



# **Te Apiti Wind Farm Project**

**(Previously the Lower North Island Wind Project)**

## **Project Design Document**

### **ERUPT 3**

***Project:*** *Te Apiti Wind Farm Project (Previously Lower North Island Wind Project)*

***Reference:*** *ERU 03/06*

***Document:*** *Baseline Study*

***Version:*** *2*

***Programme:*** *ERUPT 3 Stage 2*

***Date:*** *August 2003*

## 1 PROJECT DETAILS

### 1.1 Project characteristics

<b>Supplier</b>	
Company name	Meridian Energy Limited
Address	15 Allen Street
Zip Code & City Address	Wellington
Postal Address	PO Box 10-840
Zip Code & City Postal Address	Wellington
Country	New Zealand
Contact Person	Ms Tracy Dyson
Job Title	Sustainable Energy and Climate Change Advisor
Telephone Number	+64 4 381 1271
Fax Number	+64 4 381 1201
E-mail	tracy.dyson@meridianenergy.co.nz
Bank/Giro Number	Upon Request
Bank	WestpacTrust
No. of Employees	202
Company's Main Activity	Electricity Generation, Retailing, Trading
CPV Number	WN/938552
Registration Number Professional or Trade Register	Not Applicable
Date of Registration	17 <sup>th</sup> March 1999

#### Local contacts and other parties involved

The local contact will be Meridian Energy Ltd who will be the project owner, project manager and project developer.

## 1.2 Project Abstract

**Project Title** Te Apiti Wind Farm  
**Host country** New Zealand

### Abstract

Meridian Energy, New Zealand's largest generator of electricity from renewable resources and a state owned enterprise would like to develop a wind generation project in the lower North Island of New Zealand. This project is called the Te Apiti Wind Farm and will have a capacity of between 82.5-96.25 MW. Wind speeds on the site average about 9.3m/s giving an annual output of between 313-342 GWh with the most likely generation being 325 GWh. This level of generation is expected to offset approximately 944-1,031 kt CO<sub>2</sub> with the most likely reduction being in the order of 980 kt CO<sub>2</sub> for a period of five years (2008-2012). The New Zealand Government's recognition of the emission reduction benefits of this project through the allocation of Kyoto compliant emission units will help bring forward the economic development of this project which under certain market conditions may never have been developed.

**Location of Investment** Saddle Road, Manawatu, Lower North Island, New Zealand

**Expected investment starting date** 2004 with the sale of ERUs  
**Expected construction starting date** First half 2004  
**Expected construction finishing date** Last quarter 2004 - first half 2005

## 1.3 Background and justification

Meridian Energy is the largest renewable energy generator in New Zealand. It generates approximately 12,000 GWh per annum from renewable energy generation capacity of approximately 2,300MW. Meridian Energy's core business is the generation, marketing, trading and retailing of energy and wider complementary products and solutions which meet customer needs.

One of Meridian Energy's major objectives is to increase its ability to provide sustainable energy to New Zealand's energy consumers. At present the majority of its electricity generation is from hydro resources in the South Island of New Zealand. This wind project will assist with the further diversification of Meridian Energy's energy sources and the geographical spread of its generation.

This project also enables Meridian Energy to assist the New Zealand Government in meeting its energy, renewable energy, emission reduction and business opportunity objectives (further information is available in the Intervention section below).

Meridian Energy has proven experience in the development of large scale multi-disciplinary renewable energy projects as indicated by the successful management of the largest renewable energy project commissioned in New Zealand in 2002. This was the second Manapouri Tailrace Tunnel and further information is available on Meridian Energy's website.

Meridian Energy is the owner of New Zealand's first wind development and acquired a wind site in the Manawatu in 1999 which was consented for a 10MW development. Since that time Meridian Energy has completed site evaluation and pre-feasibility for a larger project in the same area and a number of other developments in New Zealand and Australia.

The electricity output from the wind farm will complement Meridian Energy's existing portfolio of generation, retail and hedge contracts so no additional power purchase agreements or equivalent are required in order for the power generated to be sold.

Due to Meridian Energy's strong financial position it is able to fund this project from its balance sheet, so there will be no financial partners. There will be no requirement for project related debt.

However the key issue which must be resolved for the project to proceed is economic viability. Although the site has a very good wind resource, low electricity prices in New Zealand and the absence of any existing domestic subsidies for wind energy projects means that development costs must be kept to a minimum and additional revenue from sources such as the ERUPT programme will be required to enable the project to proceed.

It is important to note that New Zealand's electricity prices are consistently one of the lowest in the developed world<sup>1</sup>. Wholesale electricity prices at present are in the order of 5c/kWh<sup>2</sup> and the currently accepted approximation of the development cost for a good wind site is 6.7 c/kWh<sup>3</sup> indicating that this project would not proceed without ERUPT funding or something similar.

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<sup>1</sup> New Zealand Energy Data File, Ministry of Economic Development, 2003, Page 145.

<sup>2</sup> New Zealand Energy Data File, Ministry of Economic Development, 2003, Page 119. (Energy cost of total retail sales/ Consumption of total retail sales = \$1,651 million/32,735,067MWh = \$50.45/MWh = 5c/kWh)

<sup>3</sup> New Zealand Energy Outlook to 2020, Ministry of Commerce (now Ministry of Economic Development), 2000, Page 11

## **Intervention i.e. goals, purpose, results and activities**

Goals – The New Zealand Government's energy policy objective is "to ensure the delivery of energy services to all classes of consumer in an efficient, fair, reliable and sustainable manner"<sup>4</sup>. The overall outcomes sought include "environmental sustainability" including continuing improvement in New Zealand's energy efficiency and a progressive transition to renewable sources of energy. The New Zealand Government ratified the Kyoto Protocol in 2002 and its climate change policy has an objective of working towards a permanent downward emission trend. This project will assist the New Zealand Government in meeting its energy, renewable energy and emission reduction objectives.

Further to the New Zealand Government's Energy Policy Framework<sup>5</sup>, a National Energy Efficiency and Conservation Strategy has been developed that includes a target of increasing the supply of consumer energy from renewable energy sources by 30PJ<sup>6</sup>. This is a best endeavours target only and hence no companies will have specific obligations regarding this target. The generation from this project will contribute to this national renewable energy target and supports the Government's Energy Policy objectives.

Whilst assisting the Government in meeting the objectives above this project will also contribute to Meridian Energy's long term strategic goal of establishing wind energy as a significant part of its generation portfolio and of New Zealand's energy mix. It will also diversify Meridian Energy's present renewable energy portfolio which is predominantly hydro.

Purpose: The purpose of the project is to construct and achieve commercial operation of a wind generation development of 82.5-96.25 MW in the Manawatu/Ruahine region of the lower North Island. The emission reductions generated by this project (likely to be in the order of 980 ktCO<sub>2</sub> from 2008-2012) will be an essential revenue stream required to make the project economic.

There is also value in participating in the ERUPT process for Meridian Energy, the Netherlands and New Zealand Governments as a Joint Implementation project of this type is very novel and provides significant opportunities to gain insights and commercial understanding of the mechanisms of the Kyoto Protocol. Due to the involvement of various New Zealand consultants it is also providing valuable capacity building opportunities to New Zealand organisations other than Meridian Energy.

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<sup>4</sup> Source: New Zealand Government's Energy Policy Framework - <http://www.med.govt.nz/ers/electric/package2000/epf.html>

<sup>5</sup> New Zealand Government's Energy Policy Framework

<sup>6</sup> Renewable energy target for New Zealand, Tuesday, 30 April 2002, Media Statement - <http://www.eeca.govt.nz>

Results: The result of the project will be an operational wind project achieving target performance of between 313 -354 GWh selling wind generated electricity into the National Electricity Market. This will assist in offsetting future greenhouse gas emissions and assisting the New Zealand Government to meet its renewable energy target. It is expected that this project will reduce carbon dioxide emissions by 944 – 1,031 kt CO<sub>2</sub>-e in total for a period of 5 years between 2008 - 2012. The most likely generation is 325 GWh resulting in a total reduction of 980 kt CO<sub>2</sub>-e for a period of five years between 2008 and 2012. This is based on an electricity emission factor of 603 tCO<sub>2</sub>/GWh calculated using the method prescribed in the Operational Guidelines for Project Design Documents of Joint Implementation Projects - Vol 2A<sup>7</sup> as discussed further in section 5.

Activities: Appendix 1 outlines the progress to date for this project and outlines the development plan which is divided into seven phases and summarised below:

	<b>Status</b>
1. Site identification and agreements	Completed 2003
2. Site evaluation and pre-feasibility studies	Completed 2003
3. Project definition and development plan	Completed 2003
4. Resource Consents	Underway
5. Design and commercial structuring	Underway
6. Construction/commissioning	2004 – on track
7. Commercial operation	2005 – on track

These work streams are not consecutive and indicative only.

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<sup>7</sup> Source: Ministry of Economic Affairs of the Netherlands, 2002

## 2 GHG SOURCES AND SINKS AND PROJECT BOUNDARIES

### **GHG emission sources and sinks due to the project**

The project is a green field wind farm generating electricity which is delivered into the national electricity transmission system.

The wind farm project does not have any net GHG emission sources or sinks.

Only CO<sub>2</sub> emissions will be considered during the operation of the project as the other gases are immaterial when considering greenhouse gas emissions resulting from the combustion of fossil fuels.

There are no significant GHG emissions once the project is operational however there are emissions resulting from the construction of the project that will be offset prior to the Kyoto commitment period. Further details of commissioning emissions are discussed in section 6.3, to ensure a conservative approach all GHG gases will be considered during commissioning.

**Direct on-site emissions** - There are no material direct on-site emissions.

**Direct off-site emissions** - ERUPT 3 has recommended an approach including emissions one step up stream and one step downstream from the project, therefore:

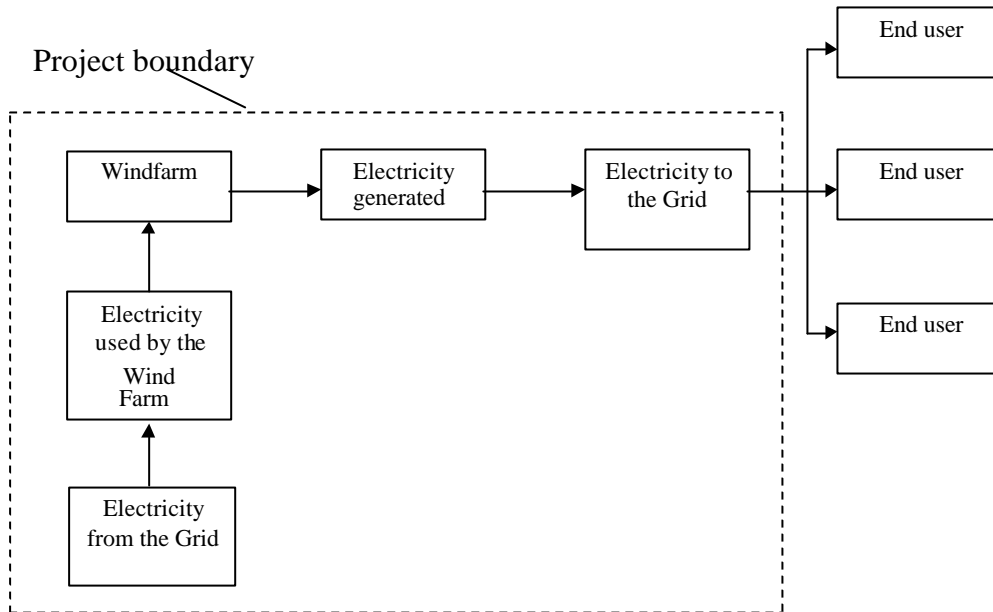
- One step up-stream - i.e. emissions from the construction of the wind farm including emissions from building civil structures on site and related transport fuels. See section 6.3.

- One step down-stream - i.e. emission reductions due to replacement of thermal electricity generated on another site. This will be the major positive impact of this project and is quantified in section 5.2.

**Indirect on-site emissions** - The project will not lead to a significant change in demand for services on-site, therefore there are no indirect on-site emissions that need to be considered.

**Indirect off-site emissions** - There are no indirect off-site emissions.

## A flow-chart of the project with its main components and connections



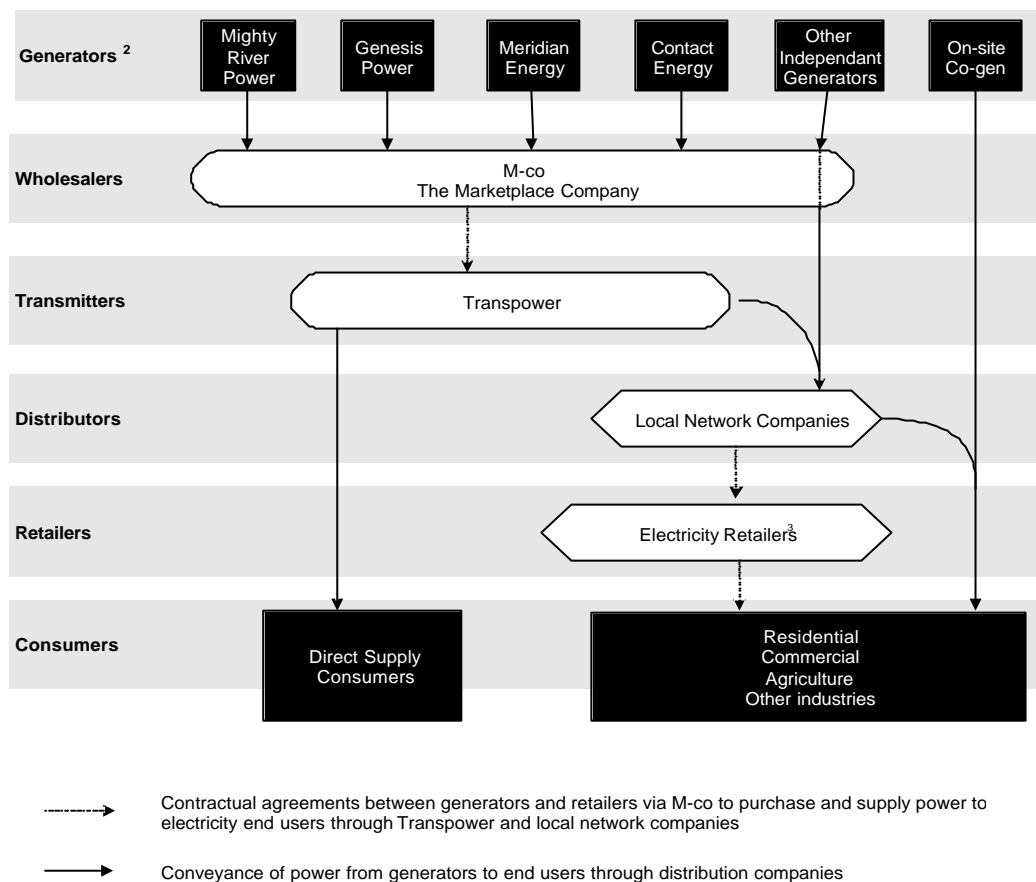
### General comments on flow chart and project boundaries

The turbines will inject electricity into the grid system when the wind speed is high enough for the turbines to generate. When the wind is low the turbines may draw some electricity from the grid prior to shut down however this will be negligible.

### 3 CURRENT SITUATION

The flowchart shows the current electricity sector in New Zealand with its main components and connections.

#### 3.1 Overview of the New Zealand Electricity Sector



Source: Energy Datafile January 2003

To the year ended 31 March 2002, Meridian Energy, Mighty River Power, Genesis Power and Contact Energy Generated about 29%, 10%, 17% and 22% respectively of total electricity used in New Zealand. On-site cogenerators generated about 8% while the remaining 14% came from independent generating companies<sup>8</sup>. The generators range in aggregate size of installed capacity from 500MW to the approximate 2,500 MW of Meridian Energy. The six largest generators own approximately 40 power stations, which range in size from a few MW to 1000MW. New Zealand's total generation capacity is approximately 8,600 MW.

<sup>8</sup> Source: New Zealand Energy Data File, January 2003, Ministry of Economic Development (MED), Page 100

The present generation mix is shown in the table below.

**Total generation (GWh) for the 2002 year (ending 31 September 2002):**

Hydro	Geo	Oil	Coal	Gas	Biogas	Steam	Wood	Wind	Total
23,819	2,611	0	1,282	8,725	97	561	364	147	37,606
63.3%	6.9%	0%	3.4%	23.2%	0.3%	1.5%	1.0%	0.4%	100%

Source: Ministry of Economic Development - Energy Data File January 2003, Section G – Electricity, page 103.

It should be noted that these proportions are highly variable due to climatic variations.

This generation was utilised by three main groups:

- 35% by the 1.501 million residential customers,
- 44% by 101,764 industrial customers,
- 21% by 128,683 commercial customers.<sup>9</sup>

**3.2 Provide information on operation mode(s) in the current situation**

The electricity market was deregulated in New Zealand in the 1990s. Since that time the environmental and greenhouse gas impacts of the different stations are not taken into account in any way in the existing market structure.

To summarise the market behaviour, every half hour of every day a price is established at each of the 244 grid connections points (nodes) around the country – these are called nodal spot prices. Simplistically prices are established at the price offered by last generator required to meet demand. Over time the marginal costs of operating fossil fuel power stations will always be higher than a renewable energy equivalent. The method used reflects energy costs, and transmission costs including losses and constraints to calculate prices. In doing this it also sends investment signals to market participants. Generators and buyers can also enter hedge contracts against spot prices.

The supply of electricity in the New Zealand market is provided mainly through hydro generation (57% of total generation<sup>10</sup>) with limited storage, the majority of which is situated in the South Island. Most of the load in New Zealand is based in the upper North Island as most of the population and industry is based there. This electricity is transported around the country from the supply point to the demand point using a transmission system that covers the country. The main North and South Islands are joined as part of this network via a transmission link.

<sup>9</sup> Source: New Zealand Energy Datafile 2003, Page113-115, MED 2003

<sup>10</sup> Source: New Zealand Energy Datafile 2003, Page100. MED 2003

With such a high reliance on hydro generation the market requires a set of flexible thermal plant capable of compensating for the variable availability of renewable energy sources such as hydro, to assist in peak load management and to provide an important contribution to meeting average demand. Currently a dual fired gas and coal thermal plant provides the flexibility required for the variable inflows that are a fact of the New Zealand market and is expected to continue to do so into the near future. If gas is unavailable to do this then it is expected that this station will ensure quality and security of supply with its coal fuel, or a new coal fired station will be commissioned to fulfill the same role. Therefore the extent to which coal generation is utilised will be reduced by any additional renewable energy generation that is available.

### **3.3 Information about the status and adequacy of the current delivery system**

Additional generation is expected to be required by 2005 to meet growing demand<sup>11</sup>. One of the most significant issues within New Zealand's electricity is the fuel sources for generation options going forward these include renewable energy, oil and gas and coal are discussed further below.

#### *Renewable energy*

Whilst the Government has a target to increase the supply of consumer energy from renewable energy sources by 30PJ this is only a best endeavors target and no company has additional responsibilities because of it. It is expected that electricity will only represent in the order of half of this target<sup>12</sup>.

The Government has indicated that it plans to implement a carbon charge in 2007/2008 of between \$0 and \$25/tCO<sub>2</sub> (depending on the international price of carbon) and to implement a project fund to encourage emission reduction projects (including renewable energy). However the mechanisms and budgets are yet to be agreed or made available,. At present most renewable energy options including wind are uneconomic.

#### *Oil and Gas*

New Zealand's reserves of oil and gas beyond 2008 are in doubt. Currently known fields will be insufficient to fully supply the energy market beyond the end of the decade. Among energy market participants (such as Genesis Energy, Contact Energy, Todd Energy and others) there

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<sup>11</sup> Source: Energy Outlook to 2020, Page 29, MED 2000

<sup>12</sup> Source: Developing the Renewable Energy Target and Mechanisms – May 2002, Energy Efficiency and Conservation Authority and the Ministry for the Environment

appears to be a consensus that there will be gas shortages in NZ after 2008 unless new, as yet unidentified, fields are found and developed<sup>13</sup>

Todd Energy was quoted in the press last year as saying “The prospects for new gas are not exciting... New Zealand would hit a ‘serious shortfall’ in gas from 2009 onwards, if there were no new significant discoveries of the size of the Pohukura field.”

If new fields do exist, and they are to found in sufficient time (at least 3-5 years before new gas is required) then explorers have indicated that the price of gas in New Zealand must increase dramatically, to make new investment in exploration economic. The impact of higher gas prices will fall in the electricity sector upon thermal generators, significantly increasing the cost of production for both existing and new thermal plant.

Furthermore, it has been signalled that new fields are highly unlikely to be able to operate as ‘swing producers’ – meaning that it would be very difficult to increase gas production in the event of a ‘dry year’ and leaving the country exposed to electricity supply risk.

Nearly 40% of New Zealand’s gas production is converted and exported in the form of liquid methanol. This production is expected to cease this year, until such time as new reserves are developed. Continued production of methanol (see Section 1.5 below) would create further pressure on supply and price in the wholesale gas market after the depletion of existing fields.

Other fuels, such as imported gas in the form of LNG or LPG, is significantly more expensive than existing local gas (or coal) supplies and New Zealand’s distribution infra-structure and ports would require considerable investment to use these fuels as substitutes.

### *Coal*

New Zealand's total in-ground coal resources are estimated to be about 15 billion tonnes, of which 8.6 billion tonnes is judged to be economically recoverable.<sup>14</sup>

The table below indicates coal is abundant in New Zealand. Coal use has declined in New Zealand as coal is considered environmentally inferior to using gas and renewable energy options. At least one third of current coal mined is being exported to higher value markets.

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<sup>13</sup> Source: Todd Energy - Review of the Responses to ACILs Report Page 8 & 15, Steve Barret CEO Contact Energy Presentation to the 2002 NZ Gas Conference slide 5, Review of the NZ Gas Sector Submission by Genesis Power Ltd January 2002 Pages 6 & 11 & 12.

<sup>14</sup> Source: Energy Data File – January 2003, pg 29, MED 2003.

## New Zealand Coal Resources

Period	Non-Renewable (Mt)
Current Usage	4.3a
Longer Term Reserves	8,643.7b

Notes:

a Source: Energy Data File Coal, January 2003, page 29, MED 2003.

b Source: Table 1: Summary of New Zealand coal resource estimates, pg 13, New Zealand Mining, Volume 25, March 1999.

Previously New Zealand operated coal power stations. These coal stations were decommissioned as new gas fired technology could be operated from gas discoveries during the 1960s and 1970s. In the year 2030, if no new gas or cost effective new technologies have been discovered, then coal-fired stations are likely to be required.

New clean coal conversion technologies are likely to emerge once gas resources have become uneconomic to develop and the resource will likely then provide New Zealand with a certain supply of energy.

The latest Government Energy forecast has two new coal plants being commissioned before 2020, totalling 675 MW<sup>15</sup>. More coal stations will be necessary to replace some of the existing gas fired plant.

Further information about the impact of demand growth and other factors influencing technology selection is provided in Section 4.

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<sup>15</sup> Source: Energy Outlook to 2020, Page 28, MED 2000

#### 4 KEY FACTORS INFLUENCING THE BASELINE AND THE PROJECT

<p>A. Environmental and technical factors that will influence:</p> <ul style="list-style-type: none"> <li>• the baseline development</li> <li>• the project's activity level and GHG emissions</li> <li>• the risks for the project</li> </ul>		
<b>Legal Factors</b>	<b>Influence</b>	<b>What is most likely to happen re factors</b>
Climate Change Response Act 2002	This Act has put in place a framework to allow New Zealand to meet its international obligations under the Kyoto Protocol and UNFCCC. One of the key measures in the Act is to provide powers to the Minister of Finance to manage New Zealand's holding of units and to trade on the international market in units.	The Act is in place, this allowed New Zealand to ratify the Kyoto Protocol at the end of 2002.
Energy Efficiency and Conservation Act 2000	This Act is the legislative basis in New Zealand for promoting energy efficiency, energy conservation and renewable energy. A requirement of the Act was that in 2001 the New Zealand Government released the first National Energy Efficiency and Conservation Strategy (NEECS). The NEECS contains two high level targets for achievement by 2012: <ul style="list-style-type: none"> <li>a. Economy-wide energy efficiency improvement of at least 20%</li> <li>b. 30PJ of additional consumer energy from renewable sources</li> </ul>	Te Apiti is positively aligned with NEECS and the Act, as it will help achieve the proposed targets.
Securing requisite land and access	If requisite land and access is not secured, then the Project can not proceed	Meridian Energy has the land and access required to continue to explore this wind farm opportunity.

Political Factors	Influence	What is most likely to happen (or did happen) re factors
Overall impact of political process	The electoral term in New Zealand is three years, with the next election expected to be July 2005. Different parties have differing views on the Kyoto Protocol	The present Labour-United Future Government is fully supportive of activities that reduce emissions and increase the supply of renewable energy.
Ratification of Kyoto Protocol	The New Zealand Government ratified the Kyoto Protocol in late 2002.	Ratification will help drive initiatives under the Act and NEECS. The project supports the aims of the Climate Change Policy (see below).
New Zealand Government Preferred Policy on Climate Change (Climate Change Policy)	<p>The New Zealand Government's Climate Change Policy provides a mix of policies to manage the international and domestic challenges of responding to climate change. There are three factors arising from the Climate Change Policy that particularly relate to ERUPT:</p> <ul style="list-style-type: none"> <li>a. Government retention of sink credits and their associated liabilities, including the Government's preferred policy to swap sink credits for emission units and save for future commitment; and</li> <li>b. Government plans to amend the Resource Management Act 1991 (RMA) to facilitate renewable energy initiatives. See Appendix 7.</li> <li>c. The Government's explicit support for emission reduction projects – the Project Mechanism is now under development. The incentives will be in the form of Kyoto compliant emission units.</li> </ul>	<ul style="list-style-type: none"> <li>a. To date, Meridian Energy has had on-going Government support on its participation in ERUPT, and anticipates continued support.</li> <li>b. Whilst RMA amendments may be beneficial, the current provisions of the RMA provide sufficient scope to allow development of the proposed Project.</li> <li>d. The ERUPT process allows the New Zealand Government to test one possible emission reduction project mechanism i.e. utilise the project as a test or pilot case.</li> </ul>

<b>Environmental Factors</b>	<b>Influence</b>	<b>What is most likely to happen re factors</b>
Adequate mitigation of environmental effects (eg noise, dust, light, etc)	In order for the project to be implemented, Meridian Energy will have to secure necessary resource consents and other approvals (eg under the RMA and Building Act 1991) to construct and operate Project. This requires, amongst other things, that Meridian Energy avoid, remedy or mitigate environmental effects associated with the Project.	Meridian Energy is confident that it can adequately address all environmental effects arising out of the Project, and has prepared the documents to secure requisite consents and approvals. This process has included undertaking extensive consultation and environmental impact assessments. There are no obvious impediments at this stage to obtaining such consents and approvals.

Socio-demographic factors	Influence	What is most likely to happen re factors
<p>Relationship between GDP Growth, Energy Efficiency and Demand Growth</p> <p>Energy Efficiency</p>	<p>New Zealand has experienced low but steady growth of around 2% pa. One core uncertainty is the rate of electricity growth and in particular the effectiveness of the energy efficiency policies in the NEECS in reducing electricity growth rates.</p> <p>Energy efficiency target of 2% improvement in energy efficiency is explicit within the NEECS. It is stated that this is made up of 1% from expected technological improvements shown within normal demand growth and increase to a further 1% improvement<sup>16</sup>.</p>	<p>This growth is expected to see consumer electricity grow from 33,800 GWh in 2000 to 42,700 GWh in 2012 (if efficiency measures are unsuccessful).</p> <p>The increase in demand is equivalent to 9,700 GWh of generation, the difference being the energy lost during transmission and distribution<sup>17</sup>.</p> <p>As additional thermal generation will be required and this is likely to be coal, the rate of exact rate of demand growth does not impact on the baseline calculations with regards to what this project will offset.</p> <p>The anticipated growth, moderated by improved energy efficiency is 1.4% pa, which would see consumer electricity grow to 39,900 GWh by 2012 (equivalent to about 6,700 GWh of additional generation)<sup>18</sup>.</p>

<sup>16</sup> Source: National Energy Efficiency and Conservation Strategy 2001, <http://www.eeca.govt.nz>

<sup>17</sup> Source: Developing the Renewable Energy Target and Mechanisms – May 2002, Energy Efficiency and Conservation Authority and the Ministry for the Environment

<sup>18</sup> Source: Developing the Renewable Energy Target and Mechanisms – May 2002, Energy Efficiency and Conservation Authority and the Ministry for the Environment

Technical Factors	Influence	What is most likely to happen re factors
Technology options	Possible deviations from the predicted wind conditions could impact on the turbine selection and project outcome	Meridian Energy has a high level of confidence in the wind data due to a 2 year + collection phase and the use of Garrad Hassan – international wind experts to complete the analysis.
Technology selection (See section 3 for further details)	<p>The technology decision to meet the 6,700 GWh requirement depends on a number of factors, fuel supply and availability, capacity of the plant, costs and risks, organisation structure, demand growth etc. Several options are possible these include:</p> <p>Coal fired – as discussed section 3 above.</p> <p>Hydro – ability to develop influenced by RMA requirements</p> <p>Hydro-efficiency – low cost options will be explored however they are unlikely to generate significant amounts</p> <p>Co-generation – depends on fuel availability</p> <p>Biomass – depends on forestry management, technology developments and location of fuel. This is a possible growth area however increase of availability of fuel is correlated with increased demand for electricity for processing</p> <p>Geothermal – some low cost options are likely to be developed</p> <p>Wind - New Zealand has one of the best wind resources in the world<sup>19</sup> with average wind speeds often reaching 10m/s. This is a potential growth area in NZ.</p>	<p>New Zealand’s existing Huntly dual coal and gas fired power station n will be decommissioned prior to 2030 and is likely to be replaced by at least one more efficient coal fired plant.</p> <p>It is likely that flue gas treatment installations will be installed in order to manage NOx, SOx and particulates (despite the fact that this reduces efficiency) and plants will become more efficient. This will decrease emissions offset by the wind project below present levels of Huntly on coal (i.e. approximately 930tCO<sub>2</sub>/kWh).</p> <p>Energy efficiency measures will increase – reducing growth in demand.</p> <p>Renewable energy will increase but the rate of increase is unlikely to meet the increase in demand in the short to medium term.</p> <p>The decision to develop one of these options will be one made by any of the generation companies based on competitive market processes.</p>

<sup>19</sup> Source: <http://www.nzwea.co.nz>. Further information about the wind regime at the project site is shown in Section 6.2

Turbine Selection	There is a possible risk of purchasing an inappropriate turbine for the site.	8 years wind data is available from the site, information has been collected from masts at 10m, 15m, 30m, 40m and more recently a 60m mast has been erected. This is all adding to the quality and quantity of wind data which will ensure the best positioning and generation from the resulting wind farm, it also enables wind turbine manufacturers to match turbines appropriately. A comprehensive tender process has been run to enable the most appropriate One of the major wind turbine manufacturers will to be selected with proven quality standards. A type 1 turbine will be selected to ensure that it can withstand New Zealand conditions.
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Economic Factors	Influence	What is most likely to happen re factors
Market prices for gas and coal	Whilst gas prices will increase as scarcity increases the cost of coal will effectively act as a price cap in the electricity market.	While the cost of additional electricity generation from coal is 6.3c/kWh and low cost wind is 6.7c/kWh no wind will be built in New Zealand <sup>20</sup> .  There is some lower price geothermal available (at 5.5c/kWh) however there is no limit to the potential supply of coal fired generation <sup>21</sup> . This is likely to increase GHG emissions in the electricity sector. It also indicates that additional funding will be required for renewable energy projects to become viable.
Availability of gas	Shortage of gas could lead to increase coal use leading to increasing emissions in the electricity sector. See section 3 above.	Presently available information suggests that existing known reserves of gas will not be able to meet New Zealand's growing electricity demands. However gas exploration will continue. See summary below for impacts.
Carbon tax	The Government plans to implement a carbon charge of \$0 - \$25/tCO <sub>2</sub> in 2007/8. This is likely to increase electricity prices.	This will improve the economic proposition for renewable energy and increase costs of thermal generators.
Renewable energy project funding and renewable energy target	See climate change policy above. The 30 PJ target is only expected to increase the proportion of consumer renewable energy from 29% to a maximum of 32% in 2012 <sup>22</sup> . As demand will also be increasing an absolute increasing in thermal energy will also be required.	See climate change policy above and summary below.
Energy efficiency target	See climate change policy above. This can reduce the rate of increase in demand to a level of approximately 1.4% per annum. However it will not completely offset growth and the new renewable energy target will not fulfill all of the new demand.	See climate change policy above and summary below.

<sup>20</sup> Source: Energy Outlook to 2020, 2000, Page 11

<sup>21</sup> Source: Energy Outlook to 2020, 2000, Page 11

<sup>22</sup> Source: Developing the Renewable Energy Target and Mechanisms – May 2002, Energy Efficiency and Conservation Authority and the Ministry for the Environment

Economic Project	If the project is not economic then the project will not be realisable. This is dependant on the revenue from emission reduction benefits of the project, the final outcome of the consent process and the turbine selection and negotiation process.	Risk management plans are in place and the final assessment will be made once all information is available.
Economics Summary	Energy efficiency activities and new renewable developments are unlikely to remove New Zealand's long term requirement for increased thermal generation in the next 30 years in order to meet demand and manage security of supply. Despite a carbon charge, due to gas availability coal generation is likely to play an important part in meeting demand especially in dry years and will assist with providing security and reliability to the system. This means electricity GHG emissions are likely to continue to increase. Therefore renewable energy projects will continue to offset thermal generation. Energy efficiency mechanisms will reduce the need for additional generation however it will not neutralise growth.	

## 5 CALCULATION OF THE BASELINE EMISSIONS

### 5.1 Identification of the most likely baseline

Annex B of the Operational Guidelines for Project Design Documents for JI Projects - Vol 2A shows the steps involved in the estimation of standardised baseline emission factors for an electricity sector. The following section describes the use of this method applied to the New Zealand situation. This will be used to assess the emission impact of the Te Apiti Wind Farm Project in New Zealand.

The ERUPT3 method is used to develop an electricity emission factor based on actual emissions in 2002 extrapolated out to the emissions from projected station technology in the year 2030 taking into account appropriate assumptions in the NZ market context as discussed in section 4.

1. Based on the prescribed method, the actual emissions that a renewable energy project built in 2002 would offset are 552.7 gCO<sub>2</sub>/kWh<sup>23</sup>. This is calculated in Appendix 2, is based on real historical data and has been corrected for the contributions of combined heat and power (CHP or co-generation).

2. The reference station for New Zealand in 2030 is an efficient coal fired station with an emission level of 730 gCO<sub>2</sub>/kWh. The methodology for assessing this is laid out in Appendix 3.

3. A straight line relationship is assumed between the emission factors in years 2000 and 2030, and the values relative to the 2008 – 2012 period apply for the ERUPT tender. This gives an electricity emission factor during this period that averages out to be 603g CO<sub>2</sub>/ kWh as shown in Appendix 4.

4. The critical aspect of this calculation is the basis for the selection of a coal fired plant in 2030. This basis is laid out in Section 4 in the column labelled “What is most likely to happen re factors”. To summarise:

- Policy will be in place that improves energy efficiency by 2% and increases the supply of renewable energy by 30PJ by 2012.
- This will reduce demand growth to about 1.4% (or 6,700GWh between 2000 and 2012) but this will not be met by the 30PJ of additional renewable energy as only some of this is

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<sup>23</sup> This number is highly dependant on climatic changes and is higher than the previous as 2002 was a drier year leading to increased use of thermal generation.

expected to be from the electricity sector. Industrial heat is expected to offer larger renewable energy opportunities.

- Therefore further thermal generation will be required.
- A carbon charge may be implemented to encourage gas over coal however due to there being insufficient known reserves of gas planning must be based on the only feasible alternative. Coal is utilised rather than oil due to its plentiful availability locally.
- The last Energy Outlook indicated that coal stations would be built rather than gas between 2011 and 2020<sup>24</sup>. We assume that this trend will continue.
- "This is consistent with projections of a lower hydro share for electricity generation and also consistent with the eventual replacement of most gas-fired thermal generation by coal-fired sources toward the end of the outlook period (2020), under current assumptions about reserves of natural gas". This quote is from New Zealand's Third National Communication under the Framework Convention on Climate Change (Page 60).
- It is assumed that the existing coal/gas dual fuel power station Huntly will be decommissioned prior to 2030 and replaced by a new plant whose efficiency will have increased to 45%. However it is likely that this station will have systems in place to reduce NOx, SOx and particulates which may reduce the efficiency. This assumption will lead to a more conservative plant emission factor.
- As shown in Appendix 5 the new coal plant is likely to have an emission factor of:

$\text{New Coal in 20 years (Coal - 45.0\%)} = 91.2 \frac{(\text{g CO}_2)}{(\text{MJ})} * 8,000 \frac{(\text{kJ})}{(\text{kWh})} = 729.6 (\text{g CO}_2 / \text{kWh})$
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*New Coal Emission Factor = Carbon Dioxide Content Per Unit Energy \* Heat Rate*

*Heat Rate = 3600 / plant efficiency (fuel to electricity)*

- As New Zealand has a high reliance on hydro generation the market requires a set of flexible thermal plant capable of compensating for the variable availability of renewable energy sources such as hydro, to assist in peak load management and to provide an important contribution to meeting average demand. Currently a dual fired gas and coal thermal plant provides the flexibility required in the New Zealand market and is expected to continue to do so into the near future. If gas is unavailable to do this then it is expected that a new coal fired station will be commissioned to ensure quality and security of supply. Therefore the extent to which coal generation is utilised will be reduced by any additional renewable energy generation that is available.

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<sup>24</sup> Source; Energy Outlook to 2020, Table 15 – Page 28, MED 2000

- Even if new gas discoveries were made at a later date the coal fired power station would still operate and its operation versus the operation of the gas plant will be dependent on the cost of gas.

## 5.2 Baseline selection, specification and calculation of the associated emissions

Baseline selection has been discussed in Section 5.1. The calculation of the baseline has been performed as per the Operational Guidelines for Project Design Documents of Joint Implementation Projects Vol 2A.

The following represents the straight line equation describing the baseline. This was **Calculated** calculated from real data today out to a coal fired plant in 2030. calculated from starting from real data today out a data point in 2030 based on the operation of a coal fired plant.

$$Z = (30 - t)/30 * X + t/30 * Y_{\text{New Zealand}}$$

Where  $X = 552.7 \text{ gCO}_2/\text{GWh}$

$$Y = 730 \text{ g CO}_2 / \text{GWh}$$

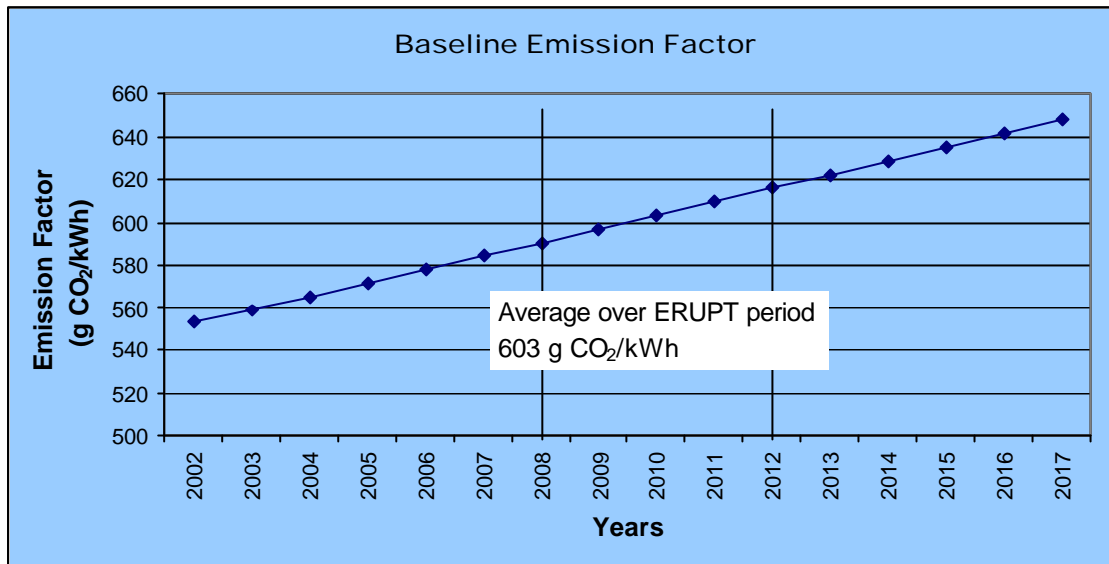
This gives the following baseline illustrated in the table and in graphical form below.

### Emission Baseline Standard per year gCO<sub>2</sub>/kWh

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
553	559	565	572	578	584	591	597	603	610

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
616	622	629	635	641	647	654	660	666	673

2022	2023	2024	2025	2026	2027	2028	2029	2030
679	685	692	698	704	711	717	723	730



This baseline increases over time as at present gas plant contributes significantly to the thermal generation mix. In future as gas supplies are less available and more expensive, coal will play an increasingly important role in the thermal generation mix.

An increasing baseline is further supported by New Zealand's Third National Communication under the Framework Convention on Climate Change, 2001, Page 58 which quotes "The updated BAU, with (climate change policy) measures projections see CO<sub>2</sub> emissions from all sources increase from 2000 to 2020. Emissions from electricity generation are projected to increase at an average rate of almost 6% per annum (assuming average inflows for hydro generation), with coal and oil based emissions rising by 1% and 2.3%, whereas emissions from gas will decline by 0.9% respectively." All energy emission projections showed increase.

**On-site emissions**

The on-site emissions for the baseline would be zero. The farming that takes place at present will continue when the windfarm is built.

**Off-site emissions**

Off-site emissions for the baseline are those generated by existing and thermal electricity generation plants. The emissions from these plants are represented by an emission reduction factor of 603gCO<sub>2</sub>/kWh.

**Total baseline emissions (aggregate of on-site and off-site emissions)**

The baseline emissions for this project is based on off-site emission reductions only which can be calculated using an electricity emission factor of 603 g CO<sub>2</sub>/ kWh as illustrated above.

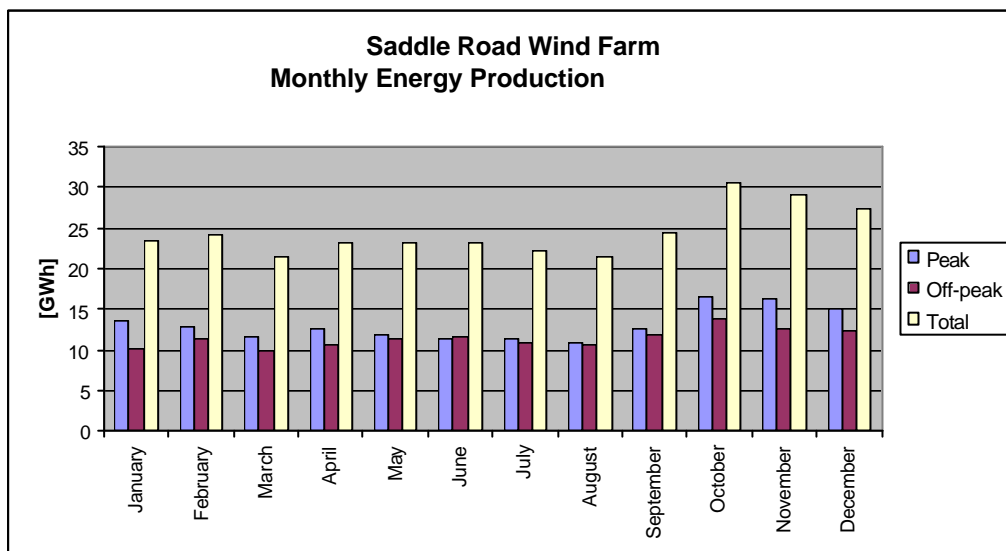
## 6. ESTIMATION OF PROJECT EMISSIONS

### 6.1 Key factors used for estimation of project emissions

- Characteristics – Offsetting thermal generation by the production of electricity by using wind energy which has no operational emissions
- Expected annual production - Output: 325 GWh per year, constant average for 20 years
- Expected range in annual production - 6 % variation in the average wind speed has been measured. A 6% increase in wind speed yields a 5.9% increase in output. A 6% decline in wind speed yields a 7.3% decrease in output.

### 6.2 Why the annual production (activity level) is expected at this level

The graph below shows a sample generation profile of the project.



The proposed project wind farm has almost even amounts of generation both off-peak (7pm to 7 am) and peak hours (7am to 7pm). The generation pattern suggests that a time weighted average approach is suitable for baseline analysis.

The wind speed of 9.3 m/s at 70 meters height has been calculated with a measuring mast located on the site. Wind measurement has occurred over a period exceeding 2 yrs, and the site data has been correlated with a long term data record from a local airport, enabling a long term data record to be synthesised. The net output using this wind data has been calculated by Garrad Hassan, an international consulting firm specialised in wind energy development.

The projected output will be secured by the appropriate construction, maintenance and

management of the plant. Meridian Energy will contract the equipment supplier for maintenance support and the power curve availability will be guaranteed under the supply contract.

The overall gross capacity factor of the wind turbines over their life is expected to exceed 45%, after taking into account equipment degradation, plant availability, array losses, and electrical losses. These factors are based on operating experience of similar installations.

The average of 325 GWh/year is calculated by taking the site specific wind characteristics into the wind turbine power curve, giving the gross and net output.

**Give a 95% confidence interval range for the activity level during the project lifetime**

- Expected level: 325 GWh
- Downside: 290 GWh
- Upside: 362 GWh

**6.3 Calculation of direct project emissions**

All gases have been considered here to ensure a conservative assessment.

**Direct on-site**

Direct on-site emissions will arise during the construction process and during on-going operations.

Direct on-site emissions during construction will arise from use of diesel fuel for construction equipment, and from decomposition of biomass that is disturbed during construction.

These are estimated as:

	tonnes CO <sub>2</sub> equiv
Diesel Fuel	505
Biomass	<u>309</u>
Total	814 tCO <sub>2</sub> -e

Direct on-site emissions during on-going operations are extremely small, and arise only from the use of petrol or diesel engine vehicles for on-site movement of maintenance crews. These emissions are insignificant within the total emissions balance of the project.

There will be a small amount of electricity used on site when the wind turbines are not operating, however this is taken into account as the electricity the electricity generation figures used are net figures after all losses and all onsite use has been taken into account. The total

annual electricity figure will represent the amount of additional electricity that the wind farm puts into the grid.

**Direct off-site**

Direct off-site emissions will arise during the construction of the project due to manufacturing of materials and equipment, and transport to site. These are estimated as:

	tonnes CO <sub>2</sub> equiv
Concrete	4,501
Steel	24,817
Aluminium	1,111
Copper	1,987
Plastic	3,358
Glass/ceramic	461
Transport fuel	<u>1,515</u>
<b>Total</b>	<b>37,749 tCO<sub>2</sub>-e</b>

(NOTE: The original data was based on a 36MW wind farm with 40 x 900kW turbines generating 139GWh. This has been scaled up by  $325/139 = 2.3$  for the purposes of this assessment. This approach will tend to overestimate emissions rather than underestimate the impacts. 25% of fuel use is assumed to be on site)

The total direct on-site and off-site emissions are 38,563 t CO<sub>2</sub> . If this is divided by the 603 tCO<sub>2</sub>/GWh emission factor it can be seen that this can be off-set by approximately 64 GWh of generation. This would on average be achieved in less than 3 months i.e. this will be offset before the end of 2005 and possibly earlier.

The emission impact one step downstream from the project is illustrated in the baseline discussed in Section 5.2.

**6.4 Calculation of indirect project emissions i.e. leakage**

**Indirect on-site emissions**

The indirect on-site emissions are expected to be the power augmentation required during fluctuating wind conditions. The quantum of power required and whether it is needed at all is a function of the technology used. It will be negligible.

**Indirect off-site emissions**

None

### 6.5 Calculation of total project emissions

<b>Year</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>Total 2008- 2012</b>
<b>Direct on-site</b>	814	0	0	0	0	0	0	0	0
<b>Direct offsite</b>	37,749	0	0	0	0	0	0	0	0
<b>Indirect on-site</b>	0	0	0	0	0	0	0	0	0
<b>Indirect on-site</b>	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
<b>Total project emissions</b>	38,563	0	0	0	0	0	0	0	0

## 7. CREDITING TIME

Start date of the project	By early 2004 (final decision to proceed on completion of resource consent process)  Mid 2005 (commencement of commercial operation)
Life time of the project	20 years
Crediting time of the project	2008 – 2012 i.e. 5 years

## 8. ESTIMATION OF THE EMISSION REDUCTIONS

In simple terms the emission factor is 603g CO<sub>2</sub>/kWh. The project is expected to generation 325 GWh per annum, yielding approximately 195,975 tCO<sub>2</sub> per annum based on the methodology prescribed for ERUPT 3. This represents a total of 980,525 t CO<sub>2</sub> for the five year period between 2008 – 2012.

### Expected scenario - Calculation of the ERUs generated by project if 90MW

Year	2005	2006	2007	2008	2009	2010	2011	2012	Total 2008-2012
GWh/Year	Up to 325	325	325	325	325	325	325	325	1625
Emission factor	572	578	584	591	597	603	610	616	603
Emission reductions	Up to 185,900	187,850	189,800	192,075	194,025	195,975	198,250	200,200	980,525
Project emissions	38,563	0	0	0	0	0	0	0	0
Potential ERUs generated	0	0		192,075	194,025	195,975	198,250	200,200	980,525
Claims on ERUs available for delivery the following year	0	0	0	106,000	106,000	106,000	106,000	106,000	530,000

Whilst not the planned scenario, if the project were only to have a capacity of 82.5MW resulting in generation of 313GWh then the project would reduce emissions by 188,739 tCO<sub>2</sub> per annum. The calculations are shown on the table on the following page.

**Possible scenario - Calculation of ERUs generated by project if only 82.5MW**

<b>Year</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>Total 2008- 2012</b>
<b>GWh/ Year</b>	Up to 313	313	313	313	313	313	313	313	1565
<b>Emission factor</b>	Up to 572	578	584	591	597	603	610	616	603.4
<b>Emission reductions</b>	179,036	180,914	182,792	184,983	186,861	188,739	190,930	192,808	944,321
<b>Project emissions</b>	38,563	0	0	0	0	0	0	0	0
<b>Potential ERUs generated</b>	0	0	0	184,983	186,861	188,739	190,930	192,808	944,321
<b>Claims on ERUs available for delivery the following year</b>	0	0	0	106,000	106,000	106,000	106,000	106,000	250,000

## 9. MONITORING AND VERIFICATION PLAN

### 9.1 Measurement, monitoring, calibration and reconciliation processes

The emission reductions from this project will be measured by measuring the GWh produced annually by the wind farm using Meridian Energy's generation meters and multiplying this by the emission factor calculated above.

All Meridian Energy's generation meters meet the electrical metering installation standards in New Zealand. These are required to be in compliance with an agreement called MARIA. MARIA (the Metering and Reconciliation Information Agreement) is an arrangement enabling electricity wholesalers and retailers to compete for customers and allocate volumes of energy in the national wholesale market. In order to trade energy, a participant must be a MARIA participant, and is then bound by the rules and codes of practice - these govern all aspects of physical data recording, handling and settlement.

MARIA governs aspects of the metering and reconciliation process, particularly the matching of data provided by retailers and generators, and includes accuracy standards for metering systems Codes of Practice governing installation and certification of meters, as well as handling of data and allocation of volumes to participants in a National Reconciliation process. Further information on MARIA can be found on the M-co web site at [www.nzelectricity.co.nz](http://www.nzelectricity.co.nz).

The MARIA Governance Board oversees MARIA's self-regulating structure, monitors and approves changes to the operational rules. The board sets up working parties to consider changes to governance rules and decides which proposed changes should be put to a vote. It also engages MARIA's Conduct Committee and Appeal Board, and appoints arbitrators for dispute resolution.

Transpower performs the role of National Reconciliation Manager (NRM). The NRM is responsible for reconciling metering data against a register of contracts and passing the data to industry participants.

More specifically, responsibility for installation, measurement and monitoring is as follows. Meters must comply with an internationally recognised standard such as IEC60687, and have passed laboratory tests to prove compliance with the requirements of the Rules of MARIA and the relevant Codes of Practice.

Installations must be carried out and site certified by a MARIA compliant Test House. Test

Houses are subject to audit, and certification will be withdrawn for Test Houses that do not meet the requirements of the Rules and Codes of Practice.

Data Administrator's are certified companies that can handle information from MARIA compliant metering systems, and only certified Data Administrator's may pass this information into the National Reconciliation process. Again, they are subject to audit and recertification, and certification will be withdrawn for Data Administrators that do not meet the requirements of the Rules and Codes of Practice.

Issues of monitoring metering systems and data for integrity, validation of information, and estimation of missing data is contained within the Rules and Codes of Practice, additionally metering errors must be notified to the National Reconciliation Manager and are open for audit.

Generation information from the wind farm will be measured and recorded half hourly. This information is collected and validated daily by a proprietary computer package. It is used within the reconciliation process to obtain payments for volumes generated and will also be the basis of the information reported to Senter International.

Note: The Government has just announced (20 May 2003) that it intends to replace the industry self regulating structure implicit in MARIA and NZEM with statutory rules and regulations. The initial indications from the Government is that codes of practice and rules relating to metering and data administration will not be subject to significant change, although the ability to change rules will now rest with the Electricity Commission (effectively the regulator) and the Minister of Energy .

## 9.2. Reporting

Meridian Energy will provide monitoring and verification reports based on this data to Senter International in accordance to the requirements of the ERUPT 3 TOR.

Monitoring reports will be provided annually from the year the project is commissioned. The GWh generation information generated from the systems described above will be multiplied by 603tCO<sub>2</sub>/GWh to quantify the emission reductions generated during the period

In addition to annual monitoring reports, a total of six finalised verification reports will be provided:

1. One year after the project has been commissioned covering the first 12 months of operation  
i.e. 2006
2. Before 1 April 2009, covering 2008 and the preceding period;
3. Before 1 April 2010, covering 2009;
4. Before 1 April 2011, covering 2010;

5. Before 1 April 2012, covering 2011;
6. Before 1 April 2013, covering 2012.

These reports will be verified by a qualified independent entity following the required process and a verification statement will be provided to Senter.

## 10. STAKEHOLDER INVOLVEMENT REPORT

The resource consenting process described in Section 11 carried out under the RMA (Appendix 7) comprehensively assesses the potential impacts of the project on the local community and environment. Appendix 8 shows a list of many of the stakeholders and stakeholder groups in this process.

Meridian Energy has a history of carrying out full and open consultation processes. In keeping with this, Meridian is undertaking a consultation process for Te Apiti which is both comprehensive and meaningful. Key stakeholders have been involved from the outset to assist with issue identification and project 'shaping'. For example, as a direct result of early consultation, Meridian was made aware of a culturally significant rock on the site and have been able to modify turbine layout and roading designs in a manner which will not compromise this site.

Early stakeholder engagement has also given real focus to the initial effects studies and has enabled Meridian Energy to present draft reports to various interest groups well in advance of applying for resource consent. Specific examples include an Ecology workshop and an Airspace Users workshop (for local pilots). These workshops enable Meridian Energy to present initial findings, receive feedback and where possible, mitigate any effects.

Similarly, 'Open Days' have enabled the general public to view printed material, see computer simulations and ask questions of staff present. Although some individuals may have concerns relating to the potential effects of the project, there has been universal support for the 'open and up-front' nature of consultation, all of which has occurred prior to lodging any resource consent application.

The methods of communicating with the project stakeholders has included direct face to face communication, a video, a specialised website ([www.windpower.co.nz](http://www.windpower.co.nz)), information leaflets, the media, community meetings, open days and written comment. A database of stakeholders, their comments and how their concerns/points are addressed is being kept. Discussions to date have been considered and where possible incorporated into the Assessment of Environmental Effects discussed in the next section. The consultation is still ongoing and formal submissions are being sought through the RMA process at present. Appendix 9 provides further detail of the consultation process.

## 11. ENVIRONMENTAL IMPACT ASSESSMENT

The wind project proposed for the ERUPT process will be subject to the Resource Management Act. As a result Meridian Energy has carried out a full assessment of environmental effects (AEE) as part of its application for a resource consent. This process is in some way similar to the Environmental Impact Assessment (EIA) carried out in other countries.

The development of projects in New Zealand which impact on the natural and physical resources of the country are subject to the Resource Management Act 1991. Appendix 7 provides additional background details on the Resource Management Act. This Act requires a full assessment of the effects of any development. If any adverse effects which result from the proposed development can be avoided, remedied or mitigated then a resource consent may be issued. This resource consent provides the developer with the regulatory approval to carry out the development.

This process has already commenced for Te Apiti and is likely to be completed in early 2004. The steps involved in this aspect of the project include:

1. Define project description. This includes the scope and size of the project to enable an effects assessment to be carried out.
2. Undertake assessment of effects based on project description. This would include a full assessment of effects including but not limited to:
  - i. Visual impacts
  - ii. Air traffic assessments
  - iii. Noise impacts
  - iv. Ecology
  - v. Tele and radio communications impact
  - vi. Flora and fauna impacts (including birds)
  - vii. Impact of project development (i.e. construction traffic) and tourism traffic impacts
  - viii. Archeological studies
  - ix. Iwi (Indigenous peoples) cultural impact assessment
  - x. Greenhouse gas impacts
3. Provide results of effects assessment to affected parties and the wider public i.e. a transparent process.
4. Full consultation with all affected parties.
5. Lodge consent application to relevant territorial authorities

6. Consent application for a project of this nature will normally be publicly notified.
7. Public makes submissions in support or opposition
8. Public hearing held to assess resource application
9. Decision to grant or reject consent made by territorial authorities under the RMA
10. Applicant and submitters can appeal decision
11. Appeals will be heard in the Environment Court.

To manage this process, a project team has worked together on the design of the Te Apiti wind farm to ensure that the proposal will have minimal effects on the surrounding area. The first six steps of the above have been completed for the Te Apiti Wind Farm and the public now have the opportunity to make submissions.

Some of the main findings of the environmental impact assessments that have been carried out include:

- The landscape can readily accommodate the wind farm's presence;
- The visibility of the turbines is not in itself an adverse effect;
- Appropriate design and siting of all earthworks can minimise ecological and landscape effects;
- Noise generated by the wind farm will be largely contained within the site;
- Impacts on sites of significance to iwi can be avoided;
- The turbines can be sited without compromising air navigation safety;
- Interference effects on radio communication and television services are negligible; and
- The transportation and construction phases will have minor effects on other road users.

Significant benefits both locally and nationally result from Project Te Apiti. These include:

- The provision of greater diversity in the supply of energy for New Zealand;
- The fact that the generation of electricity by wind uses a renewable resource;
- Wind power displaces the need to burn gas or coal to produce electricity, resulting in less carbon dioxide, sulphur and nitrous oxides being released into the atmosphere; and
- Development of the wind farm will benefit the local economy during the construction phase and could boost the local tourism industry.

The positive outcomes of the wind farm can be achieved in a way that avoids, remedies or mitigates adverse effects. Achieving positive, sustainable outcomes, while making practical efforts to deal with diverse effects is consistent with the core purpose of the Resource Management Act. A full summary of the AEE is available in Appendix 10.

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## APPENDIX 1

### Te Apiti Wind Farm Development Programme

The points below indicates the six major phases of the development programme. These work streams are not consecutive and indicative only. We are now in the final stages of gaining the resource consent allowing construction to commence – this means that four of the six processes are complete within the planned timeframe and within budget.

#### **Site identification and land agreements**

**Completed**

The site is ideally situated to take advantage of the prevailing north westerly winds that are forced through the gorge due to the funneling effects of the Ruahine ranges.

Meridian acquired control of a wind site in the Manawatu area in 1999 as part of the restructuring of the NZ electricity industry that took place in the late 1990's. This site already had planning approvals for a 10 MW wind development. With further investigation Meridian identified further wind development potential and proceeded to expand the land area covered by wind development agreements with landowners.

Meridian Energy has now secured all land owner approvals and agreements required to commence construction. The area of the wind farm easement covers 1150 hectares. The local Maori people (iwi) have named the site Te Apiti.

#### **Site evaluation, technical and environmental / planning studies**

**Completed**

In 2000 Meridian commenced detailed technical feasibility studies, economic evaluation and preparatory work for obtaining planning approval for a large scale development. In June 2003 after extensive consultation with stakeholders Meridian Energy lodged it's planning approval (resource consent) application. It is expected that, if all requirements are met, that approval will be given to commence construction early 2004.

In the preparatory stages, Meridian Energy has focused on the key elements that need to be addressed in order to provide a high level of confidence in the options proposed for further evaluation. These include:

a) *Wind resource analysis*

Over two years of data has been collected from two fifty meter masts on site and correlated with long term data records from a nearby airport. The analysis was carried out by international wind consultants Garrad Hassan. The average annual wind speeds are approximately 9.3 m/s at 70 meters.

At present there are 2 x 40m and 1 x 70m masts on site gathering data that supports the above findings.

b) *Generation Capacity*

Assessing the generation capacity has been completed and include:

- Environmental impact studies
- Assessment and consultation with affected stakeholders
- Constructability investigations
- Individual turbine energy yields and micro-siting of turbines.
- Transmission constraint assessments and negotiations with the transmission company.

These investigations have indicated that the generation capacity will be in the order of 313-342 GWh.

c) *Constructability*

Many areas of the site are relatively hilly and steep. Meridian Energy has carried out detailed review of the civil, geotechnical and seismic attributes associated with the site and has determined that it is possible to access the majority of the areas within the site and erect wind turbines. Further site investigations and work with turbine suppliers have led to the completion of the micro-siting resulting in a final capacity expectation of between 82.5-96.25MW

d) *Transmission*

The ability to export energy off site is a key element to the project viability and Meridian Energy has explored a broad range of options to insure that it is aware of the constraints, risks and associated costs in order to ensure that optimum solutions can be realised.

The site can be connected to either the local 33kV networks or directly into the 110kV national grid. The overall site capacity and economics have determined that direct connection to the national grid is the best approach and negotiations are now underway with

the transmission company, Transpower. A 33/110kV substation would be built adjacent to Saddle Road.

*e) Environmental and Planning Studies*

Meridian Energy has carried out a detailed evaluation of the site from an environmental effects and resource consent perspective. Part of the wind farm site already has resource consent. Extensive consultation has been completed and full environmental impact assessments have been completed by experts and are available for review. Summaries of these reports and processes are given in section 10-11.

*f) Technology*

Meridian Energy is in the final stages of selecting a turbine manufacturer the supplier of the technology for the development. The turbine type will be a three bladed upwind rotor, pitch controlled type – the technology most commonly used by developers today.

*g) Economic Evaluation*

Meridian Energy has carried out detailed economic evaluation of the project using standard industry evaluation techniques. Meridian Energy has sufficient confidence in achieving favourable economic outcomes to proceed with the development process so that a final decision can be made in late 2003/early 2004.

*g) Conclusion*

Since 2002, Meridian Energy has selected turbine and tower suppliers, finalised landowner negotiations, commenced the planning approval process, built a team of internal experts and widely consulted on the project. Meridian Energy is confident that if no issues emerge within the resource consenting process and if appropriate turbine contracts are finalised then the additional funding from ERUPT combined with other factors will lead to the construction of the wind farm commencing in 2004.

**Technical project definition and development plan**

**Completed**

Meridian Energy has completed the technical definition of the project. The development plan and programme are now finalised.

## **Resource consenting i.e. planning approval**

**Underway**

Meridian Energy's approach to consenting this site has been in line with its commitment to sustainability and follows closely a best practise process that is used on all Meridian projects. The website ([www.meridianenergy.co.nz](http://www.meridianenergy.co.nz)) contains various information detailing some of these process.

The purpose of this phase is for Meridian Energy to obtain resource consents for the development. The following elements have formed part of this process:

- Pre-brief the key influencers and stakeholders about Meridian Energy's intent to consent a wind farm on the site;
- Prepare a project description detailing the scope and size of the project,
- Development of a comprehensive communication strategy that ensures all stakeholders are consulted over any effects;
- Meridian Energy has retained environmental scientists and specialists to undertake the necessary studies including cultural, air traffic, transport, archaeology, communications, ecology and visual effects
- Distribution of study results to all affected stakeholders.
- Consent application (presently underway)

Meridian Energy believes this approach will provide the best chance of a successful consent application. Section 10-11 and Appendix 7-11 contains further details of the process required to fulfil New Zealand and Meridian Energy's requirements in this regard.

The successful outcome of this phase will be a Resource Consent for development of this site with acceptable conditions.

## **Design and Commercial Structuring**

**Underway**

The purpose of this phase is to complete the detailed design of the project and finalise commercial structures including the construction start, financing and electrical connection aspects of the project.

At the conclusion of this phase the Board of Directors of Meridian Energy will make a final decision regarding construction of the project, this is likely to occur in late 2003/early 2004. If it is decided to proceed then all contracts necessary for the construction and financing of the project will be executed.

**Construction and commercial operation**

**2004/5**

The purpose of this phase is to complete the construction and commissioning of the project.

The outcome of this phase will be a fully commissioned project handed over to Meridian Energy and in commercial operation. Wind projects of this nature typically take 18 months to complete from the point of placing orders, however this is dependent on equipment lead times.

The actual on site construction can be completed in as little as 10 months, depending largely on weather conditions at critical times being suitable for roading construction and turbine erection. The expectation for this site is 12-14 months. Ideally commissioning will be complete by mid 2005.

**Indicative Te Apiti Wind Farm Development Programme**

	Pre 2003	2003		2004		2005
		Q1/Q2	Q3/Q4	Q1/Q2	Q3/Q4	
Site selection	◆					
Prefeasibility study	◆					
Technical definition and project plan		◆				
Resource consenting		◆	◆			
Design and commercial structuring		◆	◆			
Construction				◆	◆	
Commercial operation						◆

## APPENDIX 2

### New Zealand Electricity Sector Emission Factor 2002- Baseline starting point

#### Source Information

The actual fuel types and consumption have been sourced from the Ministry of Economic Development Energy Data File - January 2003. Where possible September years are used to ensure consistency.

Coal used for electricity generation (excluding co-generation) totalled 13.74 PJ<sup>25</sup> for the September year 2002.

Gas for the same periods was 75.37 PJ<sup>26</sup>. The majority of the gas for electricity generation is from the Maui field.

Co-generation from coal used 0.64 PJ, whereas co-generation from gas used 18.73 PJ.

Electricity generation for the September 2002 year is 37,606 GWh, breakdown for different fuels given in Section 3. All emission factors for fuels are shown in Appendix 6.

This data will be utilised within the Senter methodology as laid out on pages 29 - 32 of the Operational Guidelines for Project Design Documents of Joint Implementation Projects Vol 2A.

#### 1. Fuel Emission Factor Calculations i.e. calculate (A) and (B)

The data above will be used to calculate (A) - the average emission factor for all gas and oil fired power generation in the country, and (B) - the average CO<sub>2</sub> emissions for all other fossil fired power generation. Both will be expressed in gCO<sub>2</sub>/kWh. Cogeneration will be corrected for. Assumptions where required are explicit and conservative.

#### *Cogeneration (or combined heat and power, CHP) Correction Factor*

The forms of cogeneration that exist in New Zealand are not corrected based on heat terms alone. Some co-generation facilities are steam led and others are electricity led. The steam led facilities predominantly burn fuel for heat, whereas the electricity led facilities predominantly burn fuel for electricity.

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<sup>25</sup> Source: Energy Data File January 2003, page 26 for coal, MED 2003

<sup>26</sup> Ministry for Economic Development, Energy Data File January 2003, page 26 for gas and coal.

To calculate the co-generation correction factor the proportion of process heat is required. As process heat information is not readily available, pro rata assumptions are required.

- Southdown is the largest co-generation plant and predominantly generates electricity consuming on average 6 – 9 PJ pa (as checked from Natural Gas NZ Ltd, Information Disclosure, Table 8.1 North Transmission System Capacity Reservations, Annualised Southdown Maximum Daily Quantity equals 9.0 PJ/a), the cogeneration steam is a by-product of the process.
- The dairy and steel industries require process heat first and electricity is a useful by product. For example, from a dairy model 30% of the fuel is effectively just for electricity production.[Todd Energy Limited, Kiwi Dairy Cogeneration Station, reference site: <http://www.todd.co.nz/te/pages/main/corporate/kiwicogen.htm>]

*Gas usage:*

Gas cogeneration: = 18.73 PJ less 8 PJ pa Southdown (electricity led, not steam led)  
(total cogen from gas)

= 10.73 PJ remaining cogeneration

= 10.73 PJ \* 30% = 3.2 PJ pa.  
(gas for cogeneration) \* (percentage fuel used for electricity only)

Therefore gas consumed by cogenerators attributed to electricity generation  
= Southdown + other cogen gas  
= 8 + 3.2 = 11.2 PJ pa,

Therefore total gas for electricity is 11.2 + 75.4 = 86.6 PJ.

*Coal usage:*

Coal cogeneration: = 0.64 PJ \* 30% = 0.19 PJ coal  
(coal for cogen) \* (percentage fuel used for electricity only)

Coal consumed by cogenerators attributed to electricity generation = 0.19 PJ.

Therefore total coal for electricity is 0.19 + 13.74 = 13.9 PJ.

**(A) = Gas Component: The average CO<sub>2</sub> emission factor for all gas and oil fired power generation.**

- Gas Usage:  $86.6 \text{ PJ} * 52.8 \text{ tCO}_2/\text{TJ} = 4,573 \text{ ktCO}_2/\text{annum}$   
(total gas usage) \* (gas emission factor - Appendix 6)
- Total generation for all gas and oil fired generation: 8,725 GWh
- (A) =  $4,573\text{kt} / 8,725\text{GWh} = 524 \text{ g CO}_2/\text{kWh}$

**(B) = Coal Component: The average CO<sub>2</sub> emission factor for all coal fired power generation.**

- Coal Usage:  $13.9\text{PJ} * 90.4 \text{ tCO}_2/\text{TJ} = 1,257 \text{ ktCO}_2/\text{annum}$   
(total coal usage) \* (coal emission factor - Appendix 6)
- Total generation for all coal fired generation: 1,282 GWh
- (B) =  $1,257\text{kt}/1,282\text{GWh} = 980 \text{ g CO}_2/\text{kWh}$

## 2. Correction For Gas and Coal Proportion of Generation i.e. calculate (C) and (D)

**(C) = Percentage Gas**

(C) = The percentage of gas and oil fired generation in total fossil fuel generation  
 $= 8,725/(8,725+1,257)$   
 $= 87.4\%$

**(D) Percentage Coal:**

(D) = The percentage of coal fired generation in total fossil fuel generation  
 $= 1,257/(8,725+1,257)$   
 $= 12.59\%$

Corrected Percentages based on the assumption that coal on the margin less than half its time:

C (corrected) =  $C+0.5*D = 0.8741+0.5*0.1259 = 0.9371$  or 93.7%

D (corrected) =  $1 - C \text{ (corrected)} = 1 - 0.9371 = 0.0629 = 6.3\%$

**3. Calculation of the baseline emission factor: i.e. calculating 2002 electricity sector emission factor (X) to be used for the start point of the baseline**

$$\begin{aligned} (X) &= A * C \text{ (corrected)} + B * D \text{ (corrected)} \\ &= 524 \text{ g CO}_2\text{/kWh} \times 93.7\% + 980 \times 6.3\% \\ &= 491 + 61.7 \end{aligned}$$

$$(X) = 552.7 \text{ gCO}_2\text{/kWh}$$

i.e. New Zealand emission factor at present (based on latest available data and methodology prescribed for ERUPT 3).

**APPENDIX 3**  
**New Zealand Electricity Sector Emission Factor**  
**Reference Station in 2030 (Y)**

Based on available information an assessment has been made of the likely fuel mix and technical specifications of the swing plants in the New Zealand generation mix in 2030. This is known as Y in the Senter methodology.

**Outlook to 2030**

The transition from the current system to 2030 is described in Sections 3.2-3.3. In the year 2030, if no new gas or cost effective new technologies have been discovered, then coal-fired stations are likely to be required.

New clean coal conversion technologies are likely to emerge once gas resources have become uneconomic to develop and the resource will likely then provide New Zealand with a certain supply of energy.

The latest Government Energy forecast has two new coal plants being commissioned before 2020, totalling 675 MW<sup>27</sup>. More coal stations will be necessary to replace some of the existing gas fired plant.

The estimated increase in efficiency of coal fired stations up to 45% in 2030<sup>28</sup> will lead to carbon emissions around 729.6 g CO<sub>2</sub>/kWh – as calculated below..

**Reference Emission Factor in 2030**

New Coal Emission Factor = Carbon Dioxide Content per Unit Energy \* Heat Rate

Heat Rate = 3600 / plant efficiency (fuel to electricity)

$\text{New Coal in 20 years (Coal - 45.0\%)} = 91.2 \frac{(g\ CO_2)}{(MJ)} * 8,000 \frac{(kJ)}{(kWh)} = 729.6 (g\ CO_2 / kWh)$
--

Y<sub>NZ</sub> = 729.6 gCO<sub>2</sub>/kWh (the expected emission values from a reference coal station at 45% efficiency). See Appendix 5.

<sup>27</sup> Source: Energy Outlook 2020, pg 28, 2000, MED

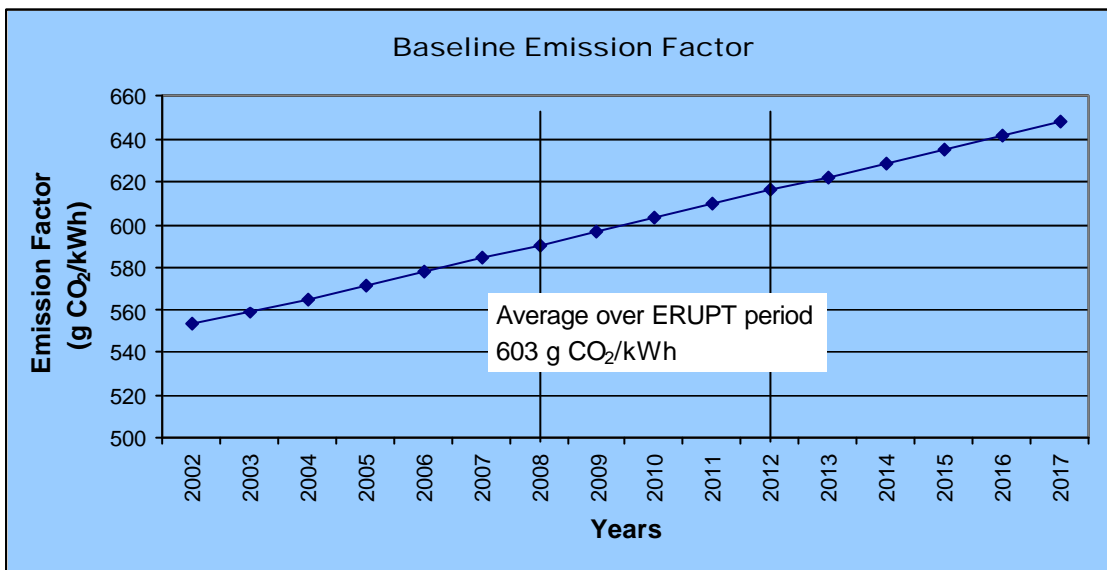
<sup>28</sup> Source: Coal Utilisation Research Council, 2002

**APPENDIX 4**  
**New Zealand Electricity Sector Emission Factor**  
**2002-2030**

**Determining Reasonable and Conservative Standardised Emission Factors i.e.(Z)**

The change in power mix occurs over a life-cycle of thermal plant, typically this is 25 – 30 years. The equation presented below expects the emission factor to increase for an electricity system, which runs coal fired plant in the year 2030.

$$Z = (30 - t)/30 * X + t/30 * Y_{NZ}$$



**Emission Base Line Standard per year gCO<sub>2</sub>/kWh**

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
553	559	565	572	578	584	591	597	603	610

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
616	622	629	635	641	647	654	660	666	673

2022	2023	2024	2025	2026	2027	2028	2029	2030
679	685	692	698	704	711	717	723	730

## APPENDIX 5

### Emission Factors for a Mix of Thermal Power Stations

Emission factors from thermal power stations depend on the fuel burnt, the configuration of the plant and the generation of technology used.

Coal has almost double the emissions of gas, at around 91.2 tCO<sub>2</sub>/TJ. A representative mix of Maui gas field and treated gas is 52.8 tCO<sub>2</sub>/TJ. New gas discoveries may be at this figure or higher.

Gas supply for the electricity industry during the ERUPT period is expected to be sourced from a number of different well-heads. Each well-head has a different gas specification and therefore the 'mixed gas' from Appendix 6 has been selected as the most appropriate for determining CO<sub>2</sub> emission factors.

Coal is currently sourced from a number of mines. Predominately sub-bituminous coal is used because of its favourable low sulphur content.

Thermal emission factors in New Zealand range from 380 g CO<sub>2</sub>/kWh for a 50% efficient combined cycle gas turbine to 932 g CO<sub>2</sub>/kWh for the existing Huntly power station burning sub-bituminous coal.

*Emission Factor = Carbon Dioxide Content Per Unit Energy \* Heat Rate*

*Heat Rate = 3600 / plant efficiency (fuel to electric ity)*

$$\text{New Coal in 20 years (Coal - 45.0\%)} = 91.2 \frac{(g CO_2)}{(MJ)} * 8,000 \frac{(kJ)}{(kWh)} = 729.6 (g CO_2 / kWh)$$

$$\text{New Gas CCGT in 20 years (Gas - 50\%)} = 52.8 \frac{(g CO_2)}{(MJ)} * 7,200 \frac{(kJ)}{(kWh)} = 380.2 (g CO_2 / kWh)$$

## APPENDIX 6

### CO<sub>2</sub> Emission factors for natural gas and coal

**Typical values for CO<sub>2</sub> emission factors corresponding to New Zealand natural gas streams**

Sales Stream	C Content (% mass)	CO <sub>2</sub> emission Factor	
		(tCO <sub>2</sub> /TJ)	(tC/TJ)
Treated Gas	69.5	52.7	14.4
Maui Sales Gas	68.3	52.8	14.4
Mixed Gas	--	52.8	14.4
Kapuni LTS Gas	44.8	84.1	22.9
Kaimiro Gas	54.9	65.2	17.8
McKee Gas	70.2	54.2	14.8
Waihapa Gas	70.7	56.2	15.3

Source: New Zealand Energy Information Handbook, Energy Data Conversion Factors Definitions, J.T. Baines 1993, pp28–29.

**Typical values for CO<sub>2</sub> emission factors corresponding to the major aggregates of New Zealand coal production:**

Aggregate	GCV (TJ/1000t)	C Content (% mass)	CO <sub>2</sub> emission Factor	
			(tCO <sub>2</sub> /TJ)	(tC/TJ)
All bituminous coals	32.1	77.9	88.8	24.2
All sub- bituminous coals	22.6	56.3	91.2	24.9
All lignite coals	15.0	39.0	95.2	26.0
All NZ Production	25.1	62.0	90.4	24.7

Source: New Zealand Energy Information Handbook, Energy Data Conversion Factors Definitions, J.T. Baines 1993, pp20–21.

## APPENDIX 7

### Resource Management Act (1991)

The Resource Management Act 1991 regulates the use, development and protection of virtually the whole range of natural and physical resources in New Zealand. The purpose of the Act is to promote sustainable management of these resources in a way, or at a rate, which enables communities and individuals to provide for their social, economic and cultural wellbeing along with their health and safety. At the same time, the Act requires that any activities that affect the environment must be undertaken in a way that sustains the potential of natural and physical resources to reasonably meet the needs of future generations, safeguarding the life-supporting capacity of air, water, soil and ecosystems and to avoid, remedy or mitigate any adverse effects on the environment.

The Act promotes the achievement of sustainable management by requiring the development and implementation of regional and district plans. These plans are statutory documents that are devised by regional and district authorities and contain rules, objectives and policies guiding the sustainable use, development and protection of natural and physical resources within their respective regions and districts. These documents are created with the assistance of public consultation and participation. This ensures that the needs of all those utilizing, or have the potential to use any particular resource, have had their concerns addressed and/or heard.

In conjunction with the operation of regional and district plans, the Act enables developers who wish to undertake activities that are not permitted or explicitly prohibited by the plans, to apply for a dispensation from complying with the rules, via a resource consent application. It is the regional or district local authority's role to duly consider any resource consent application and decide whether the proposed development is a suitable use of the resources, minimising any adverse effects on the environment. This process may also involve public consultation and participation to ensure that the desired environmental outcomes are achieved. Any party, either the applicant or a submitter (who can be anyone with a particular interest in the proposal) on the application, has the ability to appeal any decision of the regional or district authority to the Environment Court. Where the decision of the regional or district authority is appealed to the Court, it then becomes the Court's role to determine whether the proposal is an appropriate use or not based on the expected effects on the environment and the overall promotion of sustainable management.

Meridian Energy presently has approximately 120 resource consents.

## APPENDIX 8

### Te Apiti Wind Project stakeholder list

Airways Corporation (Airways)  
Adjacent land owners:  
Ashhurst Action Group  
Ashhurst Community Committee  
Ashhurst Primary School  
Ashhurst Residents Association  
Aviation Interest Groups  
Central Government  
Civil Aviation Authority (CAA)  
Civil Aviation Authority / Palmerston North Airport  
Climate Change Office of Ministry for the Environment  
Conservation Minister  
Dannevirke Deerstalkers group  
Department of Conservation (DoC)  
Destination Manawatu  
Massey University's Centre for Energy Research  
DoC local conservancy  
Ecology Interest Groups  
Energy Efficiency and Conservation Authority (EECA)  
Minister of Energy  
Minister of Environment  
Federated Farmers  
Federated Mountain Clubs  
Fish & Game local council  
Forest & Bird local branch  
General public  
Green Party  
Greenpeace  
Iwi: Rangitaane O Tamaki Nui A Rua (Dannevirke)  
Iwi: Tanenuiarangi Manawatu Incorporated (Palmerston North)

Kayakers

Landowners in immediate area

Landowners: AgResearch Limited

Local car club

Local community

Local Politicians

Manawatu District Council (MDC)

Manawatu-Wanganui Regional Council (horizons.mw)

Massey University

Ministry for Economic Development (MED)

Ministry for Economic Development - Energy officials

Ministry for Environment (MfE)

Natural Gas Corporation (NGC)

Other politicians and government officials (full list is available)

Palmerston North Airport Authority

Palmerston North City Council (PNCC)

Pohangina Valley and Hiwinui Residents Association

Prime Minister

Rotary Clubs

Rural Women local branch

Shareholding Ministers

Te Manawa

Telecom

Tramping clubs local and to Wellington

Transit New Zealand

Transrail

Users of walking track across the gorge

Vodafone

Wind Energy Association

Woodville Districts Vision

Woodville Lions Club

Woodville Primary School

Woodville Residents Association

## APPENDIX 9

### Consultation Process, Records and Outcomes

This appendix indicates the progress that has been made to date as part of the consultation process which will be ongoing.

#### Record of Consultation

A collection of documents relevant to information given and consultation undertaken by Meridian Energy is available on request. The documents include the following:

#### Schedule of consultation

This schedule outlines consultation that has taken place on issues relevant to the resource consents sought.

#### Press releases and other information

There have been a number of press releases made, and other information relevant to the proposed Te Apiti wind farm has been widely distributed. A distribution list for this information demonstrates that Meridian Energy has made a genuine effort to ensure that the community is aware of the proposal.

#### Summary Document

This document has been given to potentially interested and affected persons. It outlines the nature of the proposed works. This information is also available on the website [www.windpower.co.nz](http://www.windpower.co.nz).

#### Outline of Consultation

Prior to making a public announcement, Meridian Energy consulted several key stakeholders to 'steer' some of the initial investigations. This was initially a very general presentation of Meridian Energy's intention to construct a windfarm north of the Manawatu gorge and a request for issue identification in order to initiate preliminary effects assessments. These stakeholders included, but may not be limited to the following:

- Landowners of potential turbine locations;
- Tararua District Council (TDC);
- Manawatu-Wanganui Regional Council ([horizons.mw](http://horizons.mw));
- Palmerston North City Council (PNCC);
- Manawatu District Council (MDC);

- Transit New Zealand (Transit);
- Civil Aviation Authority (CAA);
- Airways Corporation (Airways);
- Palmerston North Airport Authority, and
- Iwi (Rangitaane O Manawatu and Rangitaane O Tamaki Nui A Rua)

It should be noted that many of these parties have been aware of the project for over 6 years given that part of the site was consented in 1998. The first consultation relating to the current proposal began in November 2002 with Meridian Energy staff meeting separately with TDC and Transit. All other parties listed above were consulted directly in early 2003 and have continued to be involved throughout the process.

### **Public Announcement**

On 8 May 2003 at the Woodville-Pahiatua Racecourse, Meridian Energy announced its Project Te Apiti proposal to a wider group of stakeholders including local authority representatives, landowners, iwi, various other stakeholders and media. The public announcement involved approximately 70 individuals and organisation representatives who heard presentations from:

- Keith Turner (CEO, Meridian Energy)
- Francis Small (Chairman, Meridian Energy)
- The Hon Pete Hodgson (MP, Minister for Energy)

The Te Apiti video was also shown and other supporting information (posters, fact sheets etc) were also provided. Several Project Te Apiti team members were present to respond to informal queries immediately following the launch.

### **Open Days**

In the 4-6 week period prior to lodging the resource consent application, Meridian Energy hosted six 'open days' within the local community to provide an opportunity for any interested parties to find out more about the proposed windfarm. All open days were staffed by a least two members of the Te Apiti project team; this generally involved one technical specialist and one person involved in the planning and/or consenting phases of the project.

The open days made available the following sources of information:

- an introductory video;
- a three-dimensional (3D) computerised 'drive-by' (presented as part of the video and as a stand-alone CD for computer playback);

- visual simulations (still images) from up to 18 viewing locations within and around the site;
- a site-specific introductory brochure showing proposed turbine layout, indicative turbine construction, and general site information;
- a wind 'Fact Sheet' i.e. a handout of commonly asked questions and answers,
- site maps and laminated posters, and
- contact details for those wanting more information i.e. an 0800 number and web address.

### **Direct Consultation**

#### **Ecology Workshop**

Meridian Energy hosted a 'Te Apiti Ecology Workshop' at Te Manawa, in Palmerston North, on 22 May 2003. This was an attempt to invite all organisations with an interest in the potential ecological effects of the proposed windfarm to hear Meridian Energy's consultant ecologist present a draft report.

#### **Manawatu District Airspace 'Aviation' Workshop**

Meridian Energy hosted an 'Airspace Workshop' at the Manawatu Aero Club on Thursday 29<sup>th</sup> May. This was an attempt to invite all private pilots, flying clubs, top-dressing companies, private flying companies etc to hear Meridian Energy's consultant aviation specialists present their draft report.

#### **Iwi**

Consultation has been undertaken with Tanenuiarangi Manawatu Inc (Iwi Manawhenua Mandated Authority for Rangitaane O Manawatu) and Rangitaane O Tamaki Nui A Rua. Some issues captured in Appendix 10 particularly section 8.

#### **Transit**

Not yet written-up. Generally supportive.

#### **Ashurst Action Group / Residents Association**

The Residents Association have expressed their general support to the proposal.

## APPENDIX 10

### Te Apiti Wind Project Environmental Impact Assessment<sup>29</sup> and Meridian's Responses

#### 1. Summary of Landscape Effects

Based on the simulations and the assessments of viewpoints, the landscape report draws the following conclusions:

- The visual effects of construction earthworks will be transient.
- Despite their size and location, the turbines will add interest and focus to the landscape.
- The refined and elegant design of the turbines proposed for Te Apiti will help to mitigate their prominence.
- Turbines sit 'lightly' on the landscape and require relatively minor modifications to the landform to accommodate them.
- The topography of the site provides considerable scope to dispose of excess spoil from earthworks, out of public view.
- The nature of the site allows good management (including landscape treatment) of earthworks during construction.
- At the local level, the Saddle Road landscape can readily accommodate the wind farm's presence.
- The turbines will be new and prominent landscape elements but not dominant in either a local or sub-regional context.
- At the sub-regional level, turbines will appear to sit in the large-scale landscape in groups and clusters.
- The physical effects on the landscape will be minor because only small areas of the landscape will need be modified by earthworks.
- Once the proposed mitigation works have been completed there will not be any permanent adverse landscape effects on vegetation or landform.
- Ancillary structures, including a substation and operations and maintenance buildings, will be effectively screened by existing and proposed vegetation.

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<sup>29</sup> Further details of each report are available on request.

## 2. Construction impacts

The large-scale earthworks proposed have the potential to result in adverse effects on the environment. Potential effects which may arise could include visual effects and effects on traffic movement, dust, noise, site stability and runoff.

Meridian Energy has commissioned a number of reports to address the effects likely to result from the construction process. These are described as follows:

- Visual Effects – the report by Boffa Miskell describes the likely visual effects associated with the earthworks.
- Construction Effects – the report by Opus International Consultants describes the likely effects associated with the construction process that specifically relate to soil disturbance and sediment discharge.
- Traffic Effects – the report by Traffic Design Group describes the potential effects associated with movement of construction materials to and within the site.
- Noise Effects – the report by Marshall Day details the noise effects associated with the construction stage of the proposal.
- Ecology Effects – the report by Boffa Miskell details the ecological effects associated with the construction works.

## 3. Noise Effects

An assessment of the expected noise levels at the boundaries of the Te Apiti wind farm site has been prepared by Marshall Day Acoustics. The noise levels from the proposed wind farm were predicted using two methods, described as follows:

- i. The NZS 6808:1998 method is a quick and simple means of obtaining an estimate of noise levels. However, this method does not take into account attenuation of noise due to intervening topography and therefore may overestimate the noise levels by up to 12 decibels.
- ii. The ISO/SoundPLAN method is expected to produce results accurate to within 2 decibels. It incorporates a map of terrain and calculates for each turbine to receiver path the resulting attenuation. This method also allows for a more accurate calculation of the effects of air absorption.

The Marshall Day report concludes that where the 40dBA contour escapes the site boundary (along some portions of the south boundary and at two locations to the east) the sound level gradient is such that it will not be significant, nor would this exceedance extend far enough into neighbouring properties to effect any notional boundary assessment point.

The effects of the noise from the wind turbines on the boundaries of the site are therefore considered to be no more than minor.

#### 4. Visual Transit Lane

##### **Effects on Air Traffic**

The AIP New Zealand Visual Navigation Chart marks a Visual Transit Lane (“V373 Gorge”) over the Manawatu Gorge area. The Visual Transit Lane allows VFR (visual flight rules) aircraft to pass through the area without needing to get clearance from Air Traffic Control at Palmerston North Airport. The area covered by the Transit Lane is outlined in red on Diagram 1b of the Airways report. However, the airspace within the Transit Lane that can be practically and safely used is significantly different to that outlined area.

The practical use of the Transit Lane is limited by the interaction of local topography and two CAA rules. The CAA rules specify that the normal minimum height for VFR aircraft is 500 feet above ground level, and the maximum height of this Transit Lane is 1300 feet above sea level. If this were a flat plain at sea level, these rules allow a band of 800 feet within which VFR aircraft can fly.

In reality, because the upper limit is fixed and the lower limit varies according to local topography, as the ground level rises the available vertical airspace decreases. The CAA rules allow the available vertical airspace to be ‘squeezed’ in this way, down to a band of 500 feet.

In effect, a VFR aircraft is required to avoid those places where land below the Transit Lane is over 800 feet above sea level. This outcome is demonstrated by Diagram 1a of the Airways report, which shows the grey shaded band of the available Transit Lane area being cut off by rising ground. Translated to a plan, the flyable area within the Transit Lane would be given an edge that follows the 244 metre (800 foot) contour of the land below. However, taking an approach that is more generous to pilots, Airways has used the 260 metre contour as the practical edge of the Transit Lane. Using that contour, as opposed to the 244 metre contour, provides more room for pilots traversing through the Gorge.

All except one of the proposed turbines are above the 244 metre/800 foot contour and therefore in a 'no-fly' area of the Transit Lane. The one minor exception is a turbine proposed to be sited at 243 metres above sea level. All turbines except that one would also be above the 260 metre contour. VFR aircraft are therefore unable to legally use the Te Apiti wind farm site as a transit lane. Airways consider that this minimises the status of the wind farm as a "hazard" under CAA rules.

The existing and proposed (already consented) turbines of the Tararua wind farm on the southern side of the Gorge are also sited above the 260 metre contour. Some of the consented Tararua turbines lie a similar distance from the Gorge as some proposed Te Apiti and that wind farm's development has been subject to the same CAA control as the Te Apiti wind farm. Since their erection in 1999, the Tararua turbines have been shown to have no significant adverse affect on the safety or regularity of aircraft operations. Given the similarity of their respective locations, the same conclusion can be drawn for the proposed Te Apiti wind farm.

### **Gorge Protection Corridor**

Airways have recommended the adoption of a corridor 700 metres either side of the Manawatu River where it passes through the Gorge, a total width of 1.4 km or approximately 1 mile. This distance is an arbitrary figure that Airways believes is reasonable in the circumstances and is based on the distance from the river of the nearest consented Tararua wind farm turbine. Of the Te Apiti wind turbines, three would fall marginally within this proposed corridor, but they would all still be outside the flyable area of the Transit Lane as defined by Diagram 1b of the Airways report. Airways believe that the location of these three turbines is acceptable in the circumstances.

### **Obstacle Limitation Surfaces**

Aircraft approaching Palmerston North Airport from the east, or taking off to the west, are required to stay above defined obstacle limitation surfaces (OLS). The relationship of those surfaces to the terrain near the Manawatu Gorge is demonstrated. Airways note that the OLS are already compromised by their penetration of some of the terrain near the Gorge. Airways suggest that because of that penetration, the current surfaces are inappropriate and the OLS should be raised.

Under a proposed OLS, based on the height of the top of the existing radio mast south of the Gorge, and shown in Diagrams 7 – 9 of the Airways report, some of the Tararua wind farm turbines penetrate the surface in a minor way. However, none of the proposed Te Apiti turbines

would penetrate that proposed OLS. Airways draw the conclusion that the Te Apiti wind farm would therefore have less impact than the existing or consented Tararua wind farm turbines.

The Airways study also addresses the effect of the wind farm on aircraft using instrument flight procedures. Airways confirm that the proposed Te Apiti wind farm development will not affect the existing procedures published in the AIP New Zealand Instrument Flight Guide. In future, if the airport was upgraded to include a precision approach Instrument Landing Surface, Airways confirm that the wind farm would have no affect on the Obstacle Assessment Surface.

### **Hazards Outside Controlled Airspace**

Part of the wind farm falls outside of controlled airspace, that is, it is not directly below the Visual Transit Lane, other controlled airspace above that, or the OLS. General aviation aircraft have the option of flying outside of controlled airspace and CAA rules therefore limit the height of structures in such areas. Structures are allowed up to 120m above ground level. As the proposed turbines would be a maximum height of 106m, the limitation of this rule would be met, and the proposal can be deemed to have no affect on uncontrolled airspace.

### **CAA Consideration**

CAA has been consulted regarding the proposed wind farm. Based on, and accepting the information provided by Airways, CAA considers that the development can proceed. CAA's consideration acknowledges that some of the turbines constitute a "hazard in navigable airspace" (as defined by CAA rules), as they are over 60 metres above ground level and within 1 kilometre of a Transit Lane. Despite falling under that definition, CAA has not chosen to restrict the location of any turbine, effectively endorsing the findings of the Airways report. CAA has stated that "... we have no intention of placing restrictions on the wind farm that may jeopardise approvals required under the RMA ...".

Because some of the turbines are in controlled airspace, and exceed 60m above the ground, CAA will require some lighting of the turbines. However, CAA accepts that the specifics of lighting can be confirmed during the detailed design stage. It is possible to design and install any lighting so that it would be largely invisible from below. The power of each lamp could be as low as 100W.

## **5. Traffic Effects**

A traffic assessment of the Te Apiti wind farm project has been prepared by Traffic Design Group Limited. This report examines the following:

- Extent and nature of traffic movements that will occur during construction;
- Traffic associated with ongoing supervision and maintenance of facilities;
- Movements associated with visitors and site-seeing ;
- Road safety performance of the roads in the vicinity of the site; and
- Appraisal of overall effects on the network as experienced by road users.

The assessment found that the main effects of the proposal in terms of traffic will be generated during the construction stage. These are summarised as follows:

- A number of the loads required to haul the wind turbine components will be defined as over-dimension or over-weight load. The assessment found that these loads can be accommodated on the existing road network from the ports of Napier or New Plymouth, with little effect on the amenity and convenience of road users. In addition, large earthmoving trucks will be brought to the site by over-dimensioned trucks. These loads would be transported by specialist haulage contractors in accordance with over-dimensioned load permits issued by the Land Transport Safety Authority.
- Localised improvements will be required to Saddle Road in order to accommodate the swept path of trucks carrying the required over-dimensioned loads.
- During the construction phase there will be approximately 15,000 truck movements to and from the site, which is approximately 50 trucks movements per working days over the twelve month construction phase. The assessment considers that these truck movements are readily able to be handled and accommodated within the established alignment and capacity of Saddle Road and its associated approach routes.
- Traffic generated by the construction team travelling to and from the site each day is considered to be relatively minor and readily handled and accommodated within the capacity of Saddle Road.

The assessment concludes that with the changes proposed and temporary traffic management procedures in place, the transportation and construction phases of the project can be accommodated with no more than minor inconvenience to other road users. In the longer term, the road improvements will result in better visibility at corners and a higher standard of alignment to the benefit of all users.

## 6. Ecological Effects

The ecology of the area and known wildlife habitats is detailed in the report prepared by Boffa Miskell.

### **Vegetation**

Several small bush remnants and swampy gullies occur within the site, which are locally important as wildlife habitat. There are also a number of protected natural areas surrounding the site, and one covenant site within the proposed wind farm site. These are regionally significant wildlife habitats.

The Ecology Assessment has confirmed that no areas of significant vegetation will be affected by the construction of the wind farm.

### **Birds**

Some wind farms in the USA and Europe have experienced problems with bird strike. For this reason, an assessment of the potential for bird strike has been included in the Ecology Assessment. The assessment has found that the wind farm design and turbine type has a range of characteristics that make it a low risk for bird strike and displacement when compared to international indicators. In particular, the Te Apiti proposal will comprise turbines that are few, large, widely spaced and, with slow moving blades, which will be sited on ridges, in an area which is rarely used by migratory species. Early wind farms often had large numbers of small turbines with fast moving blades and were closely spaced. These earlier wind farms posed a significant risk to particular bird species.

The report states that it is considered that the risk of collision with turbines of the kaka and bush falcon, the only nationally endangered bird species to visit the site, would be very low. In fact, based on research data, these birds are more likely to avoid the site.

### **Fish**

The site contains tributaries of two rivers, the Manawatu and Pohangina, which are regionally significant freshwater habitats and important for recreational fishing. The report noted that there is potential for increased sediment discharges to local streams resulting from the proposed construction works. However, with the construction site management proposed, it is believed that the movement of sediment and other contaminants into local waterways can be controlled and will not adversely affect stream habitats or wildlife.

## 7. Electromagnetic Interference

An analysis of the potential for the proposed wind turbines to interfere with radiofrequency communications has been prepared by Broadcast Communications Limited. The report concludes that, apart from the possible impact on televisions within the wind farm site and any impact on Civil Defence communication links, there is no significant risk that the proposed wind farm will have any noticeable effect on radio communication services in the area.

## 8. Cultural Effects

Meridian Energy have consulted with Tanenuiarangi Manawatu Inc (Iwi Manawhenua Mandated Authority for Rangitaane O Manawatu) and Rangitaane Tamaki Nui A Rua, to determine the potential effects of the Te Apiti wind farm on the interests of tangata whenua. Representatives of these groups were made familiar with the project.

As a result of this consultation, a number of waahi tapu and sites of significance have been identified in the area of the proposed wind farm. In particular, Te Ahua Turanga, marked by a carved rock and located close to a trig station, is considered significant to Rangitaane O Manawatu, as it is considered to be the resting place of Turangaimua and a number of Rangitaane warriors. It has been agreed through consultation that it would be inappropriate to place a wind turbine on this site and an appropriate buffer distance has been agreed. Rangitaane O Manawatu have requested involvement in determining the distance of the turbines from this site, in order to provide a buffer from Te Ahua Turanga. The construction methodology prepared by Opus has taken these concerns into account.

## 9. Archaeological Effects

An archaeological assessment of the site has been prepared by Arczoo Limited.

The report found that no archaeological sites recorded in the NZAA Site Recording Scheme or scheduled in the Tararua District Plan in the area of the wind farm. Although no archaeological evidence has been located, Arczoo Limited recommends that if archaeological evidence is discovered, work affecting that evidence must cease and the NZ Historic Places Trust and tangata whenua should be informed. An accidental discovery protocol should be included in the earthworks management plan.

This plan has now been prepared.