Te Uku: Energy from the Ages for the Future

Near Auckland, New Zealand, the past has welcomed the present in the form of majestic, environmentally friendly wind turbines, providing a source of energy for the local Maori residents that echoes their culture's centuries-old respect for the land and nature.

By Garry Barker

Raiha Gray of Ngati Mahanga *iwi* (tribe) presided over the *karanga* ceremony of welcome to the Te Uku turbines.

Photo: Jocelyn Carlin / Panos Pictures

The Rt. Hon. John Key, Prime Minister of New Zealand, is welcomed with the traditional *hongi* greeting.

Photo: Jocelyn Carlin / Panos Pictures

"New Zealand would like to harness more renewable potential and take the pressure off our emissions profile."

The Rt. Hon. John Key, Prime Minister of New Zealand

The predawn darkness shrouded us like a velvet cloak, cool, dense, and ruffled by the wind as we walked up the gravel road leading to the summit of the hill at Te Uku 400 meters above sea level on the rugged western coast of the Waikato area of New Zealand. The wind, whose power we had come to see and to celebrate, blew steadily from the sea, brushing an ancient terrain shaped by volcanic upheaval, glacial erosion, and the wind itself into deep, steep valleys and rounded grassy hills.

We walked quietly, a group of 60 or so – Maori elders, local community leaders, and the engineers whose work we had come to dedicate and connect spiritually with the land on which they stood. Voices were subdued as we all honored the significance of the event and absorbed the magic of the landscape, while dawn gave way to day. Gradually, as the first rays of the morning drove away the darkness, we became aware of a pale giant standing on the hilltop, looming ghostly from the gloom, its arms circling slowly, towering majestically over us.

This was Wind Turbine Tower 14, one of 28 raised on the 55-square-kilometer Te Uku site, the second such installation built in New Zealand by Siemens for New Zealand's Meridian Energy Limited.

A Fitting Dedication

We stopped at the gate about 100 meters from Turbine Tower 14 as two Maori matriarchs standing at its base began a *karanga*, an ancient chant calling the spirits of the Maori ancestors to welcome us and guide us in the dedication of the turbine project. As the chant ended, silence descended. Sea birds floated silently on the wind above us through the still dim dawn light. And then elders of the Maori tribes that have lived on this land for more than 1,000 years responded, assuring the women that we came in peace, with respect for the land and the ancestors who guard it.

"Come," they replied, and we all advanced to the base of the tower for speeches and prayers of thanks, led by Tuahu Watene, *kaumatua* (elder) of the Tainui tribe, and Sam Jackson, *kaumatua* of the Taranaki tribes on whose ancestral lands the earlier West Wind plant was built. Sam's wife, June Jackson, responded with the traditional chant of arriving visitors seeking admission. "It was a chant that cleared away all the negativity on the pathway that we were following to the turbine," Tuahu explained later.

"Siemens and Meridian have been good companies to work with," he says. "They have always acknowledged our interest, have asked our advice, and kept us informed throughout the whole project. This is absolutely a good thing for local people. There is now a host of opportunities ahead of them."

"Siemens and Meridian have worked collaboratively with *mana whenua* (Maori with customary authority) throughout the entire duration of the project, which has enabled the Maori to have a greater level of participation than perhaps they have had in the

Te Uku and West Wind are the only wind parks in the world built without government subsidy.

past. This is a great outcome not only for the Maori but also for Meridian and Siemens, as we are all richer for the experience and learning from each other," says Robert Batters, who is of Maori descent. Meridian involved local schools and communities from the beginning, and that effort paid off in the excellent relations the companies have had with local people.

Overcoming Challenges

Weather was a big factor, says Batters: "February 2010 was the wettest February on record since 1938; there were only six days where civil works could be undertaken, which seriously hampered progress. But the weather was kind to us in March and April. We finished the 28 turbine bases ahead of schedule, which allowed us to accelerate the turbine erection stage, and to finish two weeks ahead of schedule. The 28 wind turbines were erected and commissioned within 4 months, and the overall project was completed within 15 months. That's very quick. There were, of course, other challenges, but overall, it was a job well done, delivered early and under budget. The performance of the wind turbines has

The Rt. Hon. John Key, Prime Minister of New Zealand, speaks with *Living Energy* correspondent Garry Barker.

Photos: Jocelyn Carlin / Panos Pictures

World-Class Technology: a Visit from Prime Minister Key

The Rt. Hon. John Key, Prime Minister of New Zealand, flew in by helicopter to officially open the Te Uku plant. In an interview with *Living Energy*'s Garry Barker, he lauded the good cooperation between Siemens and Meridian, an enterprise wholly owned by the New Zealand government, in harnessing New Zealand's abundant wind.
Te Uku has been a win-win project for the companies and the people involved. At least NZ$30 million (€15.5 million) have been injected into the local economy, and more than 800 people have been employed, the majority of whom resided locally in the Waikato. More than 26 kilometers of all-weather roads have been built and 70 kilometers of underground power cables laid. A local quarry was upgraded so that it could supply over 200,000 tonnes of crushed rock for the roads and foundations.
As Prime Minister Key noted, wealth has flowed into the area, and prosperity has been enhanced since the advent of the wind turbines. Public complaints about the rise of wind turbines across the landscape have been very moderate, and at Te Uku, they were virtually nil, Key noted.

Meridian paid great attention during the construction of the Te Uku project to involving local communities with every aspect, from construction of the 26 kilometers of road across the 55 square kilometers of the site to the delivery, assembly, and construction of each turbine. Every school in the district "adopted" a wind turbine, with students making time capsules that were placed at the base of the stairs inside "their" turbine. On the day of the official opening, parents from the local school came together to help serve the breakfast that a local catering company hired by Meridian had prepared for people attending the dawn ceremony and lunch for Prime Minister Key and the 200 guests attending the official opening. Key remarked that it was an important demonstration of how closely Meridian had engaged with local communities and how well the wind turbines had been accepted by the people.

Following are some statements from the Prime Minister about the Te Uku project – and wind power in general.

- "The technology developed by Siemens is world-class. This is a very windy environment, and much work has been done in developing larger, more stable and more efficient generation technology."
- "New Zealand has a high level of renewable energy. We would like to harness more of that potential and take the pressure off our emissions profile. Wind power works very well for us and has become an increasingly important part of our stable electricity supply."
- "I think the wind turbines and their towers are very graceful. And the other beautiful thing about them is that they work very well."
- "We know that as the technology advances and is taken up around the world, wind power will become steadily cheaper. We believe it to be a good investment. After all, the fuel is free and never-ending. The cost of installation is relatively high, but as the initial capital outlay is amortized, wind power becomes a very good investment."
- "Siemens has been good at delivering a high level of output. Here at Te Uku, these 2.3-MW wind turbines are powered by 49-meter blades, bigger than those at West Wind and of a new and advanced design by Siemens that has improved efficiency and reduced noise. Standing right underneath one, you can hardly hear it."

Left to right: Tim Lusk, chief executive of Meridian Energy Ltd., John Spencer, chairman, WEL Networks, the Rt. Hon. John Key, Prime Minister of New Zealand, Chris Moller, chairman of Meridian Energy, and Julian Elder, chief executive of WEL Networks.

met expectations, nobody has been seriously hurt, and the environment has been protected. What more could you ask?"

Batters adds that the community is also in good spirits: "Livestock is grazing happily under the wind turbines, and farmers have another revenue stream. Some of the landowners' families have been working this land for over 100 years, and these wind turbines will help them continue to operate their farms in the future. It's a win-win situation."

Siemens was responsible for everything on the Te Uku site except the civil works, the roads, and the foundations. However, Siemens technicians in Brande, Denmark, provided the precision templates for the steel cages that reinforce the 800-tonne, 2.4-meter-deep cylindrical concrete foundation to which each 80-meter steel tower is bolted. Each foundation

Te Uku by the Numbers

- The Te Uku wind generation plant was built by an alliance of Meridian Energy Limited, an electricity generator and retailer, and Waikato Electricity Limited (WEL) Networks, an electricity and telecommunications network builder and operator.
- The site has 28 wind turbines, built by Siemens in Denmark. Each can generate with a capacity of 2.3 MW for a total of 64.4 MW from the site, or enough to power 30,000 average homes. The first turbine came onstream in November 2010, and the 28th came onstream on March 10, 2011.
- The site covers 55.8 square kilometers of remote sheep and cattle farming land with wind turbines set on hilltops, many 400 meters above sea level.
- Civil works at the site involved construction of 26 kilometers of road through difficult, steep hilly countryside and the laying of 70 kilometers of cable to connect all 28 wind turbines.
- More than 180 "erosion and sediment controls" to protect the environment were built as part of the civil works.
- Wind turbine foundation construction began in April 2010. Each foundation, a cylindrical block of concrete 16–18 meters in diameter and 2.4 meters deep, contains over 470 cubic meters of concrete and took 12 hours to complete. Reinforcing steel within each foundation weighs 46 tonnes.
- The wind turbine towers, each 80 meters tall, were built in three sections in South Korea and assembled on-site using a 600-tonne wheeled crane, the largest of its type ever used in New Zealand.
- Each nacelle mounted on top of each tower weighs 82 tonnes. The hub to which the turbine blades are attached weighs a further 28 tonnes.
- Each wind turbine blade, molded in one piece using fiberglass, resin and balsa wood, is 49 meters long and weighs 10.5 tonnes. Blades are hollow, allowing technicians to crawl inside to check them and, if necessary, make repairs.
- 40,000 native plants and trees were planted by Meridian and local *iwi* in an ecologically important wetland on the Te Uku site.
- Fifty-one percent of the over 800 people inducted and approved to work on the site came from the surrounding Waikato region. Others came from further afield in New Zealand and from Denmark. In all, more than NZ$30 million (€15.5 million) were injected into the local economy during the construction phase.

"The topography was a particular challenge. Nevertheless, everything ran smoothly."

Allen James, Siemens project manager Te Uku

"Performance met expectations, nobody was hurt, and the environment has been protected."

Rob Batters, Meridian Energy project manager Te Uku

was made with one continuous pour of concrete (over 470 cubic meters of concrete delivered in a tightly timed 12-hour run of 80 mixer truck loads).

"Each foundation is 16–18 meters in diameter, set with a ring of 160 bolts, each 1.475 meters long, sunk into the concrete foundation. Every bolt had to be placed exactly to fit the holes in the flange of the tower's base," says Allen James. "That it all fitted within the precise tolerances required is a tribute to both the precision of the templates made by Siemens in Denmark and the people who set them."

James, who was also project manager for Siemens at West Wind, says construction ran smoothly despite the challenges: "The topography was a particular challenge. The roads into the area are a lot narrower than normal, designed to have minimal impact on the environment, but also to make savings on the civil costs. The choice we made on equipment, such as the crane, allowed the road to be a lot narrower." The 28 wind turbines and the 84 rotor blades, made by Siemens in Denmark, were delivered to Auckland in three shipments and hauled by road according to a strict just-in-time schedule over the 160 kilometers to Te Uku.

The wind turbine nacelles, each weighing 110 tonnes, including the 28-tonne blade hub, and the blades, each weighing 10.5 tonnes, were all carried to the site on a specially adapted truck. The blade-carrying truck, 54 meters long, had a driver at each end, similar to a New York fire brigade ladder truck.

Subsidy-Free Projects: a World First

Te Uku and West Wind, the sister site built in 2009 by Siemens for Meridian Energy at Makara near Wellington, New Zealand's capital city, are the only wind power plants in the world to have been built without government subsidy, a tribute to their efficiency and that of the engineers, both local and from Siemens' Wind Power Division in Denmark.

"Our belief is that New Zealand's total future energy needs could be met by renewable sources. There is a huge wind resource here," says Tim Lusk, chief executive of Meridian Energy. "Years of wind development are still available in New Zealand before we might have to think of solar or some other source of generation."

Lusk says that the West Wind site is rated one of the most efficient in the world. The capacity factor, which assesses the power you get out of the wind turbines on average versus what you would get if they would run at full capacity at all times, is close to 50 percent at West Wind, which is very high. "We will go on building wind farms," he says. "We have a number stacked up with consented sites in Hawkes Bay, central North Island, and several very large ones in the pipeline just now going through the investigation process. Siemens is improving its technology all the time and has developed a direct-drive wind turbine which, having no gearbox, is much lighter so that civil works and construction are much cheaper."

The wind turbine blades harnessing the power of the wind are made to a patented, advanced, low-noise aerodynamic design developed by Siemens in Denmark. Each 10.5-tonne blade is molded in one piece for added strength. Rival blades are cast in two pieces and glued together. Each is hollow and large enough for a technician to get inside to make any necessary checks or repairs.

"We have a deep relationship with Siemens," says Lusk. "Our engineering people work with them very closely, and our recent experience is that as you commission these wind turbines, Siemens is able to tune out much of the noise characteristics that worry people. That has been very successful in reducing public concern."

Garry Barker is technology editor of the Age *newspaper in Melbourne, Australia.*

Further Information

www.meridianenergy.co.nz
www.energy.siemens.com/hq/en/power-generation/renewables/wind-power

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