

**IN THE MATTER**

of the Resource Management Act  
1991

**AND**

**IN THE MATTER**

of applications to the **WAIKATO  
DISTRICT COUNCIL** and  
**WAIKATO REGIONAL COUNCIL**  
by **WEL NETWORKS LTD** for  
resource consents to authorise the  
establishment, operation and  
maintenance of 28 wind turbines for  
the generation of electricity and  
associated activities on the  
Wharauoa Plateau near Te Uku

## **FURTHER STATEMENT OF EVIDENCE OF ROGER BURCHETT**

### **1. INTRODUCTION**

- 1.1 My name is Roger Burchett. I am an electricity generation business engineering consultant based in Cambridge. A summary of my qualifications and experience were set out in the evidence which I presented to the Committee on 20<sup>th</sup> November 2007.
- 1.2 I also note that I have experience with and am very familiar with economic modelling used to value generation assets. In this regard I have led technical due diligence teams in the purchase of a number of power stations and have presented expert evidence using cash flow valuation of electricity generation to the International Court of Arbitration.

#### **Purpose and scope of evidence**

- 1.3 At the close of the hearing in November, the Committee indicated that it wished to receive further information in relation to a number of matters, including the wind resource on the Wharauoa Plateau, viability of the project and project benefits. The purpose of my evidence is to provide further information requested by the Committee in relation to the Te Uku project's viability and benefits. In that regard, my evidence will address matters relating to:

- (a) The viability of the project including further details in relation to the process for determining viability and comments on related matters raised by submitters (section 3); and
- (b) The benefits of the project, having particular regard to concerns raised by submitters at the hearing (section 4).

1.4 My evidence should be read in conjunction with the evidence of:

- (a) Dr Julian Elder, who outlines the process undertaken by WEL for determining the business case for the project;
- (b) Dr Andrew Wright, who describes work undertaken to calculate energy yield;
- (c) Mr Andrew Kerley, who describes in detail the equipment required and process for measuring wind resource;
- (d) Blair Walter, who outlines the due diligence process undertaken by Connell Wagner;
- (e) Mr Jim Truesdale, who addresses the electricity market and carbon issues; and
- (f) Mr Paul Callow, who discusses Deloitte's review of the economic modelling undertaken and assesses the viability of the project.

## 2. **VIABILITY OF PROJECT**

2.1 In this section of my evidence I will comment on the process undertaken by WEL in determining the viability of the Te Uku project, my role in the economic modelling of the project and address concerns raised in submissions relating to viability issues.

### **Process of analysis**

2.2 As the project director for the Te Uku proposal, I was involved in the decision making process for establishing the methodology employed by WEL to measure and confirm the wind resource on the Wharaurua Plateau, and to assess the viability of the project, as set out in the evidence of Dr Elder.

2.3 As demonstrated by the preceding evidence from Dr Elder and the independent experts, assessment of viability involves measurement of wind speed, energy calculations, basic design and estimation of construction costs, calculation of saleable production value and modelling of future cash flows. This involves

undertaking specific measurements using specialised technology and calculations by experts in resources, engineering, financial and economics disciplines.

- 2.4 I was personally involved in selecting independent experts for the purposes of undertaking these tasks and consider that the process of selection undertaken by WEL was very robust. It involved:
- (a) Engagement of key advisors in the disciplines of wind energy, civil engineering and resource management, through a formal selection process where detailed proposals from consultancy firms qualified and experienced in wind farm development were received and evaluated;
  - (b) The formation of a core team of key advisors and management; and
  - (c) Engagement of specific experts as required based on the collective knowledge of the core team with regard to suitability.
- 2.5 In short, I consider that we selected the best experts to provide advice and assistance to this project.
- 2.6 In particular, wind speed and resulting energy output is a critical element of project viability. To ensure that any decisions WEL makes are based on the most robust assessment of wind resource WEL has implemented a number of checks and balances. The following process is followed in relation to determining wind speed and energy output:
- (a) One firm of wind experts is engaged to install certified equipment, download on site monitoring, evaluate raw data files, and produce a data verification reports (DVR) each month, along with periodic long term assessments. The experts engaged for this work are PB Power (NZ) Ltd, which is part of the global consultancy Parson Brinckerhoff Group.
  - (b) The raw data is then sent to a second firm of wind experts on a periodic basis for energy assessment. This work is done by Hydro Tasmania Consulting, which has a large internationally recognised wind energy team. In this process the long term wind speed for the site is independently calculated so there is a periodic cross check of wind data analysis.
  - (c) WEL has also evaluated other sites in the Waikato region and has a further specialist firm Wind Prospect Ltd monitoring wind speed with a 50m mast about 20km from Te Uku. This information gives WEL a very good understanding of regional resource and the ability to correlate mast data.

- (d) Energy estimates by Hydro Tasmania Consulting have been verified by independent reviews undertaken by Suzlon Energy in 2006 and Connell Wagner in 2007.
  - (e) Wind manufacturers are given the raw data from which to advise their own energy predictions and the class of plant they will guarantee at each location. This process is dependant on the willingness of manufacturers to invest in this work, and they will only do detailed analysis if there is reasonable certainty it will lead to a potential order (e.g. when consents are issued).
- 2.7 Determining whether or not a wind project is viable is a complex exercise involving in-depth analysis of a number of key variables, not only wind resource. Whilst wind speed is a key determinant for economic viability it should not be considered in isolation. To do so would oversimplify the complexity of the relationships between the key variables of the project.

#### **Analysis of economic viability**

- 2.8 One of my roles has been to assess the economic viability of the proposal. This involved developing the initial economic model, ensuring that all relevant values are accounted for in the model, and ensuring that a process is in place for each variable input to the model that produces the most reliable output as work progresses.
- 2.9 The economic model used is consistent in structure to those I use on other projects, and is similar to models used by other power companies and financiers including the World Bank. My methodology has been audited by Deloitte as described in the evidence of Mr Callow, to assure WEL that this process is accurate and dependable for investment decision making, and that the source data is reliable.
- 2.10 As with any wind farm development, the wind on the plateau is monitored continuously, verified regularly, and used to update energy estimates periodically. Energy estimates are used along with price and cost data to monitor the viability of a project. Economic modelling is a snapshot of inputs which may vary materially over time, so to be realistic all inputs need to be in the same time frame.
- 2.11 Mr Callow has explained that the viability of a project is measured by discounting the life cycle free cash flow of the project to a net present value. Free cash flow is the algebraic sum of all cash flows that contribute to surplus cash from a project. If this value is positive the project is economically viable.

- 2.12 There key variables relevant to the calculation of the commercial viability of a wind farm are:
- (a) Energy output;
  - (b) Electricity price path;
  - (c) Capital cost;
  - (d) Operating costs; and
  - (e) Financial (debt level, cost of capital, inflation).
- 2.13 There are also a number of secondary value inputs that either attach in one form or another to a key variable or are not a free cash flow component (e.g. exchange rates build into capital cost, interest and depreciation are net of free cash flow)
- 2.14 In the feasibility analysis of a project, estimates and assumptions need to be made and analysis is particularly sensitive to key variable values. It follows that reliable economic modelling must use a contemporary estimate of each key variable to provide a contemporary result.
- 2.15 The Committee has heard that whilst the economic snapshot at the time consent applications were lodged indicates a viable project, the wind farm will not be built unless at the time of tender it remains a viable project.
- 2.16 The rationale here is that in the evaluation of tenders, all of the key variables become firm and sensitivity exposure in most of these areas reduces to zero for reasons set out in the table below, noting that tenders for procurement and supply are considered at the same time.
- 2.17 Exceptions are wind resource and construction risk. The latter is allowed for with contingency sums and/or a contract methodology that contains risk exposure. Wind resource however remains a development risk which is why considerable effort, technology and expertise is applied to ensure that at the time of tender the precise quantum and probability of risk is understood and included in the final business case model.

<b>PARAMETER</b>	<b>FEASIBILITY ANALYSIS</b>	<b>PROJECT ACCEPTANCE ANALYSIS</b>
Energy Output	Estimated by consultants	Guaranteed by turbine supplier referenced to predicted site wind speeds

<b>PARAMETER</b>	<b>FEASIBILITY ANALYSIS</b>	<b>PROJECT ACCEPTANCE ANALYSIS</b>
Electricity price path	Estimated by consultants	Fixed by Power Purchase Agreement/s
Capital cost	Estimated by consultants or budgetary prices	Fixed by tender and acceptance contract/s with contingency allowance
Operating costs	Estimated by consultants	Fixed by warranty, connection and service contracts
Financial	Debt Cost of Capital Exchange rates / hedging Escalation risk	Fixed by funding arrangements Firmed by debt level and risk allocation Fixed in imported supply contract/s Fixed in offtake, connection and supply agreements

2.18 WEL carries out assessments of the key variables on a periodic basis. The most recent contemporaneous economic modelling was done in March 2007 being at the same time the resource consent application was lodged. The results of this modelling are included in the consent application.

2.19 Since then, wind resource monitoring has been continuous, electricity price forecasts are reviewed quarterly, various business models have been assessed, the economic modelling process has been audited, and the next review of energy output by consultants and manufacturers is underway.

2.20 The key variables are likely to change again before the project is put to tender and the project will be tested again at that time. With regard to the “time of tender” test and the volatility of the key inputs, this test may be repeated to find a positive outcome. If tenders are called and found not to produce the required result, it is likely that either:

- (a) Options will be purchased on the positive items for a time period; or
- (b) Tenders will be recalled after a time period.

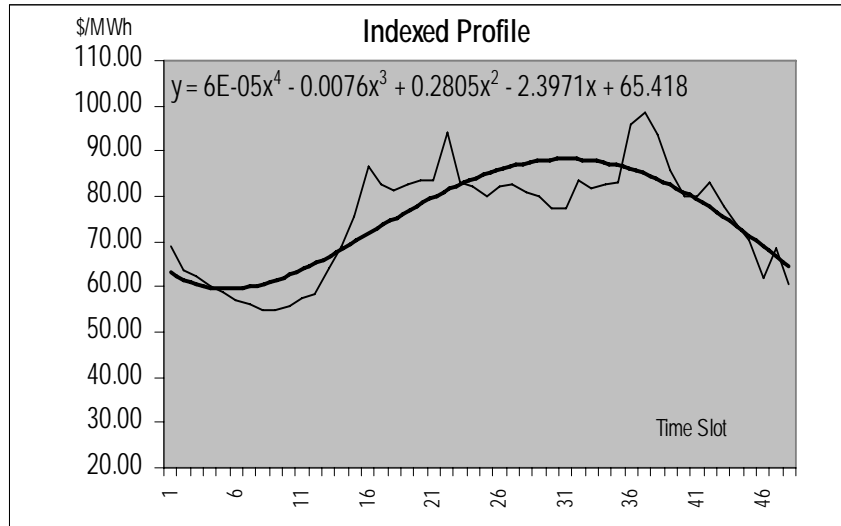
2.21 This is not unusual for this type of development. For example in my experience tenders have been held by mutual agreement until exchange rates trigger acceptance, and options have been secured on plant subject to a revenue threshold. This is a fundamental reason why the 10 year lapse period sought by WEL is important.

## **Comment**

- 2.22 Given the extensive and expert analysis that has been undertaken since 2005, and the number of variable inputs which influence viability of the Te Uku project, I find it quite surprising that Mr Cox considers that he has the technical knowledge and ability to make an assessment about the viability of this project based upon his own wind speed measurements, his own assumptions on costs, revenues and financial arrangements, and using his own modelling methodology.
- 2.23 The process undertaken by WEL has consciously involved a wide range of consultants with experience in the wind energy industry and, in my experience, demonstrates a very robust approach to the project.

## **Night Value**

- 2.24 Here I will comment on a further aspect of the submission by Mr Cox in relation to viability that I consider to be incorrect.
- 2.25 In his submission, Mr. Cox states that “power produced between 10pm and 6pm has almost no value so if a lot of wind power is installed in NEW ZEALAND the value may be negative on a windy night”.
- 2.26 In my view, this statement is incorrect. Whereas nuclear power plants for example must run all the time so will pay to generate if demand is low, wind generators do not have to run and will simply switch off if they don't get paid.
- 2.27 For preliminary feasibility analysis of the Wind Park, I analysed ½ hourly price data over 4 years to produce the mean daily price profile for the NEW ZEALAND wholesale electricity market. This is shown in the graph below, which is calibrated to an annual price of \$75/MWh which is typical of present contract prices. Whilst there are rare occasions when the price can drop to zero for a ½ hr time slot, and there is a distinct day / night differential, it is clearly seen that the mean night rates are well above zero and certainly not negative.



2.28 Whilst I agree that wind power sold into the wholesale market will be as a price taker it is only on extremely rare occasions when there is zero price and in any such event operators would switch plant off, there being no commercial sense in accruing operating costs for no return. It is also equally probable that night prices can spike to very high levels, however in doing this analysis at this stage of development the average condition as in the graph above is sufficient.

### 3. PROJECT BENEFITS

3.1 In this section, I will address matters relating to the benefits of the project, with particular regard to questions raised by submitters, Mr Cox and Mr Gallagher.

#### Carbon footprint

3.2 Mr Cox and Mr Gallagher both raise issues in relation to the carbon footprint of the proposed wind farm.

3.3 Mr Gallagher asserts in his submission that "*Carbon dioxide released during construction will accelerate climate change*" and "*...as a marginal generator the claimed reductions in carbon dioxide for Te Uku will not be achieved*". Mr Cox considers that there are better alternatives to wind generation which have a lesser carbon footprint than wind generation.

3.4 Mr Truesdale has given evidence in relation to the carbon footprint during construction of the wind farm and the length of time that the wind farm will take to pay off its carbon debit in that regard. He concludes that the wind farm will take 7.5 months to pay back its debit.

- 3.5 However, while carbon dioxide will be released during construction of the wind farm and its component parts, it is the net measure that is important for climate change and, in my view, it is necessary to look at the carbon footprint of the wind farm in the context of its entire life cycle. It is normal to measure this by fuel used on the basis that construction and operations emissions are inevitable for all types of power plant but these are very minor compared to fuel use.
- 3.6 The wind park would avoid fossil fuelled generation emissions of up to 168,000 t of CO<sub>2</sub> per year. If Mr Truesdale's calculations are applied to the entire life cycle of the wind park, with the construction carbon debit also applied to mid life refurbishment and end of life salvage the wind park would have a positive effect on carbon emissions of over 4.5 million tonnes.
- 3.7 Mr Cox's submission is that biomass would both save carbon emissions and sequester carbon from the atmosphere. EECA fact sheet Number 10 titled "Woody Biomass" states that:

*"Burning woody biomass has almost zero net greenhouse effect as the carbon dioxide given off during combustion is absorbed by the growth of the next crop of woody biomass."*

- 3.8 It appears that Mr Cox incorrectly assumes that generation using biomass or wood chip is carbon positive but as set out in the EECA document it is slightly negative. Mr Cox appears to have simply overlooked the emissions cost of harvest and has applied "a general average figure" to calculate generation only emissions. Mr Cox also omits to account for the carbon cost of building biomass plant and equipment which will make the net carbon footprint of biomass more negative. By comparison, the wind park would be carbon positive, saving over 4.5 million tonnes of carbon over its entire lifecycle.
- 3.9 In this regard I also note that whilst Mr Cox uses the index of 0.4t/MWh to calculate the carbon value of biomass he uses 0.1t/MWh to calculate the same value for wind. In my view, there is no basis for using the 0.1t/MWh figure for wind. The correct index to use at this point in time is 0.650t/MWh as has been used in my previous evidence {see Burchett main evidence paragraph 4.6} and is now confirmed in the evidence of Mr Truesdale.
- 3.10 I note Mr Cox admits that the "0.1 number is probably wrong, it is just the official MRTE number for Maui gas"<sup>1</sup>. In fact, the correct number for gas in a combined

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1 <http://blog.greens.org.nz/index/php/2007/11/27/selling-coal-to-newcastle>

cycle turbine (the most efficient use of gas) is 0.380t/MWh as given in the evidence of Mr Truesdale and used in other similar current calculations<sup>2</sup>.

- 3.11 In relation to Mr Gallagher's submission that, as a marginal generator, the carbon benefits will not accrue, wind generation is in fact baseline generation and is not marginal generation. The difference is that baseline generation is dispatched first (so always runs) whereas marginal generation is dispatched to follow load so may not always run. Mr Gallagher is suggesting wind power may not be dispatched (therefore not accrue carbon reduction benefits) however this is incorrect.

### **Alternatives to wind generation**

- 3.12 Mr Cox and Mr Gallagher propose alternative generation options and claim that these have benefits over wind generation. While this hearing only relates to the application for a wind farm, I will make some comments on the alternatives to provide balance.
- 3.13 Mr Cox states that "*Far better alternatives exist for renewable electricity generation. At least four options exist...*" He describes the barrage of the Aotea Harbour and the use of biomass as these options (i.e. gives two alternatives rather than four).

#### *Aotea Barrage*

- 3.14 Mr Cox suggests that a barrage of across the Aotea Harbour might be a better alternative to energy generation. Creating a barrage across the Aotea Harbour has a range of adverse environmental effects. Putting those to one side for a moment, the engineering merits can be simply observed.
- 3.15 This harbour has a mean tidal compartment of 47million m<sup>3</sup> and a mean tidal range of 2.3m<sup>(3)</sup>. Using these parameters in the standard hydro power conversion formula yields about 45 GWh/hr, but the cost of construction would be enormous. The barrage would need to be over 1 km long in very difficult foundation conditions and because of the very low head and high volumes generation plant would be several units with a waterway diameter about 20m (or a multitude of smaller diameter machines). The cost of one large unit alone<sup>4</sup> (i.e. with nothing left to build the barrage or the other plant) would be more than Dr Cox's estimate for the entire job. In my view, a barrage across the Harbour would not be viable for environmental and economic reasons.

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2 e.g. Te Mihi Geothermal Power Project Assessment of Benefits for Contact Energy Ltd July 2007.

3 Reference NZ Journal of Marine and Freshwater Research Dec 1975

4 Comment based on my experience pricing similar physical sized plant for Project Aqua on the Waitaki River

## *Biomass*

3.16 Mr Cox considers that biomass is a better option for the generation of energy than a wind farm at Te Uku, because it will in his words:

- *Cause less environmental damage*
- *Generate electricity far more cheaply*
- *Enhance the quality of supply*
- *Both save carbon emissions and sequester carbon from the atmosphere.*

3.17 As discussed in my main evidence (Burchett paragraph 3.16 etc), WEL has evaluated this option. WEL was advised it would need 1,144,000 m<sup>3</sup> of timber per year and do this would need to harvest 1,900ha of forest to equal the output of the Wind Park<sup>5</sup>.

3.18 This timber volume is similar to that calculated by Mr. Cox but he deduces this can be grown *“without affecting agricultural output”*. I disagree with Mr Cox because these areas are based on purpose grown energy forests. To not affect agricultural output biomass would have to come from forest residue which in NEW ZEALAND yields about 130m<sup>3</sup> per hectare over a forest life cycle<sup>6</sup>. The average life cycle for radiata pine in the Waikato is about 25 years so by my calculations it would take 1,144,000 m<sup>3</sup> x 25 years /130 m<sup>3</sup>/ha = 220,000ha of forest to equal the energy output of Te Uku Wind Park using forest residue. It would appear that Mr Cox has misread or simply does not understand the physics of biomass heat conversion.

3.19 The EECA publication Fact Sheet 10 “Woody Biomass” states that:

*“Heat supplied from wood fuel can range from 9 to 11 c/kWh.”*

*“Electricity can be produced by woody biomass, but the process requires additional and often costly steam-turbine plant. This results in electricity generation at an additional 5 c/kWh on top of the heat cost”*

3.20 Given that data it is difficult to see how Mr Cox finds economic benefit in something that costs 15c/unit to produce but can only be sold for 5c/unit as he quotes in his submission on ‘Public Good’ at page 3.

3.21 The EECA fact sheet states that purpose grown short rotation energy forests are ready for harvesting again in 4 to 8 years. With, say, 6 years rotation at 1,900 ha/year as per paragraph 4.16, a dedicated energy forest of 11,400ha would be required compared to 25ha (see Burchett main evidence paragraph 3.22) for the

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5 Reference “Wood Fired Generation Plant Requirements Te Uku Wind Farm” Connell Wagner July 2006

6 Reference “Forest Residue Harvesting for Bio-energy Fuels” EECA May 2007

Wind Park. Therefore, on a quick calculation, biomass would probably use at least 456 times more agricultural land than wind (using the Te Uku Wind Park as an indicative example).

- 3.22 I accept that biomass has a place in electricity generation and is in fact used successfully in major wood processing plants where it can use waste which otherwise has a disposal cost, and produces heat for process plant (co-generation). In these cases it is commonly co-fired to improve combustion. Biomass is also very effective in small heating plants (wood pellets) where the avoided cost is diesel. It is not however suited to utility scale power generation in NEW ZEALAND, which is why large scale wind farms are being developed and not biomass.

*Photovoltaic generation*

- 3.23 Mr. Gallagher concludes in his submission that “The alternative photo-voltaic farm proposed by SGEA for Te Uku is a much better option for WEL and NZ” and also noted orally that he considers that photo-voltaic “will provide stable network power rather than flighty wind power”.
- 3.24 Photo voltaic power stations need bright sunshine and large areas of barren flat land. On a bright cloudless day (c25°C) sunlight yields about 1kW/m<sup>2</sup> at sea level and the present efficiency of photo voltaic technology is about 15%, so yield is about 150W/ m<sup>2</sup> in the right conditions.
- 3.25 Average sunshine hours for Hamilton are 2,009 hrs per year with an average summer temperature of 19°<sup>(7)</sup>, which is well below the intensity required for optimum photo voltaic conversion. This can be compared to solar parks in Germany where capacity factors from 11% to 13% are recorded, with a typical specific yield of 137 kWh/yr/m<sup>2</sup><sup>(8)</sup>.
- 3.26 Installed capacity of photo voltaic collectors to match the Wind Park would be about (84MW x 40% capacity factor) / 12% = 280MW which would cover at least 200ha just for the panel arrays alone. Most solar parks occupy an area about double the array area because they are infrastructure intensive requiring roading space between each of the panel arrays and a large electrical network to connect the individual panels.
- 3.27 Photo voltaic developments in Europe are heavily supported by feed-in tariffs which are currently about €0.49/kWh in Italy and Germany. This is the price required to make this technology viable, and is much higher than the marginal cost of power in

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7 Reference NZ Meteorological Service

8 Reference Solarpark Zeche Göttelborn, City Solar AG Germany

New Zealand. Photo voltaic power is a price taker and will at best attract the average summer daytime price in New Zealand. This is less than half the current European tariff.

- 3.28 I accept that there is a place for this technology in New Zealand in remote areas or the like where the avoided cost of network delivery is very high. However as shown in the table below the cost of utility scale photovoltaic generation is presently about 10 times more than wind.

*Cost of alternatives*

- 3.29 To summarize the cost of wind power and alternatives that have been proposed the following data is taken from a report<sup>9</sup> by East Harbour Management Services who do a lot of work in the field for government departments. This table shows that wind generation is the most competitive renewable resource.

<b>Technology</b>	<b>Cost c/kWh</b>
Wind	9-14
Small Hydro	12-15
Bio-energy (Forest Residue)	14-16
Photovoltaic – on grid	105

**Wind penetration**

- 3.30 Mr Gallagher also questions the benefits of the proposed wind farm in terms of the level of wind generated energy that can be accommodated in the New Zealand’s electricity system. Mr Gallagher submits that *“New Zealand already has the maximum amount of wind power operating or consented”*.
- 3.31 Although it is the subject of further investigation by the Electricity Commission, initial studies have been completed for the Ministry of Economic Development and EECA<sup>10</sup> which concludes wind penetration<sup>11</sup> into a national grid system needs to be less than 35% and wind market share<sup>12</sup> less than 20%. Some European countries have a higher penetration but are able to diversify this by interconnect transmission. I accept the MED / EECA findings are reasonable limits, and I note the “1200-

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9 Tairawhiti Regional Energy Assessment, East Harbour Management Services 20th December 2004

10 Wind Energy Integration in New Zealand May 2005

11 Defined as a capacity ratio – total installed wind capacity / maximum system demand (%)

12 Defined as an energy ratio – total annual wind generation / total annual generation (%)

2400MW” or “1000-1500MW” quoted by Mr. Gallagher on two separate slides suggests he is referring to penetration.

- 3.32 At present wind penetration into the New Zealand system using that same calculation basis as the MED/EECA study is about 5%, so well short of the 35% threshold, and the 2006 generation statistics show wind has a 1% market share<sup>13</sup>. There is 321MW of wind generation in operation and a further 164MW under construction, which will take penetration to about 8%. In my view, it is incorrect to include potential energy that may be generated by wind farms currently seeking consents in the calculation of existing wind penetration. There is no guarantee that applications for wind farm consents will be granted, or that consented wind farms will be built. For example, the Awhitu wind farm which obtained consent through the Environment Court is not being constructed.
- 3.33 In this regard the Electricity Commission held a “Transmission to Enable Renewables” workshop in December 2007 at which results of its grid integration modelling were presented. Their work to date suggests wind will need to exceed 1000MW capacity before additional reserve is required and that penetration has no fixed limit but is rather proportional to reserve capacity.
- 3.34 Mr Gallagher asserts in his submission that *“Te Uku would only be a marginal generator and supply less than 6.7MW of secure power annually”*. In other words, Mr Gallagher appears to consider that the reliable output of Te Uku will only be 6.7MW and that this is to be considered in isolation.
- 3.35 Mr Gallagher bases his assertions on a German study<sup>14</sup>. However, as has already been discussed, the wind resource in New Zealand is much better than that of Germany, with the average capacity factor of wind farms in New Zealand at about 41% as opposed to 17% in Germany (see Walter paragraph 4.8 and 4.5). The capacity factor of the Te Uku wind park is around 37-41% {see Burchett paragraph 4.12}. By the time this fundamental difference is taken into account firm capacity value is much higher in New Zealand compared to Germany, further to which the value of geographic and resource diversity needs to be added for the national security context. Because of the geographic nature of New Zealand, the probability of wind speeds being identical from Southland to Northland at any given time is extremely low so the synergistic firm capacity of all wind farms in New Zealand is higher than the sum of each one.

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<sup>13</sup> ibid

<sup>14</sup> Referenced as sourced from the E.ON Netz 2005 Annual Report

- 3.36 In this regard, the workshop referred to in paragraph 4.32 was advised that modelling by the Electricity Commission shows that wind plant in New Zealand contributes 20-30% of installed capacity to peak security margin.
- 3.37 All things considered, I estimated the firm capacity of the Wind Park at 15% rated capacity for the calculation of avoided transmission benefits in economic modelling. When considered in isolation, this is the relevant calculation. When considered as a part of system security however, the synergy of diverse locations has to be included and the findings of the Electricity Commission are relevant and clearly Mr Gallagher is incorrect in applying German studies to New Zealand conditions.

**Roger Burchett**  
**January 2008**

**Appendix A**  
**EECA Fact Sheet**