

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of a Board of Inquiry appointed under s146 of the Resource Management Act 1991 to consider an application by Mighty River Power Limited for resource consents to construct, operate, and maintain a wind farm at Turitea.

STATEMENT OF EVIDENCE OF THOMAS BRENT LAYTON

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1 INTRODUCTION

Qualifications and Experience

- 1.1 My name is Thomas Brent Layton and I am a senior fellow at the New Zealand Institute of Economic Research (NZIER) in Wellington. In that capacity I undertake consultancy work for clients in both the public and private sectors in New Zealand and overseas, applying economics to fields such as economic regulation, environmental policy, emission trading schemes, climate change, energy economics and international trade relations.
- 1.2 I graduated from Victoria University of Wellington with a Bachelor of Commerce and Administration in Economics, a Bachelor of Arts with First Class Honours in Economic History and Econometrics and a Doctor of Philosophy in Economic History.
- 1.3 Work of particular relevance to the economics underlying the consenting of Turitea Wind Farm includes:
- (a) Being the principal author of a report for Business New Zealand on international experience with greenhouse gas emissions trading and a framework for emissions trading in New Zealand;
 - (b) Working with a group representing business, agricultural and Maori interests dissatisfied with some of the key details of the emissions trading scheme enacted in 2008 on an amended scheme that was more likely to achieve wide public acceptance; and
 - (c) Preparation and presentation of evidence for wind farm consent applications, including TrustPower's Mahinerangi Windfarm in Otago and Kaiwera Downs Windfarm in Southland, and Meridian Energy's Project Hayes Windfarm in Otago.
- 1.4 I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court. Except where I state that I am relying upon the specified evidence of another person or organisation, my evidence in this statement is within my area of expertise. I have endeavoured to be accurate and to cover all relevant matters relating to the topic on which I am giving evidence. The material presented and assumptions used are reasonable in my opinion and I have not omitted any material facts known to me that might alter the conclusions reached. I believe, therefore, my evidence complies with Section 5.3 of the Environment Court's Code of Conduct for Expert Witnesses.

Purpose and Scope of Evidence

- 1.5 The purpose of my evidence is to outline the economic effects, addressing both positive and negative effects, of the proposed Turitea Wind Farm and implications for consenting under the Resource Management Act 1991 (the RMA). This evidence addresses the potential sources of value to the community of the Turitea Wind Farm arising from generation of electricity, reduced use of other generation with greenhouse gas emissions, contribution to the resilience and security of the wider electricity system, and expenditure impacts in the local economy.
- 1.6 Specifically, in my evidence, I will:
- (a) Describe the contribution of Turitea Wind Farm in meeting New Zealand's energy demands;
 - (b) Outline economic effects of the Turitea Wind Farm outside the electricity sector;
 - (c) Explain the impact of Turitea Wind Farm on the local economy;
 - (d) Provide estimates of the economic value of the proposed Turitea Wind Farm; and
 - (e) Explain the scope of economics in the context of the RMA and directions of government policy.
- 1.7 A summary of my key points is set out in Section 2.
- 1.8 This evidence is given in support of Mighty River Power's applications for the construction, operation and maintenance of the Turitea Wind Farm.
- 1.9 I was engaged to undertake an assessment of the economic benefits arising from the proposed Turitea Wind Farm in 2008. The outcome of this assessment is the report "Economic Assessment of Turitea Wind Farm" included as Appendix I of the assessment of environmental effects submitted in support of Mighty River Power's applications.
- 1.10 Since preparing that report, I am aware that the proposal has been modified by deleting 9 of the originally proposed turbine zones. This evidence reflects, and is based on, that modified proposal.

2 SUMMARY OF EVIDENCE

- 2.1 Economics is the study of the value derived from the uses made of resources. Given the RMA's focus on sustainable management of resources, economic efficiency of resource use in section 7 (b) and on the benefits of renewable energy in section 7 (j), there is a distinct economic complexion to the RMA.
- 2.2 The proposed Turitea Wind Farm will have a significant impact on the local economy, with the direct injection of expenditures and jobs in the region and indirect flow on effects from further spending, both in the construction and operational phases. I estimate that the total (direct and indirect) impact in the local economy would be around \$504 million from the 336 MW installation of the Turitea Wind Farm construction phase. Similarly, in its operational phase the impact would be at least \$1.9 million per year from salary and other staff related costs. In normal economic circumstances of nearly full employment, like New Zealand has enjoyed in the recent past, this local impact would be largely offset by reductions in activity elsewhere in the economy because the labour and other resources would have been employed anyway. So the net impact from a New Zealand wide perspective would be small. In a period of recession or depression, however, some of the labour and other resources used in such a project would have been idle, so the net impact over the whole economy will be greater and more positive. But such economic impacts are not the only or the major economic consequence of such a development, and they are not informative about efficiency of use of natural and physical resources.
- 2.3 More relevant for the purposes of the RMA is the stream of benefits derived from the new wind farm once it is operational, which stem from the harnessing of a free and hitherto unused (in the Turitea locality) resource (wind) to create a valuable commodity (electricity). This has implications for those involved in supplying electricity, the consumers of electricity, and also third parties facing the effects on the wider environment.
- 2.4 That Mighty River Power wants to invest in the Turitea Wind Farm indicates that the company regards it as an efficient use of its resources. But the critical question for RMA purposes is whether the Turitea Wind Farm would create adverse effects that are so significant as to outweigh the benefits associated with its construction, operation, and maintenance.
- 2.5 In my opinion, the Turitea Wind Farm will contribute to government objectives for increasing renewable generation and reducing greenhouse gas emissions, as

expressed in the New Zealand Energy Strategy and the framework for greenhouse gas emissions trading. Its economic effects can be expected to include:

- (a) The wind farm operators recover their long run costs from the viability of the project as they would from any other investment, and there is enhanced benefit for those who receive rentals for the land it occupies;
 - (b) Power consumers obtain minor benefit from displacement of higher cost generation which suppresses price rises, and when compared with several alternatives more remote from load, the alleviation of pressures for new grid investments which would also be passed through in reduced prices to consumers;
 - (c) There are benefits, probably of substantial value, from the displacement of thermal generation and avoidance of greenhouse gas emissions; and
 - (d) There is a balance of third party effects including potential disruptions to the site (which are mostly temporary), potential displacement of recreation, and potential aversion to the effects on visual amenity and wildlife.
- 2.6 Based on the likely installed capacity of 336 megawatts (MW), at 45% utilisation, the Turitea Wind Farm could displace in a year around 503,500 tonnes of carbon dioxide from a gas-fired plant, or 1,192,500 tonnes from a coal-fired plant. If it only achieved 33% utilisation, the emissions displaced would be 368,980 tonnes or 873,900 tonnes respectively. In this way, the Turitea Wind Farm has a significant value for meeting New Zealand's future projected energy needs and its current and likely future international commitments and potential benefits from assisting to address climate change.
- 2.7 The new wind farm would also provide additional generation capacity to alleviate electricity supply risk caused by recurring dry years, by allowing the storage of water in hydro schemes, while wind is blowing and wind farms are generating.

3 THE CONTRIBUTION OF TURITEA WIND FARM IN MEETING NEW ZEALAND'S ENERGY NEEDS

- 3.1 Electricity is an essential input for modern lifestyles and for commercial and industrial activity, second only to oil as the primary source of delivered energy in New Zealand, providing 27.6% of consumer energy in 2007.¹ For many uses there is no effective

¹ Ministry of Economic Development *Energy Data File* June 2008, Table A.4a shows oil accounting for 50.3% of consumer energy, electricity for 27.6%, gas for 8.5% and the balance from other renewables (biogas, wood and solar) (7.1%), coal (4.6%) and geothermal direct heat (1.9%).

substitute for electricity, so, at least in the short term, demand is unresponsive to price rises and unanticipated shortages incur high societal costs. Therefore, secure supply of electricity at low cost has widespread benefits to the New Zealand community.

- 3.2 New Zealand has a nationwide electricity system built around a national transmission grid which carries power from generators to areas of demand, and local distribution networks which distribute power from the grid to individual consumers. A mix of generation types, including hydro, thermal (predominantly gas and coal but also some fuel oil at the Whirinaki reserve energy plant), geothermal, wind and biogas generation capacity is connected to the grid. The grid comprises high voltage Alternating Current (AC) transmission lines in each main island, and the High Voltage Direct Current (HVDC) transmission link between the lower South Island at Benmore sub-station, and the Haywards sub-station just north of Wellington. Almost all the current generation capacity in the South Island is hydro and so is heavily reliant on precipitation or snowmelt for its fuel. The North Island has more mixed fuel sources, with clusters of generation plant based on gas and hydro resources in Waikato and Taranaki, geothermal in the Bay of Plenty and Waikato regions, and the relatively newly established wind generation in Manawatu.
- 3.3 According to the Ministry of Economic Development's Energy Data File, total installed generation capacity in New Zealand currently stands at about 9,133 MW, and further wind powered plants with 564 MW capacity and geothermal plant with 150 MW capacity are expected to be installed by the end of 2009.² Very little new hydro-generation capacity is expected to be commissioned over that period.
- 3.4 The current national capacity has a potential output of just over 80 terawatt hours per year³ if all plant ran 24 hours a day all year. But no plant operates at that utilisation because of resource constraints (for hydro and wind), transmission constraints, resource consent/usage requirements, fluctuating consumption patterns that necessitate a degree of overcapacity to meet maximum demand, and plant maintenance requirements. Annual generation in calendar year 2007 was 42.290 TWh or 42,290 gigawatt hours (GWh), about 53% of the potential output.

² Ministry of Economic Development, *Energy Data File*, June 2008 Calculated from Table G.3c. See Annex 1 to this evidence.

³ The standard unit of energy is the joule (J), equal to one watt-second (one watt is equal to one joule per second); one kilowatt-hour (kWh) is exactly 3.6 megajoules, which is the amount of energy expended if work is done at a constant rate of one thousand watts for one hour. A megawatt hour (MWh) is 1,000 kWh, a gigawatt hour (GWh) is 1,000 megawatts and a terawatt hour (TWh) is 1,000 GWh or 10^{12} watt-hours.

- 3.5 Depending on the wind resource and efficiency of operations, wind farms in New Zealand can achieve utilisation of between 33% and 45%. These rates suggest the average annual output from an installed capacity of 336 MW could be in the range of around 971-1325 GWh per year. With the proposed lower installed capacity level of 281 MW, the potential output range would be 812-1108 GWh per year.
- 3.6 This means the proposed Turitea Wind Farm would at its maximum 336 MW capacity add 3.7% to the current installed generation capacity in New Zealand, and between 2.3% and 3.1% to annual generation at the utilisation rates above. This is about as large again as the current contribution of wind to New Zealand electricity generation, although by the time of commissioning both total generation, and wind's contribution to it, are likely to have risen from current levels. The new wind farm adds to the electricity system in other ways, adding diversity and resilience to the system and avoiding other costs or capturing potential benefits associated with greenhouse gas emissions and also potentially relieving some costs of transmission upgrades.
- 3.7 There is no economically viable way to store electricity in bulk, except by storing water in hydro lakes or stockpiling fuels. Despite recent additions to generating capacity in the North Island, New Zealand remains a long thin country, in which major generation and storage capacity is in the South Island, but major consumption loads are concentrated in the North Island. Imbalances between supply and demand within and between regions give rise to the need for transmission. Power flows predominantly from south to north, but also flows in the other direction when hydro stocks are low compared with the level desired by generators to meet future consumer needs and North Island generation is used to meet demands in the South Island so that hydro stocks can be conserved or increased.
- 3.8 The injection of new generation from locations in the lower North Island can be expected to relieve some of the demands placed on South Island hydro and storage capacity, and alleviate some of the risk of generation constraints during dry years when the lakes are low. Because such new generation would be closer to the main centres of demand in New Zealand, it will also have lower transmission losses in supplying that demand than when drawing on more distant generation sources.
- 3.9 Historically, demand for electricity has been closely correlated with economic growth, with electricity consumption rising on average 2.8% per year between 1975 and 2005. Over the same period, New Zealand's population grew on average at just under 1.0% per year from 3.1 million to 4.1 million people. Recent forecasts from the Ministry of

Economic Development have a lower growth expectation of 1.3% per annum,⁴ predicated on assumptions of a significant improvement in energy efficiency. In its revised *Statement of Opportunities* released in August 2008, the Electricity Commission forecast annual average growth in electricity demand nationwide of 1.4% per year, and capacity required to meet this forecast demand growing at a slightly higher rate of 1.8% nationwide, as this needs to be sufficient to meet the peaking variation around the average rate of consumption growth. The Commission's forecasts for the Central Region in which Turitea Wind Farm would be located show a lower expected rate of demand growth than the average for the nation at large.⁵ This is not a constraint on new generation in the region because the national grid allows transmission of electricity to other regions with demand.

- 3.10 New Zealand has experienced a recent succession of dry years, with pronounced price spikes in the winter of 2001 and the autumns of 2003, 2006 and 2008. There is also uncertainty over the availability of gas for electricity generation in the medium term, because of the imminent run down of the Maui gas reserve and insufficient substantial new discoveries to replace it. Such fuel constraints are likely to increase over time as demand increases, unless there are some major gas discoveries or increased investment in generation capacity other than those using hydro and gas resources. There are also increasing transmission constraints on parts of the grid, including the ageing inter-island HVDC link, necessitating investments in transmission upgrades or alternatives to transmission. Adding new generation capacity in the lower North Island helps to alleviate these constraints by diversifying the generation mix and deferring the urgency of some transmission upgrades.
- 3.11 The proposed Turitea Wind Farm will be linked to the national transmission grid through an existing injection point at Linton. This will enable it to supply power to the wholesale electricity market, so the benefits of its additional generation are more national, than local, in scope. Across the grid, 3.7% of electricity is lost in transmission, a smaller percentage than average losses on local distribution networks (4.0%). The combined transmission and local distribution losses are on average about 7.7%.⁶ Providing generation closer to demand load helps to reduce these

⁴ Ministry of Economic Development *New Zealand's Energy Outlook to 2030*, November 2006. Data behind Figure 3.2 on page 27 show electricity supply and use increasing by 39% between 2005 and 2030, equivalent to an annual average rate of growth of 1.3%.

⁵ The figures are derived from the national demand forecasts (Table 8), regional demand forecasts (Table 23, Appendix 2) and national peak forecasts (Table 25, Appendix 3) in the Commission's latest SOO. See <http://www.electricitycommission.govt.nz/pdfs/opdev/transmis/soo/pdfssoo/2008/Final2008SOO.pdf>

⁶ Ministry of Economic Development, *Energy Data File*, June 2008, Footnote to Figure G.4. The data on losses are for the March year 2007.

losses across the system. Turitea is closer to load than several other potential locations for additional generation capacity.⁷

- 3.12 The grid is operated by Transpower New Zealand Limited, and since 1996 the buying and selling of wholesale electricity has been done via a pooled market in which generators offer to supply electricity at particular locations, at prices set for half-hour intervals. The system operator has responsibility for ordering dispatch from the stack of generator offers to match demand, and to do so using the sources that satisfy demand at the lowest overall cost, after taking into account expected transmission losses, the requirements for reserve generation, and the physical constraints on the capacity of the transmission grid at each location.
- 3.13 To minimise costs of energy, transmission charges and losses, and to avoid undue loadings on the grid, electricity will often be sourced from generators close to the point of demand, but there is no necessity that this will be so. Unlike most other electricity markets in the world, the New Zealand wholesale market⁸ is designed so that the selection of generation plant to dispatch takes into account the expected transmission losses to meet demand from various sources. So, if two generation plants are offered, but the output of either one is sufficient to satisfy demand then, other things equal, the plant that will generate the lowest cost inclusive of expected transmission losses will be dispatched. Moreover, the price of electricity varies at the nodes distributed around the country to reflect proximity to loads and the availability of generation and the impact of losses. On average, prices are generally lowest in the south and highest in the north. As a result of this, and the impact location has on the probability of being dispatched at a given price, generators will take into account the economic consequences of transmission losses when making decisions about where to locate a generating plant.
- 3.14 In effect, transmission losses are not externalities that need to be considered when assessing the public benefits and costs of proposals under the RMA, as they will have already been factored into the decisions of the applicant. However, the fact that the proposed Turitea Wind Farm will be injecting power into the grid closer to consumption centres than some of the alternative generators it will displace will, other things being equal, reduce some losses and increase the efficiency of the electricity

⁷ Table 6 in the *Energy Data File* of June 2008 shows some of the largest wind farms being planned are in Otago and Southland, where they will have similar benefits in relieving demands on hydro storage and increase security for supplying South Island load, but do not reduce transmission losses when power is despatched to the North Island.

⁸ For a description of the various markets for electricity in New Zealand see NZIER's document prepared for the Electricity Commission:
<http://www.electricitycommission.govt.nz/pdfs/opdev/wholesale/market-design/Electricity-markets.pdf>

system as a whole, as generators will be selected to dispatch so as to satisfy demand at minimum overall cost.

- 3.15 The design of the wholesale electricity market means that generators facing competitors are incentivised to offer power at their short run marginal cost (SRMC), the efficient price, so as to maximise their likelihood of selection for dispatch and enable selection of lowest cost generation for each dispatch stack. The prices paid for supply in each dispatch stack are based on the offer price of the plant at the margin, i.e. the one last selected with highest cost power. This means all other plant in the stack with lower SRMC earn a producer surplus that enhances their profit and provides a return on the investment in the plant. The 'marginal' plant (or plants) is paid on the basis of its offer price, but other plants that generate are paid more than their offer prices.
- 3.16 Once built, wind farms have SRMCs close to zero, as their fuel (wind) is free and has to be used when it is available, or otherwise lost, as there is no way of storing wind energy. Because of this, and as a *quid pro quo* for being allowed to alter their actual generation from the quantity offered if the windspeed dictates, the Electricity Governance Rules (EGRs) require wind generators to be offered at \$0.01 per MWh.
- 3.17 Hydro-electric schemes also have SRMCs close to zero, except when they have capacity to store water for a later period, and it is expected that water will become more valuable due to dry conditions. In these circumstances, the water has an opportunity cost and this raises their SRMC, sometimes to very high levels if conditions are dry. So wind farms are likely to be used to generate whenever they have sufficient wind and transmission capacity to do so. When they do run, they will generally displace higher SRMC thermal plants. Wind farms may also initially displace power from hydro-electricity schemes when the value of the water in their dams is high because of dry conditions or the hydro plant faces transmission constraints that the wind farm does not, or when the start up and shut down characteristics of large thermal plant results in them staying on for longer than would be indicated on strict economic considerations.
- 3.18 Even when wind displaces a hydro plant, if the water can be stored for later use it will often be used to displace thermal generation. So, at least while wind is a small proportion of total capacity and a significant level of capacity is provided by thermal plants, as is currently the situation, injecting new wind power into the stack of generation available for dispatch will usually displace thermal generation, directly or indirectly.

- 3.19 There are limits to the share of wind generation that can be accommodated by an electricity system before the variability of the resource affects the reliability of the system, given the technology employed and rules of operation. Wind generation needs to be operated with other sources of generation in reserve if it is to provide a substantial portion of the generation capacity. Experience in Denmark and other countries with longer histories of wind utilisation than New Zealand suggests up to 20% of total supply could come from wind generation before variability imposes serious instability on the electricity supply system and grid integration.⁹ Where there are good connections with back-up generation to balance wind variability, wind energy penetration can reach higher proportions: over 60% has been reported in Jutland (Western Denmark).¹⁰
- 3.20 In response to the growing number of wind generation proposals and installed plant, the Electricity Commission established in mid-2005 a Wind Generation Investigation Project. The purpose of the project is to “determine what changes will need to be made to the EGRs and industry arrangements to enable integration of a large amount of wind generation into the New Zealand power system and electricity market”.¹¹ The project’s purpose is not to establish a limit on the amount of wind generation that can be connected to the grid. As the analysis undertaken for the project has highlighted, the impact of wind on the system depends in part on the state of technology and also on the EGRs and how well they have been adapted to cater for wind. The technology is changing rapidly and the EGRs are also capable of change.¹²
- 3.21 If reliance is to be placed on substantial wind generation, quick responding (and cheap) “reserves” are needed to provide back-up against the short-term variability of wind. Hydro is very good at providing this kind of reserve compared with other generation types that require longer start up times (e.g. gas, coal or oil fired). Whereas in some other countries the environmental benefits of wind power are often discounted because the reserve generation depends on thermal sources, this does not apply to New Zealand which is well placed to utilise wind because of its high reliance on hydro generation and expanding network of geothermal generation. With wind power currently accounting for 3.5% of installed capacity and approximately

⁹ Ministry of Economic Development, *Sustainable Energy; Creating a Sustainable Energy System*, October 2004, http://www.med.govt.nz/templates/MultipageDocumentTOC___10124.aspx.

¹⁰ EnergyLink Ltd & MWH Ltd (2005) *Wind Energy Integration in New Zealand*; Report to Ministry of Economic Development, Wellington

¹¹ See Wind Generation Investigation Project, *Discussion Paper on Initial Options Assessment*, October 2007. <http://www.electricitycommission.govt.nz/consultation/optionsanalysis> .

¹² See particularly Chapter 2 of the *Discussion Paper on Initial Options Assessment*, *ibid*.

2.2% of electrical energy generated in New Zealand, in my opinion there is substantial scope for more wind power within the electricity system without incurring major system problems requiring expensive solutions. I believe the outcomes to date of the Wind Generation Investigation Project support this opinion.

- 3.22 With constraints faced by New Zealand's two main generation sources, hydro and gas, wind power offers potential to provide additional generation capacity and diversify New Zealand's energy sources. It has the additional attraction of using a free renewable energy source with zero carbon emissions in operation. Whether it is economically efficient to do so depends on wind generation displacing or deferring more costly sources of generation. Although under the EGRs a wind farm must offer into the market at \$0.01 per MWh, the price it receives on average needs to cover its long run marginal cost (LRMC), which includes not only its variable operating costs but provision for the capital cost of the facilities used. I return to this issue later with some estimates of the economic value of the proposed Turitea Wind Farm.

4 THE EFFECTS OF TURITEA WIND FARM OUTSIDE THE ELECTRICITY SECTOR

- 4.1 Other potential external effects from wind farms that are felt outside the electricity system include visual intrusion, land cover and ecological disturbance, and impacts on amenity, recreation and tourism activity. Most of these are localised and can be avoided, mitigated or remedied to varying degrees by the design and operation of the scheme. Such effects depend on the particular characteristics of the surrounding area and they are not equally apparent at all wind farms. There can also be positive effects, such as the development of new tourist attractions or landscaping that improves ecological conditions in the vicinity. Although they are not explicitly priced, these effects have economic value in terms of what the community is prepared to pay to avoid them or have them, if they are positive. An economic value is implicit in all decisions on consents and the measures taken to avoid, remedy or mitigate them. For instance, if the Turitea Wind Farm is built to operate within specified limits or conditions to control for these effects, the economic value can be regarded as internalised within the design and operational costs of the wind farm and there is no unaccounted-for external effect.

- 4.2 There are various non-market valuation techniques available to estimate the community's willingness to pay to manage such effects. These usually require collection of specific information from surveys of visitors or other affected persons to infer how much they value the effect in question. These surveys can be costly and time consuming to implement. They can produce results that may be unreliable or

subject to challenge if they do not appear to conform to actual behaviour, for instance, if the answers are likely to reflect strategic bias among respondents. Such analysis has not been undertaken for the proposed Turitea Wind Farm because this uncertainty as to outcome means they would not provide reliable guidance to the Board in weighing up the evidence on such effects.

4.3 One external effect of the proposed Turitea Wind Farm on which firmer economic guidance can be given is its impact on national emissions of greenhouse gases. In displacing thermal generation, Turitea Wind Farm will reduce such emissions relative to what would have occurred in its absence. It will also reduce other emissions such as sulphur dioxide, nitrous oxide and particulates. These have a more localised effect on air quality and health, the value of which varies with the characteristics of the receiving environment around thermal plant. As it is not possible to predict with accuracy how much output is displaced from which thermal plants, it is not possible to estimate the value of such localised emission reductions. But restraining emissions of greenhouse gases into the atmosphere is a beneficial global environmental effect with a uniform value wherever it might occur, for which reasonable estimates of the economic value to New Zealand can be provided.

4.4 When the New Zealand government ratified the Kyoto Protocol in 2002, it committed New Zealanders to containing annual average emissions of six greenhouse gases to 1990 levels, or purchasing carbon credits for any excess emissions in the Protocol's first 5-year commitment period between 2008 and 2012. A number of other developed economies have entered into similar commitments. In its estimates of the position at the end of February 2009, the New Zealand Treasury estimated that, New Zealand's emissions over the first Kyoto commitment period could exceed its target by 21.7 million tonnes of carbon dioxide equivalent, creating a contingent liability of \$546 million.¹³ Subsequently, the government has re-estimated the likely emissions and now forecasts they will be 9.6 million tonnes of carbon dioxide equivalent less than the target, creating a contingent asset of \$241 million in carbon credits that could be sold.¹⁴ A dollar reduced from a contingent liability gives as much economic benefit to New Zealand as a dollar added to a contingent asset and there is no assurance that the currently forecast surplus will not turn into a liability again. Furthermore, the small surplus forecasted is anticipated to be claimed by the owners of New Zealand's post 1990 forests and not be available to the Crown (and the taxpayer).¹⁵ For these reasons, the current government, like its predecessor, seeks

¹³ <http://www.treasury.govt.nz/government/liabilities/kyoto/kyoto-table-feb09.xls>

¹⁴ <http://www.mfe.govt.nz/issues/climate/greenhouse-gas-emissions/net-position-qa.html#netposition>

¹⁵ See press release by New Zealand Government at 10:49am, 15 April 2009.

to encourage renewable generation sources (hydro, wind and geothermal), which can not only supply power at low cost, but also avoid some emissions of greenhouse gases (principally carbon dioxide) and other pollutants.

- 4.5 New Zealand's policy on how to promote capture of the benefits to be derived from reducing emissions has fluctuated in recent years. Up to 2001 officials were working on an emissions trading scheme in greenhouse gases, then policy switched to a carbon tax planned for introduction in 2007. This was abandoned in 2005 and work reverted to developing the current emissions trading scheme intended to cover all Kyoto gases and all sectors successively over the next few years. Since the change of government in the 2008 election this has been placed under review by a Select Committee, and may be changed again. Emissions trading may be reduced in its ambition, scope or timing, and replaced partly, or in the interim, by a carbon tax and tax payer funded contributions. Whatever the policy, emissions reductions in the period up to the end of 2012 is still of value to New Zealand unless it were to withdraw from the Kyoto Protocol. Withdrawal appears a very unlikely course of action as there is no indication this is contemplated by the new government and the diplomatic consequences for a small economy dependent on trade and access to foreign markets on favourable terms would appear to be severe.
- 4.6 The international community has still to reach agreement on any successor to the Kyoto Protocol. Negotiations and discussions have been under way for more than two years. Multi-lateral international agreements of this kind are generally not easy to achieve, especially when they will have real and significant impacts on the economies of countries. The protracted nature of the various rounds of World Trade Organisation negotiations held since the 1940s aimed at reducing barriers to trade illustrate the difficulties, and in this case all economies generally benefit from trade liberalisation, although there are winners and losers within participant countries. There is no net advantage for all economies from emission reductions.
- 4.7 The current financial crisis, which is adversely impacting most of the world's economies and especially the United States, Japan and Europe, will add materially to the difficulty of reaching agreement. It will make governments more reluctant to impose costs on consumers, firms and businesses in their own economies and also make them very reluctant to add further to their own fiscal problems which have been exacerbated by the economic downturn and the policy responses to it. However, unless there is a sudden turnaround in the consensus among scientists about climate change, it seems highly likely that some deal will eventually be struck which imposes costs on New Zealand if it does not reduce its emissions materially to at least its 1990

level, and probably significantly below it over time and benefits if it exceeds its emission reduction targets..

- 4.8 Emissions avoidance will have real economic value for the government, its taxpayers or other New Zealand residents both during and after the Kyoto Protocol period, whatever policies emerge from the current review of the emissions trading scheme and irrespective of whether it is in surplus or deficit relative to its commitments. A liability to acquire and hold emission entitlements is created by all emissions in countries participating in the Kyoto scheme. The net national balance simply indicates how many entitlements New Zealand entities will have to sell, if in surplus, or how many they have to buy, if in deficit. If the government requires emitting activities to participate in emissions trading, the liability for emissions is devolved to the companies and individuals that control those activities, who may be able to pass on the liability in full or in part to consumers of their goods and services. Those selling into the New Zealand market are more likely to be able to do this than those exporting and competing with suppliers without similar restraints on emissions.
- 4.9 Similarly with a carbon tax, a liability falls on emitters in the first instance, which may be able to pass on the cost to their customers. Some emitting activities are exempted from emissions trading (such as agriculture for the first five years of the current emissions trading scheme), and that emissions liability remains with government. It is ultimately borne by national taxpayers. In either case of liability devolution or retention by government, the liability rests with New Zealand residents in their capacity as consumers, business owners or taxpayers. Therefore, in both cases there is a national benefit in reducing the country's liability (or increasing its asset) by creating new renewable generation capacity to avoid the need for higher emitting thermal generation.
- 4.10 In short, the benefit to New Zealand from reducing emissions does not depend on whether we have an emissions trading scheme, a carbon tax or pay for international liabilities from general taxation. The benefit stems from the existence of international agreements which impose obligations on countries. While there may be uncertainty as to how we will distribute and manage the incentives to reduce emissions internally it is, in my opinion, very likely that over the foreseeable future New Zealand will have an obligation to reduce emissions by a significant amount or face an international price for emissions if it does not. New Zealand will also very likely have under any agreed scheme a significant financial incentive to exceed its obligations and reduce emissions more than its target.

- 4.11 Allowing for the carbon emitted in combustion from the different fuels, and their different transformation efficiency in generating electricity, a GWh of electricity from a gas fired plant would emit 380 tonnes of carbon dioxide, while generating the same power from a coal fired plant would emit 900 tonnes on average.¹⁶ On the conservative assumption that power dispatched from the Turitea Wind Farm would face the average transmission loss of 3.7% in reaching its load (whereas a thermal station displaced would not because most thermal stations are closer to the major consumption loads around Auckland), one GWh dispatched from the Turitea Wind Farm would avoid emissions of 867 tonnes of carbon dioxide if displacing coal fired generation, or 366 tonnes of carbon dioxide if displacing gas-fired generation. In total, a 336 MW wind farm at 45% utilisation could displace in a year around 484,950 tonnes of carbon dioxide from a gas fired plant, or 1,148,775 tonnes from a coal fired plant. If it only achieved 33% utilisation, the emissions displaced would be 355,386 tonnes or 841,857 tonnes respectively.
- 4.12 The potential economic value of these emission reductions is examined later in my evidence.

5 THE IMPACT OF TURITEA WIND FARM ON THE LOCAL ECONOMY

- 5.1 Economic benefit is commonly associated with the impact of expenditures of major production plant and developments on the local economy. I understand Mighty River Power's direct expenditure on construction of the Turitea Wind Farm is expected to be about \$900 million for 336 MW installed capacity.
- 5.2 From previous experience of wind farms in New Zealand, around 80% of capital cost is spent on imports of equipment and consulting skills, with the remaining expenditure spent on supplies from the local economy. If this ratio holds for the Turitea Wind Farm, the local impact of construction will be around \$180 million, depending on the final number and configuration of turbines. The number of persons expected to be employed on site during construction is approximately 100.
- 5.3 Much of the operations and maintenance expenditure after commissioning is also likely to be payments for goods or services imported from elsewhere with little direct implication for local expenditure. Operational expenditures which are most likely to be retained in the local economy are payments to staff on the site, of which I understand

¹⁶ These figures are derived from the Ministry of Economic Development's Energy Greenhouse Gas Emissions Data and contain no allowance for greenhouse gases other than CO₂. According to the United Kingdom Parliamentary Office of Science and Technology the carbon footprint of a coal fired power station is in excess of 1,000 tonnes CO₂e/GWh, and that for a gas fired power station is approximately 500 tonnes CO₂e/GWh. See: <http://www.parliament.uk/documents/upload/postpn268.pdf>

there will be 15 full time equivalents (FTE) per year. Total operations and maintenance expenditure I have been told by Mighty River Power is likely to be around \$11 million per year for a 336 MW installation. The direct impact from operations is likely to be at least around \$1.2 million per year, allowing for salaries and direct overheads of \$80,000 per person for those staff, and it would be higher to the extent that operational spending includes purchases from local suppliers.

5.4 Indirect impacts arise from the further spending in the locality by the recipients of the direct expenditures, e.g. suppliers of goods, services, labour and so on. These are estimated by means of economic multipliers which calculate how much additional spending occurs per dollar of direct expenditure, after allowing for the amount of “leakage” from the local economy on purchase of goods and services imported from elsewhere. In a much cited but now rather dated study, multipliers for output and employment in electricity, gas and water industries were estimated to be 1.6 and 1.7 respectively in Manawatu, compared to 3.2 in New Zealand at large.¹⁷ The national multiplier exceeds the regional multiplier because the smaller the region of interest, the greater the proportion of expenditure “leakage” as more supplies are sourced from outside the region. The corresponding figures for construction activity were 2.8 for output and 2.5 for employment in Manawatu, and 4.3 and 4.0 respectively in the country at large. The total expenditure impact of the Turitea Wind Farm could be indicated by applying these multipliers to construction and operational phases of the project, on the assumption that these multipliers have not changed since the dated study.

5.5 If these output multipliers still apply, and I believe that within a reasonable margin of error they should, the total (direct and indirect) impact in the local economy would be around \$504 million from the 336 MW installation of the Turitea Wind Farm construction phase. Similarly, in its operational phase the impact would be at least \$1.9 million per year from salary and other staff related costs, and would be higher if operational spending were on local purchases of supplies. The ground rentals to landowners would also generate further indirect expenditures, bringing the total impact from that source to \$3.0 million per year.¹⁸ If the labour multipliers still apply, and again I believe that within a reasonable margin of error they should, the total

¹⁷ Recent regional multipliers for specific industries in New Zealand are hard to come by because of limitations in the collection of inter-industry transactions statistics needed to calculate them, but the MAF publication “Regional Income Output and Employment Multipliers” (1985) estimates multipliers of 2.0 for output and employment in the electricity, gas and water sectors in Manawatu.

¹⁸ Calculated using the Manawatu pastoral sector output multiplier of 1.9.

(direct and indirect) impact would be approximately 250 FTE jobs during the construction phase, and 26 FTE jobs per year during the operational phase.

- 5.6 This impact will provide a stimulus to economic activity in the local economy, particularly in the construction stage. In the context of the economy around Palmerston North the impact will be less than in more remote locations with fewer employment alternatives. However, this can be an advantage, as the Palmerston North economy is large and diverse enough not to be overwhelmed by the influx of new activity on a single large project. It is also an advantage that there are other wind farms in the district, as the Turitea Wind Farm will bolster the demand for the pool of contractors specialising in servicing wind energy that is emerging in the district. The impact of the Turitea Wind Farm construction may also have added significance over the next couple of years as the country grapples with the impacts of local recession and the global financial crisis.

6 THE ECONOMIC VALUE OF THE TURITEA WIND FARM

- 6.1 As previously stated, the proposed Turitea Wind Farm with an installed capacity of 336 MW will have an annual output of electricity of around 1325 GWh at 45% utilisation, or 971 GWh at 33% utilisation. The economic value of this output for New Zealand depends on the resource costs avoided by having the Turitea Wind Farm, as indicated by the cost of generation by the next best alternative means, including the external costs of that alternative generation. This is a more appropriate measure of value than trying to estimate the net revenues received from the Turitea Wind Farm's operation. The latter is important from a private company perspective but from a national perspective is complicated by some of the profitability involving effective transfers from other companies.
- 6.2 In the short term, the next best alternative means of generating extra electricity output is likely to be an existing thermal plant. The Electricity Commission's latest Statement of Opportunities has assumed SRMC for gas and coal generation of \$56 and \$52 per MWh respectively¹⁹. These are based on conditions as at December 2007 and may be on the conservative side in light of increases in gas and coal prices in the first half of 2008, but they nevertheless serve to illustrate the magnitude of values involved. At the higher utilisation rate of 45% the proposed Turitea Wind Farm would generate 1325 GWh per year. Without allowing for transmission losses, at these SRMC alternative thermal generation would cost around \$74.2 million from a

¹⁹ See Electricity Commission SOO August 2008 (op. cit), Table 15

gas fired plant, and \$68.9 million from a coal fired plant.²⁰ Such generation would result in emissions of around 503,500 tonnes of carbon dioxide from a gas-fired or 1,192,500 tonnes from a coal fired plant. These emissions reductions have an economic benefit to New Zealand under the Kyoto Protocol and any similar international agreement that succeeds it.

6.3 The future price of carbon credits is difficult to accurately predict in the absence of a fully functioning global market. Currently a number of different types of carbon instruments are available, but their values vary widely because of differences in what they cover and where they can be used which effectively means they are operating in different markets. For instance, as an example of a mandatory regulated and Kyoto compliant market, the European Carbon Exchange trades European Union carbon dioxide emission allowances (EUAs) for use in the European Emissions Trading Scheme (EU-ETS). On 3 April 2009 the price for contracts for delivery in December 2009 was €12.52 per tonne of carbon dioxide or NZ\$29.10 at the current exchange rate.²¹ On the same day, the price of Certified Emission Reduction Units created under the Clean Development Mechanisms of the Kyoto Protocol for delivery in December 2009 was €10.82 per tonne of carbon dioxide or NZ\$25.15 per tonne. There is further price variation for Kyoto credits caused by a range of factors, such as risks around the delivery, the type of project, and the exchange rate. These prices have decreased from 2008 as the international financial crisis has intensified. It is likely that as the first Kyoto commitment period proceeds, the market for Kyoto compliant carbon instruments will broaden and may settle outside the current range. In the long term prices can be expected to rise as emission restrictions tighten and apply to more countries over time.

6.4 The value per tonne of carbon dioxide used by the Treasury in its estimate for February 2009 of the Kyoto liability is NZ\$25.15.²² Previously it had been around \$21 for some months, so I will illustrate the potential value of emission avoidance with a range that straddles the Treasury estimate, with a lower value of \$21 per tone and an upper value of \$33 per tonne. At the lower \$21 value the annual emissions avoided would be worth \$10.6 million if displacing gas or \$25.0 million if displacing coal. Combining the difference in generation costs with the value of emission reductions,

²⁰ This calculation is based simply on replacing 1 GWh of wind with 1 GWh of thermal generation. The costs of thermal generation may be slightly less if thermal plant are closer to the load demands they serve, and hence have lower transmission losses than the Turitea Wind Farm. However, it is not possible to predict which plant would be displaced or which load served, so I assume both plant face identical transmission conditions.

²¹ On 3 April 2009 NZ\$1 was worth €0.4302 (Reserve Bank of New Zealand).

²² <http://www.treasury.govt.nz/government/liabilities/kyoto/kyoto-table-feb09.xls>

the annual generation costs avoided and emissions reduction benefit from having the Turitea Wind Farm's generation would be \$84.8 million if displacing generation from gas-fired plant, and \$93.9 million if displacing generation from coal-fired plant.

- 6.5 With an upper range value of \$33 per tonne of carbon dioxide, the value of emissions avoided would be around \$16.6 million if displacing gas or \$39.4 million if displacing coal. The combined avoided cost of generation and emissions reduction benefit would then be between \$90.8 million and \$108.3 million, depending on the fuel displaced. As the Turitea Wind Farm is likely to displace generation from a mix of plant depending on conditions on the day, the annual result is likely to be somewhere within this range.
- 6.6 If the Turitea Wind Farm only achieves a low utilisation of 33% it will generate 971 GWh per year. The cost for an extra 971 GWh would be around \$54.4 million for a gas fired plant and \$50.5 million for a coal fired plant. In addition, thermal generation would emit around 368,980 tonnes of carbon dioxide from a gas fired plant or 873,900 tonnes from a coal fired plant. At \$21 per tonne of carbon dioxide the avoided emission of the Turitea Wind Farm would be worth \$7.7 million for a gas fired plant, and \$18.4 million for a coal fired plant. So the annual combined cost of generation and emissions reduction benefit by the Turitea Wind Farm at its lower utilisation would be \$62.1 million if displacing gas-fired plant and \$68.8 million if displacing coal-fired plant. At the higher cost of \$33 per tonne of carbon dioxide the combined annual figure would be \$66.6 million from gas or \$79.3 million from coal.
- 6.7 In comparing the displacement of a new wind farm of an existing thermal plant it is necessary to take account of the capital cost of the wind farm and compare its long run marginal cost (LRMC) against the SRMC of existing alternatives. On the basis of the construction and operating costs expected for the Turitea Wind Farm, the LRMC of the wind farm at 45% utilisation appears to be around \$69/MWh.²³ This is greater than the SRMC of generation alone for either gas or coal of \$56/MWh and \$52/MWh respectively. But as a consultant's report for the Electricity Commission indicates, the capital costs of gas and coal plants add approximately \$30/MWh for gas and \$50/MWh for coal to their respective SRMC, so it is clear that additional capacity wind

²³ This estimation is based on 30 year lifespan of the wind farm equipment, an 8% real rate of return on capital and \$11.4 million in real operating costs each year. 8% is the real rate of return Treasury requires to be applied in public sector cost benefit analyses of energy and water infrastructure.
See <http://www.treasury.govt.nz/publications/guidance/costbenefitanalysis>

generation using a high quality resource like that at Turitea is currently competitive with both of these alternatives for new plant commissioning.²⁴

- 6.8 For comparison with existing capacity, adding the value of the reduction in emissions at the conservative value of \$21/tonne of carbon dioxide would make the SRMC for gas approximately \$64/MWh and for coal \$71/MWh. Comparatively, the Turitea Wind Farm would not be competitive with existing gas plants, but would be competitive with existing coal-fired generation.
- 6.9 At the lower utilisation of 33%, however, the LRMC of the Turitea Wind Farm appears to be around \$94/MWh. This is still a better LRMC than from new coal-fired plant, but greater than a new gas-fired plant before accounting for emission reductions. Turitea Wind Farm's LRMC is less than the LRMC of coal-fired plant when the value of emission reductions are included, at even the lower \$21/tonne of carbon dioxide and lower utilization rate. Its LRMC on these conservative assumptions is very similar to the LRMC of electricity from a gas-fired plant. So, unless it was considered likely that the actual utilisation of the Turitea Wind Farm would be near or below 33%, it would be the choice of next plant to build if the alternative options were either a gas-fired or coal-fired plant. But the Turitea Wind Farm would not be competitive with existing plant unless the SRMC of thermal options or the price of carbon credits is considerably higher than they are in the base analysis.
- 6.10 What this implies is that, assuming New Zealand continues to honour its international commitments under Kyoto and to face a value for greenhouse gas emissions post Kyoto similar to or greater than it currently does under Kyoto, the Turitea Wind Farm is clearly a better option for expanding generation capacity than new thermal plant, provided its utilisation rate will be above about 35%. As new generation will be required to support expected growth in electricity consumption, new wind generation will have a worthwhile role to play in expanding generation. In the short run, its competitiveness depends on achieving a high utilisation and/or the price of carbon credits being above approximately NZ\$30. As it is likely that the price of carbon credits will increase over time, the situation may be less finely balanced than appears in the above estimates.

7 THE SCOPE OF ECONOMICS IN THE RESOURCE MANAGEMENT ACT

- 7.1 The Turitea Wind Farm is proposed to be located along a ridge of the northern Tararua Range, and is planned to have an installed capacity of up to 336 MW. The

²⁴ Parsons Brinkerhoff Associates (2006) *Electricity Generation Database: Statement of Opportunities Update 2006*, October 2006.

construction and operation of the wind farm will bring new expenditures into the local economy, and create new jobs, both from the direct expenditures related to the project and from the indirect flow on effects of subsequent rounds of spending by the recipients of that direct expenditure. In the context of the local economy in and around Palmerston North, these impacts are reasonably significant during the construction phase. This is especially so if this corresponds with a current period of low economic activity, but it is of relatively minor significance in the longer term into the operational phase.

- 7.2 The main economic significance of the new wind farm for resource management purposes is in the harnessing of a free and hitherto unused natural resource, wind, to create a valuable commodity, electricity. This is of benefit to the wind farm's developers, Mighty River Power, but also to the wider community, because of its ability to generate power to meet demands from consumers across the electricity system, and because of other consequences for the wider environment.
- 7.3 The purpose of the RMA is to promote sustainable management of natural and physical resources and there are several distinct threads in the RMA which take what the Environment Court in the *Marlborough Ridge* case described as an "economic" approach to sustainable management (*Marlborough Ridge Limited v Marlborough District Council* [1998] NZRMA73). Most relevant of these to the proposed Turitea Wind Farm is the reference in Section 7 (b) to efficient use of resources. Harnessing a free natural resource to create something of value will promote efficient use of resources provided the costs of harnessing are not greater than the value created. It can also have beneficial effects on the wider environment if the new wind farm displaces other less environmentally benign generation elsewhere, such as thermal generation with greenhouse gas emissions.
- 7.4 That Mighty River Power wants to proceed with developing the Turitea Wind Farm indicates that it believes it is an efficient use of its own resources. The company is a state owned enterprise charged with operating on commercial principles for its owner, the government, and has a responsibility to undertake viable projects. For RMA purposes, therefore, the private efficiency of the investment can be taken as given, and the focus can turn to the effects that are external to the company on the wider environment. The overall resource efficiency depends on a balancing of external effects that can be both positive and negative and, if the balancing is negative after all options to avoid, mitigate or remedy have been explored, on whether the balance is so large as to offset the efficiency gains the wind farm would provide.

- 7.5 The proposed wind farm fits particularly well with changes to the RMA made in 2004 and the objectives of government policy as currently expressed. The Resource Management (Energy and Climate Change) Amendment Act 2004 specifically amended Section 7 of the RMA to require decision makers to have particular regard to the benefits associated with the use and development of renewable energy sources (section 7 (j)). Section 104E regarding discharges of greenhouse gases requires consent authorities not to have regard to their effects on climate change, except to the extent that development and use of renewable energy enables a reduction of such discharges to air.
- 7.6 The New Zealand Energy Strategy, released in October 2007 after a period of preparation and consultation, outlined a long-term direction for New Zealand's energy system, to assist the energy sector and consumers to respond with greater certainty and confidence to future energy challenges and opportunities. This included a specific target to raise the proportion of electricity generation obtained from renewable resources to 90% by 2025, from around 70% at present, which would require substantial increments of new renewable generation capacity to be added. Further, the emissions trading scheme for greenhouse gas emissions, with a phased introduction for different sectors over the 2008-2013 period, which was provided for in legislation passed in October 2008, is intended to make emitting activities like thermal generation more expensive, so as to encourage electricity generation from lower emitting renewable sources.
- 7.7 The new government elected in November 2008 has repealed the previous government's legislative ban on the construction of new thermal generation plant for purposes other than security of supply. It has also set up a Select Committee to review the current emissions trading scheme and issued a new draft Government Policy Statement on Electricity Governance (GPS). This revised the previous GPS by: emphasising the priority which should be accorded by the Electricity Commission to security of supply; expressing the government's desire to facilitate small grid upgrade projects by streamlining the investment decision process; and deleting reference to the New Zealand Energy Strategy and the New Zealand Energy Efficiency and Conservation Strategy because both strategies will be reviewed in 2009.
- 7.8 These changes are, however, unlikely to signal the abandonment of policies aimed at reducing emissions and promoting renewable energy generation, such as wind farms, like the one proposed at Turitea. The National Party's official energy policy at the 2008 election included the following statements about what National will do: "make security of supply a priority, while providing clear policy settings that favour renewable

electricity generation”; “introduce an emissions trading scheme within nine months of taking office. We expect our ETS will result in no new coal stations unless carbon capture technology is proven” and “support the 90% renewables target but not let it get in the way of security of supply.”²⁵

7.9 The measure of economic value of the Turitea Wind Farm is its contribution to economic well-being in the community at large. This includes the benefits it provides to producers of electricity, to consumers of electricity and to third parties, such as those facing the consequences it creates on the wider environment. The scope of this benefit is national, not confined to just the local or regional economy, including:

- (a) Creation of a valuable commodity from a naturally renewable and previously unharnessed resource at this location;
- (b) Displacement of the need for additional thermal generation and its associated emissions;
- (c) Wider consequences for the electricity supply system and the availability of electricity to its consumers;
- (d) Net effects on local environmental amenity and on recreational and tourism opportunities; and
- (e) Expenditure impacts from employment and purchases in the economy (more significant for the local/regional economy than the national economy but more significant for the national economy in a time of recession or depression).

8 RESPONSE TO SUBMISSIONS

8.1 In my evidence I have provided what I consider to be responses to a number of the themes in the submissions made on the Turitea Wind Farm proposal. For clarity I will summarise the themes and my responses in this section.

8.2 A number of submitters have suggested that the project is of no benefit to the local community. I have provided estimates of the likely direct and indirect impact on the Manawatu economy in the form of expenditure and jobs. In my opinion, these are reasonably significant during the construction phase, especially if this corresponds with a period of low economic activity, but of relatively minor significance in the longer term into the operational phase. However, local residents will also share

²⁵ See <http://www.national.org.nz/Article.aspx?ArticleId=12069>

with other New Zealanders in the benefits arising from the reduction of New Zealand's Kyoto and post-Kyoto contingent liabilities or increase in its contingent assets, even if these are largely paid to Mighty River Power. It is a state-owned enterprise and its profits are available to the government. I have provided estimates of what these benefits could be at a national level. In addition, the local council will benefit under the arrangements it has made with Mighty River Power in return for access to the land and these benefits should flow through to the local community in the form of either lower rates or more services.

- 8.3 Another theme in submissions is that the Turitea Wind Farm will not reduce power prices. I have shown that Turitea Wind Farm is a relatively efficient way to increase electricity capacity when compared with gas-fired and coal-fired plant. If we do not increase generating capacity to keep up with the growth in the demand for electricity then there is nothing surer than that electricity prices will rise. Moreover, as I have also noted, given the insensitivity of demand to price in the short-run, the rise in electricity prices if supply does not keep up with demand would be very significant.
- 8.4 Several submitters have expressed the view that there are already too many wind farms in the region and extra plant should be placed elsewhere. The concentration of wind farms in the region reflects the favourable resources in terms of wind and other factors like grid location and support facilities in the region. There are real economic benefits to New Zealand from utilising the most favourable sites first. I have noted that there are also advantages in locating new plants where there are existing plants to utilise the infrastructure and local expertise that develops around an industry with specialised needs.
- 8.5 A related point raised in some submissions is that it would be more efficient to locate wind farms closer to the main load centre of Auckland. I have pointed out in my evidence that the New Zealand electricity market was designed to ensure that the costs of transmission are taken into account when deciding which plants will operate and transmission costs are also reflected in the price differentials around the country. This was done very deliberately to ensure generators are incentivised to take into account transmission costs when making decisions about where to locate additional generation capacity. That Mighty River Power wants to build the plant at Turitea indicates that, even taking into account transmission losses, it is the best option available to it, and one that it thinks will be relatively efficient compared with other possible locations for plant, given the quality of the wind resource available elsewhere.

- 8.6 Some submitters have argued we should not build more generating capacity as it just encourages waste. We should increase our energy conservation efforts instead. In my evidence I noted that the forecast of increased demand for electricity from the Ministry of Economic Development has a much lower growth expectation than the actual growth in demand experienced in the 30 years to 2005. It is forecasting 1.3% per annum whereas the historical experience was 2.8% per year. The Ministry's forecast already assumes a significant improvement in energy efficiency.
- 8.7 A stated aim of both the last Government and the current Government is to improve New Zealand's income relative to that of other countries in the OECD and relative to Australia. To realistically achieve this, the New Zealand economy will need to grow at 4 – 5% per annum in the medium term. Obviously, the 1.3% per annum increase in electricity demand relative to this 4 – 5% per annum economic growth implies a very significant reduction over time in the use of electricity per unit of national income.
- 8.8 A further argument raised in submissions is that wind farms are a passing fad that are only economic because of subsidies for reducing emissions and when the emission trading scheme is abandoned they will become uneconomic “white elephants” blotting the landscape. I have pointed out in my evidence that it is not the emission trading scheme that gives rise to the economic benefit to New Zealand as a whole from wind farms reducing greenhouse gas emissions. It is New Zealand's international agreements to reduce its emission levels that create the benefit. The emission trading scheme or a carbon tax or whatever approach we eventually adopt, is about how we as a community manage and distribute that cost and incentivize reductions in emissions. It is not about the benefit of emission reductions themselves. I have also given reasons why I believe New Zealand's potential liabilities or benefits in relating to emissions reductions are unlikely to disappear or become less onerous or potentially valuable in the foreseeable future, unless there is a major change in the global consensus of scientific thinking about climate change.
- 8.9 My evidence also shows that wind-powered generation on favourable locations, like Turitea, is a cost competitive compared with new gas-fired generation and significantly superior to new coal-fired generation, even without the benefits of reducing greenhouse gas emissions. New Zealand is in the fortunate position of having some high quality wind resources so it can efficiently expand electricity production by developing wind farms and get as a bonus a reduction of emissions. In most other countries they have to pay for the reduction in emissions by accepting a significantly less efficient form of generation.

9 SUMMARY

9.1 In summary, the proposed Turitea Wind Farm harnesses a free natural resource to create a commodity of value, creating a stream of economic benefits for the owners and the community for years to come. The sources of that benefit are:

- (a) Enhanced profitability for those connected with the production of electricity, principally Mighty River Power as plant operator but also the Palmerston North City Council and other adjoining landowners who receive rental from the occupation of the wind farm. These are private benefits for the parties concerned, although, in the case of the Reserve which will be utilized, the City ratepayers will benefit directly, and the general public will be the beneficiary indirectly. We can presume these arrangements to be beneficial as they are freely entered into;
- (b) Benefits, probably of substantial value, from the displacement of thermal generation and avoidance of greenhouse gas emissions, in the order of \$62 million to \$108 million per year, depending on the level of Turitea wind plant utilisation achieved, the price of carbon credits and whether gas or coal-fired generation is displaced;
- (c) Benefits for power consumers, through restraint on price rises over time because of less recourse to use of higher cost generation, though not readily quantifiable for a single plant such as Turitea;
- (d) Benefits to other aspects of the electricity system, in particular reducing transmission losses compared with some other options for expanding production, deferring the need for grid upgrades, and reducing the probability of power shortages: this is also scarcely discernible from a single plant; and
- (e) Positive stimulus to economic activity in the district, particularly during the construction stage, and if construction is undertaken during a period of low economic activity.

9.2 Against these benefits must be weighed a balance of third party effects such as disruptions to site use, displacement of some recreation activity, and potential impacts on visual amenity.

9.3 The proposed Turitea Wind Farm will improve resource use efficiency consistent with section 7 (b) of the RMA, and clearly aligns with the intent of section 7 (j). It also contributes to various strands of current government policy in making a contribution

towards New Zealand reaching or exceeding its Kyoto targets and helping to diversify the sources and locations of electricity generation in New Zealand.

- 9.4 In my opinion, granting the consents sought for the Turitea Wind Farm would provide substantial economic benefits for the national electricity system and New Zealand community. Incurring costs by restricting consents in favour of some other outcome would only be efficient if the gain to that outcome was greater than the value lost in restricting consents.

Brent Layton

1 May 2009

ANNEX 1

Table 1 Current generation across New Zealand

Calendar Year 2007

	Net generation		Installed capacity	
	GWh		MW	
Hydro	23,283	55.1%	5,366	58.8%
Geothermal	3,272	7.7%	450	4.9%
Oil	1	0.0%	156	1.7%
Coal	2,921	6.9%	671	7.3%
Gas	11,199	26.5%	2,029	22.2%
Biogas	157	0.4%	35	0.4%
Waste heat	43	0.1%	24	0.3%
Wood	486	1.1%	80	0.9%
Wind	928	2.2%	322	3.5%
Total	42,290	100.0%	9,133	100.0%

Source: MED, *Energy Data File*, June 2008, Tables G.1a, G.3b