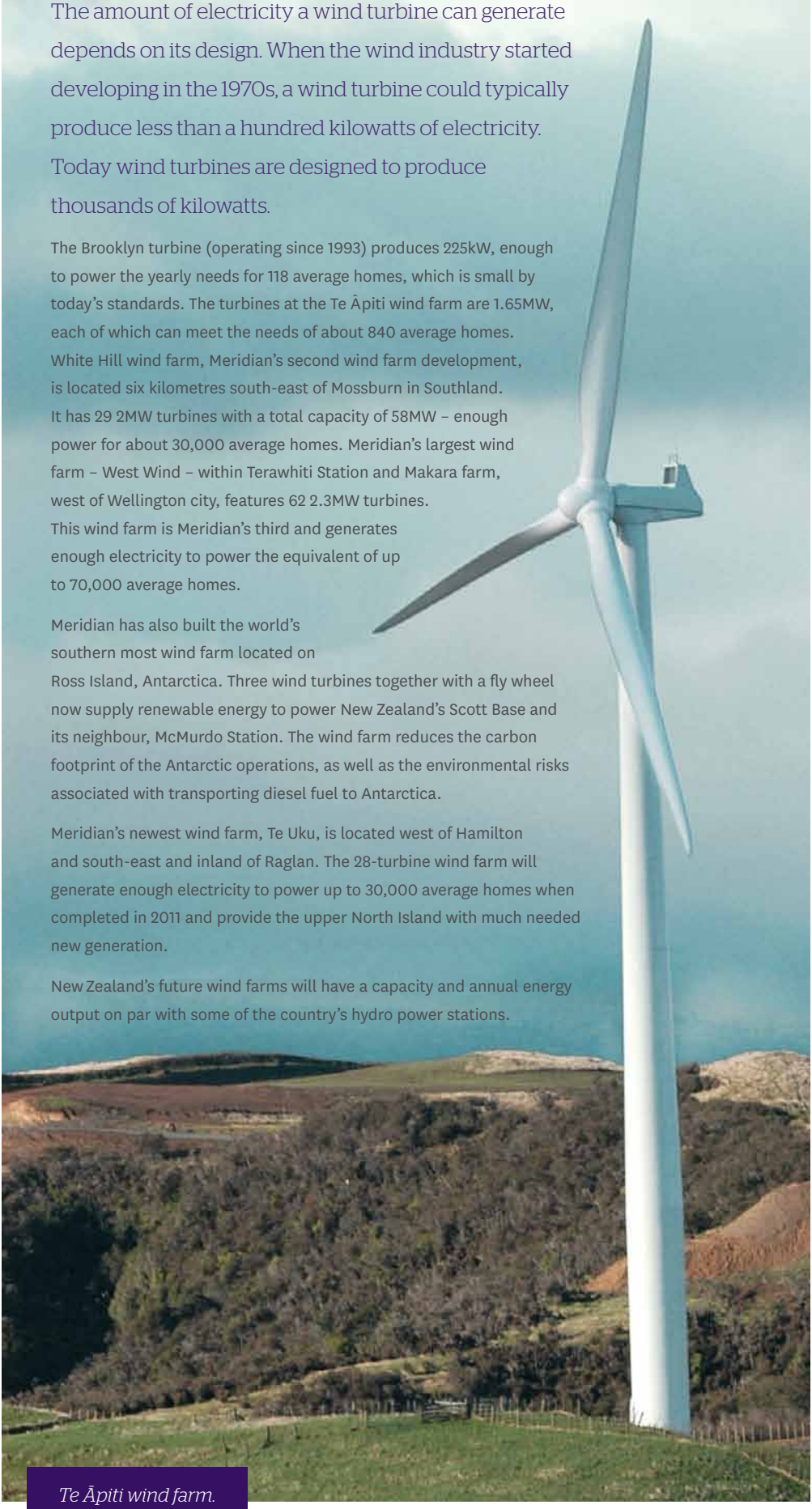
The amount of electricity a wind turbine can generate depends on its design. When the wind industry started developing in the 1970s, a wind turbine could typically produce less than a hundred kilowatts of electricity. Today wind turbines are designed to produce thousands of kilowatts.

The Brooklyn turbine (operating since 1993) produces 225kW, enough to power the yearly needs for 118 average homes, which is small by today's standards. The turbines at the Te Āpiti wind farm are 1.65MW, each of which can meet the needs of about 840 average homes. White Hill wind farm, Meridian's second wind farm development, is located six kilometres south-east of Mossburn in Southland. It has 29 2MW turbines with a total capacity of 58MW – enough power for about 30,000 average homes. Meridian's largest wind farm – West Wind – within Terawhiti Station and Makara farm, west of Wellington city, features 62 2.3MW turbines. This wind farm is Meridian's third and generates enough electricity to power the equivalent of up to 70,000 average homes.

Meridian has also built the world's southern most wind farm located on Ross Island, Antarctica. Three wind turbines together with a fly wheel now supply renewable energy to power New Zealand's Scott Base and its neighbour, McMurdo Station. The wind farm reduces the carbon footprint of the Antarctic operations, as well as the environmental risks associated with transporting diesel fuel to Antarctica.

Meridian's newest wind farm, Te Uku, is located west of Hamilton and south-east and inland of Raglan. The 28-turbine wind farm will generate enough electricity to power up to 30,000 average homes when completed in 2011 and provide the upper North Island with much needed new generation.

New Zealand's future wind farms will have a capacity and annual energy output on par with some of the country's hydro power stations.



Te Āpiti wind farm.

How reliable is New Zealand's wind resource?

Wind power is unlikely to ever replace other forms of generation such as fossil fuel or hydro power stations. This is because the wind does not always blow consistently enough, though New Zealand has strong winds when compared with most other countries. This makes wind power generation much more reliable here.

On average, New Zealand wind farms generate twice as much electricity when compared with international wind farms. Generally speaking in New Zealand, you can expect a wind turbine to be generating for over 85% of the time, at a reasonable site with good wind resource.

Wind farm opponents often suggest that due to the variability of wind, every wind farm should have an equivalent amount of back-up generation from another generation source. However, New Zealand's electricity system already provides additional capacity (some 3,000 MW) should there be a failure at a generation plant or the temporary loss of the Cook Strait cable.

Te Āpiti wind farm.

West Wind under construction.

How much does wind generation cost compared with other methods?

Wind power is one of the most cost-effective forms of renewable energy. Meridian is a large-scale wind farm developer and is able to use its position and experience to ensure that the turbine technology selected and the construction processes keep costs to a minimum.

Indicative unit costs for different generation options are outlined in the table following:

Costs of different types of generation (c/kWh):

Wind	7.8 - 10.1
Hydro	7.3 - 10.5
*Gas	7.4 - 12.4
*Coal	8.2 - 10.2
*Geothermal	7.0 - 9.2

* These prices do not include an adjustment for New Zealand's Emissions Trading scheme.

Source: Meridian's *Options, Choices, Decisions, 2009*

Avian risks

Internationally, poorly sited wind farms constructed many years ago have been associated with bird mortality, but these wind farms are an exception. While any tall structure poses some risk to birds, the impact of wind turbines on bird mortality rates is very small if careful consideration is given to how the wind farm location fits into the natural ecology of the area.

In the past Meridian has used human spotters to identify and count bird species. This has proven both time consuming, expensive and challenging due to difficulty in accurately tracking the altitude and paths of flocks of birds. In 2008, Meridian purchased the most advanced and tested Avian Radar System on the market called Merlin XS2530e. The Merlin environmental surveyor is one of the most powerful tools available for the assessment of proposed wind farm sites. When used in conjunction with human spotters, Merlin generates a detailed data set which can be used to accurately track migratory birds and ensure the wind farm is designed to cause minimal impact.

Did you know?

Merlin can track birds at night and even on cloudy days and give accurate descriptions of distance, height and the times the birds were spotted.

Merlin will further inform the already detailed ecology studies which identify what types of birds are in the area, and enable proper siting of turbines to avoid flight paths and significant habitats. Overseas studies show that, in general, birds will become accustomed to wind turbines and learn to avoid them. In the case of the Brooklyn wind turbine in Wellington, which is located on the boundary of Zealandia (formerly Karori Wildlife Sanctuary), there have been no recorded incidents of bird mortality in its 15 years of operation.

Wind turbines and sound

Most of the sound produced by a wind turbine is a broadband noise, a swishing sound created by the rotating blades. Design improvements have greatly reduced sound levels, and if you stand directly beneath a modern wind turbine, you can easily have a conversation without raising your voice.

Like other forms of environmental sound, such as airports, ports and construction, wind farms must adhere to an appropriate or relevant noise standard. The standard ensures that while wind farms will be audible at times, the level of sound heard at a location will be at a similar level to the natural sounds in the background - such as wind in the trees.

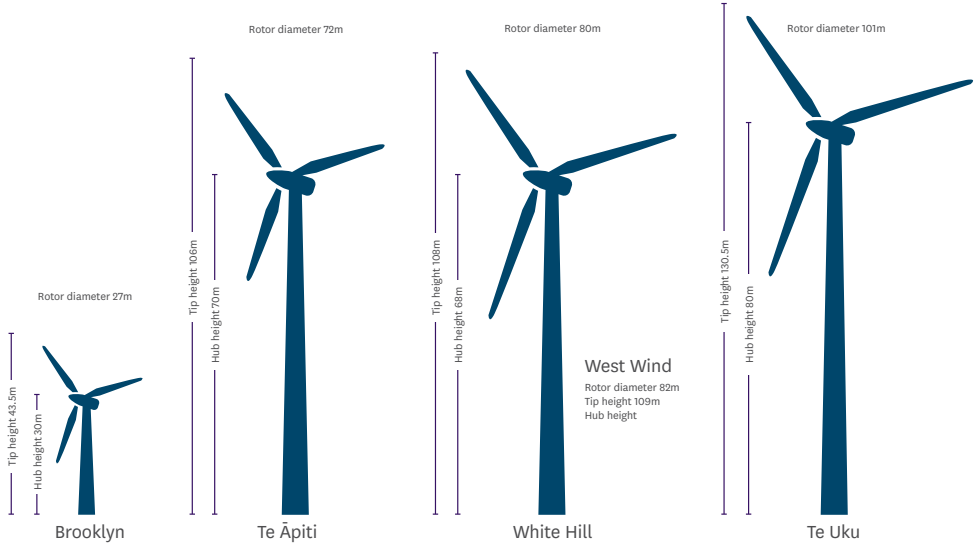
The limits of the wind farm noise standard are also intended to provide protection against sleep disturbance and maintain a reasonable amenity at locations surrounding a wind farm.

In 2010, Standards New Zealand updated the wind farm noise standard (NZ6808:2010). The standard was originally developed as an aid to planning consent procedures and to provide guidance on the limits of acceptability for sound received at locations near wind farms. Changes to the standard are intended to provide greater protection for communities by addressing and clarifying issues such as cumulative effects, special audible characteristics and noise predictions.

What about the visual effect of wind farms?

Wind farms need to be built in locations where they can make best use of strong, unimpeded wind flows, such as hilltops and ridgelines. This can make wind farms a striking and impressive feature on the landscape, a visual effect that many people like but some do not. The visual effect for local residents is a significant consideration when potential sites for wind farms are investigated.

Meridian applies a clean site philosophy to its wind projects that minimises the visual impact of the project, in particular the roading and substation placement. The internal electricity networks are kept underground wherever possible, the turbines have no branding and Meridian undertakes a comprehensive vegetation reinstatement programme after construction.



Why do wind turbines have to be so large?

Wind speeds are usually greater and less variable the higher you are above ground level, so wind turbines are built on tall towers to take advantage of better wind conditions. Also, there are efficiencies to be gained from utilising larger turbines. Small increases in blade length can significantly increase the energy output of a turbine. This means fewer turbines, fewer roads, smaller project footprint, and lower maintenance cost. As turbines have got larger, the rotor speeds have decreased. This has dual benefits, from both a visual and ecological perspective.

Why is wind energy good for the environment?

From an environmental perspective, wind energy is one of the best new generation options immediately available in New Zealand, because wind can't be used up. Fossil fuel generation stations emit greenhouse gases on an ongoing basis, and most other renewable options have similar capacities, longer lead times, or are more expensive.

Wind farms reduce greenhouse gases when they displace generation from thermal sources, such as coal, which emit greenhouse gases. Building wind farms mean less thermal generation is needed from thermal power stations and that ultimately fewer thermal power stations will be built.

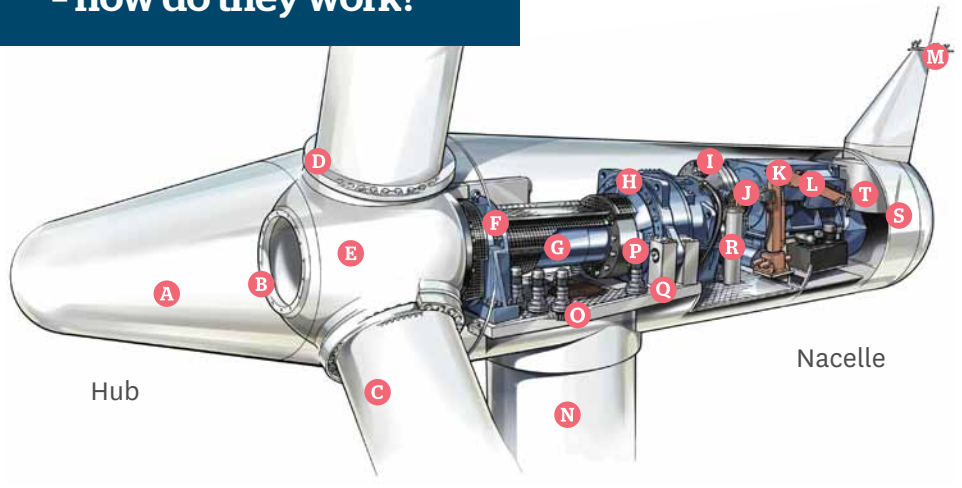
Public opinion indicates that wind energy is the preferred option for generating electricity in New Zealand. Research conducted in 2008 by the Energy Efficiency and Conservation Authority (EECA), a government agency established to encourage, promote and support the uptake of energy efficient initiatives and new renewable energy, showed that 91% of people nationwide see wind energy as having a positive impact as an energy source for New Zealand in the future.

Did you know?

Wind farm development is compatible with farming, providing an additional income stream for farmers while using a small proportion of the land.

Turbines

– how do they work?



- A Spinner
- B Spinner bracket
- C Blade
- D Pitch bearing
- E Rotor hub
- F Main bearing
- G Main shaft
- H Gearbox
- I Brake disc
- J Coupling
- K Generator
- L Service crane
- M Meteorological sensors
- N Tower
- O Yaw ring
- P Yaw gear
- Q Nacelle bedplate
- R Oil filter
- S Canopy
- T Generator fan

Meridian – committed to renewable energy

At Meridian, we take our responsibilities to New Zealand and the environment very seriously. We generate all our electricity using renewable resources and work closely with local organisations and the Department of Conservation.

We have made a commitment to sustainable energy. Our electricity is generated using only renewable resources – water and wind.

We're wholly owned and operated by the people of New Zealand, and we're committed to meeting the energy needs of this country by increasing the efficiency of our generation assets and investigating other economical methods of new generation – such as wind.

We are proud of our involvement with local communities, through community and sporting activities and the arts, and with non-profit organisations.

We work with organisations like the Energy Efficiency and Conservation Authority (EECA) to bring New Zealanders ways to save energy and we are constantly on the lookout for new energy-efficient products and processes to help New Zealanders use electricity wisely. Using our resources wisely and efficiently helps protect our environment and helps ensure we have ongoing energy supplies for future generations.

WE'RE HERE TO HELP

Please feel free to contact our Customer Service Team.

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