BEFORE THE HURUNUI DISTRICT COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application by Mainpower New Zealand Limited for Resource Consent to Establish the Mt Cass Windfarm

STATEMENT OF EVIDENCE OF TODD STANLEY MEAD

INTRODUCTION

1. Qualifications and Experience

1.1 My full name is Todd Stanley Mead.

1.2 I am the Commercial Manager for MainPower New Zealand ("MainPower"). I have worked for MainPower since November 2004 as the Generation Development Manager responsible for the development of MainPower's Generation Strategy, including the investigation and commercialisation of renewable generation projects. In February 2007 my title changed to Commercial Manager and my role was expanded to develop and manage MainPower's energy efficiency strategy, stakeholder relationships and business development functions.

1.3 From April 2002 until November 2004 I was the Hydro Business Manager for ALSTOM Power, securing and managing a range of Power Generation projects both in New Zealand and Australia. From 2000 until 2002 I was an Engineering Consultant for Flour Daniel, an Engineering Consulting Company managing large engineering projects in the United States. From 1985 until 1999 I held a number of electricity generation engineering and project management positions for ECNZ/MightyRiverPower. Between 1990 and 1993 I was employed in the oil and gas industry working offshore as a field engineer in various countries.

1.4 My qualifications include a New Zealand Certificate in Mechanical Engineering 1987, Bachelor of Mechanical Engineering (First Class Honours) from Auckland University 1989 and a Masters in Engineering Management from Colorado University 1998.

2. Purpose and Scope of Evidence

2.1 The purpose of my evidence is to discuss the following aspects relevant to the Mt Cass application:

a. The importance of electricity and key issues in respect of its generation;

b. Growth in demand for electricity both nationally and locally;

c. Renewable energy as the preferred generation option;

d. The benefits of wind powered generation;

e. A discussion of alternative generation technologies and alternative wind farm sites being explored by MainPower; and

f. Conclusions

3. Executive Summary

3.1 A reliable supply of electricity is one of the most fundamental requirements of modern life. Without this reliable supply, the social and economic wellbeing of New Zealand will be compromised.

3.2 MainPower has a strong commitment to explore and develop options for the generation of renewable energy in order to meet the ongoing growth in demand for electricity consumption nationally and, more importantly, in the North Canterbury and Kaikoura regions.

3.3 Demand for electricity in New Zealand has consistently been growing at a rate of 2% per annum over the last 20 years. For the last 5 years the demand growth has been close to 4% per annum for MainPower's region. This growth in demand cannot be met simply by efforts or initiatives to reduce energy consumption. Even assuming a strong increase in energy efficiency, approximately 3,000-3,500 MW of new renewable generation will be required by 2025.

3.4 To mitigate the impacts of climate change and protect energy security, the Government has provided clear policy preference for renewable energy generation with a headline target of 90% renewable generation by 2025.

3.5 Wind is a mature and cost-effective technology and is ideally suited as a means of generation in North Canterbury.

3.6 Mt Cass is MainPower's only commercial wind generation site in North Canterbury

4. Importance of Electricity to New Zealand

4.1 Mr Berge has already provided the panel with some background as to MainPower and its long association with the North Canterbury Community. Mr Berge has also referred to MainPower's conscious

decision to diversify into renewable electricity generation as a complement to its role as a distributor.

4.2 It would be fair to say that the provision of electricity is something communities take for granted, notwithstanding ongoing media reports highlighting, in particular, the supply risk associated with meeting increased winter demand during dry years like the 2008 winter.

4.3 A reliable and competitively priced supply of electricity is critical to the wellbeing of New Zealand society. It is a key element supporting all spheres of the New Zealand economy including commerce, manufacturing and industry. It supports other fundamental facilities including communications, schools and universities, hospitals, entertainment facilities, libraries and of course our homes.

5. **Drivers for Renewable Energy**

Flight from Fossil Fuels

5.1 Recently the major New Zealand generators have moved away from investment in new fossil-fuel plants to renewables (including wind) in response to the relative future economics of renewable energy. For example, Meridian Energy announced in 2004 a commitment to generate energy solely from renewable sources in the future.

5.2 A leading driver of this change is that carbon emissions from, amongst others, thermal generation plants will now be priced in the New Zealand economy via the recently introduced Emissions Trading Scheme (ETS)..

5.3 Cheap Maui gas has underpinned low energy prices in New Zealand since the 1970's. However, this resource is now in sharp decline and oil and gas prices have risen steeply in the last few years and are currently very high by historical trends. This rise is in part due to the recognition of 'peak oil', the realization that extractable oil reserves are not being replaced by new discoveries, whilst world oil demand

continues to rise. The International Energy Agency expects global demand for oil to grow by 37% by 2030[1]. New Zealand is particularly exposed since the bulk of its oil consumption is imported at a cost of NZ$ 4.4 billion per annum[2] severely affecting the country's balance of payments.

5.4 The combined concerns of price, climate change and energy security have resulted in many countries establishing ambitious targets and policy frameworks to encourage an increasing percentage of energy coming from indigenous renewable resources rather than from fossil fuels.

Emissions Reductions

5.5 By signing the Kyoto Protocol in December 2002, New Zealand committed to reduce its annual average greenhouse gas (GHG) emissions to 1990 levels in the first commitment period between 2008 and 2012. The Ministry for the Environment reported that New Zealand's total GHG emissions in 2006 were 33% higher than the 1990 level[3].

5.6 To encourage a reduction in emissions the Government introduced an Emissions Trading Scheme (ETS) across the economy that means eventually *"all major sectors of the economy will be exposed at the margin to the international price of emissions[4]*". The stationary energy sector (*i.e.*, electricity generation) is scheduled to be brought into the scheme on 1 January 2010.

5.7 With the introduction of the ETS, renewable generation will become economically more attractive because fossil fuelled generators will have to pay for any carbon emitted.

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[1] www.worldenergyoutlook.org/2007.asp

[2] New Zealand Energy Strategy 2007

[3] www.med.govt.nz/upload/63349/GHG%20Report.pdf

[4] www.mfe.govt.nz/publications/climate/framework-emissions-trading-summary-sep07

A Need for Urgency

5.8 Global climate change is happening. The recently released Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report found that "*warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level*[5]".

5.9 Recently the Chair of the IPCC, Rajendra Pachauri said "*climate change was moving faster and more destructively than once thought and only seven years remained for decisive action. To limit global temperature increases at century's end to no more than 2.0 to 2.4 degrees Celsius emissions have to peak no later than 2015*[6]"

5.10 The United Nations Development Programme published the Human Development Report 2007/2008 in late 2007. This report applied the findings of the IPCC Fourth Assessment Report on climate change, assessed the implications on human development and proposed a range of mitigation and adaptation strategies. The headline finding was that the world has less than a decade to start the transition to low-carbon energy systems and the report calls for the developed nations to act swiftly to make deep cuts in emissions and then provide support to the developing nations to allow further development without fossil fuel dependence.

5.11 The human development report also predicts:

> *"The world is heading towards unprecedented losses of biodiversity and the collapse of ecological systems during the 21st*

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[5] www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

[6] //www.terradaily.com/reports/Serious_omission_in_G8_summit_climate_pledge_IPCC_chief_999.html

Century. At temperature increases in excess of 2°C, rates of extinction will start to increase[7]"

5.12 More recently, the Australian Garnaut review (June 2008) observed that emissions scenarios used for the IPCC Assessment Report do not adequately consider the recent acceleration in emissions growth from developing countries and thus may overestimate the time available in which to take action. Garnaut comments:

"Mitigation effort is increasing around the world, but too slowly to avoid high risks of dangerous climate change. The recent and projected growth in emissions means that effective mitigation by all major economies will need to be stronger and earlier than previously considered necessary[8]"

Preference for Renewables

5.13 Renewable energy sources are indigenous resources, they enhance energy security as supply chains cannot be disrupted by global demand or conflict. They also provide a buffer against escalating costs as diminishing fossil fuel reserves are increasingly benchmarked against global markets.

6. Do We Need More Renewable Generation?

6.1 The demand for electricity has grown at a consistent rate over the past 20 year's ref Figure 1. Electricity consumption has increased from approximately 27700 GWh in 1985 to 41500 GWh in 2005, which represents an average growth rate of approximately 2.2% per annum. This is attributable to a combination of economic growth as measured in Gross Domestic Product (GDP) and also a growth in population.

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[7] www.hdr.undp.org/en/reports/global/hdr2007-2008/

[8] www.garnautreview.org.au

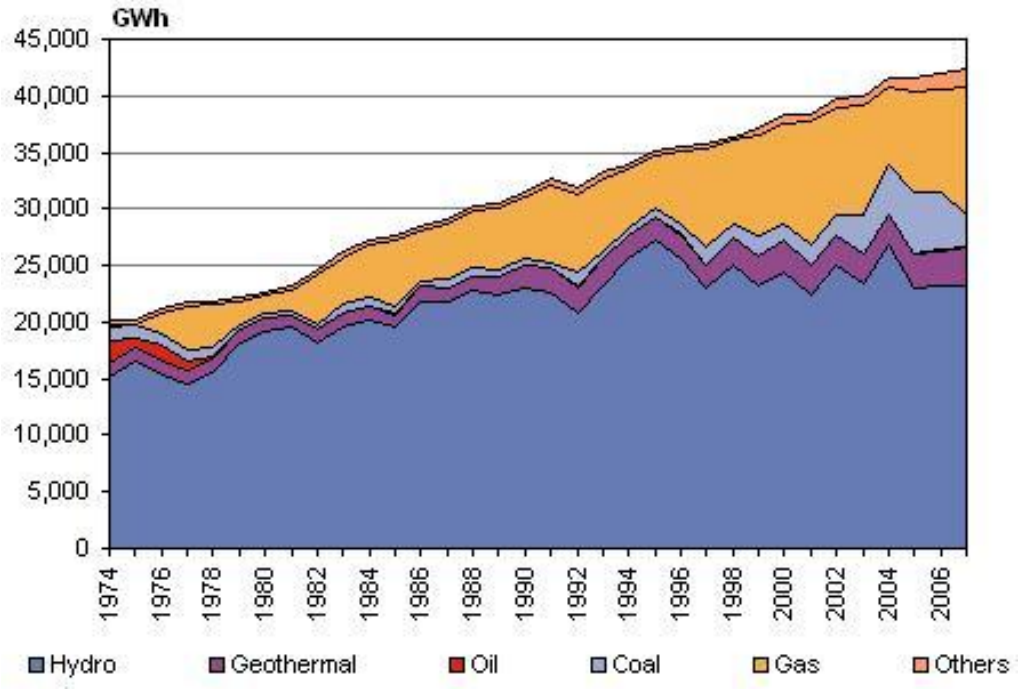

Figure 1: New Zealand electricity demand 1974 - 2007

6.2 As of 2007, New Zealand has around 6,100 MW of renewable generation capacity and 2,800 MW of fossil fuel generation.

6.3 The New Zealand Energy Strategy (NZES) sets a target of 90% renewable electricity by 2025. The NZES is complemented by the New Zealand Energy Efficiency and Conservation Strategy (NZEECS) which sets ambitious targets for demand reduction over the same period.

6.4 Electricity demand is forecast to grow by 1.3% per annum which equates to 25-30% growth by 2025[9]. This projected growth is significantly lower than recent historic levels of growth (around 2% per annum).

6.5 Taking account of growth in overall demand, introduction of energy efficiency measures and generation load factors, means that approximately 3,000-3,500 MW of renewable generation capacity will need to be built by 2025. In other words, New Zealand needs around

[9] New Zealand Energy Strategy 2007

150-175 MW of new renewable generation capacity each year, most of which is expected to come from wind and geothermal sources.

Regional Issues

6.6 Environment Canterbury has sponsored the Canterbury Regional Energy Strategy Project. Their Stage 1 report (April 2007) highlights the dependence of the Northern South Island on transmission links from the Waitaki Hydro schemes and an increasing reliance on thermal generation from the North Island[10].

6.7 The impacts of this shortfall of local generation include; reduced security of supply and a high cost in transmission losses. Across New Zealand an average of 7.7% of electricity generated is lost during transmission and distribution[11] as a result of generation located remotely from the electricity consumer, this figure is higher during times of peak demand**.** Proposed solutions include developing more local generation incorporating diversity in both geographic location and energy source.

6.8 Within MainPower's region, the population and economic growth has exceeded the national average and the population (in Kaikoura, Hurunui and Waimakariri districts) is forecast to grow from 56,934, by 42%, to 80,690 by 2031[12].

6.9 Electricity demand growth in MainPower's region has averaged approximately 4% pa for the last 5 years (ref Figure 2) and is forecast to continue to grow at around twice the national average - from 520 GWh at present - to 770 GWh by 2018.

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[10] Canterbury Regional Energy Strategy Project – Stage 1

[11] Energy Data File 2008; Ministry of Economic Development

[12] www.dol.govt.nz/publications/lmr/regional/indepth/canterbury/aidr-canterbury-08_04.asp

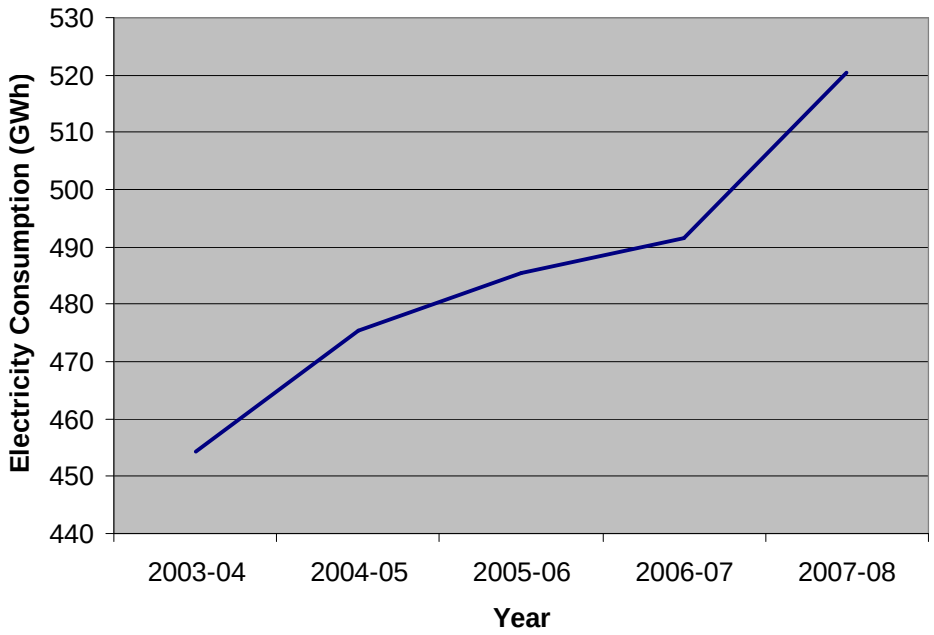

Figure 2: Electricity demand growth in MainPower area of supply over past 5 years

6.10 This high regional growth is driven by the encroachment of Christchurch's urban growth into the surrounding districts; irrigation and subsequent intensification of land use, and; increasing tourism activities in places like Hanmer, Kaikoura and Waipara. 'Clean Air' initiatives by Environment Canterbury and 'energy switching' from more expensive fossil fuels will also contribute to an increase in local electricity demand.

6.11 At present there is no electricity generation within MainPower's region. A wind farm at Mt Cass could supply the annual energy needs of up to 40% for MainPower's region at the current level of demand.

7. Why Wind?

7.1 Wind is a mature and now competitively priced source of generation. Countries such as the United States Denmark, Germany, Spain, the United Kingdom, India and China have seen massive growth of wind farm installations with wind energy being now used in more than 70

countries. In 2007 alone, 19,700 MW of new wind energy capacity was added, generating in total more than 1% of global electricity.[13]

7.2 In New Zealand's high wind climate, wind can produce power at costs competitive with other forms of generation. However, New Zealand's installed wind generation capacity is lagging significantly behind these and other countries where government support has fostered a growing industry.

7.3 The fuel (wind) is free and everlasting which, in comparison with fossil fueled generation means that the future price of electricity from a site is more-or-less locked in at the time of construction. The recently released report into hydro and wind correlation by the New Zealand Institute of Economic Research confirmed "*the role of wind and hydro power in suppressing spot prices*[14]"

7.4 Wind's short-term variability also dovetails extremely well with New Zealand's base load hydro capacity which has fast start/stop capability. Wind "*varies less then lake levels, between months and between years*[15]" providing consistency over the long-term.

7.5 The environmental footprint of wind is low compared to other forms of generation because the land around the turbines (typically 97% of a site area) can continue to be used as it always has. Wind farms are 'reversible' - If future technology developments mean that wind energy is no longer required then the turbines can be removed and land restored substantially to its former condition.

Consistency with Current Government Policy

New Zealand Energy Strategy (NZES)

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[13] http://www.wwindea.org/home/images/stories/pr_statistics2007_210208_red.pdf

[14] Exploring wind-hydro correlation, NZIER, September 2008

[15] Exploring wind-hydro correlation, NZIER, September 2008

7.6 The Government published the NZES in October 2007. As noted above the Strategy sets a major objective of achieving 90% renewable electricity by 2025, up from approximately 66% in 2006. This will require approximately 3,000-3,500 MW of additional renewable generation capacity by 2025. The Government has also recently enacted legislation to enforce a moratorium on the building of new thermal baseload generation plant for 10 years.

7.7 The NZES lists 3,600 MW of new generation projects that have "*either been given consent or are under consideration, although not all will be built or given consent*[16]". It lists 1,935 MW of wind projects (including Mt. Cass) and, since the NZES was released, Contact Energy announced the 540 MW Hauauru Ma Raki (Northwest Wind) project on the Waikato west coast.

7.8 Including Hauauru Ma Raki, 82% of planned projects are renewable and nearly 2,500 MW of the total (58%) are wind projects, together with 633 MW of new geothermal and 149 MW of new hydro projects. Clearly the majority of new generation developments in New Zealand will be wind farms (ref Figure 3).

7.9 Investing in wind projects will reduce New Zealand's dependence on fossil fuels, lead to a reduction in CO_2 emissions and will help meet New Zealand's Kyoto commitments.

[16] New Zealand Energy Strategy 2007

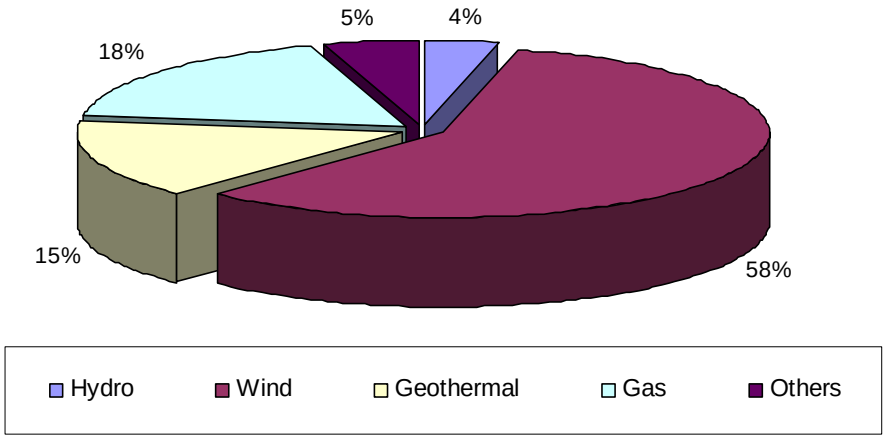

Figure 3: Proposed new generation under consideration[17]

Energy Efficiency and Conservation Strategy (NZEECS)

7.10 The NZEECS was published at the same time as the NZES and includes an action plan to increase the efficiency of energy use and promote the uptake of renewable electricity.

7.11 The NZEECS places a strong emphasis on reducing consumption of electricity and encouraging small scale network connected 'distributed generation'. MainPower is a leader in both of these initiatives.

7.12 Since 2004 MainPower has led energy efficiency in the North Canterbury community by promoting and part-funding a 'warm homes' insulation program in the North Canterbury and Kaikoura communities. In 2008 the 500th 'warm home' installation was completed, representing more than $1 million investment in installation retrofits in MainPower's community (funded approximately one-third by MainPower).

[17] New Zealand Energy Strategy 2007

7.13 Other energy efficiency programs funded by MainPower include energy audits of large users, energy efficient light-bulb promotions, a school education programme promoting the efficient use of energy and seed funding to establish a new program to assess and improve New Zealand's home efficiency.

7.14 MainPower can also demonstrate a strong involvement in promoting small scale distributed generation technology. Specific projects are discussed more fully in Appendix A.

7.15 Energy efficiency and small-scale distributed generation will remain important to MainPower. But alone, it will not be enough to off-set the growth in electrical demand.

National Policy Statement for Renewable Electricity Generation (NPS)

7.16 The proposed NPS has been discussed by Mr Christensen in his legal submissions and will be referred to by Ms Whyte in her planning evidence. In my view, it is yet another example of a consistent response by the Government to confronting climate change.

7.17 Quite clearly, the proposed NPS requires decision-makers to balance the national and regional benefits of renewable generation against the inevitable local effects which will occur with the development of any renewable energy project. Decision-makers must however recognise the simple reality that renewable energy development will inevitably create effects, but that to a greater or lesser degree (depending on the project), such effects can be reversible.

7.18 Importantly, the NPS recognises that the benefits of renewable generation, regardless of scale is a matter of national significance. From a policy point of view, this lends considerable weight to projects such as Mt Cass.

Electricity Industry Reform Amendment (EIRA)

7.19 Outlined in both the NZES and the NZEECS is the objective of relaxing some conditions around investment in generation by lines companies. After consultation during 2006 and 2007, legislation was passed that encouraged lines companies to invest in generation with a clear preference for renewable generation.

Wind Generation Investigation Project (WGIP)

7.20 Since 2005 the Electricity Commission has been conducting strategic and tactical projects to assess the likely impact of wind generation development on the New Zealand power system[18].

7.21 The studies found that there are significant benefits to New Zealand's electricity system in geographic diversity of wind farms. Benefits include:

a. **Consistency:** Greater diversity of location means that it is more likely that a wind farm somewhere in New Zealand will be generating at any one time.

b. **Smoothness:** Greater diversity means that it is less likely that wind farms will be experiencing extreme wind changes at the same time, so the overall output from all wind farms is smoother.

c. **Predictability:** If wind farms are geographically separated, forecasting errors will have less effect on the overall output from wind farms.

7.22 A wind farm project in North Canterbury will be an important addition to the geographic diversity of current wind farm locations in New Zealand. Apart from the single wind turbines located at Gebbies Pass

[18] www.electricitycommission.govt.nz/opdev/comqual/windgen/wgip

and Southbridge, South Island's only operational wind farm is located near Mossburn, approximately 460km from Mt Cass.

8. Alternative Wind Sites to Mt Cass in North Canterbury

8.1 MainPower is monitoring wind at a total of 9 sites in North Canterbury.

8.2 These sites were selected using engineering judgement along with a number of factors to prioritise sites including:

- Likely wind resource
- Proximity to the National grid and/or local network
- Surrounding topography and accessibility
- Consent-ability (including consideration of proximity to dwellings, main viewsheds and district plan designations)

8.3 Investigation and wind farm development rights were negotiated at six of these sites with the Landowners. Table 1 illustrates the current status of MainPower's wind monitoring program

Site	Tallest mast	Monitoring Since:
Mt Cass	60m	1997 (at 12.5m)
Doctors Hills	50m	2005 (at 10m)
Mouse Point	10m	2004
Isolated Hill	50m	2004 (at 10m)
Mt Catherine	20m	2005 (at 10m)
Greta	10m	2006
Hawkswood range 1	10m	2003
Hawkswood range 2	12m	2003
Teviotdale	20m	2007

Table 1: MainPower's Wind Monitoring Sites

8.4 Data recorded at all sites includes wind speed and direction at 10 min intervals. Analysis of the wind data includes an assessment of turbulence intensity, gustiness and a correlation with a record of long-term wind speed. The monitoring programme is in conformance with appropriate international standards.

8.5 Figure 4 shows a comparison of all nine sites based on the mean annual wind speed and normalised to allow direct comparison with Mt Cass.

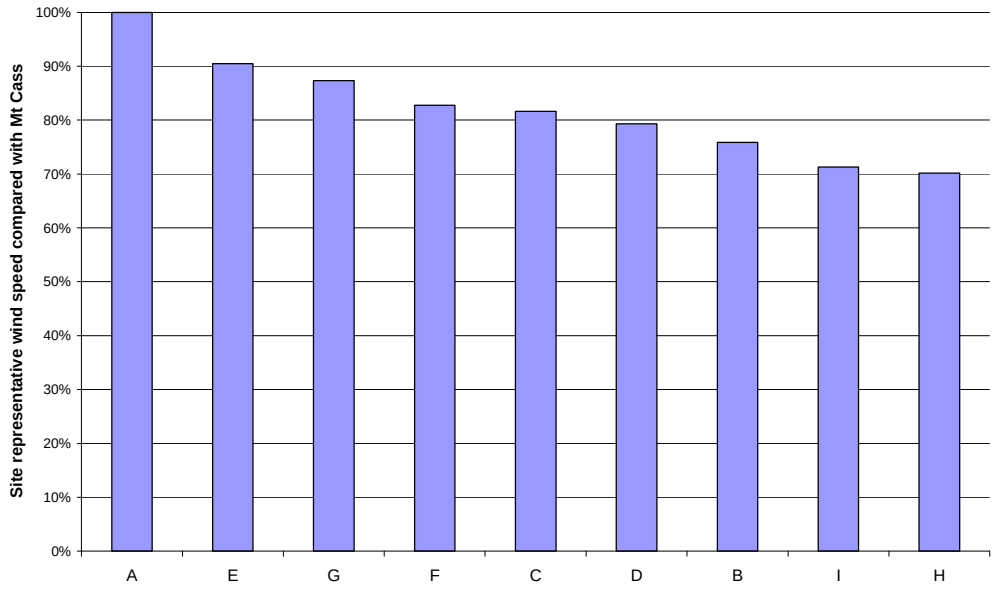

Figure 4: Comparison of all nine MainPower sites based on the mean annual wind speed

Figure 4 is graphed on the following basis:

- Sites are normalised for comparison with Mt Cass (where Mt Cass is 100%)
- Sites are sorted in order of mean annual wind speed and do not relate to the order in the monitoring programme in Table 1.
- Mean wind speeds are predicted from the measured data and from wind flow modelling as being indicative of the long-term annual average, at an assumed 80m hub-height.
- Mean wind speeds are also modelled to be representative of the entire wind farm site.

8.6 Mt Cass has the best wind resource of all the potential wind farm sites in North Canterbury that MainPower is currently monitoring. Mt Cass has an average wind speed at least 10% higher than the next best site in MainPower's portfolio.

8.7 The average wind speed at a particular site is the key determinant in calculating the energy yield per turbine. Mr Wong Too from Garrad Hassan will expand on this in his evidence.

8.8 In addition to the excellent wind resource and availability of property rights, the Mt Cass site has other positive attributes, including isolation from dwellings and the proximity of the existing lines network and a robust connection to the national transmission system.

8.9 A number of submitters have suggested MainPower should develop a windfarm on Doctor's Hill instead of Mt Cass. However, the mean wind speed at that site, current electricity price forecasts and turbine prices preclude MainPower even investing in a full feasibility study at Doctors Hill. Some time in the future this may change and if it does MainPower will commence work. However, given climate change and energy security concerns along with increasing electricity demands, MainPower is of the view both sites should then be developed.

8.10 MainPower recently submitted an application to EECA for part funding of a feasibility study[19] for a small wind farm located on Isolated Hill using second-hand turbines. The approximate windfarm size will be 5 MW and will be contingent on obtaining consents and locating suitable second-hand turbines.

Long Run Marginal Cost (LRMC)

8.11 A useful measure of the economic viability for any generation project is the Long Run Marginal Cost – or LRMC. The LRMC is the wholesale price of electricity whereby if the expected price of power exceeds that level, it is worthwhile proceeding with the project. That is to say that LRMC can be regarded as the break-even power price to enable the project to proceed.

8.12 The project economic analysis for Mt Cass shows the LRMC to be around $100/MWh which fits into the expected LRMC range identified in the NZES for new generation in New Zealand (ref Figure 5) and it can be considered an efficient use of the available resource.

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[19] EECA Pilot feasibility fund for distributed generation, September 2008

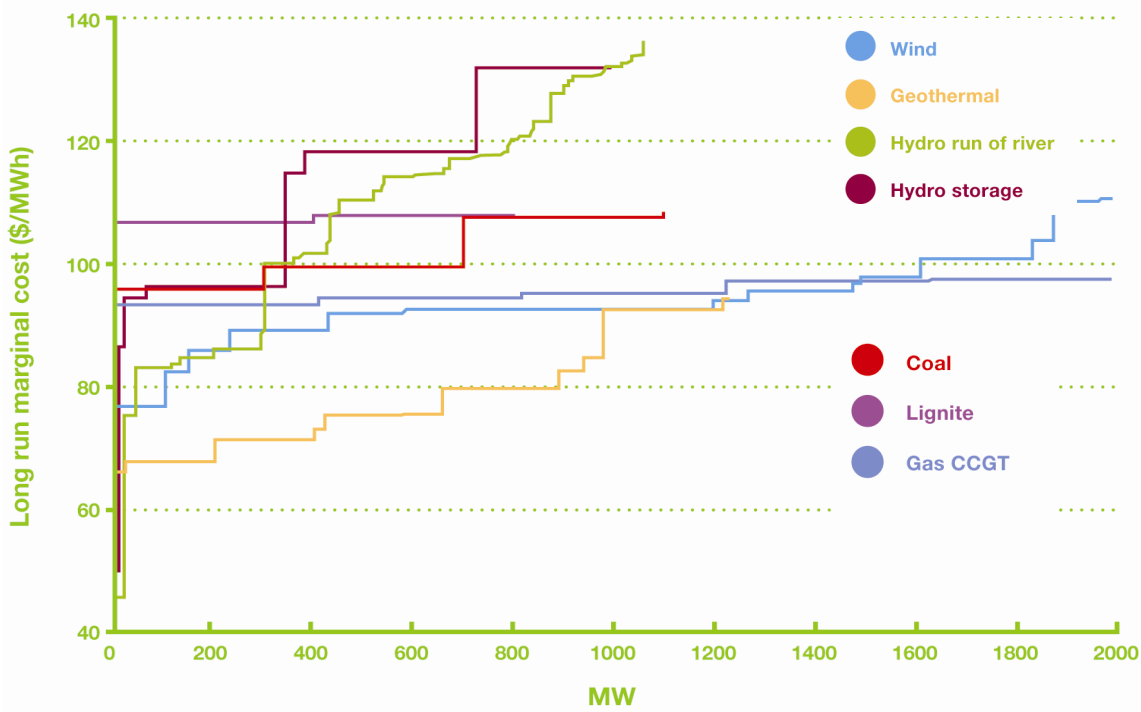

Figure 5: LRMC Paths from the New Zealand Energy Strategy 2007

8.13 MainPower calculated the LRMC for its other sites based on similar assumptions to Mt Cass including: turbine characteristics (hence generation profile); turbine prices; unit costs for civil construction, and; electrical works. But, using site specific information such as: mean wind speed and direction; turbine layout; road length, and; distance to a suitable network connection, shows that the next best site has an LRMC of approximately $120/MWh. That is a 20% increase in average long term wholesale electricity price will be needed before MainPower's next project becomes an economic proposition even though MainPower's next best site has only 10% lower mean annual wind speed.

8.14 Figure 5 shows that all the electricity generation development envisaged in the NZES to 2025 (150-175 MW a year or approximately 3,000-3,500 MW overall) is expected to be developed from renewable sources at less that $120 LRMC. Thus sites at this price level are not expected to be developed until after 2025.

Wind Farm Size in the New Zealand Context

8.15 The Mt Cass wind farm is not large when compared to other wind farm projects throughout New Zealand. In an analysis of 24 existing and proposed wind farms, (ref Figure 6), Mt Cass is in the bottom third at about 10% of the size of Project Hayes and Hauāuru mā raki.

8.16 Mt Cass is a similar size and in a similar wind environment to the Te Uku Windfarm near Raglan which was recently granted resource consent. Economic evidence presented at the Te Uku hearing showed that development to be marginally economic and having just sufficient economies of scale to make the project viable. A reduction of just one or two turbines was demonstrated to render the project uneconomic.

8.17 Mt Cass is in a similar position to Te Uku, in that the scale of the project is critical to project viability and the full ridge needs to be utilised.

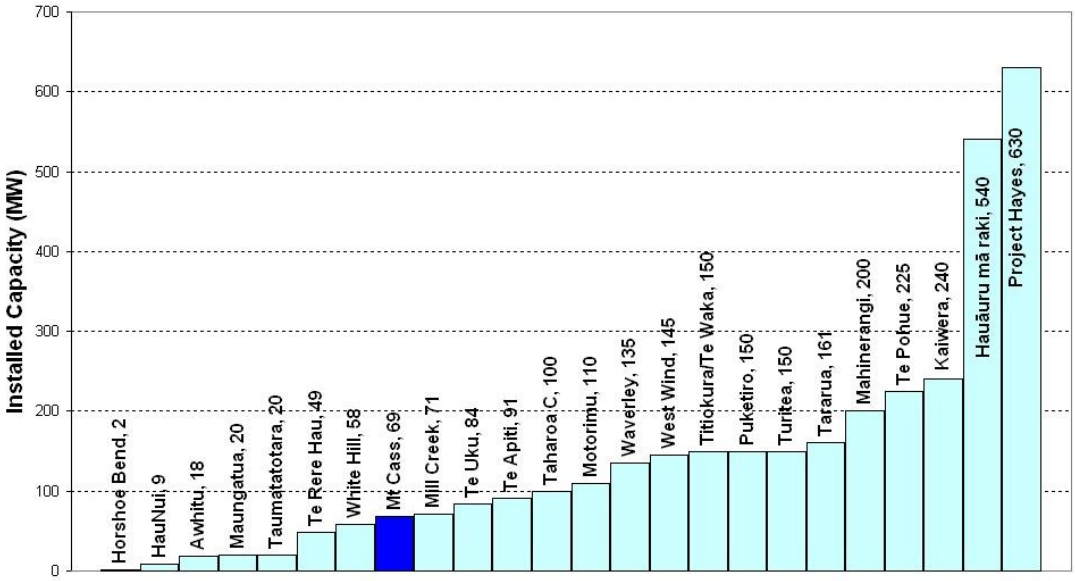

Figure 6: Comparing size of existing and proposed wind farms

8.18 White Hill wind farm is slightly smaller than Mt Cass and was commissioned in 2007. The site was consented in late 2004 at 70 MW installed capacity but was built with less turbines due to

constraints in the local electricity network, it is also understood to have a better wind resource than Mt Cass.

8.19 The economic viability of the White Hill windfarm was assisted by Carbon Credits received under the now defunct Projects to Reduce Emissions programme.

MainPower's Wind Sites - Summary

8.20 MainPower has completed desktop feasibility analysis on all sites but has undertaken a comprehensive feasibility study only on the Mt Cass site because that is the site with the best wind resource and the only commercial wind resource using present electricity price forecasts.

8.21 The analysis results in the clear conclusion that given current wholesale electricity price expectations, MainPower would not commit to building another wind farm from its current suite of sites in North Canterbury. This is for two reasons:

- As a community trust owned business MainPower is a guardian of public money and has a responsibility to spend that money prudently.
- For a project the size of Mt Cass prudent investment and risk management will mean that MainPower will either have a development partner or substantial debt component of the project. Accordingly, the project has to provide a sufficient return to attract either an equity and/or debt partner.

Alternative Renewable Generation Technology

8.22 Along with wind, MainPower is actively pursuing other renewable generation projects including small-scale hydro and solar. MainPower is also monitoring technology advancements in other areas including marine and micro-generation. This work is outlined more comprehensively in Appendix A.

8.23 Some projects are at very early stages of investigation. Other projects have extensive planning hurdles to be navigated. While some of the projects and technologies have possibilities, it is clear that at best, they represent a useful complement to Mt Cass in enabling the North Canterbury community to become self-sufficient in renewable energy.

9. **Conclusion**

9.1 Increasing demand for electricity and a lack of expansion of New Zealand's generation capacity have seen prices rise and growing concerns about shortages. Within MainPower's region, the demand for electricity is growing faster than the national average, but there is still no commercial electrical generation. Transmission constraints and demand growth in the Northern South Island make it one of the most exposed regions for electricity supply in the country.

9.2 International concern over climate change and sustainability in general, has led to the recent adoption of the NZES and the introduction of the ETS with a target for 90% renewable energy by 2025 and a 10-year moratorium on new thermal base-load capacity. Wind power is expected to make up the vast majority of new capacity required to reach that 90% target.

9.3 Having wind farms with geographic diversity helps with forecasting changes from wind generation and smooths the inherent variability of wind energy production.

9.4 MainPower has investigated opportunities for development of generation projects within its region over many years, including this becoming a significant business focus since 2004.

9.5 The Mt Cass wind farm will:

a. Supply power within the Northern South Island;

b. Add to the geographical diversity of wind generation;

c. Provide up to 40% of the annual power requirements for MainPower's region;

d. Have sufficient wind resource and scale to be an economically viable site; and

e. Produce power within the LRMC paths shown in the NZES.

9.6 Mt Cass is the only MainPower site that meets all of the above criteria.

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APPENDIX A – Alternative Renewable Generation Technology

Hydro

i. MainPower is actively investigating two-mini hydro projects. Both hydro projects will be in conjunction with irrigation schemes. However, current planning guidelines and the competing demand for fresh water means any proposed hydro developments are extremely time consuming, costly and risky to navigate through the relevant planning frameworks.

ii. If both hydro projects are developed they have the potential to supply approximately 9.5 MW or 10.8% of the peak load and 11% of MainPower's regional annual energy consumption. However, as both schemes have yet to enter the detailed design stage, these figures should be treated as preliminary.

iii. MainPower has also investigated the potential hydro opportunity in the Amuri Irrigation scheme, near Culverden. This irrigation scheme has the technical potential to supply approximately 3.5 GWh or 0.7% of MainPower's regional energy consumption by utilising the existing water race 'drop structures' to generate electricity. However, there remains significant practical issues to resolve around the joint use of the irrigation assets including year-round use of the intake and canal assets, operating and maintenance cost sharing and liability issues prior to any detailed design work being initiated. Without year-round water use, none of the drop-structure schemes are economically viable for electricity generation. Full resource consents for water use would also have to be obtained.

iv. MainPower is also involved in the Hurunui Water Project which is investigating storage potential in the headwaters of the Hurunui. While this project is focused on providing reliable irrigation water, there is potentially 10-15 MW of hydro generation available,

equating to approximately 11-16% of MainPower's energy needs assuming a 65% capacity factor.

v. However, this project is still in the early feasibility stages and the LRMC of the electricity generation infrastructure appears high and there are significant planning hurdles including a water conservation order application to work through. So this potential electricity generation should be considered to be at the pre-feasibility stage at best.

Landfill Gas

vi. Although MainPower does not have any ownership interest in the Kate Valley Landfill, it is expected to generate some power from landfill gas production. Projections provided with the resource consent application suggest sufficient gas will be available for a small generator from around 2010 and the supply will build up to a peak of around 6 MW after 30 years. Generation will decline after the peak and will be less than 1 MW after another 40 years.

vii. During its years of operation the landfill gas generation will make a valuable contribution to regional demand but will meet less than 10% of peak load and about 10% of annual consumption. It will also have a finite life.

viii. This generation will be complementary to Mt Cass and their geographic proximity has the benefit of allowing sharing of some infrastructure. It may also be possible to control the flow of landfill gas to help balance variations in the wind generation, although this has yet to be investigated.

Geothermal

ix. MainPower has conducted a desktop review of the geothermal resource concentrated around the Hanmer Basin. The resource is already well utilised by the Hanmer Springs Thermal Reserve and

is too low in temperature to be used for electricity generation. Some low heat industrial use may be possible, which could then possibly offset electricity or fossil fuel use.

Methane

x. MainPower is involved in an assessment trial with Hanmer Springs Thermal Reserve to assess the quantities of methane gas from existing hot water bores in Hanmer. This gas source was previously used to fuel streetlights in Hanmer prior to local electricity reticulation. Investigations are at an early stage but indications are there is no commercial resource of methane available for electricity generation.

Solar Photovoltaic

xi. MainPower has maintained a strong interest in grid connected solar photovoltaic's (PV) since the mid-1990's when it installed what was then South Island's largest grid connected PV array at Rangiora High School and become a founding member of the New Zealand PV Association.

xii. In 2006 MainPower commissioned a larger PV array on its Rangiora office frontage by installing 83 PV panels with a total capacity of 6.6kW to provide both building shading and to generate local electricity.

xiii. MainPower also installed smaller grid-connected PV arrays on a local fire station at Oxford, a St John's building in Culverden and the Takahanga Marae in Kaikoura.

xiv. Solar energy is the most widely available renewable resource in Canterbury (and the world) and MainPower chose to be an early adopter of this technology to understand the effects on its network and to demonstrate the technology and associated costs and benefits to the local community.

xv. However, while MainPower continues to monitor the technology, the costs of PV are simply too high at present to consider for commercial electricity generation.

xvi. For example, the 2006 PV installation on MainPower's Rangiora office was installed at an approximate cost of $10 / Watt (or $10 million per MW), equating to a LRMC of approximately eight times the range of LRMC's the Government lists in the NZES, covering likely generation sources through till 2025.

xvii. Consequently grid-connected PV still has to significantly shift its cost structure before it becomes cost competitive and this is why there are so few installations in NEW ZEALAND even on the customer side of the meter when solar power is saving the retail rate of electricity.

xviii. There is substantial research and development investment overseas, with the aim of driving the cost of PV down to around US$1 per Watt, but it is too early in the development cycle to consider large scale deployment of low cost PV in New Zealand. Other countries (e.g. Germany, Japan, Spain and United States) have substantial subsidies for PV which has stimulated investment, however it is unlikely subsidies will become available here given New Zealand's relative wealth in alternative renewable energy sources.

Solar Hot Water

xix. MainPower sponsored the design, supply and installation of a large solar hot water system at the Hanmer Forest Camp to provide hot water for the camp's abilities lodge. Since that successful commissioning, MainPower has also sponsored a pilot program called the *EcoSmarthome*, which offers an energy assessment and a range of energy efficient products including a solar hot water system to home-owners in North Canterbury.

xx. Given current power prices, solar hot water systems are economic for high water-usage households as they off-set electricity on the customer-side of the meter at retail rates. It is for this reason that retail customers should and do install their own systems. This trend is likely to continue with increasing energy costs and Government installation grants.

xxi. However, until accurate water meters are more cost effective, it is unlikely an Electric Utility can make a positive business case from selling energy from solar hot water systems. From a network point of view there is no business case to be made from network capital expenditure deferral due to New Zealand's strong predominant winter peak in electricity demand, coincident with the lowest availability of solar energy.

xxii. As an example, spending $150 million on a wind farm at Mt Cass will provide sufficient energy for 23,000 homes. The same expenditure could provide solar water heating systems for 30,000 homes (assuming $5,000 each system). But, since water heating is approximately one third of a households electricity use and solar hot water is usually expected to provide only 75% of domestic water heating, the equivalent energy production is 0.75 x 0.33 x 30,000 = 7,500 homes (approx). That is for a given capital expenditure solar water heating will produce one-third of the energy of a wind farm.

Marine Energy

xxiii. The potential for marine energy to become part of New Zealand's energy supply portfolio is recognised in the NZES. In part this recognition arises from the many wave and tidal energy technologies under development overseas and here in New Zealand. Overseas the first pre-commercial tidal stream device was deployed in April this year and is due to supply electricity into Northern Ireland's transmission system in late 2008.

xxiv. There are currently eighteen identified marine energy deployment projects in New Zealand and, indeed, the first experimental wave device was deployed in Pegasus Bay between December 2006 and May 2008.

xxv. One resource consent has been granted for a tidal stream prototype project in Cook Strait and a second, for a tidal stream project in Kaipara Harbour, may be granted later this year. Marine energy technologies are at an early stage of development and these technologies will be deployed in areas of good wave or tidal/ocean currents to maximize energy recovery.

xxvi. New Zealand has 'world-class' wave resources, widely distributed throughout the Coastal Marine Area (out to 12 nautical miles from the coast). Most of the more energetic wave resources are, however, on south- and west-facing coasts, since ocean swells propagate north-eastwards from the Antarctic Ocean. The main islands block these ocean swells so wave energy on east- and north-facing coasts is much weaker (about a ¼ of the energy on west- and south-facing coasts). As a result Pegasus Bay is a good area for testing small prototypes but its potential for commercial generation of electricity from waves may be limited.

xxvii. Tidal/ocean current energy is restricted in New Zealand. There are three potential areas – Cape Reinga, Cook Strait and Foveaux Strait. Other well known areas such as French Pass and Tory Channel are relatively small and have difficulties with regard to competing uses. The main North Island harbours have similar problems with the addition of environmental issues. Although there are some areas of reasonable flows caused by tides around Banks Peninsula, these do not extend northwards inshore to Pegasus Bay.

xxviii. In summary, whilst there are many potential sites for wave energy projects and some for tidal/ocean current energy projects, there

are few potential sites off the Canterbury coast for marine energy technologies at their present state of development.

xxix. The NZES calls for approximately 150-175 MW of new renewable generation to be built each year to achieve a target of 90% of electricity generation from renewable sources by 2025. The Government's LRMC estimates, shows that there is presently significant number of wind, hydro and gas generation projects that could be built. It is too early to establish a LRMC for marine energy technologies but it would unquestionably be higher than the costs for wind, hydro and gas projects for the next 10 years or so.

xxx. Marine energy has significant potential to supply electricity to New Zealanders in the future and this potential has been recognised internationally. Wave energy projects may eventually be widespread, although tidal/ocean current projects are likely to be restricted to the regions of best resources. Marine energy technologies are on the verge of becoming commercially viable and deployments in New Zealand waters will occur in the next 3 – 5 years. Nonetheless, widespread uptake of marine energy will only occur when the technologies become cost-competitive with other forms of electricity generation. Eventually technologies may become viable off the Canterbury coast but it will not be the region of first choice for project developers.

Micro-generation

xxxi. One of MainPower's objectives is to act as an independent 'clearing-house' of information on the technologies and costs and benefits of micro-generation on behalf of the local community. To obtain this information, MainPower has been involved in a number of micro-generation projects including the solar PV projects mentioned above, a micro-hydro project to power a DoC hut in the Hurunui, a prototype micro-wind research project and the Totara Valley research project in conjunction with IRL and Massey University. In addition, MainPower maintains a membership of SEANZ (Sustainable Electricity Association of New Zealand).

xxxii. While there are some exciting developments in micro-generation, no micro-generation projects MainPower has been involved in (or is aware of) can generate electricity anywhere near the Governments LRMC projections.

xxxiii. Micro-generation technology is useful as a substitute for grid-connected electricity when large grid-connection fees are required, which can then off-set the initial capital expenditure of the system. MainPower will continue to monitor technological advancements to ensure the local community have current system information.

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