IN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF of the proposed Horizons One Plan notified by the Manawatu-Wanganui Regional Council hearing relating to Infrastructure, Energy and Waste

SUPPLEMENTARY STATEMENT OF EVIDENCE OF TREVOR ANDREW NASH

INTRODUCTION

1 My name is Trevor Andrew Nash. I am the Wind Generation Development Manager at Mighty River Power, a position I have held for over 5 years. In this role I am responsible for the investigation, selection and predevelopment of wind generated electricity for the company. Of 25 years in industry, I have 19 years experience in utility-scale wind energy in the United Kingdom and New Zealand. This experience includes all aspects of wind energy including wind turbine design, research and development; site assessment; windfarm construction and operation; and in wind energy strategy, policy development, and management.

2 I hold a Bachelor of Engineering (Honours), and a Graduate Diploma in Business Administration from the University of Auckland. I am a founding member of the New Zealand Wind Energy Association and have served on its board several times. I am a Member of the Institute of Professional Engineers New Zealand (IPENZ). I have served as the New Zealand representative to the International Energy Agency (IEA) Implementing Agreement for Co-operation in the Research Development, and Deployment of Wind Energy Systems - IEA Wind.

3 I am authorised to present this evidence on behalf of Mighty River Power, in support of their submissions and further submissions to the Horizons Regional Council (Horizons) Proposed One Plan (the Plan).

SCOPE AND SUMMARY OF SUPPLEMENTARY EVIDENCE

4 This supplementary evidence has been prepared to update the Hearings Panel on the importance and potential for wind generation in New Zealand, and the significance of the Horizons region in particular.

5 My evidence will outline:

- the security of electricity supply,
- the scope for wind energy in New Zealand and the Horizons Region; and;
- the characteristics of wind energy development with respect to regional policy statement and plan policy.

6 New Zealand has a world class wind resource, which needs to be utilised in order to achieve the New Zealand Energy Efficiency and Conservation Strategy (NZEECS) target (to generate 90% of New Zealand's electricity demand from renewable energy sources by 2025).

7 The Horizons region is arguably the most important for wind-farming in New Zealand as it contains some of the country's best wind generation resources. However a sound regulatory framework is needed if New Zealand is to sufficiently utilise this high quality wind resource.

8 There is a finite availability of the premium renewable energy sources, and those that become unavailable may be difficult to substitute for in the short term and may increase reliance on other non-renewable fuels. It must also be recognised that there are many factors that influence the location of a successful wind farm project, as well as potential barriers to developing wind generation projects, including economic factors. Some of these themes will be explored in this evidence.

MIGHTY RIVER POWER'S ACTIVITIES

9 Mr Hunter has set out in his presentation and evidence to the Hearings Panel the generation assets and aspirations for new generation of Mighty River Power. I will focus more particularly on the wind development programme and the contribution

that wind energy could play in meeting the demand for electricity in the Horizons Region and New Zealand.

EXECUTIVE SUMMARY

10 In the first part of my evidence I outline:

(a) the importance of wind in contributing to diversity in electricity generation sources, and so contributing to security of supply;

(b) the significant global increase in wind generation world-wide;

(c) the contribution that wind can make to achieving the New Zealand Energy Efficiency and Conservation Strategy target (to generate 90% of New Zealand's electricity demand from renewable energy sources by 2025);

(d) New Zealand's world class wind resource, and the factors that influence location of a successful wind farm project;

(e) potential barriers to developing wind generation projects; and

(f) economic factors that influence whether wind generation projects will ultimately proceed.

11 This evidence is intended to provide the Hearings Panel with background information regarding the developing importance and potential for wind generation in New Zealand. Given the finite availability of the premium renewable energy sources, those that become unavailable may be difficult to substitute for in the short term and may increase reliance on fossil fuels.

12 In the second part of my evidence, I outline the high quality wind resource located in the Horizon's Region, and the significant additional potential of the Region to contribute to increased renewable electricity generation. There are a number of areas in this Region that are favourable areas for potential wind development. This is demonstrated by the level of existing activity in the Region. The Horizons Region is arguably the most important in New Zealand for wind generation.

ELECTRICITY SECURITY OF SUPPLY

13 New Zealand needs a diversified energy base because sole reliance on particular fuels or connection to neighbouring countries for our electricity needs is not possible. Electricity generation from wind will assist with security of electricity supply as outlined in the evidence by Mr Hunter. It will also assist in reducing the vulnerability of the region to climatic extremes in other parts of the country.

WIND ENERGY IN NEW ZEALAND

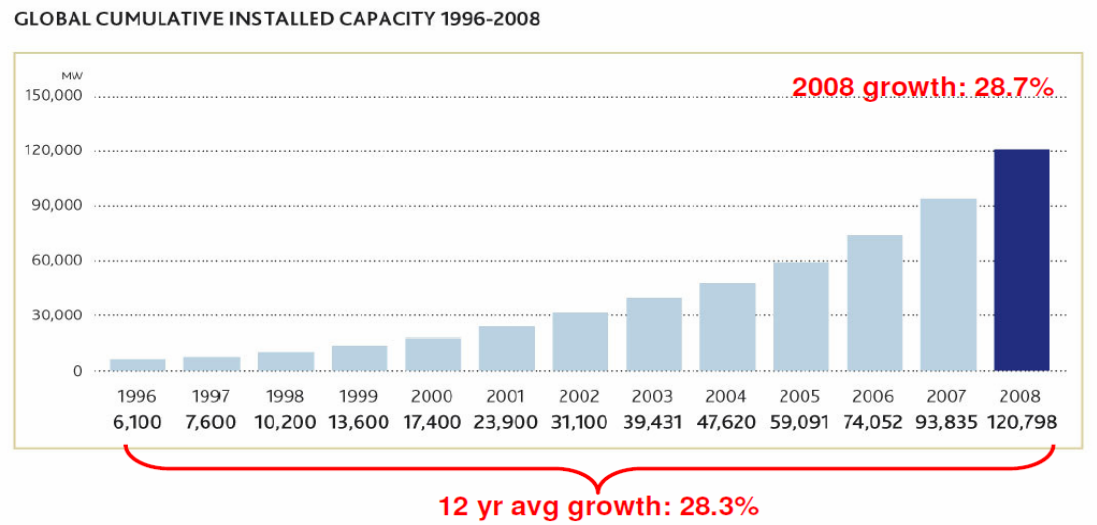
14 In 2006 under 13% of the global energy mix was from renewable sources, of which hydro is the main contributor.[1] But the portion of energy from renewable sources is increasing steadily. At the end of 2007 the global total installed wind capacity was more than 94,000 MW supplying around 200 TWh or just over 1% of the world's electricity[2]. In 2007, wind attracted more investment than nuclear or hydro (approximately US$37 billion), and accounted for more new generation capacity in Europe than any other power source.[3] In the USA wind energy was second only to natural gas in terms of installed capacity.[4]

15 At the end of 2008 the global installed wind energy capacity had increased to more than 120,000 MW[5]. Globally the wind industry is estimated to employ around 200,000 people.

16 This worldwide growth in wind energy is demonstrated in Figure 1, which has been growing at an average rate of 28.3% over the period from 1996-2008. Global wind energy capacity is forecast to reach as high as 330,000 MW by 2013 (based on a forecast annual growth rate of 17%).[6]

[1] Caller, F (2009) 'Renewable Energy: Part of the Mix' (NZ Wind Energy Conference 2009, Wellington).
[2] From the Global Wind Energy Council's 'Global Wind 2007 Report', April 2008.
[3] UNEP Sustainable Energy Finance Initiative, 'Global Trends in Sustainable Energy Investment 2008', July 2008.
[4] Babcock & Brown Wind Partners, 'Presentation to Deutsche Bank Wind Energy Seminar', 2 July 2008.
[5] Sawyer, S (2009) 'Global Wind Power' (NZ Wind Energy Conference 2009, Wellington).
[6] UNEP Sustainable Energy Finance Initiative, 'Global Trends in Sustainable Energy Investment 2008', July 2008.

Figure 1: Global Cumulative Installed Wind Capacity [3]



17 For New Zealand, the Energy Efficiency and Conservation Strategy (NZEEC) sets a target of 90% of New Zealand's electricity demand from renewable energy sources by 2025. Mr Hunter will discuss the significance of this target and the significant contribution needed from new renewable energy generation to achieve it. The contribution renewable sources of energy can make, varies significantly on a national, regional and district basis due to factors such as the nature of the resource (i.e. wind, geothermal, hydro, etc.) and related factors such as latitude, topography and the hydrological cycle. The efficient and effective use of renewable sources of energy is also location specific as the infrastructure required to harness the energy needs to be located close to the energy source. In addition, greater emphasis is now being given to maximising the opportunity for generation of energy within each district and region to overcome transmission losses and meet local demand for electricity. Due to the diversity and extent of the renewable resources that are available renewable energy has the potential to provide New Zealand with a more sustainable supply of electricity.

18 New Zealand's wind resource is situated in the "Roaring Forties", where the winds are known for their strength and persistence and are unhindered by land mass. Being a narrow island, there is good exposure to coastal winds while our ranges and areas of elevated terrain give localised wind speed accelerations.

19 New wind projects are feasible where cost of energy is at or below the cost of other fuel options and electricity price forecasts. The key driver for siting wind energy developments is the wind resource available at a site. Wind energy potential is highly sensitive to the site wind speeds and these are strongly influenced by location and elevation. Accordingly sites in valleys, forests, and low lying inland locations where wind speeds are lower generally do not have an economic wind resource.

20 Other requirements for successfully developing wind energy projects include:

- *Location and access* – A good site requires proximity to the grid or local network and access to a route to connect to that grid or network as well as suitable road access for construction and the delivery of the large turbine elements. Additional benefits can accrue to the project if connected to a local lines network rather than the national grid due to the resulting reduction in transmission requirements. While offshore marine locations can have a very good wind resource the relative costs are in the order of twice those of conventional onshore developments and this, together with challenges around infrastructure and maintenance means that such projects are unlikely in New Zealand in the short or medium term.

- *Transmission capacity* – Like any form of generation, wind generation requires sufficient transmission capacity (both local and regional) to carry the generated electricity. In many instances the transmission system can be upgraded to increase its capacity without the need for new lines to be built.

- *Turbine price and efficiency* - Wind turbine technology has been getting larger, is trending cheaper and more efficient. At a given site, a single modern wind turbine annually produces 180 times more electricity and at less than half the cost per kilowatt-hour (kWh) than its equivalent of 20 years ago.[7] There can be cost variations due to commodity prices (such as the price of steel), wind turbine supply and demand and changes in the currency exchange rate. These factors also affect other sources of electricity generation.

[7] Advisory Council of the European Wind Energy Technology Platform, 'Wind Energy: A Vision for Europe in 2030', September 2006.

21 Mighty River Power is a significant operator of hydro electricity generation in the North Island and is well placed to utilise the synergy between wind and hydro generation.

22 Potential barriers to developing wind generation projects include:

- The cost and length of time for technical and environmental investigations to firstly determine project feasibility, and secondly to support an application for resource consent. For wind energy projects this includes wind measurement studies, which are usually conducted over a 2 – 3 year period. These studies typically require the use of measurement masts with heights similar to those of the turbine towers (30 – 100 metres). Any land use or district plan changes that over this time that restrict the ability to develop the wind farm would adversely affect the viability of a project.

- Windfarms can take many years to develop, due to long transmission routes or other reasons, and are prone to reverse sensitivity risks from lifestyle subdivision and other neighbouring land-use changes. Locations of outstanding wind generation resources are typically evident and locally known, however there is little provision (other than receiving project resource consents) to protect these sites from conflicting developments on adjacent sites. The latter activities often have more choice of location as opposed to premium wind generation resources which are somewhat location specific.

- Risks associated with the uncertainty of the timing and outcome of the resource consent process and the potential implications of conditions (if granted). In recent times, wind development proposals seeking resource consents have faced vocal but finite local opposition concerning the perceived adverse visual and noise effects, with most proposals being appealed to the Environment Court. These factors have time and cost implications.

- As noted above, international trends in commodities, wind turbine demand and changes in the currency exchange rate may adversely influence the project economics. Similar effects on other technologies or their fuel sources can also affect a project's viability compared to other potential projects. These are usually temporary effects.

23 There is some debate regarding the wind energy's potential contribution to New Zealand's electricity supply. The previous Government's New Zealand Energy Strategy (NZES) identified that 9,200 GWh per year of available wind generation (around 22% of present demand) was available at a cost of less than $90 per MWh.[8]

24 The New Zealand Wind Energy Association estimates[9] that in 2025 there could be approximately 2,500 to 3,000 MW of additional wind energy capacity installed, generating over 9,000 GWh of electricity per annum. This estimate has been made with consideration of the constraints of economics (including those of competing technologies), transmission and consenting that will affect the uptake of wind energy.

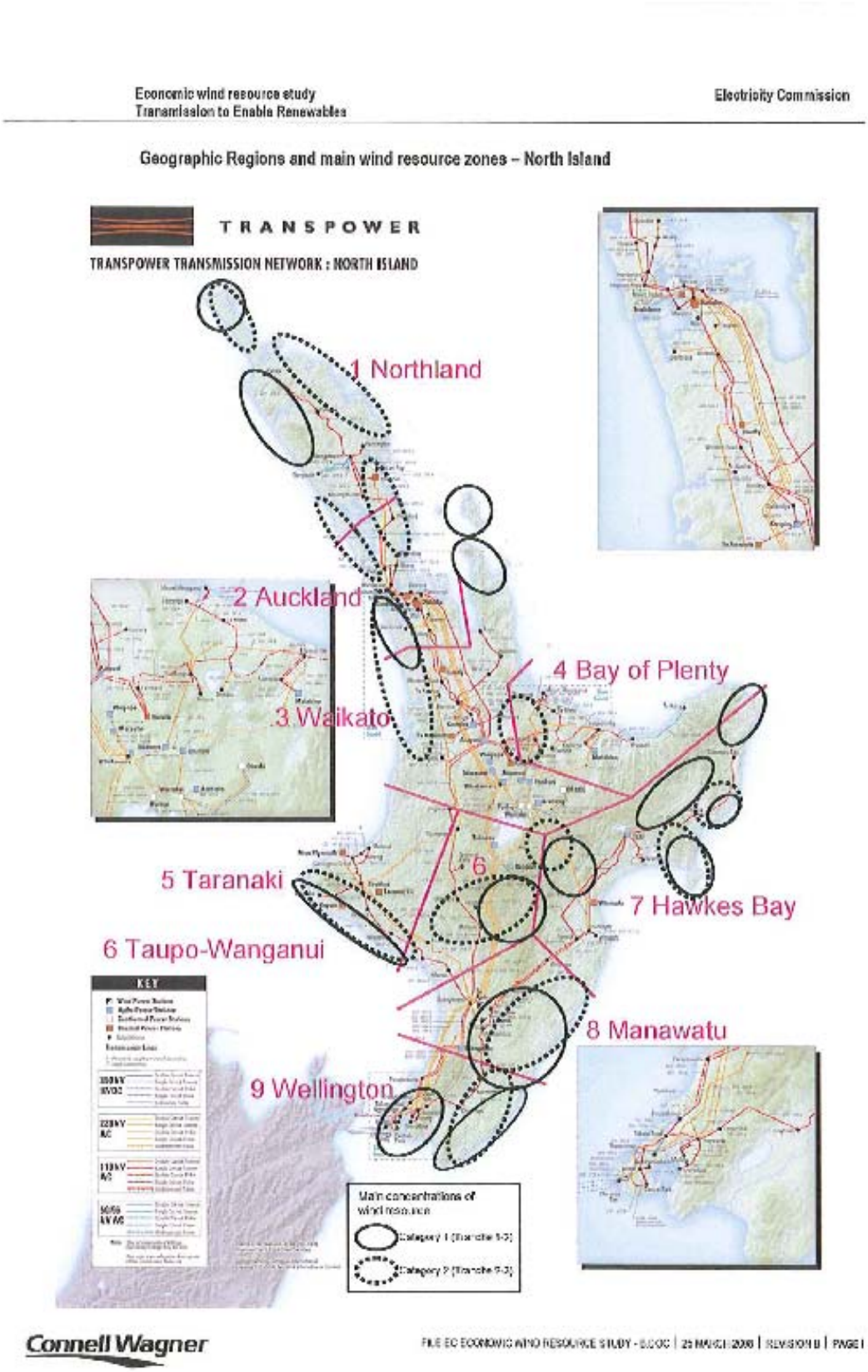
25 It is within this market context that new electricity generation projects, including new windfarms are assessed, approved and constructed incrementally by generation companies. At Mighty River Power, electricity technologies at the economic margin include geothermal, wind, small-hydro and thermal generation. In other words, candidate projects using various technologies will become economically viable on a merit-order basis as the forecast for future electricity price increases or as the cost of electricity generated using these technologies improves.

26 The New Zealand public has expressed a preference for renewable energy technologies such as wind and hydro, over thermal technologies such as gas and coal.[10]

27 Figure 2 below shows a high level wind resource map of the North Island. This shows that there is a reasonably diverse geographic spread of high wind resource, although much of this would not be feasible in the near term.

[8] From Table 9.1 of the New Zealand Government's 'New Zealand Energy Strategy to 2050 – Powering Our Future', October 2007. Note these costs are now higher due to exchange rate variations.
[9] NZ Wind Energy Conference 2008, "The Way Forward", Fraser Clark, NZWEA.
[10] Research conducted by Nielsen for EECA, 'Public perceptions of renewable energy' May 2008, available from http://www.eeca.govt.nz/renewable-energy/documents/renewable-energy-nielsen-research-report-may-08.pdf

Figure 2: Wind resource map of North Island



28 Currently there is over 400 MW of installed wind generation in New Zealand, with a further 110 MW under construction. This will bring New Zealand's total installed capacity to 513 MW by mid 2010. There is almost 3,000 MW of potential future wind development that is either consented (but not constructed), seeking consents or under appeal with many more sites being investigated[11]. This represents over 10 years worth of annual load growth.

29 In summary, wind energy is becoming increasingly economic as a source of new electricity generation. It is also well supported by the New Zealand public and is consistent with government policy (NZES, NZEECS and New Zealand's obligations under the Kyoto Protocol). A number of potential windfarm projects are now economically viable, and more sites are expected to become viable in the future. There are a number of factors that could influence the uptake of wind energy including shifts in price forecasts (based on fuel supply and price, dry years, etc.), investments into other generation technologies, exchange rate variations, emissions policy and pricing, and the availability of the best wind sites according to land designation, landowner willingness and resource consents. Given the finite availability of the premium renewable energy sources, those that become unavailable may be difficult to substitute for in the short term and may increase reliance on other fuels such as thermal generation.

SITING OF WIND ENERGY DEVELOPMENTS WITHIN THE REGION

30 Wind is an attractive natural energy resource available within the Manawatu-Wanganui region. Estimates by the Electricity Commission have identified that there is significant undeveloped wind energy potential in the region. [12]

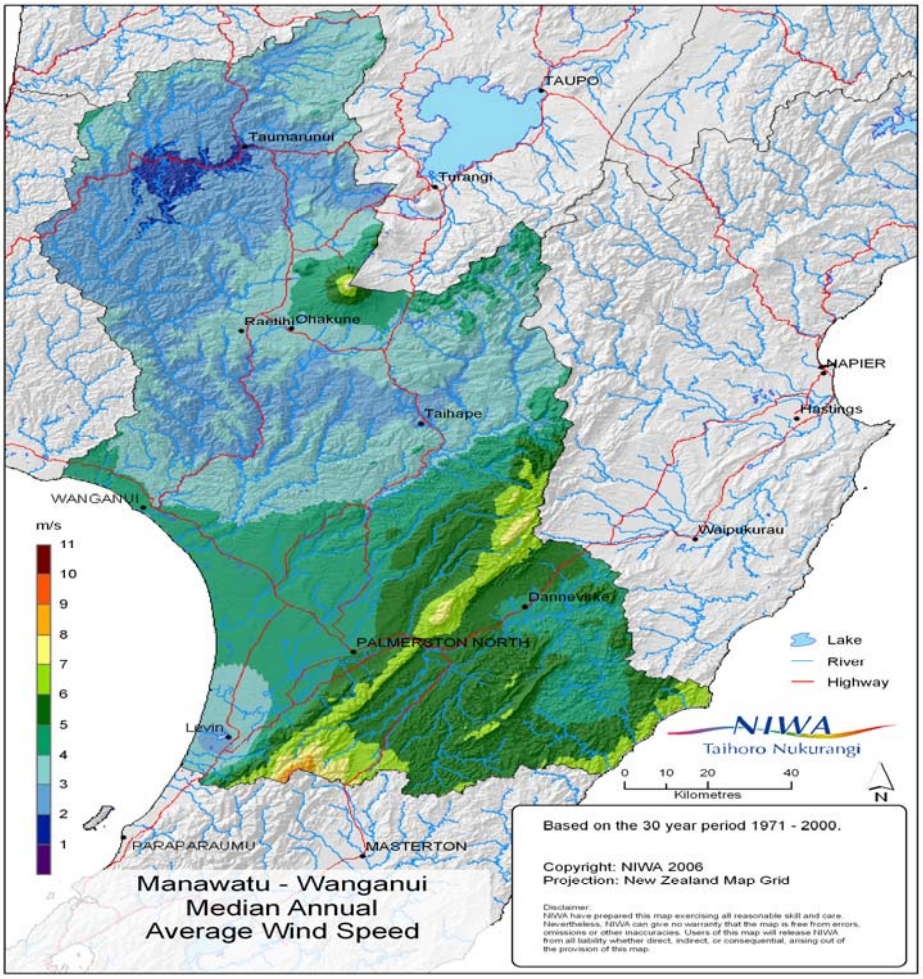
31 The Electricity Commission study identified 560 MW (1,960 GWh per year) in the Taupo-Wanganui region and 3,230 MW (11,320 GWh per year) in the Manawatu that could potentially be developed at a cost of $75 to $90 per MWh. An additional 800 MW (2,450 GWh per year) and 1,790 MW (5,490 GWh per year) respectively could potentially be developed at a cost of $90 to $105 per MWh. The general areas where this

[11] Clark, F (2009) 'The path for wind in our turbulent economic climate' (NZ Wind Energy Conference 2009, Wellington).
[12] http://www.electricitycommission.govt.nz/pdfs/opdev/transmis/renewables/TTER-App4.pdf

resource is available is shown in Figure 3 below, where "Category 1" refers to potential costs of $75-90/MWh and "Category 2" to costs of $90-$105/MWh.

32 It can be seen from Figure 3 below that there are a number of areas in the region that are favourable areas for potential wind development. These areas include the Ruahine and Tararua Ranges and areas east of the Tararua Ranges (such as the Puketoi Range) to the east coast. It should also be noted that there are limitations associated with mapping at this scale and localised pockets of high wind resource may exist in other areas, such as areas along the coast and other elevated inland ranges. There is considerable investment required in monitoring wind resources on a site by site basis to prove the resource for development purposes.

Figure 3: Wind Resource Map of the Manawatu-Wanganui Region[13]



[13] Map prepared by NIWA and available from https://secure.niwa.co.nz/climate-explorer. Note that the map should be used to consider the general wind resource only and is not suitable for identifying potential wind farm sites. The data is only at 10 metres elevation (i.e. well below the higher speeds at turbine height) and has been calculated by simple interpolation only (i.e. it does not consider effects such as the acceleration of wind due to terrain, etc).

33 The best wind sites are in exposed locations, typically ridgelines and hilltops and seldom in valleys, forests and low lying inland locations that are typically relatively sheltered. Mighty River Power has monitored the wind resource on the Tararua and Puketoi Ranges and found it to be a constant and high quality wind source. In fact we have found that the mean wind speeds for Mighty River Power's proposed Turitea project (which is partly within the Tararua District) exceed those on any wind farm developed in New Zealand to date, and are also very rare on an international scale. Mighty River Power's wind monitoring to date at Puketoi reveals a similarly high quality wind resource. I consider the wind resource at these sites to be exceptional on a national and international scale. Overall, parts of the Manawatu-Wanganui Region offers some of the highest capacity factors in New Zealand and also globally, with many sites offering 40% or higher against global benchmarks of 20-25%. The wind resource here in simply world class.

34 The wind energy potential of the Horizons Region is also demonstrated by the level of existing activity in the region:

Operating wind farms	
Tararua (Stages 1 – 3)	161 MW
Te Apiti	91 MW
Te Rere Hau	21.5 MW operating, with construction of a further 27 MW underway and consent being sought for a further stage
Consented wind farms	
Motorimu	68MW (on hold)
Publicly discussed wind farms	
Turitea (Tararua Ranges) and Puketoi (Mighty River Power)	
Project Central Wind, north of Taihape (Meridian Energy)	
Waitahora Wind Farm, Puketoi Ranges (Contact Energy)	
And at least 3 other sites not disclosed	

35 Wind farm developments will assist New Zealand to meet its obligations under the Kyoto Protocol and any future international obligations that may be agreed post 2012. Mighty River Power considers its wind farm development programme as an important step towards New Zealand becoming self sufficient, energy efficient and in offsetting the country's carbon emissions in a sustainable way.

36 In order to achieve this goal, it is necessary to first ensure the statutory planning and policy framework provides an appropriate foundation for wind development to proceed. To this end, for the last three years or so, Mighty River Power has participated actively in council plans and policy developments in a number of regions, districts, and cities. The purpose of this participation is to ensure appropriate regulatory frameworks are developed to enable future potential wind farm activities where such activities are appropriate.

37 To assist in realising our wind development aspirations, Mighty River Power has also invested significant time and money in developing expertise in this area. This has included developing a team of world class specialists in the wind generation field, led by myself. I have held this position for more than 5 years, and as discussed earlier, I have more than 19 years experience in utility-scale wind energy in the United Kingdom and New Zealand.

38 To provide avenues of further technical expertise for Mighty River Power's wind development team, the company has also formed key alliances with world-class wind generation consultancies, including Garrad Hassan.

39 Mighty River Power began investigating potentially feasible wind generation sites in 2003. Since then my team has considered more than 250 potential sites across the country. Of these 250, seven prospects were selected as potentially viable for wind generation. The selection criteria used for these prospects considered:

- likely quality of the wind resource;
- landowner willingness;
- transmission access; and
- environmental impacts.

40 These prospects include sites in the Wairarapa, Central North Island, Taranaki coast, Auckland, Wellington, Marlborough, and Manawatu. Three of these prospects, representing over half our wind interests by volume, are within the Horizons region. A comprehensive programme of wind monitoring and feasibility investigation is underway at all of these sites. Mighty River Power is also currently in the process of Hearings in

front of a Board of Inquiry, for resource consents to build and operate the Turitea Wind Farm in and around the Turitea Reserve, in the Manawatu. As well, Mighty River Power is also pursuing a smaller network-embedded windfarm at Long Gully near Wellington city, through a contract with Windflow Technology Ltd. The application for resource consent has been lodged.

41 Viable sites need to be in high wind areas and as near to grid as possible. Benefits of generating near consumers are signalled through differences in average nodal spot prices – these generally increase northward. For these reasons the lower North Island currently offers the best economics for wind power, and sites elsewhere in the country with lower wind speeds are not currently economic.

42 Within the Manawatu-Wanganui region, electricity demand exceeds the existing generating capacity, which is currently provided mainly by hydro and wind sources. Having more local generation would help to reduce total transmission system losses. Wind power could further assist in reducing the vulnerability of the district and region to the effects of generation and transmission constraints in other parts of New Zealand.

CHARACTERISTICS OF WIND ENERGY DEVELOPMENT AND PLAN POLICY

43 Wind farms must be located where the wind resource is. The footprint for a wind farm however can respect the landform and in many cases the existing use of the land can continue in conjunction with the wind farm. In a pastoral farming situation land can continue to be productively used. A relatively small portion of a site (typically 1-2%) is used for windfarm infrastructure post-construction. Access roads constructed for a windfarm can often also facilitate more effective use or management of land.

44 Turbines will have a defined "life" before they need to be removed or replaced. By the time turbines need to be replaced, New Zealand's economy and electricity market (both electricity generation and electricity demand) may be vastly altered from where it is today. Turbines will only be replaced if it is economically feasible to do so. Land occupied by turbines that are removed can be readily rehabilitated enabling the land to continue to be used for rural purposes or alternative developments. The ability for windfarm land to be returned to its previous rural state is in contrast to most other forms of development.

45 Overall, there is limited flexibility in the location of potential wind development sites, which is dictated by the wind resource, site and physical constraints (including grid constraints). However there is usually some flexibility to modify the siting of turbine sites *within* the general site envelope to minimise site-specific effects.

CONCLUSIONS

46 Today wind energy already provides around 3% of our electricity requirements. It is expected to play a significantly greater role in meeting our increasing demand for electricity in the future, and our efforts to curb greenhouse gas emissions.

47 There is a high quality wind resource within parts of Manawatu-Wanganui Region. Indications from both current wind generation activity and wind monitoring suggest that the Tararua, Ruahine and Puketoi Ranges have a wind resource that rivals any experienced internationally. There are areas of significant potential in other elevated and coastal areas of the region.

48 The viable wind resource is finite, and must be captured where the wind is located. Wind energy development can be undertaken in a way that retains the landform and enables rural land use to continue alongside the wind farm.

49 It is a flexible technology allowing projects to be built of different sizes or in stages. Ultimately the wind turbines are removed at the end of their project life, and the project either re-powered or the site reinstated to its former state. This flexibility is an added benefit of this form of renewable energy, in addition to the benefits already outlined by Mr Hunter in his evidence.

Trevor Nash
For Mighty River Power Limited
28 July 2009