

IN THE MATTER of the Resource Management Act 1991.

AND

IN THE MATTER of a resource consent application by MainPower New Zealand Limited to establish and operate a windfarm at Mount Cass.

STATEMENT OF EVIDENCE OF PHILLIP THOMAS DONNELLY

1 Qualifications and experience

- 1.1 My full name is Philip Thomas Donnelly. I am the principal of Philip Donnelly and Associates Limited, an economic consulting company.
- 1.2 I graduated with a Masters Degree in Economics from Canterbury University in 1967. I have around 40 years experience in applied economics. During the last 16 years, I have been an economic consultant and have specialised in regional and resource economics, particularly in matters pertaining to the Resource Management Act 1991 (RMA). As a consultant, I have been engaged by several councils, and the Minister for the Environment, and was a member of the Resource Management Act Reference Group, which advised on legislative changes to the RMA and the implementation of programmes to improve practice and performance in the resource management area.
- 1.3 Prior to my work as a consultant, I was employed for six years as regional economist by the Canterbury Regional Council, and its predecessor the Canterbury United Council.
- 1.4 Before working for regional government, I held several senior economist positions in central Government. In two of these positions, I specialised in matters involving analysis of the industrial structure of the New Zealand economy and assessment of the impact of major development projects on it. That included being senior economist of the Forest Services economic unit, where I was responsible for undertaking costs benefits analysis of afforestation proposals and evaluating proposals to establish new industries to utilise State-owned forests. In addition, for about nine years, I was the Director of Statistics New Zealand, responsible for the development of the New Zealand System of National Accounts and the development and review of price indices.
- 1.5 I have undertaken a wide range of projects for private and public sector institutions. I have also undertaken work for central Government departments, local authorities, quasi-government organisations, a university, business organisations, community groups, local authority trading companies, public listed companies, a State-owned enterprise and private individuals. In particular, those projects have included work for Contact Energy, Mighty River Power, TrustPower, Bay of Plenty Energy, King Country Energy and Crest

Energy. Those projects included assisting those companies in renewing existing consents to generate electricity and/or build new generation facilities. Recently, I was also engaged as sub-consultant for Riley Consultants Limited who have a contract with the West Coast Regional Council to assist in the processing of the applications for Meridian Energy's proposed Mokihinui River Hydroelectric Power Scheme.

- 1.6 While this is a council hearing, my evidence has been prepared to comply with the Code 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2006.

2 Scope of evidence

- 2.1 I have been asked by MainPower Limited (MainPower) to present evidence relating to the economic impacts and benefits arising from the proposed Mt Cass wind farm. The aim of this is to indicate whether the granting of consents will promote sustainable management as defined in section 5(2) of the RMA, from a socio-economic perspective.
- 2.2 My evidence is based on a report I prepared for MainPower¹, the principal findings of which were included in the Assessment of Environmental Effects (AEE) accompanying MainPower's resource consent application. These findings were based on marginally lesser turbine numbers in two of the turbine "envelopes". Consequently, there are some variations between some of the main AEE findings on economic effects and my evidence. However, these variations do not affect my overall opinion and, if anything, the findings in the AEE are overly conservative.
- 2.3 My evidence presents the findings of the economic impacts of three different size wind farm scenarios that are under consideration, namely, the R90, R60 and R33. The rationale for the R90 and R60 options is that they represent the upper and lower limits, respectively, in terms of economic impacts/benefit enabled by granting the required consents to construct and operate the wind farm. The reason for including the R33 option is that it involves the use of a locally produced two-blade wind turbine. The higher domestic content in the

¹ Economic Impact Assessment Mt Cass Wind Farm, Philip Donnelly and Associates Limited, November 2007.

R33 means that it will have a higher level of impacts per MW of installed capacity than the R60 and R90.

- 2.4 In addition to presenting the economic impacts of the proposed wind farm, I will also discuss the local and national benefits that will result from the operation of the proposed wind farm and quantify the potential scale of effects on the electricity industry's cost structure and prices.

3 Economic impact assessment of change to the economy

Introduction to EIA

- 3.1 In this section of my evidence I present the findings of an economic impact assessment (EIA) of the proposed wind farm. EIA is one of two generally accepted economic assessment methods. EIA examines how the proposed construction and operation of the wind farm will change the Canterbury regional economy, assessed in terms of snapshots of different points in time. In this respect, it selects three important indicators of economic activity, namely, output², added value³ and employment counts.
- 3.2 The EIA is targeted at assessing the impact of the proposed wind farm on the socio-economic well-being of society. This is because EIA assesses the potential for more jobs (a social benefit) and higher growth. The latter is a prerequisite to increased societal well-being, improved funding of social services and creation of positive community views about the future of the economy.
- 3.3 From an RMA perspective this is relevant in helping to determine whether the Mt Cass application will promote the enabling provisions of section 5(2) in respect to social and economic well-being.

² Output is more or less the equivalent of an industry's turnover or sales.

³ Added value, on the other hand, is a component of output. It includes salary and wage payments and profits before payment of interest and taxes. Added value excludes intermediate inputs (i.e. the products and services purchased from other industries) from the value of an industry's output and, thereby, the measure avoids double counting of economic activity. For example, in measuring the activity of the construction sector it excludes the goods and services purchased from wood processing industries, concrete slurry manufacturing and so forth. Added value is conceptually the same as Gross Domestic Product (GDP) which is the universally accepted measure of economic activity.

- 3.4 The Mt Cass EIA evaluates two types of effects, namely direct and indirect impacts. The direct impacts are the first-round expenditure effects relating to the construction and operation of the wind farm. For example, they consist of the all-expenditure effects caused by MainPower's demand on contractors to construct the wind farm.
- 3.5 The indirect impacts relate to the flow-on or cascading effects resulting from the first round or direct expenditure impacts. That is, the wind-farm contractors' demands on their suppliers, and the suppliers' demands on other suppliers and so forth. For example, expansion in the construction industry will lead to expansion in the cement and steel industries. The indirect impacts also include induced effects caused by the supply of goods and services to the employees that are directly or indirectly involved in the project. For example, expansion of wages in the construction industry will lead to expansion in the supermarket and restaurant industries.
- 3.6 Those forward and backward impacts are generally referred to as multiplier impacts. Thus multipliers are estimates of the relationship between direct and total economic impacts.⁴

Estimated scenario construction cost and impacts

- 3.7 Turbine type and number are the principal determinants for wind-farm scale and resulting economic impacts/benefits. Another factor influencing the construction, but not operating impacts, is the ratio of imported to domestic content of the turbines. In this respect, MainPower are considering a number of turbine options. They are, however, unlikely to make a final decision on turbines until after the end of the resource consent process. This is because they wish to ensure that they can select the best available technology and optimise the project's economics within environmental constraints.
- 3.8 Thus, to overcome this problem for the purpose of presenting my evidence, I have selected three alternative scenarios. These scenarios represent envelopes that capture the range of potential economic (and other environmental) impacts that could result from construction and operation of the

⁴ SNZ produce input-output tables for the New Zealand economy that indicate the multiplier impacts for each industry. However, as there are no sub-national multiplier estimates, a proprietary model was used to derive multipliers for the purpose of the economic assessment from the latest national 2000/01 input-output study.

proposed wind farm, i.e. in respect to minimum and maximum MW capacity and potential ratio of import to domestic content. Effectively, any one of the three envelopes, each with different economic impacts, could be selected.

3.9 The selected scenarios are as follows:

- R90 scenario – based on 23 imported turbines with an estimated output of up to 69MW and construction cost of about \$159M
- R60 scenario – based on 42 imported turbines, output of 35.7MW and estimated construction cost of \$118M
- R33 scenario – based on 83 domestically produced turbines and an estimated output and construction of 41.5MW and construction cost of \$93M.

3.10 Construction is assumed to take place over two financial years for all scenarios while construction and operating costs and generation revenues are based on 2006 prices.⁵ The combined implication of subsequent changes to real construction and operating costs and electricity prices is to increase the assessed EIA values. Consequently, the following EIA results are likely to be understated and, therefore, a conservative estimate of impacts.

3.11 Table 1 summarises, for the three wind generation scenarios, the estimated value of work that can reasonably be expected to be handled by the region's and the rest of New Zealand's construction and manufacturing sectors.

Table 1: Summary of capital expenditure by source - \$M

<i>Source of supply</i>	<i>R90</i>	<i>R60</i>	<i>R33</i>
	\$M		
Imported	116	86	10
Region	38	29	45
Rest NZ	4	3	38
	158	118	93
	Percentage of total		
Imported	73%	73%	11%
Region	24%	25%	48%

⁵ In 2008 prices, construction are probably higher in real terms while forecast real electricity prices have increased significantly due to the Government's introduction of the Emissions Trading Act. This Act imposes a cost for carbon emissions while generally banning the introduction of new coal or gas fired generation for 10 years.

Rest NZ	3%	2%	41%
	100%	100%	100%

3.12 The import content, as a percentage of total costs, is approximately the same for the R90 and R60, namely, 73 percent. The import content of the R33 scenario, which uses locally produced turbines, is much lower at 11 percent of total cost. Conversely, the regional and rest of New Zealand output is highest for the scenario based on use of domestic turbines.

3.13 Table 2 summarises by scenario and by industry the estimated output, added value and number of jobs that could reasonably be expected to be created by construction of the wind farm, regionally and nationally. Where applicable some of the totals are shown in undiscounted and discounted terms (i.e. net present value - NPV)⁶.

Table 2: Construction output and added value by industry - \$000

<i>Activity</i>	<i>Output - region</i>	<i>Output - New Zealand</i>	<i>Added Value - region</i>	<i>Added Value - New Zealand</i>
R90				
Business services	3,345	4,038	1,826	2,205
Construction	21,834	21,963	6,457	6,495
Manufacturing	12,358	14,976	4,715	5,713
Transport	750	1,500	304	608
Total	38,288	42,477	13,303	15,021
NPV	35,608	39,529	12,442	14,038
R60				
Business services	2,848	3,417	1,555,156	1,865,462
Construction	16,637	16,736	4,920,201	4,949,479
Manufacturing	9,132	10,790	3,484,473	4,116,733
Transport	500	1,000	202,548	405,096
Total	29,118	31,942	10,162,378	11,336,770
NPV	27,076	29,725	9,493	10,601
R33				
Business services	2,440	2,941	1,332	1,606
Construction	11,123	12,712	3,289	3,759
Manufacturing	31,236	66,762	11,915	25,467
Transport	275	550	111	223

⁶ Discounting enables costs and benefits occurring at different points in time to be compared as it recognises the time value of money and, therefore, the fact that the value of money in the future is not the same as the equivalent sum of money now. For example, at 10 percent discount rate \$1000 in year 20 and year 30 is the equivalent of \$164 and \$63, respectively, in year 1. The effect of discounting is to give more weight to current rather than future financial flows. The sum of discounted costs and benefits is referred to as net present value (NPV). Selection of the discount rate tends to be problematic, but for the purpose of analysis of the scheme, 10 percent is used as this rate is commonly used in New Zealand with respect to public sector project evaluation. A lower discount rate increases NPV while a higher percentage reduces it.

Total	45,073	82,964	16,648	31,055
NPV	41,759	76,744	15,468	26,767

3.14 Over the total construction period, the region is predicted to expand direct output by \$38M (\$35M NPV) for the R90, \$29M (\$27M NPV) for the R60 and \$45M (\$42M) for the R33 scenario. The direct increases for New Zealand are slightly higher, mainly due to greater capture of total activity by the manufacturing sector.

3.15 Because of the local manufacture of turbines in respect to the R33 scenario, the region's manufacturing sector's contribution to output (\$31M) is far greater than the construction sector's contribution (\$11M) for this wind farm option.

3.16 For the total construction period, direct regional added value, a component of output, is estimated to increase by \$13M for the R90 scenario (\$12M NPV), \$10M for the R60 (\$9M NPV) and \$17M for the R33 (\$15M NPV). Nationally, the increase in direct added value is only slightly larger than the regional increase for the R90 and R33 (i.e. one to two million dollars), but it is significantly greater for the R33, i.e. almost double.

Table 3: Total job-years' work from wind farm construction

Industry	Region	New Zealand
	R90	
Business services	19	23
Construction	76	76
Manufacturing	49	59
Transport	4	8
Total	149	168
	R60	
Business services	17	20
Construction	58	58
Manufacturing	36	43
Transport	3	6
Total	114	127
	R33	
Business services	14	17
Construction	39	44
Manufacturing	124	265
Transport	2	3
Total	178	330

3.17 The estimated “direct” regional job-years of work resulting from the construction of the wind farm for the three scenarios is estimated at 149 for the R90, 114 for the R60 and 178 for the R33. Nationally, job-years increase to 168 for the R90, 127 for the R60 and 330 for the R33.

3.18 For the R90 (\$22M) and R60 (\$17M) scenarios, the construction sector is the main beneficiary of the jobs created by the wind farm development (about half of the regional jobs), although the number of manufacturing jobs is also large. However, manufacturing contributes most of the jobs for the R33, namely 70 percent for the region and 80 percent nationally.

Direct ongoing impacts of the wind farm

3.19 Table 4 summarises the ongoing direct impacts of the scheme over 26 years, being an estimated turbine life.⁷ The impacts are shown by year and for the total period. The ongoing direct impacts are the same for the region and for New Zealand.

⁷ The wind farm itself could continue beyond that period with new, more up to date turbines. However, it is too speculative to take the analysis of economic impacts beyond 26-years while doing so would have little impact on total discounted values.

Table 4: Ongoing direct impacts by scenario

	R90			R60			R33		
Year	Direct Output \$000	Direct Added Value \$000	Direct Jobs	Direct Output \$000	Direct Added Value \$000	Direct Jobs	Direct Output \$000	Direct Added Value \$000	Direct Jobs
1	0	0	0	0	0	0	0	0	0
2	3,081	2,414	0	1,596	1,216	1	1,441	1,137	1
3	12,874	9,993	1	6,718	5,065	1	6,003	4,695	1
4	13,750	10,739	1	7,215	5,478	1	6,446	5,072	1
5	14,653	11,630	1	7,692	5,948	1	6,873	5,493	1
6	14,351	11,329	1	7,534	5,789	1	6,731	5,351	1
7	15,567	12,545	1	8,172	6,428	1	7,301	5,921	1
8	14,921	11,899	1	7,833	6,088	1	6,998	5,618	1
9	14,488	11,465	1	7,606	5,861	1	6,795	5,415	1
10	15,656	9,745	1	8,219	4,346	1	7,343	5,095	1
11	13,493	7,581	1	7,083	3,211	0	6,328	4,080	1
12	13,493	7,581	1	7,083	3,211	0	6,328	4,080	1
13	13,493	7,581	1	7,083	3,211	0	6,328	4,080	1
14	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
15	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
16	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
17	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
18	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
19	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
20	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
21	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
22	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
23	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
24	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
25	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
26	13,493	10,470	1	7,083	5,339	1	6,328	4,948	1
Total	335,227	250,616	24	175,918	125,255	1	157,187	120,367	24
NPV	117,302	87,861		61,524	43,864	0	54,983	42,215	

- 3.20 It is assumed that generation commences in year two of the project rising to full output during year three after the completion of construction. At full production, the value of direct output for the R90 fluctuates between \$13M to \$16M per annum. For the R60 real output fluctuates between \$7M to \$8M while for the R33 output varies between \$6M to \$7M.
- 3.21 Over the life of the turbines, total direct operating output is estimated at almost \$335M (\$117M NPV) for the R90, \$176M (\$62M NPV) for the R60 and \$157M (\$55M NPV) for the R33.
- 3.22 At full development, the annual direct operating added value component of output is estimated to vary between \$8M and \$13M for the R90, between \$3M and \$6M for the R60 and \$6M and \$7M for the R33. Over the life of the wind farm, total operating added value is estimated to sum to \$251M for the R90 (\$88NPV), \$125M for the R60 (\$44NPV) and \$120M for the R33 (\$42NPV).
- 3.23 It is assumed that most work is contracted out and hence only one person is required by MainPower to operate and maintain the wind farm. Thus, about 24 direct job-years' work is created by operation of the wind farm over the expected turbine life for the three wind farm scenarios.

Direct and indirect impacts

- 3.24 Table 5 summarises the direct plus indirect construction, ongoing operation and total combined impacts by scenario.

Table 5: Direct plus indirect construction ongoing operation and combined effects

	Construction						Operation						Total					
R90	Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct Output \$000		Direct Added Value \$000		Direct Jobs	
Year	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ
1	17,491	21,554	7,376	9,193	73	89	0	0	0	0	0	0	17,491	21,554	7,376	9,193	73	89
2	45,783	54,712	17,100	20,755	169	201	3,918	4,802	2,797	3,179	4	7	49,702	59,514	19,897	23,934	174	208
3	2,922	3,492	1,091	1,325	11	13	16,193	19,845	11,474	13,054	18	28	19,116	23,337	12,566	14,379	29	40
4	0	0	0	0	0	0	17,293	21,192	12,313	13,999	19	30	17,293	21,192	12,313	13,999	19	30
5	0	0	0	0	0	0	18,428	22,583	13,287	15,084	21	31	18,428	22,583	13,287	15,084	21	31
6	0	0	0	0	0	0	18,049	22,119	12,958	14,718	20	31	18,049	22,119	12,958	14,718	20	31
7	0	0	0	0	0	0	19,578	23,992	14,284	16,193	22	33	19,578	23,992	14,284	16,193	22	33
8	0	0	0	0	0	0	18,766	22,997	13,579	15,410	21	32	18,766	22,997	13,579	15,410	21	32
9	0	0	0	0	0	0	18,221	22,329	13,107	14,884	20	31	18,221	22,329	13,107	14,884	20	31
10	0	0	0	0	0	0	19,690	24,130	11,939	13,860	22	34	19,690	24,130	11,939	13,860	22	34
11	0	0	0	0	0	0	16,969	20,795	9,580	11,235	19	29	16,969	20,795	9,580	11,235	19	29
12	0	0	0	0	0	0	16,969	20,795	9,580	11,235	19	29	16,969	20,795	9,580	11,235	19	29
13	0	0	0	0	0	0	16,969	20,795	9,580	11,235	19	29	16,969	20,795	9,580	11,235	19	29
14	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
15	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
16	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
17	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
18	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
19	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
20	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
21	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
22	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
23	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
24	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
25	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
26	0	0	0	0	0	0	16,969	20,795	12,022	13,677	19	29	16,969	20,795	12,022	13,677	19	29
Total R90	66,197	79,759	25,567	31,272	253	304	421,645	516,713	290,760	331,884	474	720	487,842	596,472	316,327	363,156	727	1,023
NPV R90	61,528	74,179	23,823	29,156			147,567	180,839	101,919	116,312			209,095	255,018	125,742	145,467		
R60	Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs	
Year	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ
1	13,045	15,990	5,570	6,900	55	67	0	0	0	0	0	0	13,045	15,990	5,570	6,900	55	67
2	33,434	39,530	12,475	14,973	123	145	1,915	2,346	1,341	1,528	2	3	35,348	41,876	13,816	16,500	125	148
3	2,401	2,839	896	1,075	9	10	7,934	9,723	5,511	6,285	9	14	10,335	12,561	6,407	7,360	18	24
4	0	0	0	0	0	0	8,518	10,439	5,949	6,780	10	15	8,518	10,439	5,949	6,780	10	15
5	0	0	0	0	0	0	9,082	11,130	6,431	7,317	11	16	9,082	11,130	6,431	7,317	11	16
6	0	0	0	0	0	0	8,895	10,901	6,269	7,137	10	15	8,895	10,901	6,269	7,137	10	15
7	0	0	0	0	0	0	9,649	11,824	6,923	7,864	11	16	9,649	11,824	6,923	7,864	11	16
8	0	0	0	0	0	0	9,248	11,333	6,575	7,477	11	16	9,248	11,333	6,575	7,477	11	16
9	0	0	0	0	0	0	8,980	11,004	6,343	7,218	11	15	8,980	11,004	6,343	7,218	11	15
10	0	0	0	0	0	0	9,704	11,892	5,280	6,226	11	17	9,704	11,892	5,280	6,226	11	17
11	0	0	0	0	0	0	8,363	10,249	4,117	4,933	10	14	8,363	10,249	4,117	4,933	10	14
12	0	0	0	0	0	0	8,363	10,249	4,117	4,933	10	14	8,363	10,249	4,117	4,933	10	14
13	0	0	0	0	0	0	8,363	10,249	4,117	4,933	10	14	8,363	10,249	4,117	4,933	10	14
14	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
15	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
16	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
17	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
18	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
19	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
20	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
21	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
22	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
23	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
24	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
25	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
26	0	0	0	0	0	0	8,363	10,249	5,808	6,623	10	14	8,363	10,249	5,808	6,623	10	14
Total R60	48,879	58,358	18,941	22,948	187	222	207,732	254,569	138,472	158,732	246	355	256,611	312,927	157,413	181,681	433	577

	Construction						Operation						Total					
NPV R60	45,423	54,272	17,651	21,400	0	0	72,669	89,054	48,495	55,582	0	0	118,092	143,325	66,146	76,983	0	0
R33	Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs		Direct & Indirect Output \$000		Direct & Indirect Added Value \$000		Direct & Indirect Jobs	
Year	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ	Region	NZ
1	15,957	29,851	6,735	12,437	66	121	0	0	0	0	0	0	15,957	29,851	6,735	12,437	66	121
2	48,367	98,042	18,930	38,942	186	378	1,679	2,058	1,204	1,368	2	3	50,046	100,100	20,133	40,310	188	381
3	3,473	7,040	1,359	2,796	13	27	6,974	8,547	4,963	5,644	8	12	10,448	15,587	6,323	8,440	22	39
4	0	0	0	0	0	0	7,488	9,177	5,354	6,085	9	13	7,488	9,177	5,354	6,085	9	13
5	0	0	0	0	0	0	7,984	9,784	5,779	6,558	10	14	7,984	9,784	5,779	6,558	10	14
6	0	0	0	0	0	0	7,820	9,583	5,637	6,399	9	13	7,820	9,583	5,637	6,399	9	13
7	0	0	0	0	0	0	8,482	10,394	6,211	7,038	10	14	8,482	10,394	6,211	7,038	10	14
8	0	0	0	0	0	0	8,130	9,963	5,906	6,699	10	14	8,130	9,963	5,906	6,699	10	14
9	0	0	0	0	0	0	7,894	9,674	5,701	6,471	9	13	7,894	9,674	5,701	6,471	9	13
10	0	0	0	0	0	0	8,530	10,454	4,781	5,613	10	15	8,530	10,454	4,781	5,613	10	15
11	0	0	0	0	0	0	7,352	9,009	3,759	4,476	9	13	7,352	9,009	3,759	4,476	9	13
12	0	0	0	0	0	0	7,352	9,009	3,759	4,476	9	13	7,352	9,009	3,759	4,476	9	13
13	0	0	0	0	0	0	7,352	9,009	3,759	4,476	9	13	7,352	9,009	3,759	4,476	9	13
14	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
15	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
16	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
17	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
18	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
19	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
20	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
21	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
22	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
23	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
24	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
25	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
26	0	0	0	0	0	0	7,352	9,009	5,231	5,948	9	13	7,352	9,009	5,231	5,948	9	13
Total R33	67,797	134,933	27,024	54,176	266	527	182,608	223,781	124,815	142,625	219	312	250,405	358,714	151,839	196,801	485	838
NPV R33	62,797	124,798	25,067	50,150			63,878	78,281	43,694	49,924			126,675	203,079	68,761	100,074		

- 3.25 The maximum economic impact is experienced in year two for all scenarios. Over the life of the wind farm, total regional direct plus indirect output is estimated at \$488M (\$209M NPV) for the R90, \$257M (\$118M NPV) for the R60 and \$250M (\$127M NPV) for the R33. For New Zealand, those direct and indirect output impacts increase to \$596M (\$255M NPV) for the R90, \$313M (\$143M NPV) for the R60 and \$359M (\$203M NPV) for the R33.
- 3.26 The combined direct plus indirect regional construction and ongoing added value impacts of the wind farm are estimated at \$316M (\$126M NPV) for the R90, \$157M (\$66M NPV) for the R60 and \$152M (\$69M NPV) for the R33. For New Zealand, the direct and indirect added value totals are \$363M (\$145M NPV) for the R90, \$182M (\$77M NPV) for the R60 and \$197M (\$100M NPV) for the R33.
- 3.27 The total direct plus indirect job years of work supported over the life of the wind farm is estimated at 727 for the region and 1023 nationally for the R90. The total is estimated at 433 for the region and 577 for New Zealand for the R60 and 485 for Canterbury and 838 nationally for the R33.

4 National and regional economic benefits of wind farm

- 4.1 The proposed wind farm will be part of a nationally integrated electricity system and its output will affect the electricity industry's cost structure and prices, i.e. over and above the costs and revenues to MainPower. Those impacts do not form part of the EIA.
- 4.2 The following section of my evidence describes the national and regional benefits of the Mt Cass wind farm resulting from its effects on the electricity industry's cost structure and prices.

National generation cost implications

- 4.3 New Zealand's generation system is dominated by hydro schemes with limited storage capacities that are subject to periodic dry-year events. Dry-year events, combined with inadequate power and energy margins, can cause considerable price variability on the wholesale market. Price variability can also be exacerbated by outage of a major generation plant, or catastrophic failure of the distribution network. For example, in autumn 2003, the lack of coal stocks for the Huntly electricity plant to run it continuously, combined with

maintenance work being poorly timed, caused significant wholesale price volatility as inadequate thermal generation forced South Island hydro generators to use water reserved for winter use.

- 4.4 Because the Mt Cass wind farm scheme will be part of a nationally integrated electricity system its output will affect the electricity industry's cost structure and prices with potential positive benefits for consumers, nationally and locally. By reducing price variability, it will enable electricity prices to be lower than what would occur in the absence of the proposed wind farm. It will also, thereby, promote section 7(b) – efficient use of natural and physical resources and the enabling provisions of section 5(2), RMA in respect of economic well-being.⁸
- 4.5 The mechanism by which the proposed wind farm will reduce price variability and, thereby, lower wholesale prices and, thus, generation costs is explained in Appendix 1. It is noteworthy, however, that due to the method by which spot prices are determined, the wholesale price reductions will substantially exceed the value of MainPower's generation.
- 4.6 Lower national generation cost will in part express itself in the form of lower fossil fuel cost as less gas and coal will need to be consumed to meet demand. However, a key issue is whether lower generation cost resulting from the Mt Cass wind farm, as a consequence of lower average wholesale prices, will be passed on to electricity consumers.
- 4.7 In this respect, there is a definite, but complex relationship between wholesale spot prices and retail electricity prices. For some large electricity consumers directly exposed to the wholesale spot price the relationship is direct. However, for most electricity consumers the relationship is more obscure as energy-traders, who are also generators, will try and charge the highest price possible for their electricity. This is so as to maximise the gap between the generation/purchase cost, including distribution, and what they can sell electricity for, as this will determine their profitability. Energy-traders will only

⁸ Providing that section 7(b) assessments are based on economic efficiency, they can be used as a barometer to determine whether natural and physical resources are being used in a way, or at a rate, that enables people and communities to provide for their economic well-being. This is because economic efficiency and economic well-being are synonymous concepts in economics

pass on lower wholesale prices if they are forced to by competition and/or they consider it will increase their share of the market and total profit.

- 4.8 In this respect, the price charged by energy-traders is capped by competition and/or the threat of competition, just as it is in non-electricity markets. If incumbent energy traders try to charge too much it would encourage new retailers or not-represented retailers in a particular area to enter the retail market, and offer lower prices so as to capture a share of the excess profits, as reduced nodal prices are available to all existing and new retailers. In addition, if incumbent retailers do not pass on lower wholesale prices, it may encourage some large electricity consumers to buy directly from the wholesale market. Therefore, it is likely that sustained lower national generation costs as a consequence of lower wholesale prices will be passed on to consumers as they will result in lower nodal prices.

Efficiency gains to the national grid

- 4.9 There are two main cost elements that determine electricity prices, namely, generation and distribution cost. The latter includes national and local transmission costs (i.e. operating and capital).
- 4.10 There are significant transport costs, operating and capital, in the electricity transmission system and, as a consequence, electricity consumers can benefit from close proximity to an electricity generation system. This is because it has a positive impact on transmission losses and nodal power prices and in some cases may defer the need for capital expenditure on the national grid.⁹ Lower distribution costs indicate improved productive efficiency¹⁰, as less generation is required to produce the same level of consumption.
- 4.11 In this respect, Mt Cass will lower the operating costs of electricity transmission and, thereby, promote the efficiency of the industry. The wind farm will do this by reducing transmission losses, as it should help reduce the need to import electricity into the region in periods of peak demand. Lower transmission losses

⁹ Node refers to any of the national grid injection or exit points. These points are used by Transpower to calculate the price paid by purchasers based on the cost of providing another unit of electricity at that node. Hence, the term nodal price. This cost will include a number of physical effects such as constraints and losses in the transmission system.

¹⁰ Productive efficiency is one of the three components of economic efficiency. Productive efficiency is improved when less input is required to produce the same level of output.

will mean that Transpower will have to dispatch less electricity to meet demand which, occasionally, may also have the effect of avoiding the need to commission a higher cost generator in some half-hour periods, i.e. it will promote productive efficiency.

4.12 Therefore, the proposed scheme should lower regional distribution (i.e. supply) costs which I am informed by counsel that the Environment Court in *Genesis Power Limited v Franklin District Council* said is relevant to section 7(ba), RMA.

4.13 Reduced transmission losses in turn imply the potential for lower nodal wholesale prices. But, as previously stated, the relationship between reduced nodal power and retail prices is complex for consumers not directly exposed to the wholesale market.

4.14 It is also noteworthy that the scheme is located closer to the main regional load than the majority of existing generation. While in some circumstances this may provide the opportunity to defer capital expenditure on the national grid this is very unlikely in the case of the Mt Cass wind farm.

Summary of Energy Link analysis

4.15 To quantify the scale of electricity industry impacts described above, MainPower engaged Energy Link Limited to make the required modelling assessment. Their assessment examined the likely impact on national and local wholesale prices, energy savings to the transmission network, reduction in the use of thermal fuels and savings in CO₂ emissions.

4.16 Energy Link's modelling involved determining the base case (i.e. without a wind farm at Mt Cass) and determining how the proposed project changed that base case. Because of the amount of work involved in examining each wind farm scenario, the modelling was confined to two options, namely, the R90 and R33.

4.17 Subsequent to the analysis being undertaken by Energy Link, additional turbines have been added to the R90 and R33 options. Thus, the capacity of the two options has increased from 63MW to up to 69MW (9.5 percent) for the modelled R90 option and 35 MW to 41.5MW (18.6 percent) for the R33 scenario.

4.18 The implications of those changes to the two scenarios are that the effect of the proposed wind farm on modelled wholesale electricity prices and generation cost will be understated. For reasons explained in Appendix 1, the effects of reducing wholesale prices in any half-hour period are entirely random.. Therefore, it is not accurate to merely increase Energy Link's estimate of national generation cost savings by the percentage increase in generation capacity, as the larger the wind farm's generation capacity in any half-hour period the more chance there is of reducing wholesale electricity prices in any half-hour period. That is, the changes are likely to be greater than a pro rata increase in the proposed compared to the modelled MW capacity. Because of this, I have not rated up Energy Link's estimates and, therefore, they will understate the likely values quantified below.

4.19 The main findings and/or conclusions derived from the study were as follows:

- The R33 will reduce the weighted average wholesale electricity price across New Zealand by \$0.50, and the R90 by \$1.12. This equates to annual savings in national generation costs of around \$20M for R33 and \$46M for the R90 scenario. Over the life of the wind farm this equates to around \$150M NPV for the R33 and \$340M NPV for the R90.
- Across MainPower's distribution area, the price impact is an expected reduction of \$0.75 and \$1.68 in the weighted-average wholesale prices for the R33 and R90, respectively. This implies a reduction of wholesale electricity costs in the region of \$400,000 and \$900,000 per annum for the two scenarios. Over the life of the wind farm, this equates to savings of \$3M NPV to \$7M NPV.
- The wind farm will bring about significant savings in energy losses on the New Zealand transmission system. For the R33 and R90 scenarios, the expected savings are 5300MWh and 12,500MWh, respectively, which provides annual savings of \$950,000 and \$2,100,000. This could result in energy savings over the life of the wind farm of around \$7M NPV and \$15M NPV.
- The wind farm will displace generation at some of the thermal power stations. This will accrue from both the output of the wind farm (around 86,000 MWh and 195,000 MWh for R33 and R90 scenarios, respectively,) and the savings in transmission losses. The value of

the savings in fuel costs is \$3,200,000 and \$7,400,000 per annum, respectively, for R33 and R90.

- The savings in thermal fuel equate to 35,000 tonnes of CO₂ emission per annum for the R33 scenario, and 79,000 tonnes for the R90 scenario¹¹. Those savings equate to 404 tonnes of CO₂ emissions per GWh of generation output by the wind farm. At full development, this equates to annual emission cost savings of about \$1M to \$2.4M, respectively, for the two scenarios. Over the life of the wind farm, this is about \$8M for the R33 and \$18M for the R90.

Saving in greenhouse gas emissions

4.20 The Kyoto Protocol (which New Zealand ratified in December 2002) commits New Zealand to reducing its average net emissions of greenhouse gases over the period 2008-2012 to 1990 levels, or to take responsibility for the difference. As at May 31, 2008, the New Zealand Treasury estimated this obligation at \$480M.¹² On a population basis, that equates to a potential liability of about \$63M for Canterbury region's population.

4.21 To reduce greenhouse gas emissions, the Government recently introduced an emissions trading scheme to be progressively phased in, beginning with the forestry industry, and including all sectors and gases over time. The new legislation generally involves a 10-year ban on new gas or coal fired plants. The Government's objective is to increase renewable generation as a percentage of total generation to 90 percent by 2025.¹³

4.22 The Emission Trading Scheme will ultimately place a value on the emissions saved by wind generation. This will not necessarily reflect the real value of damage avoided to the environment.

¹¹ As a result of the increase in turbine numbers subsequent to the EnergyLink report, the savings in CO₂ emissions will increase correspondingly and is now estimated at 35,000 and 82,000 tonnes.

¹² New Zealand Treasury website.

¹³ The Government defines renewable generation as energy produced from solar, wind, hydro, geothermal, biomass, tidal, wave and ocean current sources. Excluding biomass and geothermal, renewable generation has no greenhouse gas emissions. However, at present, only wind generation and hydro generation are proven commercially viable options.

- 4.23 There are no greenhouse emissions associated with the ongoing operation of the Mt Cass wind farm. However, the wind farm will lessen the need to burn gas and/or coal as frequently and, thereby, reduce CO₂ emissions.
- 4.24 The scheme's ability to reduce greenhouse gas emissions is an important benefit that will be derived from the use and development of renewable energy. This benefit is relevant to section 7(j) - the benefits to be derived from the use and development of renewable energy, RMA.
- 4.25 Because of the uncertainty at the time the Energy Link study was undertaken over the introduction of CO₂ emission charges, no costs were factored into the study's estimates. The recent introduction by the Government of the Emissions Trading Scheme will result in further understatement of the Energy Link results.

5 Conclusion

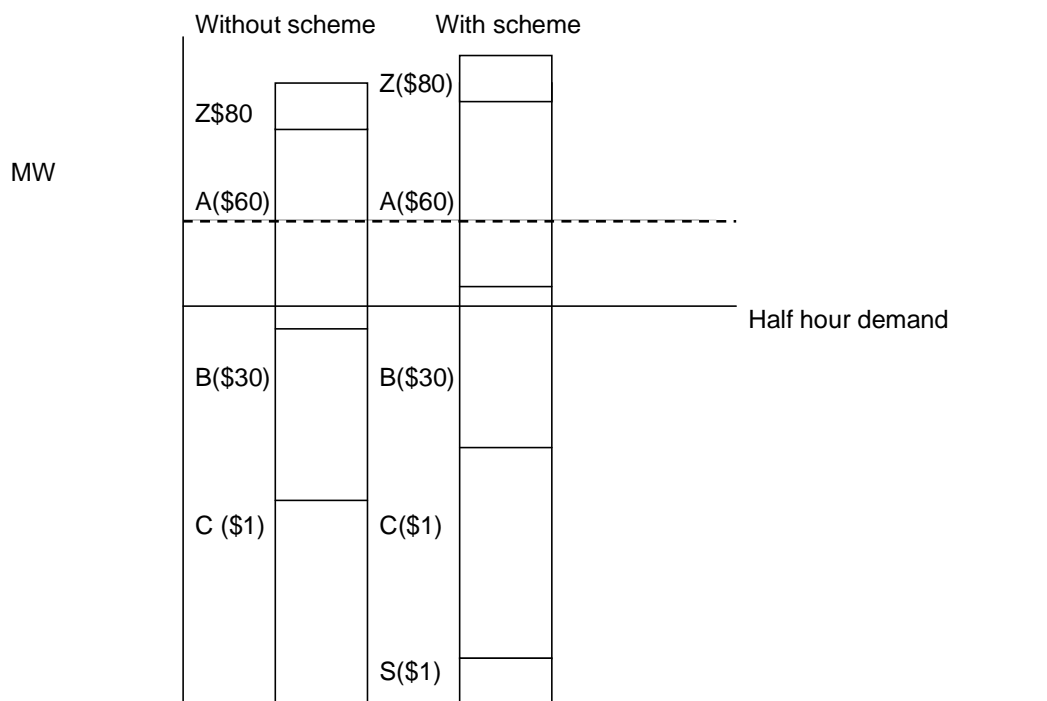
- 5.1 The Mt Cass wind farm will improve regional socio-economic well-being as it will increase regional output, added value and jobs. Namely, regional output could increase by \$118M NPV to \$209M NPV, added value by \$69M NPV to \$126M NPV and job years by 433 to 723, over the life of the wind farm depending on the scenario chosen by MainPower.
- 5.2 The proposed wind farm should lower wholesale electricity prices and save annual national generation cost by between \$20M and \$46M or by \$150M NPV to \$340M NPV over the expected 26-year life of the turbines. This provides the potential for lower national retail prices.
- 5.3 Wholesale electricity prices in MainPower's distribution area are expected to reduce by \$400,000 to \$900,000 per annum while national transmission losses should reduce by between \$7M NPV and \$15M NPV over the life of the wind farm.
- 5.4 The proposed wind farm will reduce CO₂ emissions by between 35,000 tonnes and 82,000 tonnes.

Appendix 1: Mechanism for dispatching electricity

- A1 The scheduler (Transpower) uses dispatch offers tendered by generators to schedule generators for dispatch. The scheduler starts with the generator with the lowest price offer for any half-hour period and then selects the next cheapest bid until there is enough generation to meet demand. The last scheduled generator's price sets the price for all generation in each half-hour period.
- A2 There can be significant differences between generator bids, especially in dry years, as the cost for each generator can vary significantly. This can cause substantial price movements as the marginal generator is brought on stream. For example, if three generators, A, B and C, were stacked for dispatch with bids of \$1, \$30 and \$60 per MW, respectively, prices could vary by this range of price. A and B may generate continuously throughout the period while C may cover periods when demand exceeded their generation capacity, thus causing the spot market price to fluctuate between \$30 and \$60 per MW. Alternatively, if A and B's generation capacity was adequate, they may avoid the need for C's generation, thus restricting the wholesale price to \$30 and avoiding the cost to the industry and, ultimately, consumers of more expensive generation.
- A3 The value of avoided generation cost can be estimated by determining the difference in generation price "with" and "without" the proposed scheme's output. For example, if for a specific half-hour period the wholesale price with the scheme's generation is restricted to \$30 per MW, but, without, it is \$60 per MW, the value of the scheme in terms of generation cost avoided is equal to \$30 times the total generation produced in the half-hour period.
- A4 The proposed scheme generation will be offered into the wholesale market at almost zero price to ensure it will be dispatched. At times it will displace the need to use more expensive thermal generated electricity, thus lowering the average wholesale price for that period. Figure 1 demonstrates this potential effect. The diagram shows a hypothetical stacking of generator bids to supply electricity for a half-hour period, without the scheme (shown by the boxes on the left) and with the scheme (shown by the boxes on the right). Offers to supply different quantities of electricity are stacked in order of price on top of each other, with the lowest bids on the bottom as shown by the price in brackets. In most half-hour periods there are many more bids to supply than

are actually required. Thus, the height of the boxes represents the amount of MWs a generator is offering to supply to the wholesale market. The straight horizontal line represents the load or demand for electricity for the half-hour period.

Figure 1: Offer stack without and with scheme for half-hour period



A5 As previously stated, the proposed scheme's output (represented by box S) will be bid at close to zero to ensure dispatch as the scheme is wind generation. The scheme's generation will increase the total available capacity, which is highlighted by the boxes on the right being taller than those on the left. The scheme will also displace higher bids from time-to-time, moving them up the dispatch order. In the diagram, by chance, A's offer to supply is no longer required with the scheme, as S, C and B generation is adequate to meet demand and, as a consequence, the half-hourly wholesale price is \$30/MW. However, under the 'without' scheme scenario, where A's generation is also dispatched so as to meet demand, the wholesale price is \$60.

A6 It is self evident that if the half-hour demand or load curve dissected the left-hand box A at about the half-way point, as shown by the dashed horizontal line in Figure 1, then it would also dissect box A on the right. Under that situation, the wholesale price would be \$60, both 'with' and 'without' the scheme as the marginal generator dispatched, in this case, A, determines the price. Therefore, the impact of the proposed scheme on wholesale prices depends on where the load curve dissects the marginal generators' offers to supply. Clearly, the scheme is more likely to affect wholesale prices when there are significant price differences in the offers of generators who are at the margin of being dispatched (i.e. thermal power generators with high fuel costs, hydro generators offering stored water set aside for later use). The scheme is also likely to have the most effect when generation fuel is scarce (e.g. in a dry year).