In the matter of:	the Resource Management Act 1991
and	
In the matter of:	an application by Mighty River Power the Northland Regional Council and the Whangarei District Council for resource consents relating to a Coal Fired Power Station

STATEMENT OF EVIDENCE OF DR GREG MILLER

1. My full name is Gregory John Miller.

2. I am the Director of ENVIROTEST, based in Brisbane, Australia and an Environmental Scientist.

3. I hold the degrees of Bachelor of Applied Science (QIT), Master of Philosophy and Doctor of Philosophy (Environmental Sciences) (Griffith University).

4. I am a member of the Environment Institute of Australia and New Zealand.

5. I am a Contaminated Land Signatory for Queensland.

6. I have been practicing in environmental chemistry and science since 1973 and started ENVIROTEST in 1988. My previous positions were Chemist and State Analyst for

Queensland Health and Teaching Fellow in Environmental Chemistry at Griffith University (Brisbane).

7. I have performed environmental investigations for a wide range of industrial and commercial facilities and government agencies including oil and gas, manufacturing and resource development and local, state and federal authorities.

8. I have appeared as an expert witness in various cases, from forensic toxicology (drugs and poisons) to environmental matters in Local Government Environment and Planning Courts, Australian Administrative Appeals Tribunals, Commissions of Inquiry and Magistrates and Supreme Courts.

9. I was approached by Greenpeace New Zealand, Inc. (Greenpeace) for my assessment of the application for a resource consent for the proposed repowering of the Marsden B station on coal. My evidence is given in support of the submission by Greenpeace relating to the application

10. I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note and agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Structure

11. My evidence is given in association with evidence from Shelley Anderson of Envirotest. My specific topics are:

- Introduction to environmental issues related to Marsden B proposal

- The sustainability of non-renewable technology and increased pollution compared with alternative options,
- Coal burning emissions of regional and international concern, and
- Environmental costs of Marsden B proposal related to pollution emissions and alternative options.

Introduction

12. The witnesses for the proposed Marsden B Project have variously concluded that there will be minimal effects on the surrounding environment. In response, the officers reviewing the application have concluded that the discharges to air, waters, coastal areas and land are unlikely to result in significant adverse effects on the surrounding environment, provided a recommended set of conditions and mitigation measures are met by the applicant.

13. I emphasise that this type of outcome could be applied to almost any energy-related project where in fact, the overall effects mean the project is unsustainable.

14. It is apparent also that the assessment approach used to determine the environmental significance of the proposal was very limited and does not include detailed evaluation of other options such as siting or alternative technologies.

15. Nonetheless, the set of conditions and mitigation measures recommended for the project clearly demonstrate that significant environmental impacts and risks are associated with the coal-fired power station proposal.

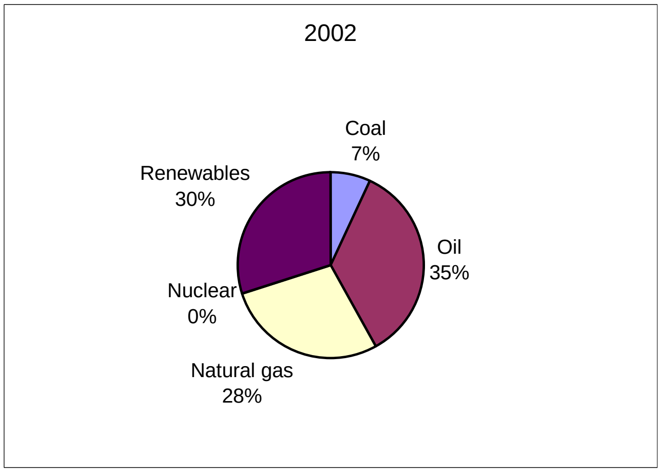
16. What are not shown, are the environmental costs of controlling coal related emissions and wastes plus residual contamination and uncertainties (e.g. health and seafoods) for 35 or more years.

Inappropriate technology

17. The proposed coal fired power station represents a significant expansion in dependence on non-renewable and imported energy sources at the expense of cleaner renewable energy sources.

18. The cost of adopting coal-based technology requires consideration of the additional release of greenhouse gas (e.g. 2 million tonnes of carbon dioxide each year) and the social and environmental costs on a regional and local scale in comparison to alternative renewable technologies and sites. There is also the potential adverse impact of the Marsden B Project on future of renewables and the capacity to reduce carbon dioxide emissions. If the cost of coal-fired generation is considered to be 7.4 cents per kWh, then this would appear to be cheaper than renewables (8.5 cents per kWh). This suggests that the short-term development of coal could occur at the expense of the longer-term viability of renewables plus the opportunity to reduce real greenhouse gas emissions and climate change effects.

19. The use of coal accounted for only 7% of energy consumption in New Zealand in 2002 (see Figure 1).



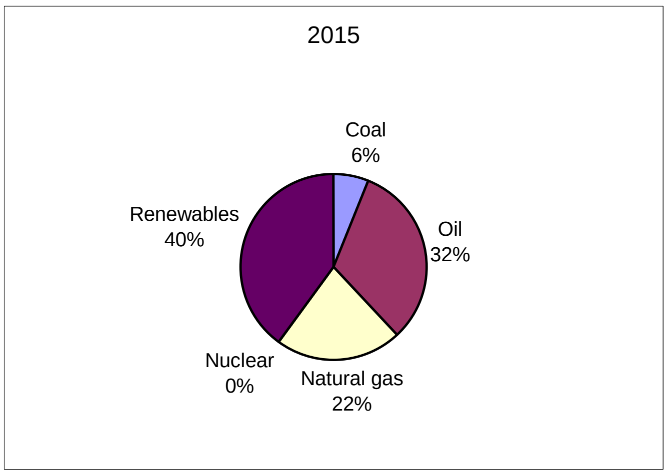


Figure 1: Current and projected energy consumption by fuel, New Zealand

(Source: ABARE 2004 research report 04.1)

20. In electricity generation, coal and natural gas as fuels have shown increasing trends in use (see Table 1).

Table 1: Electricity generation, by fuel, New Zealand

	1980		1990		2000		2002	
	TWh	%	TWh	%	TWh	%	TWh	%
Coal	0.4	1.9	0.5	1.5	1.0	2.6	1.6	4.0
Oil	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Natural gas	1.7	7.5	5.7	17.6	9.6	24.4	10.1	25.1
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables	20.5	90.4	26.1	80.8	28.7	73.0	28.6	70.9
TOTAL	22.6	100	32.3	100	39.2	100	40.3	100

Source: ABARE (2004)

21. Coal in particular has increased significantly. CO_2 emissions from coal fired generation increased from 491 kt in 1190 to 1,321 kt in 2002 and then to 2,817 in 2003. That is an increase of 473.8% from 1990 to 2003 and 113.2% from 2002 to 2003 (given an uncertainty of +- 5%) (MED 2004[1]).

22. Emissions from thermal electricity generation in 2003 were about 20% higher than 2004, largely because more than twice the amount of coal was used at the Huntly power plant in 2003 as in 2004 (MED 2004). Gas use has tended to fluctuate according to thermal electricity generation. However, the drop in emissions from gas between 2002 and 2003 and conversely the increase in emissions from coal largely reflect reduced gas supplies.

23. Renewables have declined from 90% (1980) to 71% (2002) (ABARE 2004[2]). Despite this, New Zealand has a strong potential for renewable energy use in electricity generation.

24. The energy review of New Zealand, by ABARE (2004), notes that New Zealand is likely to experience a gas supply shortfall by the end of this decade unless new resources are

[1] MED (2004). *Energy greenhouse gas emissions 1990-2003*. Ministry of Economic Development 2004. Wellington New Zealand.

[2] ABARE (2004). *The Asia Pacific LNG Market.* http:www.abare.gov.au/research/energy. Accessed February 2005.

found and developed. Of course wind is such a source. The fuel mix for New Zealand, as shown in Table 2, predicts an increase in hydro, geothermal and other renewable sources from 71 to about 80%. Coal-fired electricity generation is inconsistent with such trends.

Table 2: Electricity generation, by fuel, New Zealand

	2002 %	2010 %	2015 %
Coal	4.0	3.7	3.0
Natural gas	25.1	16.0	17.1
Hydro and thermal	69.0	74.2	72.9
Other renewables	1.9	6.1	6.9
TOTAL	100	100	100

Source: ABARE (2004)

25. In a local environment context, proposed coal (or oil-fired) technology for electricity generation does not exist and features the larger impacts of air emissions, waste disposal to land and discharge of wastewater into inshore waters of Bream Bay. With consent approvals, this would continue to occur for 35 years (the projected life time of the project is 50 years).

26. Alternatives to coal fired technology, which generate lower greenhouse or negligible gas emissions, include renewable energy sources such as wind, solar, hydro, geothermal and tidal, and natural gas (non-renewable).

27. Life cycle analysis has been used to compare net energy yields from different methods of electricity generation. Similarly, it has been used to compare carbon dioxide emission figures for various generation technologies. The life cycle analysis for electricity generation is shown in Figure 2.

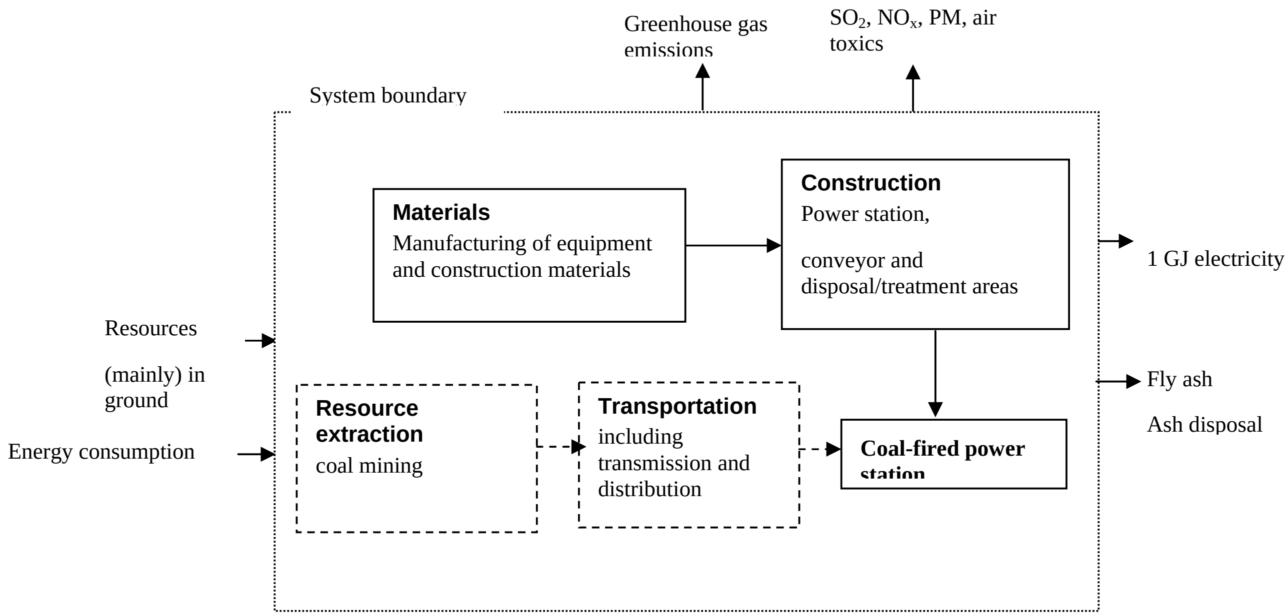


Figure 2: Life cycle analysis for electricity generation

28. Examples for Japanese and Scandanavian estimates of life cycle carbon dioxide emissions are given in Table 3. Values are in tonnes per megawatt hour (t/MWh). Renewable energy sources produce low carbon dioxide emissions. For example, coal combustion generates over 30 times the carbon dioxide emissions that wind-based energy releases according to these estimates.

Table 3: Life cycle carbon dioxide emission figures for various electricity generation technologies

Energy technology	Carbon dioxide emissions (tonnes/MWh)		
	Japan	Sweden	Finland
Coal	0.975	0.980	0.894
Gas thermal	0.608	1.170	-
Gas combined cycle	0.519	0.450	0.472
Solar photovoltair	0.053	0.050	0.095
Wind	0.029	0.0055	0.014
Hydro	0.011	0.003	-
Nuclear	0.022	0.006	0.010-0.026

Source: Uranium Information Centre (2004)[3]

29. Renewable sources release low to negligible levels of other emissions. Coal-fired technology is estimated to release 97 per cent of life cycle CO_2 emissions from coal at the point of combustion.

30. Among renewable technologies for electricity generation, wind farms are clearly a clean and cost-effective alternative. The cost of wind power is considered competitive with

[3] Uranium Information Centre (2004). *Energy analysis of power stations*. UIC nuclear issues briefing paper #57. January 2004. http://www.uic.com.au/nip57.htm. Accessed February 2005.

many other energy sources, without the enhanced greenhouse effects (Australian Academy of Science 1997[4]).

31. .European countries such as Holland, Denmark, the United Kingdom and Germany are currently expanding the use of this technology. For example, Denmark currently obtains about 20 per cent of its electricity from wind turbines and intends to increase this output to 40 per cent by 2030. Wind farms, however, require siting assessment and should involve local ownership and community participation in the project (see Australian Academy of Science 1997).

32. The current capacity and potential of wind energy projects in Australia are summarised in Table 4. It shows that completed (252MW), under construction or at tender stage, and with planning approval have a total capacity of 1889MW. Those at the feasibility stage account for 3154MW while completed and proposed have a combined capacity of 4997MW.

Table 4: Summary of wind energy projects in Australia

Completed	252MW
Under construction	193MW
Under tender	386MW
Planning approved	1058MW
Feasibility	3154MW
Completed and proposed	4997MW

Source: Australian Wind Energy Association (2004)[5]

[4] Australian Academy of Science (1997). *Enhanced greenhouse gas emissions from different energy sources.* http//www.science.org.au. Accessed February 2005.

[5] Australian Wind Energy Association (2004). www.thewind.info/downloads/wind elecsyst es.pdf. Accessed February 2005.

33. Feasibility studies are addressing wind energy projects of up to 320MW. Pacific Hydro, for example, has commenced construction of Stage 1 (30MW) of a 195MW wind project at Portland, Victoria. Pacific Hydro argue that a wind generator manufacturing industry will create hundreds of new jobs in Victoria, mainly in rural areas, providing a significant boost to regional Victoria and an export market worth up to 100 million per year (Blue Wind Energy 2005[6]).

[6] Blue Wind Energy (2005). *Portland Wind Project Update*. http://www.bluewindenergy.com.au. Accessed February 2005.

Emissions of regional and international concern

Persistent toxic substances

34. The United Nations Environmental Program (UNEP) Governing Council decided in February 1998 (Decision 19/BC) that immediate international action should be initiated to protect human health and the environment through measures which will reduce and/or eliminate the emissions and discharges of an initial set of twelve persistent organic pollutants (POPs) including dioxins and furans. These POPs were targeted at the Stockholm Convention of 2001.

35. However, there are many other persistent toxic substances (PTS) that are of international concern and satisfy the criteria for POPs. These have been the subject of a recent regional based assessment by the Global Environment Facility (GEF) and UNEP. PTS evaluated have included arsenic, mercury compounds and polyaromatic hydrocarbons (PAHs). Dioxins, arsenic, mercury and polyaromatic hydrocarbons are emitted or released from coal fired power stations, among other pollutants such as particulates, gases, heavy metals and volatile organic compounds.

36. The key properties that govern the environmental behaviour and effects of PTS on biota are bioaccumulation, environmental persistence, toxicity and endocrine disruption capacity.

37. Mercury emissions from coal-fired power plants have been identified by the US-EPA as the largest unregulated source of mercury in the United States. The United States has 1100 coal burning plants that emit about 48 tonnes of mercury each year (Baltimore

2005[7]). EPA estimates that 60-75% of mercury in US waters is from human pollution sources (EPA 2001[8]). The principal health concern from mercury emissions is the exposure of pregnant women to methyl mercury in seafood leading to neurological disorders in infants.

38. The US-EPA has therefore announced plans to regulate mercury emissions from coal-fired power plants. The proposed rules are the subject of considerable debate between energy utilities and environmental groups.

39. The US findings and proposed actions are applicable to the Marsden B Power Station proposal. Rather than introducing a new set of contaminants into the local environment such as the waters of Bream Bay, technology exists to move away from dependence on coal to renewable energy sources which do not require “maximum achievable control technology” to regulate mercury emissions or achieve proposed target reductions of 95% or more.

40. Predicting health risks or impacts associated with local depositions of mercury emissions from coal-fired plants is relatively complex and uncertain. It is generally accepted that some mercury emitted from coal-fired power stations deposits locally (within 50km), potentially leading to higher concentrations in water bodies and fish.

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[7] Baltimore, C. (2005). *U.S. EPA understated utility mercury cuts – report*. www.alertnet.org/thenews/newsdesk. Accessed February 2005.

[8] EPA (2001). *Mercury is a major public health problem*. EPA Working Group. http://www.ems.org/energy_policy/mercury.html.

41. Health risk assessments performed by Sullivan et al (2003)[9] on two US coal-fired power plants indicated that for the general population, the risks were found to be highly dependent on consumption patterns. Simply, people that eat more seafood have a higher risk of mercury intake and accumulation.

42. Because mercury is persistent, bioaccumulative and neurotoxic, added exposure from a known point source, whether through air emissions or ash-based discharges to the marine environment, imposes involuntary risks on the local community. The significance of the added risk should be weighed with other risks from emissions.

43. In addition to mercury contamination, other PTS such as dioxins and furans (PCDD/PCDFs) will be readily generated and emitted from the proposed coal-fired plant. UNEP (2002)[10] has reported on dioxins and furans in South East Asia and the South Pacific among other PTS.

44. This assessment noted that dioxins and furans are by-products resulting from the production of other chemicals and from the low temperature combustion of fuels such as coal and incineration processes. They have no known use.

45. These compounds are characterised by their lipophilicity, semi-volatility and resistance to degradation (half-life of TCDD in soil of 10-12 years) and long-range transport. They are

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[9] Sullivan, T.M; Lipfert, F.D; Morris, S.M, and Renniger, S. (2003). Assessing the mercury health risks associated with coal-fired power plants: Impacts of local depositions. Presentation at Air Quality IV Conference, Arlington, VA, September 23, 2003. http://www.netl.doe.gov/coal/E&WR/air_q/health_effects/PRH-2_AQIV_Sullivan.pdf. Accessed February 2005.

[10] UNEP (2002). *Regionally Based Assessment of Persistent Toxic Substances*. *South East Asia and South Pacific Regional Report.* United Nations Environment Program and the Global Environmental Facility (GEF). December 2002.

also known for their ability to bioconcentrate and biomagnify under typical environmental conditions.

46. The toxicological effects reported refer to the 2,3,7,8-substituted compounds (17 congeners) that are agonist for the AhR (aryl hydrocarbon receptor that is important in mediating the biological and toxicological effects of TCDD and dioxin-like compounds). All the 2,3,7,8-substituted PCDDs and PCDFs plus coplanar PCBs (with no chlorine substitution at the ortho positions) show the same type of biological and toxic response. Possible effects include dermal toxicity, immunotoxicity, reproductive effects and teratogenicity, endocrine disruption and carcinogenicity. At the present time, the only persistent effect associated with PCDD/PCDFs exposure in humans is chloracne. The most sensitive groups are fetuses and neonatal infants (see UNEP 2002).

47. No air samples were sampled at Whangarei near the proposed power station site. However, a low average level of dioxins (about 0.9 ng I-TEQ/kg) was found in soils (parks and reserves) at Whangarei. Typically, levels throughout New Zealand soils ranged between 0.17-1.99 ng I-TEQ/kg of dry soil (forest and grassland soils), 0.17-0.90 ng I-TEQ/kg (agricultural soils) and 0.52-6.67 ng I-TEQ/kg (urban soils). Most of the dioxins in the soils were considered to have come from atmospheric transport and deposition.

48. International comparisons suggest that New Zealand soils have lower dioxin levels than results reported from other surveys except in urban centres.

49. The available New Zealand evidence indicates that dioxin "background" levels are likely to be low in the Whangarei district. Furthermore, the low levels of dioxins present in New

Zealand agricultural soils are given as the reason why the levels of dioxin in meats and dairy products are also very low (fish levels are elevated by comparison).

50. In contrast, the existing oil refinery at Whangarei is a recognised source of dioxin emissions and the proposed coal-burning Marsden B plant will also release significant and additional levels of dioxins into the local and regional airshed (see Table 5). The combustion of 830 000 tonnes of coal each year is estimated to release 0.05 g to 0.29 g of dioxins. Industrial and agricultural coal combustion is already estimated to be contributing 0.034-4.0 g of I-TEQ per year.

Table 5: International emissions data for polychlorinated dibenzo dioxins and furans (PCDD/PCDF) – coal combustion

Emissions study	PCDD/PCDF emissions (ng I-TEQ/tonne coal-fired)
US	
Average	194
UK	
Power plant	60-320
Industrial/commercial	40-4800
Netherlands	
Power plant	350
Industrial	1600
Australia	
Utility side coal combustion	60-350*
Industrial	40-4800*

* adopted estimates only

Source: Environment Australia (2002)[11]

51. Leachate or seepage of dioxins from landfills in New Zealand is also estimated to be a major source of annual emissions to land.

[11] Environment Australia (2002). *Sources of Dioxins and Furans in Australia: Air Emissions – Revised Edition.* Canberra, Australian Capital Territory.

Environmental costs

Electricity generation

52. The "total cost" of an energy conversion project such as Marsden B comprises the economic, environmental and health costs of the entire operation over the projected lifespan and remediation period.

53. Various environmental and health-related costs of coal-fired electricity have been compared in Europe and Australia to some degree with the costs of generating coal-fired electricity. For example, Diesendorf (2003/2004)[12] has argued that the conservative cost of generating coal-fired electricity becomes about A 11c/kWh if greenhouse gas and local air pollution health hazards are valued. Current costs of generating electricity from coal-fired power stations in eastern Australia are given as about A 4c/kWh compared with Australian wind farms of A 8-10c/kWh (2003) and projected costs of A 6-8c/kWh (2010). If basic environmental and health-related costs are included in the cost of electricity generation (in kWh), then a renewable technology such as wind energy, with negligible or low environmental and health costs, becomes more cost competitive than coal-fired generation.

54. Projected New Zealand costs of electricity generation from different types of fuel or energy sources are given in Table 6. For new generation plants, wind, geothermal, hydro and gas combined cycle can be seen as cost competitive with coal especially with the inclusion of the carbon tax.

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[12] Diesendorf, M. (2003/2004). http://www.sustainabilitycentre.com.au/WindPowersStrength.pdf. Accessed July 2005.

Table 6: Comparison of Future Electricity Generation Costs in New Zealand and Proposed Marsden B

Energy or Fuel Type	New Generation Plants (1)		
	Quantity (GWh)	Estimated Cost per kWh	
		Exclusive of Carbon Charge (cents)	Inclusive of Carbon Charge (cents)
Wind	4140	6.2 – 8.5	6.2 – 8.5
Geothermal	5475	4.0 – 8.5	?
Hydro	4800	4.5 – 8.5	4.5 – 8.5
Gas combined cycle	10 000	5.7 – 7.7	6.5 – 8.5
Coal	Very large	6.1 – 7.1 (South Island)	7.6 – 8.6 (South Island)
	No limit	8.3 – 9.4 (North Island)	9.8 – 10.9 (North Island)
Liquefied natural gas	No limit	8.5 – 10.6	9.3 – 11.6
Fuel oil	No limit	11.3	12.0
Distillate	No limit	16.0	17.0
Cogeneration	1700	4.6	?
	Marsden B Proposal – Refurbishment (2)		
Coal	2500	7.4	(8.5)

(1) Modified from New Zealand Ministry of Economic Development (2003), New Zealand Energy Outlook to 2025, Wellington, New Zealand.

(2) Taken from Statement of Evidence of Philip Thomas Donnelly, Economic Consultant, p. 42

55. Donnelly in evidence before this Hearing understands that the electricity generation cost of the refurbished Marsden B plant will be NZ 7.4 cents/kWh compared with NZ 8.5 cents/kWh for alternatives such as wind, geothermal and gas combined cycle plants.

56. While it is unclear how the 7.4 cents/kWh has been derived, it is critical to include total environmental costs in any evaluation.

57. Such costs are directly applicable to the Marsden B proposal and consent conditions which will result in added costs of pollution control, monitoring, carbon tax (CO_2 equivalent

emissions), health-related risks, waste disposal, loss of land, mitigation and amenity effects.

58. The potential scope of environmental costs, including health-related risks for the Marsden B Project, is summarised below, based on various submissions and evidence prepared for the Northland Regional Council/Whangarei District Council Joint Hearings.

Environmental Costs of Marsden B Proposal

59. Evaluation of the total cost of the proposed Marsden B coal-fired power station to the community needs to include the environmental costs that result from emissions to air, releases to waters, waste disposal to land, alienation or loss of land through infrastructure development and other externalities such as the mining and transport of coal (about 1 million tonnes/year).

60. Local and regional environmental costs include:

- Pollution control or treatment and monitoring of air emissions and water releases
- Waste disposal and clean-up of ash materials
- Alienation and loss of land
- Contamination of local and regional airsheds, groundwaters, inshore waters and seafoods
- Potential damage to local forests
- Added health costs and risks in terms of morbidity and mortality
- Provision and maintenance of local amenity
- Externality costs of greenhouse gas emissions
- National interests related to global issues and international commitments

Contamination of Local and Regional Environments

61. Local airshed contamination with gases, particulates or dusts, trace element and organic emissions that are likely to be significantly above existing levels.

62. Short-term events of elevated sulphur dioxide levels with potential for short-term exceedances of proposed ambient limits.

63. Increased potential of incidences of asthma or chronic airways obstructive diseases. About 15 percent of New Zealanders are reported to suffer from asthma, which is considered a major public health issue in New Zealand. Children are particularly vulnerable.

64. Exposure to respirable dusts (PM_{10} and $PM_{2.5}$) has been predicted to be low to negligible due to proposed controls. However, no ambient monitoring is proposed for the effectiveness of dust controls despite large scale handling and burning of about a million tonnes of coal each year.

65. An indication of health risks and costs associated with exposures to respirable dusts is given in Table 7.

66. Potential health costs are likely to be associated with exposures to increased levels of a combination of air pollutants.

67. Pollution emissions (and wastes) from a coal-fired power station will also add an identifiable source to the pollutant inventory for the region, including persistent toxic substances (PTS).

68. Coal emissions contain substantially higher levels of mercury than natural gas.

69. Mercury emissions from the power station will increase deposition of mercury within the local-regional airshed and are likely to add to mercury levels in marine ecosystems. There is potential risk of increased mercury levels in marine fish in combination with other natural and discharge sources.

70. Local consumers of high fish diets, particularly pregnant women, are likely to have significant health risk from mercury intake in contaminated fish.

71. There are daily releases of trace element and dioxin contaminants into inshore waters used for seafood harvesting and aquaculture.

72. There is actual or perceived contamination of local seafoods with potential loss of income and recreational value for exposed marine waters.

Table 7: Summary of Projected Environmental Costs for Marsden B Coal-Fired Power Station

		Indicative Costs (NZ$)
Direct Environmental Costs		
Pollution Controls		
Air	• Construction of 119m stack • Electrostatic precipitation baghouse (reduce flyash emissions) • Flue gas desulphurisation (SO_2 reduction) • Selective catalytic reduction (SCR) (reduce NO_x) • Operational costs	?
Waters – Coastal Inshore	• Maintenance of cooling water intake and discharge pipes • Treatment of cooling waters	?
Waters – Stormwaters/ Leachates	• Construction and maintenance of collection/drainage network/sumps • Primary settlement pond • Ash disposal pond • Secondary pond/tanks • Treatment of ash leachates/pond waters and process waters	?
Land	• Disposal of 4 million cubic metres of ash materials on 50ha within 74ha of farmland • 6 million tonnes of regulated wastes @ $50/tonne disposal cost over 35 years • Permanent loss and alienation of 74ha of farmland	300 000 000
Pollution Monitoring		
Air	• Continuous and emission testing of stack gases • Ambient air (continuous monitoring) sites $(S)_2$ and NO_x)	?
Water	• Intake and discharge monitoring • Receiving waters and sediments monitoring • Monitoring of seafoods • Stormwater monitoring • Groundwater monitoring	?
Carbon Dioxide Emissions	• Carbon tax estimate ($15/t of CO_2 equivalent) - $28.5 million per year @ 35 years	998 000 000*
	• Financial Assurances (Bond) on risks of ash landfill remediation costs - $? @ 500 000 000m² plus off-site risks	?
	• Future mercury emission controls (e.g. potential carbon injection)	?

		Indicative Costs (NZ$)
Indirect Costs		
Air	• Contamination of local airshed significantly above existing levels • Loss of amenity for community and existing industry (e.g. oil refinery) • Health related costs (asthma, allergies, respiratory, cardiovascular, morbidity and mortality)	? (**)
Inshore Waters	• Permitted contamination of mixing zone and other local inshore waters and sediments significantly above "background" • Risk of increased mercury contamination of fish from atmospheric deposition and discharge • Real and perceived risks of seafood contamination of inshore fisheries from Bream Bay and also aquaculture production between or near Marsden A and B outfalls	?
Indigenous Forests	• Risk of damage to local forests from emissions and potential acid rain	?
Recreation/ Tourism	• Loss of amenity at Bream Bay – reduced use of beaches/facilities and recreational fishing	?
National and International Interests	• Significant increase in emissions and releases of carbon dioxide and persistent toxic substances (PTS) into regional airshed and waters	?

* Unadjusted rates and undiscounted but about 1/3 of current European trading price of carbon
** For example, Australian averaged costs for hospital admissions have been derived as:
Asthma $8875
Cardiovascular disease $11709
COPD $9610
Source: NEPC (2002), Impact Statement for $PM_{2.5}$ Variation, National Environment Protection Council, Canberra

Conclusions

73. The proposal to repower the Marsden B power station using pulverised coal combustion for electricity generation requires proper life-cycle analysis of environmental and economic effects of the project..

74. There is an opportunity cost for the local and regional environments because of the irreversible loads of wastes and pollutant emissions that will occur during the life-time of the project (estimated to be 35 years) and, to some degree, post-closure.

75. This project therefore is considered to have a low degree of sustainability in terms of natural and physical resources and waste production, contaminant discharges to air, water and land, and renewable energy resources in New Zealand. The contamination of the adjacent coastal marine areas of Bream Bay and Whangarei Harbour and former grazing land is likely to be irreversible. Contaminant discharges are difficult to control and effectively measure. Even with recommended consent conditions, the impacts on marine resources from coal-fired power generation are very uncertain. There is inadequate safeguarding of the marine resources because outcomes will not be evident in the short-term.

76. The proposal will cause significant increases and residual contamination of some physical and natural resources of the area, long-term impacts of waste disposal and uncertainties in safeguarding local resources, including their longer-term use and additional environmental costs for the community, particularly in comparison with alternative option.