SUBMISSION

NORTHLAND REGIONAL COUNCIL

CARING FOR NORTHLAND AND ITS ENVIRONMENT

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On An Application for a Resource Consent

This submission is made under Section 96 of the Resource Management Act 1991.

(Before completing and sending this submission form please refer to Notes A and B below.)

For Council Use Only

To: The Secretary
Northland Regional Council
Private Bag 9021
Whangarei

1. Person or Body making Submission

Name: Greenpeace New Zealand, Inc.

Postal Address: 113 Valley Road, Mount Eden, Auckland
Attention: Steve Abel

Telephone: 09 630-6317 Fax: (09) 630-7121

2. Name and Address for Correspondence (if different from name and address given above)

Name:

Postal Address:

Telephone: ( ) Fax: ( )

3. Application to which Submission Relates

Applicant: MIGHTY RIVER POWER LTD.

Proposal: MARSDEN B COAL FIRED POWER STATION

NRC Application Number: CON 20031101101

4. General Nature of Submission (tick one box)

☐ In support of application, or

☑ In opposition of application, or

5. The Particular Parts of the Application I Support/Oppose are:

☑ The whole application (tick box), or the following parts of the application

Important Notes:

(A) Please ensure that all sections of this form, on both sides of the form, are completed.

(B) If this Submission is faxed to the Council, it would be helpful if the "original" submission was also posted or delivered to the Council as soon as possible.

For Page 2, Please Turn Over

6. The Reasons for making the Submission are:

I oppose the proposed repowering of the Marsden power station to be powered by coal because:

(1) it will emit over 1.8 million tonnes of carbon dioxide per year, at a time when the effects of climate change are becoming more and more evident when, the Kyoto Protocol has entered into force and when New Zealand must reduce its greenhouse gas emissions, and to do so will have to increase its renewable energy resources such as wind;

(2) The effects of climate change and the numerous benefits to be derived from renewable energy alone mean this consent should be refused. Approval of the proposal will impede New Zealand's moving towards renewable energy generation projects and will impede New Zealand meeting the strategic directions set following the Climate Convention and the Kyoto Protocol. Granting these consents would seriously undermine the economic viability of clean renewable energy alternatives   Marsden B is contrary to numerous national directives and strategies on waste, coastal policy, energy efficiency and conservation and climate change;

(3) Greenpeace opposes the emission and discharge of pollutants such SOx, NOx, particulates, polycyclic aromatic hydrocarbons (PAHs), naturally occurring radioactive materials, mercury, cadmium and other heavy metals to the air, and persistent and toxic substances including PAHs and heavy metals, including mercury, cadmium and copper, as well as dioxins to the marine environment for reasons of their known and potential negative impacts on the environment, wildlife, food species and human health;

and for the attached reasons.

The purposes of the Act being the sustainable management of natural and physical resources will be fulfilled by declining the application.

(Attach Additional Sheet If Necessary)

7. Decision Sought from the Council on the Application

☐ To grant consent ☑ To refuse consent

If Consent is granted, the conditions I seek are:
(Note – you do not have to suggest conditions, particularly if you seek that consent be refused)

(Attach Additional Sheet If Necessary)

8. Attendance at any Council Hearing (See Note (1) Below)

☑ I wish to be heard in support of my submission
☐ I do **not** wish to be heard in support of my submission

*Please clearly tick **ONE***

9. Signature of Person making Submission, or Authorised Agent, and Acknowledgement of Service on Applicant

Signature: ______________________________
(Person making Submission or Authorised Agent)

Date: 23 February 2005

8I acknowledge, in signing this submission, that a copy has been sent, or will be sent, to the applicant. (see Note 2 below).

Notes:

(1) Under Section 100 of the Resource Management Act, the Council is not obliged to hold a hearing on the application, unless the applicant or any person making a submission requests a hearing. Section 99 of the Act also makes provision for pre-hearing meetings for the purpose of clarifying, mediating, or facilitating resolution of any mater or issue.

(2) Section 96(4) of the Act requires every person who makes a submission to serve a copy of it on the applicant as soon as reasonably practicable after serving the submission on the Council.

Greenpeace Submission on Mighty River Power Ltd Application for Repowering Marsden B as a Coal Fired Power Station

INTRODUCTION

Greenpeace New Zealand, Inc. ('Greenpeace') opposes the resource consents applied for by Mighty River Power limited for the repowering of Marsden B power station for coal. The proposed power generation facility would emit over 1.8 million tonnes of carbon dioxide per year and require 850,000 tonnes of coal per annum, imported from outside the region, and probably even outside the country. The Bream Head/Te Whara Reserve, the wetlands of the Ruakaka Estuary, Passenger Island Marine Reserve and Whangarei Harbour are in the immediate vicinity of the proposed facility, and Marsden B proposes to discharge SOx, NOx, particulates, polycyclic aromatic hydrocarbons (PAHs), naturally occurring radioactive materials, mercury, cadmium and other heavy metals to the air, and persistent and toxic substances including PAHs and heavy metals, including mercury, cadmium and copper, as well as dioxins,to the marine environment.

This application underlines the need for a national sustainable energy generation strategy. Approval of the proposal would impede New Zealand's moving towards renewable energy generation projects and would impede New Zealand meeting the strategic directions set following the Climate Convention and the Kyoto Protocol. The effects of climate change and the benefits to be derived from renewable energy alone mean this consent should be refused.

Coal-fired power stations are major world polluters responsible for emissions of a wide range of pollutants for example mercury, SOx, NOx, particulates, cadmium and other heavy metals, POPs, PAHs and dioxin. This would cause cumulative effects on sediments in the marine environment. Storage of ash waste close to the facility is not environmentally secure for the long term. There are no considerations for removal of the ash or proposed clean-up in the case of accidents or at the expected discontinuation or closing of the plant. This application violates the principles of the Treaty of Waitangi in relation to pollution of air, land and water, including kai moana.

Granting of this consent would undermine the economic viability of clean renewable energy alternatives such as wind energy. Marsden B is contrary to numerous national directives and strategies on waste, coastal policy, energy efficiency and conservation and climate change. Marsden B is also contrary to international commitments including the Stockholm Convention and the Convention on Biodiversity.

The Assessment of Effects on the Environment (AEE) required by Schedule 4, although voluminous, is inadequate. It neither includes an adequate description of the proposal, nor does it make a serious attempt to provide a description of any possible alternative locations as required by paragraph (a) or methods for undertaking the activity – i.e. renewable energy, as required by paragraph (b). The assessment is limited to one coal type but the quality of the range of coal types to be burned at the power station remains unspecified, and in particular the range of effects across coal with possible sulphur contents is not assessed. In addition, while the assessment on the effects of cooling water abstraction and discharge was based on a flow rate of $7.6m^3/s$, the application seeks permission for up to $13\ m^3/s$. This represents a 71% increase in cooling water discharges or an underestimation of effluent concentrations by a factor of 1.7 and means the AEE is inadequate.

The attached report by Envirotest in support of this submission provides further detail with respect to the above and other matters.

All consents should be refused. Greenpeace wishes to be heard in support of its submission.

I. RESOURCE MANAGEMENT ACT 1991 PART 2 CONSIDERATIONS

All matters to which the consent authorities must have regard under section 104 are subject to Part 2 of the Act. Sections 5, 6, 7 and 8 of the Act are highly relevant to this application.

Section 5

The purposes of the Act being the sustainable management of natural and physical resources in section 5 of the Act will be fulfilled by declining the application. The proposed power station would not sustain the potential of natural and physical resources, including water and air, to meet the reasonably foreseeable needs of future generations, so is contrary to section 5(2)(a) of the Act. It would not safeguard the life-supporting capacity of air, water, soil and ecosystems as required by section 5(2)(b) of the Act, and in fact would degrade the life-supporting capacity of each. It would not adequately avoid, remedy or mitigate the adverse effects of the proposed activity on the environment, as is required by section 5(2)(c) of the Act.

Section 6

Section 6 of the Act requires that in achieving the purpose of the Act, being the sustainable management of resources, all persons exercising functions and powers under it, in relation to managing the use, development and protection of natural and physical resources, shall *recognise and provide for* the stated matters of national importance. These include

(a) the preservation of the natural character of the coastal environment, including the coastal marine area (CMA), and its protection from inappropriate use and development.

The Bream Head/Te Whara Reserve, the wetlands of the Ruakaka Estuary, Passenger Island Marine Reserve and Whangarei Harbour are in the immediate vicinity of the proposed facility, and Marsden B proposes to discharge persistent and toxic substances and heavy metals, including mercury, cadmium and copper, as well as dioxins to the marine environment. The proposal, far from preserving the natural character of the coastal environment and the CMA, would degrade and pollute it, and the discharge of chemicals and heavy metals is an entirely inappropriate use of the CMA.

(b) the protection of outstanding features and landscapes from inappropriate use and development. Bream Bay/ Te Whara Reserve would suffer pollution from the proposal in a way that is completely inconsistent with the sustainable management purposes of the Act.

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna. The proposal would degrade Bream Bay, Whangarei Harbour, the Te Whara Reserve and the Whangarei Heads area which are nationally significant habitats for marine life and birdlife. See *Appendix 1: Outline of some key conservation values in vicinity of Marsden B*

Marine mammals, including whales and dolphins, are known to bioaccumulate dioxins. The impacts of the proposal on these mammals have not been addressed.

(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga. The proposed power station discharges would pollute historic and current sources of kai moana such as the tuatua beds adjacent to Marsden B.

Section 7

In achieving the purpose of the Act, all persons exercising functions and powers under it, in relation to managing the use, development and protection of natural and physical resources, are required to have *particular regard* to the following.

(a) *Kaitiakitanga*. The proposed power station discharges would pollute historic sources of kai moana.

(aa) *the ethic of stewardship*. Granting a resource consent to pollute Bream Bay is inconsistent with the ethics of stewardship.

(b) The efficient use and development of natural and physical resources. This proposal would undermine the economic viability and use and development of clean renewable energy alternatives including using wind resources. Marsden B is contrary to numerous national directives and strategies on waste, coastal policy, energy efficiency and conservation and climate change. Approval of the proposal would impede New Zealand's moving towards renewable energy generation projects using wind resources. The proposed power generation facility would emit over 1.8 million tonnes of carbon dioxide per year and require 850,000 tonnes of coal per annum, imported from outside the region, and possibly even outside the country.

(c) the maintenance and enhancement of amenity values. The widely enjoyed and valued amenity values of Bream Head/Te Whara Reserve, the wetlands of the Ruakaka Estuary and Whangarei Harbour would be greatly affected by the discharge, as would the amenity values of land from the air discharges of SOx (sulphur oxides) and NOx (Nitrogen oxides). Meridian Energy CEO Keith Turner asked rhetorically with respect to coal, "does Auckland want to be rained on by sulphur dioxide? I doubt if it will." (NZ Herald 15 February). Nor do the residents of Whangarei and surrounding areas. Swimming, surfing, shellfish gathering (mainly tuatua) and surfcasting, fishing, pipi and scallop harvesting, rock lobster potting and other recreational and food gathering activities would suffer.

The repowering of Marsden B using a coal-fired boiler would impact on the scenic and amenity values and recreational attributes of this part of the coastline. This would directly impact the lifestyle of the Ruakaka community as well as the tourism potential (and therefore economic impacts) of the area.

(d) The intrinsic values of ecosystems. Heavy metals and POPS would bioaccumulate in the ecosystem. There is no assessment in the AEE of accumulative acidification of soils, and the indigenous soil fauna & flora from acid gas releases & deposition. The ecosystems would be degraded.

(f) maintenance and enhancement of the quality of the environment. The air discharges, including SOx (sulphur oxides) and NOx (Nitrogen oxides), and water discharges and leachates from the ashpile discharged to the groundwater and sea, as well as the effects of climate change, mean that the quality of the environment would not be maintained, let alone enhanced, by the proposed power station.

(g) *Any finite characteristics of natural and physical resources.* The degradation of Bream Bay, the discharges into air and the contribution to climate change from the proposed power station would take place in contravention of the recognition that land, water and air is finite and must be managed sustainably.

(i) the effects of climate change and (j) the benefits to be derived from the use and development of renewable energy. *S*ection 104E provides that when considering an application for a discharge permit relating to the discharge into air of greenhouse gases, a consent authority must not have regard to the effects of a discharge on climate change, except to the extent that the use and development of renewable energy enables a reduction in the discharge into air of greenhouse gases either (a) in absolute terms or (b) relative to the use and development of non-renewable energy.

It is therefore clear from the provisions of sections 7 and 104E that the councils assessing this application must have particular regard to the effects of climate change, must have particular regard to the benefits to be derived from the use and development of renewable energy, and must have regard to the effects of the Marsden B discharge of greenhouse gases on climate change to the extent that the use and development of renewable energy enables a reduction in the discharge into air of greenhouse gases either (a) in absolute terms or (b) relative to the use and development of non-renewable energy.

Marsden B would emit from 1.8 million to 2.17 million tonnes of carbon dioxide per year. It would significantly impede New Zealand meeting the strategic directions set following the Climate Convention and the Kyoto Protocol. This coal station would increase the hurdles to renewable electricity generation in New Zealand in providing the coal industry with further effective subsidies including the failure to internalize the cost to the country and the environment of the emissions of greenhouse gases, the effect on the price and supply of electricity and the failure to send strong signals to the electricity generating sector that generation of electricity by fossil fuels is to stop.

Relevant considerations under section 104(c) include relevant international obligations. The United Nations Framework Convention on Climate Change (UNFCCC) is the overarching Convention addressing climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other heat-trapping gases. Under the Convention, governments gather and share information on greenhouse gas emissions, national policies and best practices, launch national strategies for addressing greenhouse emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries, and cooperate in preparing for adaptation to the impacts of climate change. New Zealand is a party to the Framework Convention. The 1997 Kyoto Protocol to the Convention shares the Convention's objective, principles and institutions, but significantly strengthens the Convention by committing Annex I Parties to individual, legally-binding targets to limit or reduce their greenhouse gas emissions. New Zealand has ratified the Kyoto Protocol, which entered into force on February 16, 2005. Individual targets for Annex I Parties, which include New Zealand, are listed in the Kyoto Protocol's Annex B. New Zealand's target is 100%, which means that New Zealand is required under the Protocol to reduce its greenhouse gas emissions back to 1990 levels on average during the first commitment period of 2008-2012. Meeting this target would require reductions in CO2 emissions, but more drastic reductions would need to be negotiated for future commitment periods.

Renewable energy such as wind energy would significantly assist New Zealand to meet its obligations under the Kyoto Protocol whilst helping to meet New Zealand's growing electricity demand without increasing the use of thermal generation, a major contributor of greenhouse gases to climate change.

Section 8

All persons exercising functions and powers under the Act are required to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). This requires more than just consultation. There is an obligation to recognise tini rangatiratanga, which includes management of resources and other taonga according to Maori cultural preferences. There is also an obligation of active protection of Maori interests. The proposal, in its many discharges, would clearly affect Maori, in its effects on kai moana and otherwise.

A. The Contribution of Coal to New Zealand's CO_2 Emissions

The Ministry of Economic Development report *New Zealand Energy Greenhouse Gas Emissions 1990-2003*, (June 2004) shows that since 1990, being the Kyoto base year, emissions from thermal electricity generation were the fastest growing sector of emissions, having increased by 90%, from 3,518 kt CO_2 to 6,687 kt. Gross emissions, on the other hand, increased by 40%. Emissions from thermal electricity generation in 2003 were about 20% higher than in 2002, largely because more than twice the amount of coal was used at the Huntly power plant in 2003 as in 2002.[1]

Table 1.1.1
Gross CO_2 Emissions by Sector[1]

	Thermal Electricity Generation	Other Transformation	Industry	Domestic Transport	Other Sectors	Subtotal Combustion	Fugitive	Total (Energy) [2]	Industrial Processes	Gross [3]
	COMBUSTION ACTIVITIES									
	kt CO_2									
1990	3,518	2,566	4,782	8,718	2,889	22,474	615	23,089	2,404	25,492
1991	3,911	2,243	5,207	8,723	2,672	22,756	700	23,456	2,529	25,985
1992	5,063	2,567	4,803	9,115	2,947	24,496	667	25,163	2,665	27,828
1993	4,096	2,499	5,004	9,535	2,651	23,785	628	24,413	2,795	27,208
1994	3,262	2,194	5,380	10,246	2,806	23,887	676	24,563	2,693	27,255
1995	2,951	1,778	5,539	10,965	2,689	23,923	625	24,548	2,770	27,319
1996	3,741	1,565	5,891	11,052	2,649	24,899	633	25,532	2,765	28,297
1997	5,695	1,257	5,942	11,371	2,683	26,948	670	27,618	2,632	30,251
1998	4,023	1,230	5,911	11,564	2,791	25,519	651	26,170	2,761	28,931
1999	5,400	1,201	5,931	11,829	2,873	27,234	615	27,849	2,883	30,732
2000	5,047	1,167	6,116	12,476	3,071	27,877	579	28,456	2,854	31,310
2001	6,524	1,182	6,310	12,885	3,157	30,058	618	30,676	2,934	33,610
2002	5,581	1,230	6,536	14,040	3,195	30,582	610	31,191	2,952	34,144
2003	6,687	1,215	5,910	14,663	3,355	31,829	647	32,477	3,133	35,610
∆90-03	90.1%	-52.6%	23.6%	68.2%	16.1%	41.6%	5.2%	40.7%	30.4%	39.7%
∆90-03pa (Mean)[4]	5.1%	-5.6%	1.6%	4.1%	1.2%	2.7%	0.4%	2.7%	2.1%	2.6%
∆90-03pa (Trend)[5]	4.1%					2.3%		2.3%		2.2%
∆02-03	19.8%	-1.2%	-9.6%	4.4%	5.0%	4.1%	6.2%	4.1%	6.1%	4.3%
% of 03	20.6%	3.7%	18.2%	45.1%	10.3%	98.0%	2.0%	100.0%		
Uncertainty	±3%	±3%	±5%	±7%	±6%	±5%	±7%	±5%	±5%	±5%

MED: NZ Energy Greenhouse Gas Emissions Table 1.1.1

Coal use at the Huntly plant more than doubled from 2002 to 2003, and Huntly was largely responsible for a 56% increase in emissions from coal since 1990.[2] CO_2 from thermal electricity generation grew faster between 1990 and 2003 than emissions from any other sector.

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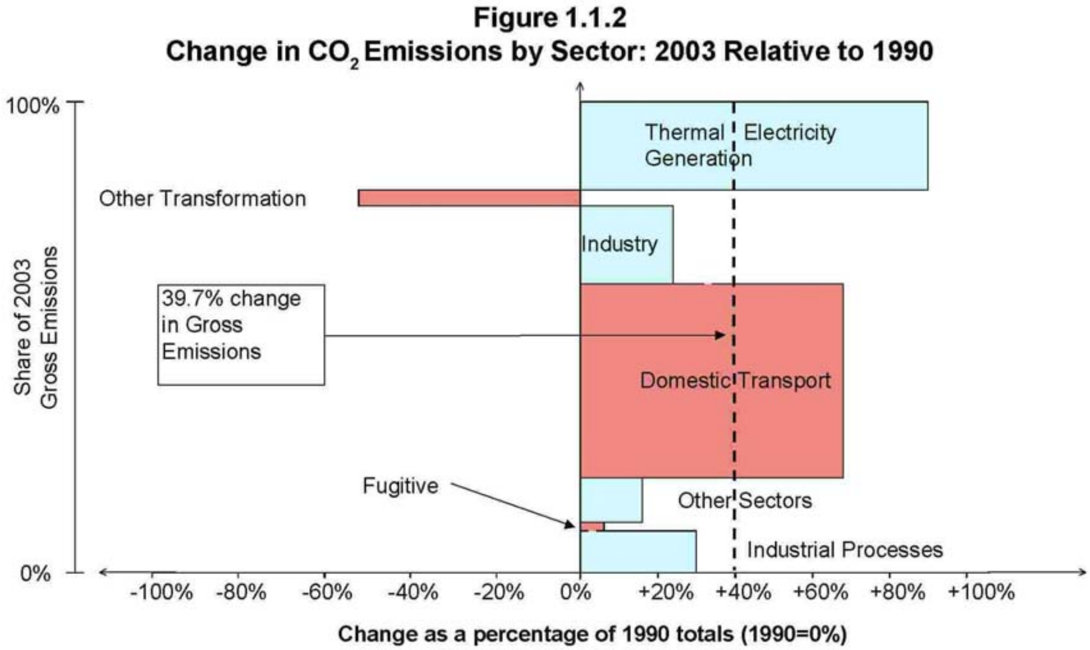
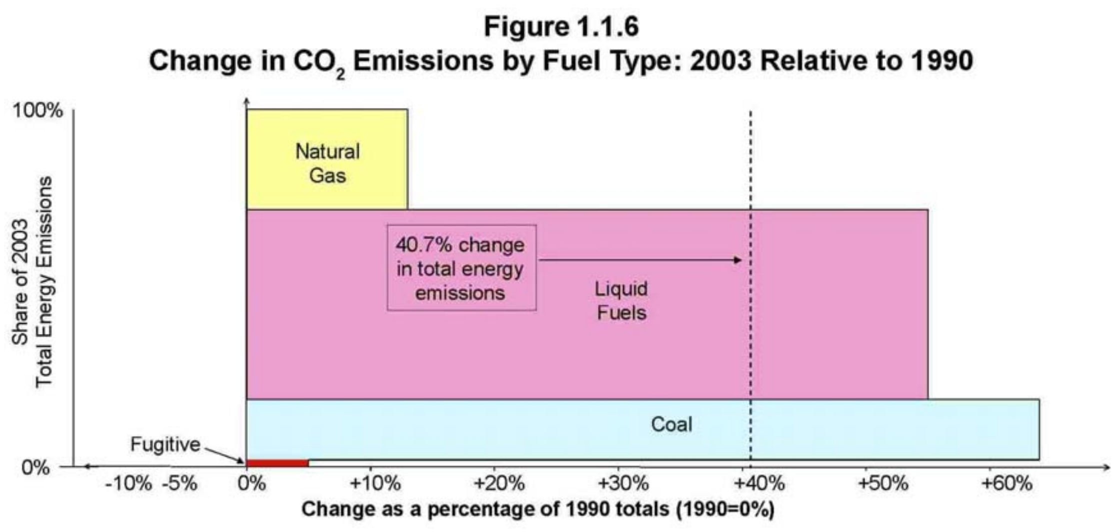
[1] Chapter 1, Table 1.1.1, Gross CO_2 emissions by sector.

[2] Chapter 1, page 5.



MED: NZ Energy Greenhouse Gas Emissions Figure 1.1.2

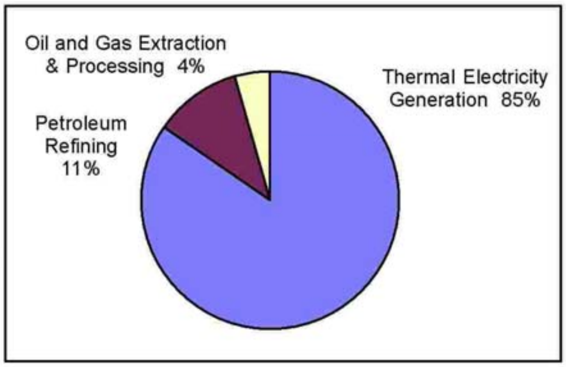
Between 1990 and 2003, emissions from coal grew more than any other fuel type in percentage terms, by 64%.(Figure 1.1.6).



In 2003, CO_2 emissions from thermal electricity generation represented 85% of Co2 emissions from transformation.[3]

[3] Transformation emissions are emissions from fuels burnt by energy producing industries and from combustion during the conversion of primary forms of fuels to secondary and tertiary forms.

Figure 2.1
CO_2 Emission Shares from Transformation: 2003



MED: NZ Energy Greenhouse Gas Emissions Figure 2.1

Of this, emissions from coal increased from 491 kt CO_2 in 1990 to 2,817 kt in 2003: an increase of 473.8%.

Table 2.1.2
CO_2 Emissions from Transformation by Fuel Type

	Gas	Liquid Fuels	Coal	Total
		kt CO_2		
1990	5,365	228	491	6,084
1991	5,694	232	229	6,154
1992	6,306	412	913	7,631
1993	5,874	275	446	6,595
1994	4,897	169	389	5,456
1995	3,896	273	561	4,729
1996	4,487	205	614	5,306
1997	5,598	155	1,199	6,952
1998	4,294	192	767	5,253
1999	5,242	220	1,139	6,601
2000	5,167	170	877	6,215
2001	6,191	182	1,334	7,707
2002	5,317	172	1,321	6,811
2003	4,874	210	2,817	7,902
Δ90-03	-9.1%	-7.8%	+473.8%	+29.9%
Δ90-03pa	-0.7%	-0.6%	+14.4%	+2.0%
Δ02-03	-8.3%	+22.0%	+113.2%	+16.0%
% of 03	15%	1%	9%	24%
Uncertainty	*±3%*	*±7%*	*±5%*	*±3%*

B. The Effects of Climate Change

"Climate change" is defined in section 2 of the RMA as:"… a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods."

A large and increasing body of evidence indicates that due to climate change, the world is likely to experience a rise in temperature, resulting in increasing sea levels, more frequent extreme weather events and a change in rainfall patterns. These climatic changes will potentially impact on New Zealand native ecosystems, industries, infrastructure, health, biosecurity and economy. In the long term, if unchecked, climate change increases the risk of major and irreversible changes to the Earth. For example, even for relatively moderate warming, the Greenland ice sheet is expected to melt completely over the next several thousand years, which would lead to a sea-level rise of as much as 6-7 metres. The cost of doing nothing about climate change could be severe and the impacts on our environment, economy and society are likely to get steadily worse if greenhouse gas emissions are not reduced significantly over the coming decades. In 2001, the IPCC completed the Third Assessment Report - Climate Change 2001 which set out in four volumes its assessment of the effects of climate change. The IPPC is currently undertaking a Fourth Assessment Report.

Some of the global effects of climate change that can be expected include:[4]

- an increase in global average surface temperature of about 0.5°C in the 20th century due to anthropogenic forcing (human activity) alone;
- decrease of snow cover and sea ice extent and the retreat of mountain glaciers in the latter half of the 20th century;
- a rise in global average sea level and the increase in ocean water temperatures;
- likely increase in average precipitation over the middle and high latitudes of the Northern hemisphere, and over tropical land areas and an increase in the frequency of extreme precipitation events in some regions of the world;
- shrinkage of glaciers;
- loss of land and salinition of water supplies in low lying Pacific Islands, flood plains and river deltas because of rising sea levels, and many major cities built along coasts or waterways could be affected;
- lower crop yields in tropical and subtropical countries;
- more frequent, intense and extreme climate events such as droughts, heavy rainfall and storms in many areas;
- increasing prevalence of diseases such as dengue fever, malaria and cholera;
- thawing of permafrost;
- lengthening of the growing season in middle and high latitudes;
- poleward and altitudinal (upward) shift of plant and animal ranges;

[4] Working Group I, Intergovernmental Panel On Climate Change (IPCC), Climate Change 2001: The Scientific Basis, *Summary for Policymakers* (2001) and Working Group I, Intergovernmental Panel on Climate Change (IPCC), Climate Change 2001: *Impacts, Adaptation and Vulnerability: Summary for Policymakers(2001)*.

- the decline of some plant and animal species; and

Some of the climate change effects New Zealand is likely to experience include:[5]

- higher temperatures, especially in the North Island;
- increasing sea levels (research has shown that sea levels globally are expected to rise between 9 and 88 cm by 2100, compared with an average rise of 10 to 20 cm in the 20th century) and greater susceptibility of coastlines;
- more frequent and intense extreme weather events such as storms, droughts and floods;
- a change in rainfall patterns such as higher rainfall in the west and less in the east, possibly adversely affecting Otago hydro schemes, and thus adversely impacting on renewable energy;
- a risk of drought and spreading and newly emerging pests and diseases;
- changes in distribution of other species affecting horticulture, pastoral farming and cereal production in Canterbury;
- increased risks of heat stress and subtropical diseases;
- native ecosystems could be invaded by exotic species, the distribution of trees may change, and species may be driven to extinction;
- rising sea levels will increase the risk of erosion and saltwater intrusion, increasing the need for coastal protection;
- snowlines and glaciers are expected to retreat and change water flows in major South Island rivers; and
- costs to the country and to insurers from extreme weather events such as storms, floods and droughts are likely to increase.

C. The Benefits of Renewable Energy in New Zealand

"Renewable energy" is defined in section 2 of the RMA as "… energy produced from solar, wind, hydro, geothermal, biomass, tidal, wave, and ocean current sources."

The National Energy Efficiency and Conservation Strategy[6] identifies the sources / technologies of renewable energy as including the following – hydro, geothermal (with certain controls), wind, solar, biomass and wave current.

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[5] New Zealand Climate Change Office, Climate change impacts in New Zealand, *www.climatechange.govt.nz*.

[6] National Energy Efficiency and Conservation Strategy.

Renewable energy in New Zealand as at year 2003 comprised the following:[7]

Renewable Energy Source	Net Consumer Energy (PJ)
Hydro	80.60
Geothermal – electricity	8.64
Geothermal – direct use	13.20
Wind	0.51
Bio-energy (total)	35.81
Solar (total)	0.19
TOTAL	**139.0**

Benefits of renewable energy include the following.

1. Security of Supply

Wind energy assists with long-term electricity supply security by adding to, and diversifying, New Zealand's generating base. Wind energy complements New Zealand's existing renewable generation sources, allowing hydro resources to be stored during dry periods.

Diversity in energy supply through the development of renewable energy, such as wind energy, reduces wholesale electricity costs, as wind energy resources have limited exposure to energy supply disruptions or price shocks. In contrast, thermal generation costs can rise sharply as a result of fuel supply interruptions and changing fuel prices.

2. Reduction in greenhouse gas emissions

Wind energy assists in meeting New Zealand's growing electricity demand without emitting any greenhouse gases during operation.. Such an activity directly assists to meet New Zealand's climate change obligations under the Kyoto Protocol. In the case of Tararua Wind Farm, the installed capacity of the wind farm is 67.98MW, and it produces enough electricity annually over 30,000 homes and offset approximately 160,000 tonnes per annum of CO_2 emissions.

3. Reduction in dependence on the national grid

Wind energy farms may be installed relatively close to the source of electricity demand, minimising load on the national grid and avoiding or delaying the need for transmission upgrades.

4. Reduction of transmission losses

When electricity flows through wires, some of it is dissipated as losses (effectively heat). The further the distance the greater the losses. Losses also rise disproportionately with the amount of electricity being carried in a particular cable or power line: much larger portion of electricity in a

[7] Taking electrical transmission & distribution losses of 9.4% into account. Renewable Energy Industry Status Report 30 June 2004, page 3. See EECA website *www.eeca.govt.nz*. One PJ (petajoule) equals 278 GWh. A ty the size of Nelson would consume about 1PJ annually. As at March 2002, the total energy production in New Zealand was 487.07 PJ, of which electricity accounted for 118.98 PJ, fossil fuel for 315.72 PJ (for non-transport purposes 119.51 PJ, and for transport purposes 196.21 PJ), biomass for 46.35 PJ and geothermal for 6.02 PJ.

transmission line operating near maximum capacity will be lost in transit than at low transmission rates. At very high transmission rates through the Cook Strait cables, over 15% of each extra MW transmitted is lost.

5. Reliability

Wind is a relatively reliable natural resource. The annual wind energy variation is typically 10%, compared to rainfall variation which is 20%. Wind is also a relatively reliable economic resource. Whilst all primary fuels for thermal-powered electricity generation (oil, coal, LNG and natural gas) have been the subject to significant price increases and volatility over the last few years, and it can be expected coal will be similarly volatile, the primary fuel of a wind turbine - the wind – is free. This means that once a wind farm is built, it has no ongoing fuel price issues, and the cost of producing electricity from the wind depends primarily on the average annual wind speed which is relatively constant from year to year. The only economic volatility that wind power faces is the electricity sale price.

6. Development Benefits

Wind energy initiatives result in industry development, profitable business opportunities and regional development. The promotion and development of wind energy technologies create new employment opportunities. Direct employment arises in areas of research, manufacturing, installation and distribution, and maintenance of renewable energy technologies, in addition to indirect employment opportunities. Windflow New Zealand Ltd is a New Zealand manufacturer of wind turbines that would benefit from the development of wind energy in New Zealand.

7. Contribution to the Renewable Energy Target

Each wind farm will contribute to the New Zealand Renewable Energy Target.

8. Meeting Sustainability Criteria

A report prepared by the Parliamentary Commissioner for the Environment[8] considers the sustainable electricity sector in New Zealand and provides core sustainability criteria applicable to the electricity sector:[9]

Regeneration: Using electricity generated from renewable resources efficiently,
Ensuring that the use of renewable resources does not exceed their long-term rates of natural regeneration.

Substitutability: Using non-renewable resources efficiently, and facilitating the use of new, more efficient electricity technologies and renewables, and distributed generation.

Assimilation: Minimising emissions of: greenhouse gases, other contaminants to air and contaminants to water

Avoiding Irreversibility: Avoiding irreversible impacts on ecosystems and the loss of biodiversity significant cultural and historic landscapes or areas with wild and scenic attributes

Wind power meets these sustainability criteria.

[8] Parliamentary Commissioner for the Environment: Electricity, Energy and the Environment Part A: Making the Connections. June 2003.

[9] Ibid, page 39.

II. ACTUAL AND POTENTIAL EFFECTS ON THE ENVIRONMENT

When considering the application, and these submissions, the consent authority must under section 104(1)(a), subject to Part 2, have regard to any actual and potential effects on the environment of allowing the activity. Those effects include effects from water discharges, air discharges and the leachate. These effects are described below and addressed in more detail in the Envirotest Attachment. It is clear that despite the applicant's rhetoric about low emissions, there are not only serious doubts about the efficacy of the Flue Gas Desulfurisation (FGD) and other devices, but after pollutants are collected by pollution control devices to prevent emissions to the air, pollutants are merely shifted to another waste stream as solid or liquid wastes. [10]

A. Water Discharges

The assessment on the effects of cooling water abstraction and discharge was based on a flow rate of 7.6m^3/s but the application seeks permission for up to 13 m^3/s. This represents a 71% increase in cooling water discharges or an underestimation of effluent concentrations by a factor of 1.7. This alone introduces an element of unacceptable uncertainty into the application.

Marsden B would discharge POPs and heavy metals to the marine environment.[11] There are numerous instances of inadequate assessment, including failure to assess the accumulative effects of heavy metals in the ecosystem, as opposed to water trigger values. Nor are there undertakings to monitor the effect of the discharges on the ecosystem or population. Heavy metals are bioaccumulative. Metals of concern include the following:

1) *Mercury*: It is unacceptable to pump mercury into the area from Marsden B.[12] Mercury is known to convert to bioavailable form after release to water bodies, and subsequently biomagnify, mercury cycles are highly complex, and need to have a comprehensive and ongoing monitoring program for fish/shell fish in the area. The AEE[13] admits that contaminant loads may reach mass loads of 75% of permissible mass load for human health protection for fish consumption, and the mercury content of coals is very variable. Global action is underway to address mercury impacts primarily from sea food species accumulation of mercury; accepted safe consumption levels have very recently been lowered and some mercury experts say they should be lowered further.

2) *Cadmium*: The AEE recommends the measurement of background cadmium concentration in the Bream Bay sea water to determine acceptable discharges of this toxic and bioaccumulative metal. It is unclear whether this has will be done.

3) *Copper*: Copper is a metal to which aquatic organisms are particularly sensitive. There is no data available for contaminant loadings of copper for NZ coal type A, and this is despite recognition that copper is toxic to marine bivalves at low concentrations.

4) *PAHs:* These are persistent, toxic and bioaccumulative compounds, and some are carcinogenic. Calculations on discharge loadings are based upon only one PAH, assuming

[10] Clean Air Task Force (2001).

[11] OSPAR (PARCOM Recommendation 97/2,) (Convention for the Protection of the Marine Environment of the North-East Atlantic) states that "Seawater scrubbing should only be used to remove SOx if appropriate cleaning systems are installed to effectively minimise transfer of POPs and heavy metals to the marine environment".

[12] Safe human levels are lowering: see http://www.who.int/ipcs/food/jecfa/summaries/en/summary_61.pdf and http://www.efsa.eu.int/science/contam/contam_opinions/259/opinion_contam_01_en1.pdf.

[13] *Effects of Cooling Water Abstraction and Discharge*, p72

no additive carcinogenic effects. Even the authors acknowledge the limitations of this assumption.[14]

5) *Dioxins*: The AEE[15] states that as a result of their fine size, there would be no retention of discharged sedimentary particles within the bay. Yet no evidence is cited for this assertion.

6) *Biocides*: With the recognised problems associated with the discharge of Degaclean 150, it is not stated what monitoring would be in place to ensure that proposed sulphite treatment is, at all times, effective in addressing this issue.

7) *Sediment and cumulative impacts*: The assessment only considers inputs in the form of ash particles and concludes there are no problematic impacts on sediment as a result of widespread distribution.[16] Since a significant fraction of many heavy metals discharged to the FGD waters would be in soluble forms, partly as a result of acidification of the water from SO2, accumulation in suspended and bottom sea sediment particles in the marine environment is to be expected. This would result in greater accumulation of heavy metals (and possibly some organic compounds) described in the report. Many of which are toxic to aquatic life and have bioaccumulative potential. There is no mention of combined impacts from temperature increase and pollutant loadings expected from seawater FGD (sulphate, acid and other pollutants) in the studies[17] used to demonstrate negligible impacts from cooling waters. These cumulative impacts have not been assessed.

B. Air Discharges

The Whangarei Heads community (located on the Whangarei Heads peninsula, on the north bank of the Whangarei harbour, within a radius of 5.5km to 10km from Marsden B) is directly in the path of dominant wind flows. The Bream Head Reserve, a reserve of national significance, also lies directly downwind of the plant. The AEE is manifestly inadequate in addressing the effects of air emissions. Emissions include SOx,[18] NOx,[19] particulates, naturally occurring radioactive materials and mercury, cadmium and other heavy metals all of which could affect more than one region. No data has been used for stack releases for metals, including mercury, cadmium, lead and others), PAHs (polycyclic aromatic hydrocarbons), and VOC (volatile organic compounds).

Some of the proposed coal types are higher than 1% maximum sulphur.. The AEE states the SO_2 limit will affect coal choice, but the maximum sulphur content of the coal is not defined.[20]

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[14] 6.3.16

[15] *Effects of Cooling Water Abstraction and Discharge*; 6.3.11 page 65.

[16] *Effects of Cooling Water Abstraction and Discharge* table 6.5, Cd annual load=17Kg, but from *Effects of Cooling Water Abstraction and Discharge* appendix 1, this is from combined vapour and ash contributions.

[17] Section 6.1 of *Effects of Cooling Water Abstraction and Discharge.*

[18] Sulphur oxides. A family of gases that includes sulphur dioxide (SO2), a contributor to acid rain.

[19] Nitrogen oxides. One of the six criteria pollutants. The term used to describe the sum of nitric oxide (NO), nitric dioxide (NO2), and other oxides of nitrogen, which plays a major role in the formation of ozone. The major sources of man-made NOx emissions are high temperature combustion processes, such as those occurring in automobiles and power plants.

[20] *Effects of Cooling Water Abstraction and Discharge* states at page that 6 that "coal sulphur content can range from less than 0.3% to about 3%" however, Some NZ coals have up to 5% sulphur (http://crownminerals.med.govt.nz/coal/properties/nzprop.html). It is not stated that the higher sulphur coals will be excluded from use.

Table 4.2 of the Envirotest Attachment sets out estimated stack emissions of gases, particulates and volatile organics

Air pollutant[21]	**Tonnes per year**
Carbon dioxide (CO_2)	2100 (b)
Carbon monoxide (CO)	511 (a)
Nitrogen oxides (NO_x)	6935 (a)
Nitrous oxide (N_2O)	14-20 (c) (f)
Sulphur dioxide (SO_2)	2847 (a)
Methane	16-22 (c) (f)
Total suspended particulates	121 (d)
	7-738 (e)

* assumes annual combustion of 830 000 tonnes of coal per year and 300 MW capacity

One coal plant has listed discharges to air including arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, thallium, vanadium, zinc, hydrochloric acid, hydrogen fluoride, ammonia, PACs, dioxins, and benzo(g,h,i)perylene.[22] Boron is another element of concern.[23]

(1) ***SOx***

Sulphur dioxide (SO_2) is a colourless gas with a sharp and irritating odour. It can affect the respiratory system, the functions of the lungs and cause eye irritation. When sulphur dioxide irritates the respiratory tract it causes coughing, mucus secretion, aggravates conditions such as asthma and chronic bronchitis and makes people more prone to respiratory tract infections. Sulphur dioxide can attach itself to particles, which can cause more serious effects if inhaled.

Residences close to the power station may also be exposed to fine particulate matter and nuisance dust both during the construction phase, which is estimated to take 2 to 3 years, and normal operation. Nuisance dust and odours are the two most common reasons for complaint to local and regional councils.

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[21] Notes:
(a) Emission factors used in air dispersion modelling – Marsden B Proposal
(b) Various estimate based emission factors – Greenhouse Gas Inventory and power station reporting data (tonnes per year)
(c) Factors from Australian Greenhouse Gas Inventory
(d) Based on annual reporting (tonnes per year), Tarong North Power Station – 445MW, Queensland, Australia
(e) Depends on removal efficiencies of combinations of baghouse filter, electrostatic precipitator and scrubber
(f) NZ Coal (21-32 MJ/kg)

[22] See footnote 26.

[23] See Envirotest Appendix.

New Zealand's SO_2 emissions from thermal electricity generation increased from 2,067 tonnes in 1990 to 12,417 tonnes in 2003: a massive 500% increase. This represents 20% of total SO_2 emissions by sector.

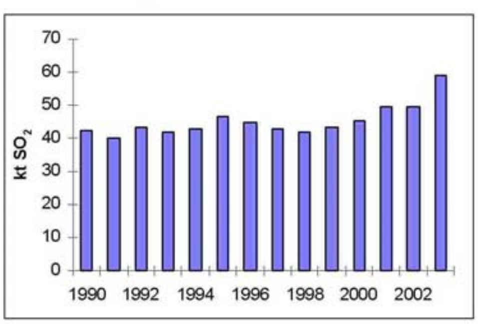
Table 1.7.1
Total SO_2 Emissions by Sector

	Thermal Electricity Generation	Other Transformation	Industry	Domestic Transport	Other Sectors	Subtotal Combustion	Fugitive*	Total
	COMBUSTION ACTIVITIES							
				t SO_2				
1990	2,067	5,764	18,694	5,672	10,066	42,263	2,750	45,013
1991	970	6,137	19,451	5,783	7,806	40,147	3,095	43,243
1992	4,076	5,788	17,865	6,229	9,311	43,269	2,876	46,144
1993	1,865	6,130	19,557	6,703	7,626	41,882	3,011	44,893
1994	1,622	4,135	21,376	7,930	7,748	42,810	3,229	46,039
1995	2,339	6,733	20,944	8,805	7,639	46,461	2,543	49,004
1996	2,561	4,977	20,954	8,495	7,916	44,903	2,836	47,739
1997	5,059	2,947	19,189	7,629	7,963	42,786	3,256	46,042
1998	3,249	4,247	18,550	7,381	8,531	41,958	3,241	45,199
1999	4,742	5,157	17,142	8,537	7,815	43,392	3,020	46,412
2000	3,653	4,604	18,121	11,633	7,464	45,476	3,531	49,007
2001	5,555	4,788	20,260	11,166	7,676	49,446	3,590	53,036
2002	5,503	4,261	19,474	12,420	7,666	49,324	3,476	52,801
2003	12,417	5,247	19,452	13,201	8,589	58,906	3,680	62,587
Δ90-03	+500.8%	-9.0%	+4.1%	+132.7%	-14.7%	+39.4%	+33.8%	+39.0%
Δ90-03pa	+14.8%	-0.7%	+0.3%	+6.7%	-1.2%	+2.6%	+2.3%	+2.6%
Δ02-03	+125.6%	+23.1%	-0.1%	+6.3%	+12.0%	+19.4%	+5.9%	+18.5%
% of 03	20%	8%	31%	21%	14%	94%	6%	100%
Uncertainty	*±20%*	*±20%*	*±20%*	*±20%*	*±20%*	*±20%*	*±20%*	*±20%*

MED: NZ Energy Greenhouse Gas Emissions Table 1.7.1

New Zealand's SO_2 emissions are clearly growing in a disturbing trend.

Figure 1.7.1
Total SO_2 Emissions: 1990–2003



MED: NZ Energy Greenhouse Gas Emissions Figure 1.7.1

Efforts to control emissions from coal power plants are notoriously unreliable. In one case, American Electric Power bought the entire town of Cheshire, Ohio after residents had complained of burning eyes, headaches and sore throats from SO_3 emissions from the plant attributed to NOx scrubbing technologies, requiring residents to forfeit their rights to sue for property damage or health problems as part of the agreement.[24] The Gavin plant which uses FGD technology[25] emitted 680 tonnes of sulfuric acid in 2003.[26]

Another plant, Healy Clean Coal Plant, partly funded by the US Department of Energy's Clean Coal Technology Program, has been closed since 2000, five years after construction, since safe, reliable and economical operation was not possible wih the experimental technology.[27]

The AEE's Modelling[28] shows maximum 1-hour ground level concentrations of SO_2 of 85% of the Air Quality Standard: the maximum is 680 µg m^{-3} whereas modelling shows 500 680 µg m^{-3}.[29] When combined with the uncertainties in the modelling as well as in FGD technology, there are also uncertainties about emissions from NZRC during peak loads up to 1.7 tonnes per hour, it is far from clear that the maximum output from NZRC and Marsden B will be as low as is projected. The necessary consequence of this is that the resource consent must be declined[30] since if the discharge to be permitted by the resource consent is likely, at some time, to cause the concentration of sulphur dioxide in the airshed to breach its ambient air quality standard. Nor are there any undertakings to monitor effects on the ecosystems or health in the populations affected by the discharges.

The AEE has not demonstrated the impact of using coal with varying sulphur contents. Failing to specify the coal types presents a great deal of uncertainty for design of the FGD system and the maximum allowable emission rate could be easily exceeded. To give an illustration, the report on repowering- process description and technical inputs assumes an 85% control efficiency for seawater FGD. Taking that assumption, total emissions without controls would amount to 42 500 tonnes per year (116 tonnes per day) for 5% sulphur coal[31] and with controls would amount to 6375 tonnes per year (18 tonnes per day). Obviously the projected 7.8 tonnes (page 14 and 39 Air Discharge Assessment) which are additional to NZRC emissions of 12 tonnes, would be exceeded as would the Air Quality Guidelines in t0068is scenario. This shows how important the coal input is, yet the applicant failed to specify it. This is clearly for the simple reason that the applicant does

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[24] Alexander's Gas and Oil Connections Company News: North America, "An unusual way to handle an emissions problem," May 16, 2002, at http://www.gasandoil.com/goc/company/cnn22046.htm. See description of Greenpeace Briefing "Clean Coal" Technology, at http://www.greenpeace.org.nz/pdfs/CleanCoalBriefing.pdf. The briefing describes risks and failures of FGD and other technologies, and the incident including failure of technologies in a plant at Cheshire Ohio

[25] See AEP Press Release, January 31, 2002, at http://www.aep.com/newsroom/newsreleases/default.asp?dbcommand=displayrelease&ID=887.

[26] See toxics release inventory for 2003 at http://www.aep.com/environmental/emissioncontrol/rtk/docs/individplants2003.pdf. Other substances released to the air included arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, thallium, vanadium, zinc, hydrochloric acid, hydrogen fluoride, ammonia, PACs, dioxins, and benzo(g,h,i)perylene.

[27] See Golden Valley Electric Association, "Healy Clean Coal Plant", at http://www.gvea.com/projects/healycoal.php

[28] Air Discharge Assessment page 61.

[29] Air Discharge Assessment page 61.

[30] Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004 Clause 21 provides that a consent authority must decline an application for a resource consent to discharge sulphur dioxide into air if the discharge to be permitted by the resource consent is likely, at any time, to cause the concentration of sulphur dioxide in the airshed to breach its ambient air quality standard.

[31] See footnote 20.

not know. However the incentive for the applicant to use low quality and high sulphur coal is clear. This leads to enormous and unacceptable uncertainties in sulphur dioxide output.

The effects of the release of SOx have not been adequately assessed for other reasons as well:

- Accumulative impacts from pollutants released to air have not been addressed other than a limited investigation of potential impacts from SO_2 releases on vegetation.
- There is no assessment of accumulative acidification of soils, and the indigenous soil fauna & flora from acid gas releases & deposition, vital components of functioning ecosystem. There is no discussion of the acid buffering (cation exchange) potential for receiving soils. Some soils are acidic peat, with low ability to buffer deposited acid.
- There is no adequate assessment of impacts from persistent and accumulative pollutants (such as heavy metals and PAHs) or of the combined effects (such as acidification increasing mobilisation of heavy metals already in soils combined with increased deposition of these metals.)
- The AEE is heavily dependent on modeling, which may or may not be accurate. Yet little allowance is made for error: 85% of Air Quality Standard (AQS)[32] leaves very little margin for error.
- Cumulative effects of air discharges from both the NZRC (NZ Refining Company) and Marsden B have also been based on maximum emission limits rather than site-specific estimates of pollutant loads. There is no evidence that cooperation between the two sources is achievable.

(2) ***NOx***

Nitrogen oxides (NO_x) is a mixture of nitric oxide and nitrogen dioxide. Nitrogen dioxide is an odorous, brown, acidic and highly corrosive gas and is a critical component of photochemical smog. Elevated levels of nitrogen dioxide can cause damage to the mechanisms that protect the human respiratory tract and can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease. N_{Ox} emissions from the thermal electricity generation sector increased from 13.2 tonnes in 1990 to 26.3 tonnes in 2003: an increase of 99.6%.

[32] Air Discharge Assessment page 61.

Table 1.4.1
Total NO_x Emissions by Sector

	Thermal Electricity Generation	Other Transformation	Industry	Domestic Transport	Other Sectors	Subtotal Combustion	Fugitive	Total
	COMBUSTION ACTIVITIES							
	kt NO_x							
1990	13.2	17.11	23.3	68.1	14.4	136	0	136
1991	14.6	14.57	26.5	68.8	12.6	137	0	137
1992	18.8	17.16	24.3	70.7	13.5	144	0	144
1993	15.4	16.36	25.8	72.3	13.2	143	0	143
1994	12.3	13.80	28.7	76.5	14.2	145	0	145
1995	11.2	10.22	31.3	80.7	14.1	148	0	148
1996	14.2	8.06	35.1	78.9	14.8	151	0	151
1997	21.6	4.71	35.6	77.8	15.4	155	0	155
1998	15.3	4.41	35.3	76.2	16.5	148	0	148
1999	20.7	4.08	37.1	77.3	15.7	155	0	155
2000	19.3	4.12	39.2	83.1	14.5	160	0	160
2001	25.0	4.29	38.7	81.8	14.4	164	0	164
2002	21.3	4.48	40.1	87.0	15.2	168	0	168
2003	26.3	4.42	30.6	88.2	15.3	165	0	165
Δ90-03	+99.6%	-74.2%	+31.6%	+29.5%	+6.5%	+21.2%	na	+21.2%
Δ90-03pa	+5.5%	-9.9%	+2.1%	+2.0%	+0.5%	+1.5%	na	+1.5%
Δ02-03	+23.4%	-1.4%	-23.6%	+1.4%	+0.8%	-1.9%	na	-1.9%
% of 03	15.9%	2.7%	18.6%	53.5%	9.3%	100.0%	0.0%	100.0%
Uncertainty	*±33%*	*±33%*	*±33%*	*±33%*	*±33%*	*±33%*		*±33%*

MED: NZ Energy Greenhouse G0061s Emissions Table 1.4.1

NOx emissions from coal during the period grew from 12.5 tonnes in 1990 to 21.8 tonnes in 2003 (Table 1.4.2)

There was no information reported on existing concentrations of NO_x in the local area.

While a low NOx burner is being used, the plant would still be releasing over 14 tonnes per day of NOx. NOx and SOx have related impacts, yet catalytic or non-catalytic NOx reduction equipment is not being installed.[33] NOx is not considered to be scrubbed from the flue gas by the seawater FGD: manufacturer information does not make any claim for NOx reduction through any FGD system.

(3) ***Particulates:***

As is noted in the Envirotest Attachment, the PM_{10} concentrations (24 hour average) measured at the Carter Holt Harvey Plant already range from 2.8 to 21.1 µg/m^3. The maximum value is 42% of the air quality goal. The typical background level for rural areas in New Zealand is less than 1 µg/m^3. Very fine particulates ($PM_{2.5}$) are now considered to be the major contributor to health effects, as these particles can block the very small passages of the lungs. This fraction has not been assessed. Air toxics such as PAHs, dioxin and mercury adsorb to particulate matter, including the $PM_{2.5}$ fraction.

[33] See Effects of Cooling Water Abstraction and Discharge' p7 "flue gas upstream of FGD load=165g/sec (as NO2)).

- While particle capture and FGD will considerably reduce emissions, 100% reduction is very unlikely and very large quantities would be produced.
- Capture devices are less efficient for smallest particles, particularly ultrafine particles (0.1-1μm)
- Finest respirable particles are known to be damaging to health. The World Health Organisation (WHO) has concluded that there is a causal relationship between PM exposure and health effects.[34]
- There is no discussion of PM2.5 (other than as part of PM10) despite consideration of this fraction becoming the norm.[35]

(4) Mercury

Coal combustion is the major global source of this highly toxic metal that can biomagnify in food chains. Approximately three-quarters of global mercury emissions (estimated to be about 1900 tonnes) have been calculated to results from the combustion of fuels, particularly coal combustion.[36]

The proposed capture devices (including FGD) would not prevent the majority of mercury emissions to the atmosphere. While it would capture reactive gaseous mercury it would not capture gaseous elemental mercury.

(5) Naturally-Occurring Radioactive Materials

These include trace radionuclides in coal such as uranium and thorium. While these are discussed in the AEE for releases to water, they are not addressed in relation to air. While the main release is via ashes unless there is zero particulate emission, this may have an impact and deserve assessment.

(6) Greenhouse Gases

Marsden B would emit from 1.8 million to 2.17 million tonnes of carbon dioxide per year. Since 1990, emissions from thermal electricity generation to 2003 increased by 90%. CO_2 emissions from coal fired generation increased by 473.8% from 1990 to 2003.[37] The effects of greenhouse gases are addressed in the context of Part 2.

C. Ash Disposal and Discharge of Contaminated Water to Land

Regardless of the efficacy or otherwise of the FGD, the net effect would be to transfer contaminants to ash and thereby to leachate.

There is a longer term risk of groundwater and surface water contamination from leachate generated by the ash disposal area. Fly ash is a major waste product of the coal-fired electricity

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[34] Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide. WHO, Bonn,Germany, 2003 (http://www.euro.who.int/document/e79097.pdf.

[35] See the European Union's Reference document for Best Available Technology at http://eippcb.jrc.es/pages/FActivities.htm.

[36] Pacyna & Pacyna 2002.

[37] NZ Energy Greenhouse Gas Emissions 1990-2003, Chapter 2, Table 2.1.2.

generating industry. The current proposal plans to leave the buried ash in-situ, which means the disposal area of 50 hectares would be classified as contaminated land.

The ash disposal area would be lined, and liners will fail in time. Long-term projections about the integrity of the liner under increasing stress for the life time of the project and maintenance of the leachate collection system post-closure should also be considered. This area will be registered as contaminated land, which severely restricts any future land uses (including grazing). It will require a site management plan to prevent exposure to contaminants within the landfill by all pathways (air, water, and soil) and ongoing monitoring for an indefinite period. This is contrary to New Zealand Government Policy to implement remediation or clear management programs for all high-risk contaminated sites by December 2015. The project could run until 2043 (including 3 years for construction).

It appears that the treatment ponds would not be lined. The risk of environmental contamination is therefore transferred from one site to another. Environmental contaminants contained within the treatment pond could include metals, boron and nutrients. The contaminants that may migrate from the treatment pond to groundwater include boron, which is water soluble, and nutrients. By world standards, many New Zealand coals contain high levels of boron. Boron remaining in ash is susceptible to leaching after disposal by ponding or burial, causing potential contamination of groundwater. Seepage from the treatment pond would impact on local groundwater resources that are of drinking water quality and are used for stock watering. Solids will settle on the base of the treatment pond, which would require remediation at the completion of the project to remove and dispose of metal enriched sediments.

There is insufficient information on matters such as parameters to be measured with the monitoring bores, impacts on the Ruakaka River ecosystems to which the water would drain, information on leaching to groundwater over the long term, estimates of liner failure, estimates of efficacy of leachate collection, effect of acidic soils and groundwater on increased mobility and monitoring. These matters mean the public is unable to have any confidence in the systems proposed.

Water and air discharges are also matters of widespread public concern and interest and are dealt with below.

III. OTHER CONSIDERATIONS

The consent authorities must have regard to relevant provisions of national policy statements under section 104(b)(i) and the coastal policy statement under section 104(b)(ii), as well as any other mater the consent authority considers relevant and reasonably necessary to determine the application, under section 104(c).

Energy generation methods, and the disposal of resulting wastes, directly affect a number of national strategies and agreements. If coal power is chosen as the energy generation method of choice, as is currently demonstrated through the potential development of four new coal burning energy generation plants in the near future, then our country will not meet objectives already set by central government. Marsden B, as an example of the activities currently acceptable in the energy generation sector, is contrary to the following national directives and strategies:

The New Zealand Waste Strategy	**Targets for waste minimization, especially:** By December 2005, all regional councils will ensure that new or renewed industrial resource consents include a recognised waste minimisation and management programme and will report on the percentage of all consents

under their jurisdiction that have such a clause.

The Marsden B proposal has systems that are highly vulnerable to failure and does not propose to manage leachates from the ash heap once the station closes.

Targets for hazardous wastes, especially:

By December 2004, hazardous wastes will be appropriately treated before disposal at licensed facilities, and current recovery and recycling rates will be established for a list of priority hazardous wastes.

Marsden B intends to dump ash containing heavy metals on land near to the station without any intention to recover or recycle hazardous waste..

Targets for contaminated sites, especially:

By December 2015, all high risk contaminated sites will have been managed or remediated.

Marsden B would be packaged in clay and plastic liner which, even according to the application, will fail at some point in the future

Targets for organochlorines, especially:

"By December 2010, New Zealand will have met international obligations under the Stockholm Convention to collect and destroy PCBs and organochlorine pesticide wastes." and "By December 2020, the average body burdens of dioxins will have been reduced to 10 percent of present day levels."

Marsden B would produce additional PCBs, organochlorine compounds and dioxins.

Targets for waste disposal, especially:

"By December 2010, all substandard landfills will be upgraded or closed."

The Marsden B landfill would be operating until at least 2030 after which it would effectively become an unmanaged contaminated toxic waste site.

New Zealand Coastal Policy Statement 1994

Policy 1.1.2:

"It is a national priority for the preservation of the natural character of the coastal environment to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna in that environment by:

(a) avoiding any actual or potential adverse effects of activities on the following areas or habitats:

(i) areas and habitats important to the continued survival of any indigenous species; and

(ii) areas containing nationally vulnerable species or nationally outstanding

examples of indigenous community types”

Marsden B would produce 7.8 tonnes of sulphur dioxide per day, causing acid rain over the Bream Head Reserve, a reserve of national significance which lies directly downwind of the plant. This will be in addition to the neighboring oil refinery, which already produces 12 tonnes of sulphur dioxide per day.

Policy 3.2.4:

“Provision should be made to ensure that the cumulative effects of activities, collectively, in the coastal environment are not adverse to a significant degree.”

Policy 3.3.1:

“Because there is a relative lack of understanding about coastal processes and the effects of activities on coastal processes, a precautionary approach should be adopted towards proposed activities, particularly those whose effects are as yet unknown or little understood.”

Leachates from the ash pile would be directed into the sea. The leachate would contain unknown amounts of dioxins, heavy metals, and sulphur dioxide. The long term effects of some of the chemicals are unknown, and no assessment of the effect of the other chemicals on the sea and its resources have been carried out.

The National Energy Efficiency and Conservation Strategy

Central & local government objectives, especially:
“Commit to adopting sustainable energy principles” and “Introduce policies and actions to support economy-wide sustainable energy”

Marsden B would burn coal which is not sustainable energy.

Energy supply objectives, especially:
“Increase renewable energy supply”

Marsden B would burn coal which is not renewable energy.

Renewable Energy Target, 2002

The target is for 30PJ of renewable energy per annum. In 2000, renewable energy supplied 133.5PJ, or 29% of consumer energy. This means that by 2012 a minimum of 163.5PJ of consumer energy should be supplied by renewable sources.

Marsden B does not contribute towards this goal.

Action Plans under NEECS
The overall outcome the Government seeks is “environmental sustainability, including continuing improvement in our energy efficiency and a progressive transition to renewable sources of energy” and energy prices that “reflect the full costs of supply including environmental costs."

	See Sections 61(2)(a)(i), 66(2)(c)(i) and 74(2)(b)(i). *Marden B is contrary to this goal.*
Government Policy Statement on Electricity Governance October 2004	Policy Objectives for the Electricity Commission, especially: "Ensure that electricity is produced and delivered to all classes of consumers in an efficient, fair, reliable, and environmentally sustainable manner and promote and facilitate the efficient use of electricity" *Marsden B is not environmentally sustainable.*
Climate Change Response Act 2002	The Climate Change Response Act recites the UN Framework Convention on Climate Change and the Kyoto Protocol under that Convention. It also establishes the keeping of inventories of emissions, accounting for tradable rights and empowers the collection of statistics for the purposes of compliance. For instance there is a commitment in The Kyoto Protocol to reduce or phase out subsidies in all greenhouse gas emitting sectors in Article 2(a)(v). The purpose of the Act is to enable New Zealand to meet its international obligations under the United Nations Framework Convention on Climate Change ("FCCC") and the Kyoto Protocol, including its obligation to retire units equal to the number of metric tonnes of carbon dioxide equivalent of human-induced greenhouse gases emitted from the sources listed in Annex A of the Protocol in New Zealand in the commitment period and its obligation to report back to parties to the Convention. One of the key means of achieving New Zealand's obligations under the FCCC is to encourage sources of energy which do not contribute to or reduce the level of greenhouse gas emissions, including the use of renewable energy, such as wind energy. *Marsden B's allowance to emit CO_2 pollutants would amount to a subsidy and would not encourage renewable energy.*
Climate change policy	The Government confirmed its climate change policy package in October 2002. The policy package included **Non-price measures** – Measures include the development of business opportunities associated with climate change, public awareness campaigns research and voluntary commitments, **Price-based measures** – Measures include a planned emission charge ("**carbon tax**"), Negotiated Greenhouse Agreements ("**NGAs**") and the Projects to Reduce Emissions programme; and **Foundation policies** – The following documents are considered to be the policy package's foundation policies: - National Energy Efficiency and Conservation Strategy; - New Zealand Waste Strategy; - Growth and Innovation Framework; and - Sustainable Development Programme of Action. *The project is contrary to the above policies.*
Energy Policy	The Government's approach to energy policy is outlined in its Energy

Framework

Policy Framework,[38] which commits the Government to a sustainable and efficient energy future. Two of the outcomes sought by that Framework are “environmental sustainability, including continuing improvement in our energy efficiency and a progressive transition to renewable sources of energy”, as well as bringing about a “reliable and secure supply of essential energy services”.

The project would not bring about environmental sustainability and is contrary to a transition to renewable energy

Sustainable Development For New Zealand Programme Of Action

The Sustainable Development Programme of Action outlines policies and objectives to guide government policy and decision making. Energy has been identified as one of the four priority areas for sustainable development in New Zealand due to the importance of energy to our economy and its necessity in our lives and commercial interests.

The Sustainable Development Programme of Action for energy states that the Government is committed to a sustainable and efficient energy future for New Zealand. Within this commitment, the overarching goal for energy is to ensure the delivery of energy services to all classes of consumer in an efficient, fair, reliable, and sustainable manner. In support of this overarching goal, the Programme of Action seeks to achieve the following outcomes:

- energy use in New Zealand becomes progressively more efficient and less wasteful;
- our renewable sources of energy are developed and maximised; and
- New Zealand consumers have a secure supply of energy

In October 2004, the government released a discussion document entitled *‘Sustainable Energy: Creating a Sustainable Energy System for New Zealand’*. It represents the results of a workstream initiated by the Sustainable Development Programme of Action. This document discusses the energy challenges and opportunities facing New Zealand, the government’s thinking on sustainable energy, its policy response so far and some possible further steps towards a more sustainable energy system.

The project would not bring about and is contrary to sustainable energy.

National Energy Efficiency & Conservation Strategy

The National Energy Efficiency and Conservation Strategy ("**NEECS**") is the Government’s primary means of achieving the outcomes sought in the Sustainable Development Programme of Action for Energy.

The purpose of the NEECS is to facilitate the move towards a sustainable energy future for New Zealand by promoting energy efficiency, conservation, and a transition to the use of renewable energy sources.

The NEECS identifies two key policy directions that support New

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[38] http://www.med.govt.nz/ers/electric/package2000/epf.html

Zealand's movement towards a sustainable energy economy:

- Ongoing improvement in our energy efficiency; and
- Progressive transition to renewable sources of energy.

Accordingly, the NEECS has two high-level targets:

Economy-wide energy efficiency improvement of at least 20%; and

An additional 30 petajoules (PJ) per annum (pa) of consumer energy from renewable resources by 2012.

The project is likely to impede transition to renewable energy.

Renewable Energy Target

The mechanisms to achieve the target of 30 PJ of additional consumer energy from renewable sources by the year 2012 (include implementing policies such as those which are part of the Climate Change Policy Package) are set out in New Zealand's Renewable Energy Target,[39] which is a component of the NEECS.

As noted in the NEECS:[40] "… there is a close synergy between climate change and renewable energy policies. The NEECS … is one of the foundations policies of the Climate Change Policy Package, and renewable energy development is heavily dependent on the incentives provided by some climate change policies." The NEECS states that[41] "The renewable energy programme is designed to support renewable energy development by engaging with stakeholders and working to minimise the barriers that inhibit the realisation of the full potential of renewable energy. These barriers include: lack of knowledge and information among key parties and decision-makers, lack of economies of scale for some technologies, and institutional regulatory / planning approaches that might discriminate against some renewable energy opportunities."

The NEECS and the renewable energy target is a vital instrument in striving to provide a sustainable energy environment which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety.

The proposed Marsden B coal power station would substantially undermine the Renewable Energy Target and an institutional regulatory/planning approach that might discriminate against renewable energy must be avoided.

Government Policy Statement On Electricity

The Government Policy Statement on Electricity Governance states that the Government's overall objective for the electricity industry is to ensure that electricity is delivered in an efficient, fair, reliable and environmentally sustainable manner to all classes of consumer. To meet this objective, the Government favours industry solutions that satisfy

[39] http://www.eeca.govt.nz/Content/EW_renewables/RenewablesTargetFinal.pdf

[40] NEECS New Zealand's Renewable Energy Target, page 5.

[41] NEECS New Zealand's Renewable Energy Target, page 5.

Governance	consumers' electricity requirements in a manner which is least-cost to the economy and in accordance with the principle of sustainable development. The government has identified a number of desired outcomes consistent with the above objective and wind energy developments, such as removing barriers to investment in new generation technologies, renewables and distributed generation. *The proposal is contrary to sustainable development and is not environmentally sustainable.*

A. Economic Matters

The purpose of regional and local councils defined under s10 (b) of the Local Government Act, as being *to promote the social, economic, environmental, and cultural well-being of communities, in the present and the future.* This is consistent the sustainable management purpose of the RMA in section 5. Marsden B works directly against this purpose. It would create about 35 jobs for the community, while potentially resulting in extensive health problems, and pollution to the environment, and may render traditional kai moana gathering areas unsafe. Every kilogram of fine particles emitted in Denmark is costing the economy DKr140-2,000 in health costs, according to a study by national environmental research institute Neri. The study models impacts from pollution by the tiniest PM2.5 particles rather than larger PM10. The research was carried out in the framework of the EU ExternE programme, which aims at calculating environmental externalities of pollution in monetary terms.[42]

As noted earlier in the context of section 7(b), this proposal would seriously undermine the economic viability of clean renewable energy alternatives, including wind. Approval of the proposal would impede New Zealand's moving towards renewable energy generation projects. The proposal would provide the coal industry with further effective subsidies including the failure to fully internalize the capital cost of the project, failure fully to internalize the cost to the country and the environment of the emissions of greenhouse gases, the effect on the price and supply of electricity and the failure to send strong signals to the electricity generating sector that generation of electricity by fossil fuels is to stop.

CONCLUSION

The proposal to repower the Marsden B power station using coal is fatally flawed, is non-renewable, would pollute the environment, is based on an inadequate assessment and runs contrary to numerous government policies and objectives. The greenhouse gas emissions, effects of climate change and benefits of renewable energy in New Zealand on their own mean that this project should not proceed.

Coal-fired power stations produce more waste types than other forms of electricity generation. These wastes include potential discharges to air, the marine waters of Bream Bay and Whangarei Harbour, 50 ha of land, land, Ruakaka River and groundwaters. Potential discharges present risks to human health, natural coastal environments, recreational activities, fishing, including intake water for the Aquaculture Park, and groundwater supplies.

[42] http://www2.dmu.dk/1_Viden/2_Publikationer/3_Fagrapporter/rapporter/FR507.pdf

The quantity and quality of the coal burned would determine the air emission types and concentrations, quality of the cooling water to be discharged and quantity and quality of the coal ash for disposal to land. Yet it has not been specified, meaning the AEE is fatally flawed. Additinally, the plant design, including treatment options, should have been finalised prior to the application.

Discharges to the air from coal power generation of carbon dioxide, SOx and NOx has already been increasing rapidly in New Zealand, and this proposal would add an unacceptable amount of these and other pollutants.

Disposal of coal ash from the power station would create a contaminated site that covers 50 hectares. The coal ash would leach trace elements, which would be collected in a settlement pond prior to discharge to Bream Bay. Long-term predictions about the integrity of the liner and maintenance of the leachate collection, system post-closure, have not been addressed.

This project therefore is unsustainable in terms of resources and waste production, contaminant discharges to air, water and land, and availability of 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.

The application and all consents must be refused under Part 2 of the RMA.

Attachments:

Summary of Basic Conservation Values in the Vicinity of Marsden B

Envirotest Submission on Environmental Effects – Marsden B Power Station Repowering Project.

Summary of Basic Conservation Values in the Vicinity of Marsden B

Bream Head Reserve has large areas of coastal broadleaf forest (one of the rarer forest types remaining nationawide) and has had intensive predator control in recent years. Kiwi have been reintroduced. There are bellbirds, Pacific and green gecko. Kaka and kakariki also frequent the reserve from the Hen and Chickens Island reserves.

Botanists have recently discovered a new species of tree on Bream Head and nearby Mt Manaia. It is not yet named, but the world population seems to exist there.

The Reserve contains nationally threatened-listed plants including: *Pommaderris paniculosa* ssp. *novae-zelandiae* (a kumerahoe species – range restricted), *Carmichaelia williamsii* (a native broom – nationally endangered) and *Lepidium oleraceum* (Cook's scurvy grass – nationally endangered). Other species further down the threatened plant list are also present. Bream Head has more species of *Hebe* than any other part of Northland and the Far North.

Buller's shearwaters, which only nest on the Poor Knights Islands, frequent the waters between Marsden B and the Reserve.

There is a population of Fairy Terns, one of New Zealand's most endangered seabirds, termed 'nationally critical', that live around Bream Bay.

Bream Bay and the Whangarei Harbour and Heads is also a rich marine ecosystem. Passenger Island Marine Reserve (gazetted late last year) is near the Whangarei Harbour entrance. There are commercial fisheries of scallops and pipi and the area is of value intrinsically and also to tangata whenua, other locals and commercial fishers. There is a renowed tuatua bed directly in line with Marsden B which would be poisoned, along with the surrounding sea-life, by heavy metal discharges from the plant.

Greenpeace Submission on Mighty River Power Ltd Application for Repowering Marsden B as a Coal Fired Power Station

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Summary of Basic Conservation Values in the Vicinity of Marsden B

Envirotest Submission on Environmental Effects – Marsden B Power Station Repowering Project

ENVIROTEST
Scientific Assessment for Environmental Solutions

Submission on environmental effects – Marsden B power station repowering project.

Prepared for

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1.0 Introduction

Mighty River Power Limited is seeking resource consents for the repowering of the Marsden B power station as a coal-fired utility for electricity generation. The power station is located on Bream Bay, which is approximately 20km south of Whangarei. The repowered station will have a capacity of up to 300MW (320MW overload), and an expected load factor of 90%. It is expected that the facility will burn up to 850 000 tonnes of coal per year (at 90% capacity).

The scope of Marsden B repowering is for the complete power station plant and infrastructure from the Northport wharf through to ash disposal, and, including a new coal-fired boiler up to the maximum capacity of the existing steam turbine-generator set. The repowering is expected to take 2-3 years.

There are many reasons for declining resource consents for a power station that will be reliant on coal. Coal is a non-renewable energy source and a major source of greenhouse gas emissions. Air toxics emitted by coal-fired power stations include polycyclic aromatic hydrocarbons (PAHs) and dioxins (combustion products of organic materials), and mercury (present in coal). Waste products including contaminated cooling water will also be discharged to the coastal waters of Bream Bay and to 50 hectares of land that is currently used for grazing. There is a longer term risk of groundwater and surface water contamination from leachate generated by the ash disposal area.

The overall process of coal-fired electricity generation is relatively simple but there is a large amount of associated plant and equipment necessary to optimise the cycle efficiency and attempt to reduce environmental pollution. In this case, the applicant has not specified the types of control measures to be implemented but seeks flexibility for its final choice, following consent approval, based on a number of options with varying degrees of control efficiency. This uncertainty stems in large part from the proposal to source coal both locally and internationally (e.g. Australia and Indonesia). The coal type therefore remains unspecified and the quality, including sulphur and ash contents, will vary depending on the source. These factors will directly influence the quantities and types of emissions from the plant, and have introduced considerable uncertainties into the application.

This submission outlines some of the issues associated with coal-fired power generation in a regional, national and international context, assesses the environmental risks of the proposed waste management strategies and emissions of persistent toxic substances, and compares coal-fired power stations and alternative energy options.

It is clear that the environmental risks from this proposed coal-fired power station outweigh the benefits of a short-term solution to New Zealand’s electricity needs and will not promote the sustainable management of natural and physical resources.

2.0 Waste products

Table 2.1 shows the potential waste types that may be produced by the proposed coal-fired power station. Coal-fired power stations produce more waste types than other forms of electricity generation (e.g. gas-fired, renewable energies). For comparison, natural gas is practically free from non-combustible gas or solid residue, but still emits carbon dioxide, a major greenhouse gas. Other comparisons with alternative technologies are discussed in Section 3.2.

The quantities discharged to the environment will depend on the control technologies installed in the plant. Although the resource consent application describes options for control measures it does not specify which measures will be used. This includes the quantity of coal that will be burned, the quality of the coal types that will be used or the rates of cooling water to be abstracted and discharged (could range from 7.6 to 13 m^3/s).

Table 2.1: Waste types produced by the repowering of Marsden B

Source	Waste type	Receiving environment	Extent of impact
Coal-fired boiler	Particulates (stack and fugitive from coal storage and handling)	Air	Local
	Gases (carbon dioxide, sulphur dioxide, nitrogen oxides and carbon monoxide)	Air	Regional
	Air toxics (metals including mercury, PAHs, dioxins, halides, hydrogen sulphide and volatile organic compounds)	Air	Regional
	Odour	Air	Local
	Heat	Air	Local
	Cooling water (heat, coal ash and incorporated contaminants from FGD, biocides, phosphorus and zinc)	Marine	Bream Bay
	Seawater FGD discharges to cooling water (acidity, ash- incorporating metals, PAHs, dioxins and fluoride)	Marine	Bream Bay
	Bottom ash and collected fly ash (metals, PAHs, dioxins, fluoride, boron)	Land	Ash disposal area (50 ha)
Power station plant and infrastructure	Process water discharged to cooling water (total suspended solids, nutrients, process chemicals)	Marine	Bream Bay
	Stormwater discharged to cooling water (total suspended solids, total petroleum hydrocarbons, nutrients, faecal indicators)	Fresh and marine	Ruakaka River Bream Bay
	Seepage from treatment ponds (leachate and wastewater from the ash disposal area, cooling water and FGD water)	Groundwater Freshwater	Local Ruakaka River
	Solids from the stormwater settlement pond (total petroleum hydrocarbons, nutrients)	Land	Ash disposal area (50 ha)
Ash disposal area	Solids (coal ash, FGD wastes, solids from stormwater settlement ponds)	Land	Ash disposal area (50 ha)
	Leachate (metals, boron, mineral salts) (leachate and stormwater in contact with ash directed to primary settlement pond for eventual discharge with cooling water)	Groundwater Freshwater Marine	Local/regional Ruakaka River Bream Bay

Fly ash is a major waste product of the coal-fired electricity generating industry. The ash yield of different coals can vary from just a few to well over 20% by mass of coal (Samarin 1997) although New Zealand coals are known to have low ash content (3-5%).

Historically coal ash was sluiced to ash disposal dams but most fly ash now is compacted to a medium density, at an optimum moisture content of 30% and placed in special storage, with the potential for future utilisation. The current proposal cites a moisture content of 15% and plans to leave the buried ash in-situ, which means the disposal area of 50 hectares will be classified as contaminated land.

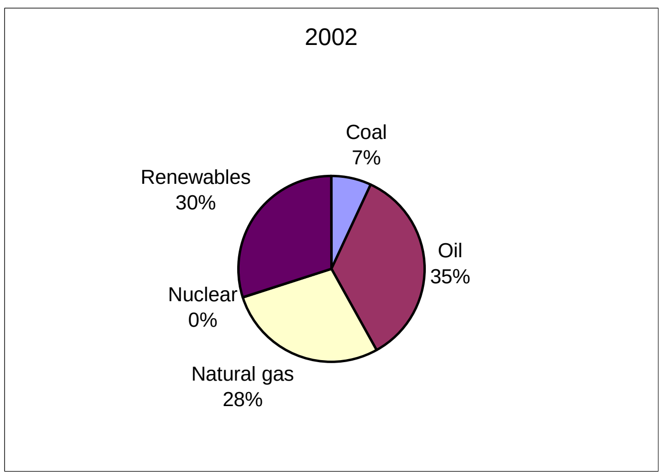
3.0 Inappropriate technology

3.1 Proposed coal-fired technology

The proposed coal-fired power station represents a significant expansion in dependency on non-renewable and imported energy sources at the expense of cleaner renewable energy sources. The cost of adopting coal-based technology in the proposed re-powering of Marsden B requires consideration of the additional release of greenhouse gas (e.g. 2 million tonnes of carbon dioxide each year) and other emissions and the social and environmental costs on a regional and local scale in comparison to alternative renewable technologies and sites. The Resource Management Act requires this type of comparison.

The proposal conflicts with New Zealand's profile as a world leader in sustainable development and appropriate technologies. Consent approval to release coal-fired emissions into the broader regional airshed would conflict with New Zealand's commitments to the Kyoto Protocol and Stockholm Convention on POPs.

The use of coal fuel in a national context for all uses can be seen in Figure 3.1. Coal made up about 7% of 2002 use (ABARE 2004).



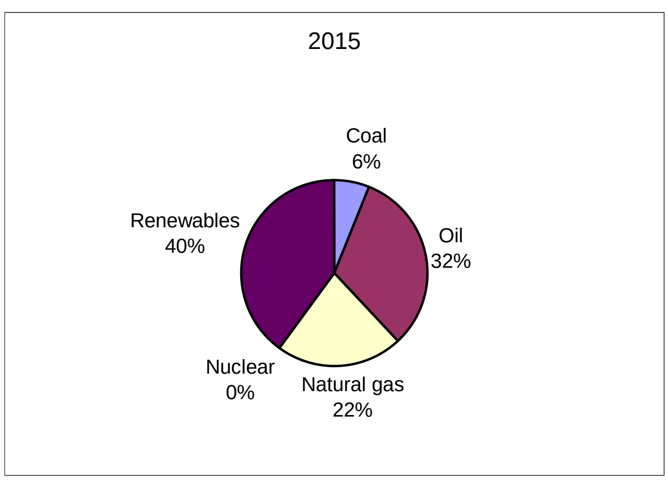


Figure 3.1: Current and projected energy consumption, by fuel, New Zealand
Source: ABARE (2004) research report 04.1

In electricity generation, coal and natural gas as fuels have shown increasing trends in use (see Table 3.1).

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 from 2003 (given an uncertainty of +- 5%) (MED 2004).

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.

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

Table 3.1: 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)

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 found and developed. Of course wind is such a source. The fuel mix for New Zealand, as shown in Table 3.2, predicts an increase in hydro, geothermal and other renewable sources from 71 to about 80%.

Table 3.2: 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)

Coal-fired electricity generation is inconsistent with such trends and clearly inappropriate technology in view of the predominant use of clean or renewable technologies in New Zealand's electricity generation.

In a local environment context, proposed coal (or oil-fired) technology for electricity generation does not exist and is an inappropriate choice because of 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.

3.2 Alternative technologies

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). The advantages of renewable technologies over non-renewable technologies are discussed in the Greenpeace Australia and Pacific webpage (www.greenpeace.org.au/climate/renewables/wind.html).

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 3.2.

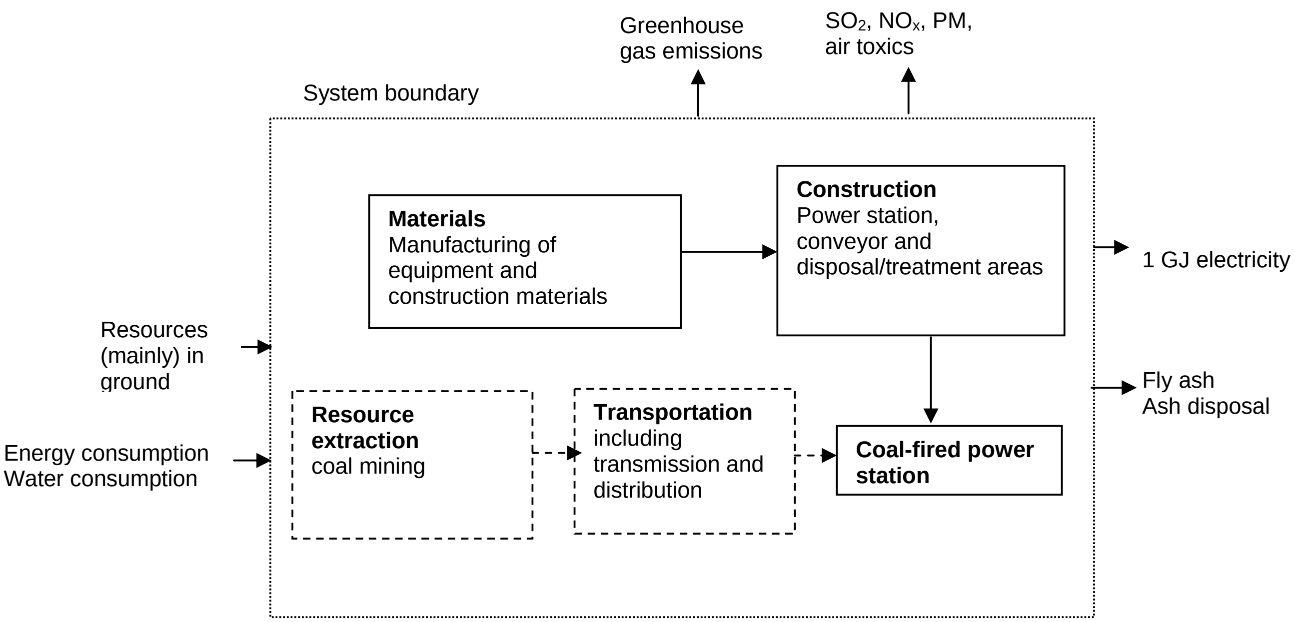


Figure 3.2: Life cycle analysis for electricity generation

Examples for Japanese and Scandanavian estimates of life cycle carbon dioxide emissions are given in Table 3.3. 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 3.3: 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)

A comparison of greenhouse gas emissions from different energy sources has been provided by the Coal in a Sustainable Society (CISS) Project Report, available from the Australian Coal Association (www.australiancoal.com.au).

For electricity generation, the findings of the Report concluded that all renewable energy technologies with the exception of hydro, have low greenhouse gas emissions compared with both coal and gas-based generation.

It was argued that life cycle greenhouse gas emissions from hydroelectricity are applicable, with carbon dioxide and methane being produced from drowned vegetation and organic inflow into the catchment. It concluded that net emissions should be established on a case-by-case basis.

While the focus in this section has been on carbon dioxide emissions, this gas can be considered a surrogate for non-carbon dioxide emissions from electricity generating sources.

Similarly, 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.

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

New Zealand should be in a similar position to European countries such as Holland, Denmark, the United Kingdom and Germany that are currently expanding the use of this technology. For example, Denmark currently obtains about 18 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).

The current capacity and potential of wind energy projects in Australia is summarised in Table 3.4. 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 3.4: 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)

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).

4.0 Emissions of regional and international concern

4.1 Persistent toxic substances

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.

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, gaseous heavy metals and volatile organic compounds.

PTS

Key properties that govern their environmental behaviour and effects on biota:

1. bioaccumulation
2. environmental persistence
3. toxicity
4. endocrine disruption capacity

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

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.

The US findings and proposed actions are applicable to the Marsden B Power Station proposal. The weight of evidence suggests that rather than introducing a new set of contaminants into the local environment such as the waters of Bream Bay, the fundamental policy action should be 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.

Predicting health risks or impacts associated with local depositions of mercury emissions from coal-fired plants, however, 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.

Health risk assessments performed by Sullivan *et al* (2003) on two US coal-fired power plants indicated that for the general population, risks from deposition of mercury from the coal-fired plants were small ($<10^{-5}$ risk of observed neurological effects) but risks could be two orders of magnitude higher for subsistence fisher populations. The estimated risks were found to be more highly dependent on consumption patterns than increases in deposition due to coal-fired power plant emissions. Simply, people that eat more seafood have a higher risk of mercury intake and accumulation.

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.

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) has reported on dioxins and furans in South East Asia and the South Pacific among other PTS.

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.

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

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.

Effects on the immune systems in the mouse have been found at doses of 10 ng/kg bw/day, while reproductive effects were seen in rhesus monkeys at 1-2 ng/kg bw/day. Biochemical effects have been seen in rats down to 0.1 ng/kg bw/day. In a re-evaluation of the total daily intake (TDI) for PCDD/PCDFs (and planar PCB), the WHO decided to recommend a range of 1-4 TEQ pg/kg bw, although more recently the acceptable intake value has been set monthly at 1-70 TEQ pg/kg bw (UNEP 2002).

Since 1995, New Zealand has commenced an organochlorine program with a series of investigations to determine the status of dioxins[1], PCBs and persistent organochlorine pesticides in the New Zealand environment.

The major industrial emitters of dioxins and furans have been identified as uncontrolled landfill fires (10-15 g I-TEQ/yr), followed by industrial and agricultural coal combustors (0.034-4.0 g I-TEQ/yr), clinical, pathological and quarantine waste incinerators (0.38-3.5 g I-TEQ/yr) and industrial wood combustors (0.85-2.4 g I-TEQ/yr). Non-industrial and natural sources, namely domestic wood burning, domestic waste burning and uncontrolled fires (forest, scrub and grass fires, structure fires and vehicle fires) also contributed significantly to PCDD/PCDFs emissions. The total annual emissions to air, land and water for 1998 were estimated to be in the range 41 to 109 g I-TEQ (Buckland *et al* 2000).

The leachate or seepage from landfills and dumps can contain PCDD/PCDFs. Data from five landfills in New Zealand showed that such PCDD/PCDFs released ranged from 7.5 to 221 pg I-TEQ/L. The New Zealand inventory (Buckland *et al* 2000) subdivided the range into 14 to 48.3 pg I-

[1] Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans are referred to generically as dioxins

TEQ/L for small and medium landfills and 7.5 to 221 pg I-TEQ/L for large landfills. The total annual emissions to land for 1998 were in the range 26-54 I-TEQ (UNEP 2002).

Ambient levels of dioxins found in New Zealand air were generally lower than those reported by similar surveys in other countries, and particularly for reference and rural sites. At New Zealand urban sites such as Auckland South, the highest winter levels were similar to levels found in a number of European cities.

Home heating was indicated as an important source of dioxins for some parts of New Zealand while urban levels in Auckland appeared to be derived from vehicle emissions (Buckland *et al* 2000). For individual sites, levels were between 0.77-7.48 fg I-TEQ/m^3 [2] of air at reference sites; 0.94-31.7 fg I-TEQ/m^3 of air at rural sites; 6.15-262 fg I-TEQ/m^3 at urban sites and 40.3-1170 fg I-TEQ/m^3 of air at an industrial site.

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.

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

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).

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 4.1). 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.

[2] Note: fg/m^3 = femtograms per cubic metre of air (equivalent to 1×10^{-18} in a cubic metre).

Table 4.1: 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). *Sources of Dioxins and Furans in Australia: Air Emissions – Revised Edition*

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

No estimate of the discharge to landfills and ponds is available for this proposal. New Zealand estimates suggest total land releases are about half of total air emissions.

4.2 Gaseous emissions

There are more than 35 trace gases that could contribute to global warming trends. These include carbon dioxide, nitrogen species, sulphur compounds, chlorofluorocarbons, chlorocarbons, bromated and isolated species, hydrocarbons, ozone and aldehydes. Among these chemical species, carbon dioxide, nitrous oxides, methane and chlorofluorocarbons are considered major culprits.

Coal combustion generates large quantities of carbon dioxide, carbon monoxide and nitrogen oxides including nitrous oxide (N_2O), sulphur dioxide (SO_2), methane (CH_4), volatile organic compounds and particulates. The atmospheric interactions and local deposition of substances are complex yet are known to contribute to changes in atmospheric properties on regional (e.g. warming) and local scales (e.g. contamination of surfaces, acidity and respiratory and allergic effects in exposed persons).

The Marsden B proposal will emit and disperse large quantities of global warming and toxic gases, particulates, metals and organic vapours into the local and regional airsheds. The amounts will depend on the effectiveness of proposed control techniques. Impacts from atmospheric dispersion depend on meteorological conditions, sensitivity of receiving environments and exposed persons.

The estimates of proposed emissions are summarised in Table 4.2 based on various emission rates given in the Proposal and emission factors from a Greenhouse Gas Inventory (Australian Greenhouse Gas Office) for those air pollutants not estimated in the Proposal.

Table 4.2: Estimated stack emissions of gases, particulates and volatile organics from the proposed Marsden B Power Station*, near Whangarei Harbour

Air pollutant	Tonnes per year
Carbon dioxide (CO_2)	2100 (b)
Carbon monoxide (CO)	511 (a)
Nitrogen oxides (NO_x)	6935 (a)
Nitrous oxide (N_2O)	14-20 (c) (f)
Sulphur dioxide (SO_2)	2847 (a)
Methane	16-22 (c) (f)
Total suspended particulates	121 (d)
	7-738 (e)

* assumes annual combustion of 830 000 tonnes of coal per year and 300 MW capacity

Notes:

(a) Emission factors used in air dispersion modelling – Marsden B Proposal
(b) Various estimate based emission factors – Greenhouse Gas Inventory and power station reporting data (tonnes per year)
(c) Factors from Australian Greenhouse Gas Inventory
(d) Based on annual reporting (tonnes per year), Tarong North Power Station – 445MW, Queensland, Australia
(e) Depends on removal efficiencies of combinations of baghouse filter, electrostatic precipitator and scrubber
(f) NZ Coal (21-32 MJ/kg)

A feature of the make-up of New Zealand's greenhouse gas emissions that sets it apart from most other developed countries is the high proportion of greenhouse gas emissions in the form of methane, which reflects the high proportion of total emissions from agriculture. While for most developed countries CO_2 is by some margin the most significant greenhouse gas, in New Zealand it accounted for only 45% of total emissions in 2002 (MED 2004). The significance of CO_2 emissions in New Zealand will increase with commissioning of a new power station at Marsden (as well as increased reliance on coal at Huntly power station).

Sulphur dioxide emissions from thermal electricity generation in New Zealand have also increased. These emissions increased from 2067 tonnes in 1990 to 12 417 tonnes in 2003, which represents an increase of 500% (MED 2004). Increased coal use is one source (47% increase in the same time period), while an increase in diesel fuel use was also a significant contributor.

5.0 Local health and environmental risks

The environmental, social and economic values of the local area that may be impacted by this proposal include:

- Human health,
- Areas of ecological significance,
- Recreational activities,
- Commercial and recreational fishing, and
- Groundwater supplies.

5.1 Human health

The sensitive receptors in the area include residences located to the south and southwest of the site and the Whangarei Heads community, which is located on the north bank of Whangarei Harbour (5.5km to 10km radius from Marsden B) and includes a school for about120 young children plus staff. The air assessment report has identified possible high contaminant concentrations in the school area. NZRC also operates a monitoring site at this location.

The Part B: Assessment of Environmental Effects (Mighty River Power 2004) states that the region currently has a high standard of air quality. This is despite the presence of NZRC. However, the maximum reported sulphur dioxide concentration recorded at Takahiwai between 1994 and 2000 was 238 µg/m^3 (1 hour average), which is 68% of the air quality goal and 86 µg/m^3 for a 24 hour average, which is 72% of the air quality goal. These results imply the cumulative impacts of another sulphur dioxide emission source may cause short-term exposures to concentrations above the air quality goal.

For comparison, maximum daily sulphur dioxide concentrations in Huntly have been reduced from 75 µg/m^3 to 15 to 20 µg/m^3 (MfE 1997). Improvements at NZRC appear to have reduced average concentrations to well below guidelines but no information is provided on maximum concentrations (2000 to 2001) nor has information from the period from 2001 to 2004 been provided. Monitoring data from the Whangarei Heads school is necessary for assessment of potential health effects on the children.

Sulphur dioxide (SO_2) is a colourless gas with a sharp and irritating odour. It can affect the respiratory system, the functions of the lungs and cause eye irritation. When sulphur dioxide irritates the respiratory tract it causes coughing, mucus secretion, aggravates conditions such as asthma and chronic bronchitis and makes people more prone to respiratory tract infections. Sulphur dioxide can attach itself to particles, which can cause more serious effects if inhaled.

Residences close to the power station may also be exposed to fine particulate matter and nuisance dust both during the construction phase, which is estimated to take 2 to 3 years, and normal operation. Nuisance dust and odours are the two most common reasons for complaint to local and regional councils.

The existing potential sources of particulate matter in the local airshed are the NZRC and Carter Holt Harvey Ltd LVL Plant. The PM_{10} concentrations (24 hour average) measured at the Carter Holt Harvey Plant range from 2.8 to 21.1 µg/m^3. The maximum value is 42% of the air quality goal. The typical background level for rural areas in New Zealand is less than 1 µg/m^3 (MfE 1997).
Very fine particulates ($PM_{2.5}$) are now considered to be the major contributor to health effects, as these particles can block the very small passages of the lungs. This fraction has not been assessed. Air toxics such as PAHs, dioxin and mercury adsorb to particulate matter, including the $PM_{2.5}$ fraction.

Nitrogen oxides (NO_x) is a mixture of nitric oxide and nitrogen dioxide. Nitrogen dioxide is an odorous, brown, acidic and highly corrosive gas and is a critical component of photochemical smog. Elevated levels of nitrogen dioxide can cause damage to the mechanisms that protect the human respiratory tract and can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease. There was no information reported on existing concentrations of NO_x in the local area.

There was no sensitivity analysis carried out in air dispersion modelling. This would be useful to demonstrate the effect of varying stack heights, exit velocities, and control efficiencies. This type of modelling is often used to set the minimum design parameters (enforced through consent conditions) such as the minimum stack height and control efficiency to achieve air quality goals (e.g. 50% of the air quality standard). The information provided is inadequate for regulators to make these decisions.

Air quality monitoring should be enforced as part of any consent approval to validate the results of air dispersion modelling and ensure air discharges comply with air quality standards. This information should be publicly available – it was noted that the SO_2 monitoring carried out by NZRC at Whangarei Heads school was unavailable for assessment.

5.2 Natural coastal areas

Sensitive habitats that may be affected during the construction and operational phases of the power station include dunes, estuary, freshwater wetlands and river margins. These areas provide habitats for a variety of threatened bird species. The Department of Conservation land to the north of the sewage ponds has also been identified as an area with moderate to high sensitivity.

Vehicle movements and road dust, noise, groundwater contamination and diversion, increased overland flows, deposition of air contaminants (including acidic compounds and fluorides) and the location of the coal conveyor could all impact on the flora and fauna of these areas. Sulphur dioxide is a major acid rain precursor.

The coastal marine area of Bream Bay will be directly impacted by contaminated water discharges. Toxins may also accumulate in the sediments of Whangarei Harbour depending on net tidal flows. The water currents in this section of the bay are dominated by tidal flows into and out of the harbour.

At Whangarei Heads, there is an expanding suite of restoration projects operated by the Whangarei Heads Landcare Forum and Bream Head Trust. These include a proposal to exclude all mammalian pests from Bream Head thereby creating a "mainland island" of very significant ecological value and with a high public profile.

5.3 Recreational activities

Recreational activities including swimming, surfing, shellfish gathering (mainly tuatua) and surfcasting. These activities are more popular to the south of the site at Ruakaka than adjacent to the Marsden power station, although staff at the Bream Bay Aquaculture Park report that the beach in the vicinity of the power station is frequented by the public, particularly in summer.

The repowering of Marsden B using a coal-fired boiler will impact on the scenic and amenity values and recreational attributes of this part of the coastline. This will directly impact the lifestyle of the Ruakaka community as well as the tourism potential (and therefore economic impacts) of the area.

5.4 Fishing

Recreational and commercial fishing are carried out in Bream Bay. Commercial fishing that occurs in Bream Bay includes:

- Pipi harvesting from Mair Bank, at the entrance to Whangarei Harbour,
- Scallop harvesting throughout Bream Bay (from shallow depths to depths of about 30m),
- Rock lobster potting, and
- Trawling / long lining / set netting / drag netting / seining for schnapper, trevally, mackerel and pilchards.

There is a risk of seafood contamination both for domestic and export markets. High levels of contaminants in fish or other seafoods (i.e. exceeding specified maximum residue limits) could be very damaging to the seafood industry. There could also be a negative flow on effect on charter fishing operators.

These concerns are relevant to the Aquaculture Park, which requires high quality seawater for its operation, both in terms of stock losses (e.g. toxic effects of copper and mercury on juvenile mussels) and damaged reputation.

The range of dioxin levels reported in fish in New Zealand is already high and exceeds the levels found in other foods (i.e. meats, dairy, poultry and cereals) (Buckland *et al* 1998). The risk is therefore increased for people that consume a high proportion of seafoods in their daily diet. Mercury exposure through food intake would also be higher for this group.

Marine mammals (e.g. whales and dolphins) are also known to bioaccumulate dioxins. There are several charter boat operators in the area that provide dolphin and whale watching tours. The impacts of the proposal on these activities have not been addressed.

5.5 Groundwater supplies

There are several registered groundwater bores in the region and potentially many more unregistered bores (because registration is only required above specified extraction volumes for domestic and stock use). The groundwater is of drinking water quality and is also used for stock watering.

Since the regional plan allows extraction of up to 2 m^3 (2000 L) per day for domestic use and 30 m^3 per day for stock use, it is assumed that this resource is being used for these purposes in the area. Use of bore water for stock watering has been observed near the power station site.

The types of contaminants that may leach into groundwater include dissolved salts such as fluoride and boron, and some trace elements. The groundwater in this area is very fresh that is, it contains low levels of dissolved salts.

Increased levels of dissolved salts will affect the aesthetic qualities of the water when used for drinking purposes. Based on health considerations, the concentration of fluoride in drinking water should not exceed 1.5 mg/L and boron should be less than 4 mg/L.

High concentrations of fluoride in irrigation water will impact on plants. It is recommended that the concentration of fluoride in irrigation waters should be less than 1.0 mg/L for long-term use and 2.0 mg/L for short-term use (ANZECC & ARMCANZ 2000).

Fluoride concentrations greater than 2 mg/L in stock drinking water may be hazardous to animal health. Concentrations of boron >5 mg/L in stock drinking water may only be tolerated for short periods.

6.0 Resource consent issues

6.1 Abstraction and discharge of seawater to and from Bream Bay

To take and use up to 13.0 cubic metres per second of seawater from Bream Bay for cooling and ancillary purposes associated with a coal fired power station and for use in the Bream Bay Aquaculture Park to discharge up to 14.4 cubic metres per second of stormwater, cooling water, and treated wastewater including biofouling agents associated with a coal fired power station, coal conveyance and storage, and a solid waste disposal area, into Bream Bay.

The assessment on the effects of cooling water abstraction and discharge was based on a flow rate of 7.6m^3/s but the application seeks permission for up to 13 m^3/s. This represents a 71% increase in cooling water discharges or an underestimation of effluent concentrations by a factor of 1.7.

Furthermore, the assessment is limited to one coal type (New Zealand Coal Type A) because the quality of the range of coal types to be burned at the power station remains unspecified.

The coal type and flow rate will impact on the predicted concentration of elements to be added to cooling water and therefore the total discharged (includes background concentrations) as well as the predicted concentrations at the edge mixing zone and Aquaculture Park intake. The predicted concentrations of elements greater than 50% of the marine chronic water quality guideline from Marsden B only were cadmium, lead and mercury. Copper and PAH loadings are unknown. Elevated levels of copper are likely to impact on the Aquaculture Park because it is toxic to bivalves at low concentrations.

The range of contaminant concentrations measured in New Zealand coals is shown in Table 2.1 of NIWA (2004). The range for arsenic, for example, is from 0.3 to 38 mg/kg while the concentration in Coal Type A is only 0.85 mg/kg. The range of mercury concentrations is 0.025 to 0.56 mg/kg while Coal Type A is only 0.043 mg/kg. The range of copper concentrations in New Zealand coals is reported to be 0.2 to 25 mg/kg.

The assessment provides safety factors to comply with the water quality guideline in the form of maximum allowable contaminant loads but the contribution from other sources in the region (e.g. NZRC) is unknown. The measured concentration of arsenic (2 µg/L) from the Aquaculture Park was approximately equal to that from the Marsden B discharge (i.e. double the load in total).

The cooling water report focuses on potential contamination associated with discharge of contaminants from the seawater FGD. It does not assess the potential contaminants associated with using wet limestone presumably because seawater FGD is the preferred option (simplest and most cost effective where seawater is available). This approach was common throughout the Assessment of Environmental Effects (e.g. ash disposal).

6.2 Discharge of contaminants to air

To discharge contaminants to air from the construction, use and maintenance of a coal fired power station and ancillary activities including coal conveyance from Northport to the Marsden Power Station site, coal storage and handling and solid waste disposal and handling.

The quantity and quality of the coal burned will determine the air emission types and concentrations, quality of the cooling water to be discharged and quantity and quality of the coal ash for disposal to land. It is difficult to determine the appropriate control technologies and assess their efficiency, and subsequent environmental impacts, when these factors have not been defined.

Whilst the air and water quality assessments have determined maximum emission limits for the plant, it has not been demonstrated whether these limits are achievable using the proposed technologies for a range of coal types (only for NZ coal type A in the cooling waters assessment).

For example, two options were presented for the removal of particulate matter from the flue gas stream, but the control efficiency will depend on the ash content of the coal and one technology is known to be more efficient than the other.

Similarly, two options have been presented for flue gas desulphurisation. This technology may be introduced to enable burning of coal fuel with higher sulphur content and therefore higher sulphur dioxide emissions. While the sulphur content of Australian and New Zealand coal is known to be low, the proposal may also use coal from other overseas sources such as Indonesia.

FGD requires significant levels of energy to operate and therefore reduces the efficiency of the power station (e.g. carbon dioxide emissions may increase). This technology will not reduce carbon dioxide emissions from the stack (using either seawater or a limestone slurry).

The resulting sulphite solution from the FGD will be oxidised in an open treatment pond to produce sulphate prior to discharge to Bream Bay. This process will produce diffuse carbon dioxide emissions.

Cumulative effects of air discharges from both the NZRC and Marsden B have also been based on maximum emission limits rather than site-specific estimates of pollutant loads. It has been assumed that the combined contribution of sulphur dioxide emissions from the two sources will not exceed air quality guidelines. There is no evidence that this level of cooperation between the two sources is achievable.

High concentrations of sulphur dioxide have been recorded at Takahiwai. The maximum 1-hr concentration was 238 $\mu g/m^3$, which is 68% of the air quality goal. The maximum 24-hr concentration was 86 $\mu g/m^3$, which is 72% of the air quality goal. Another emission source may cause short-term exposures to sulphur dioxide concentrations above the air quality goal although recent NZRC upgrades appear to have reduced air concentrations.

The release of air toxics has not been assessed. The types of air toxics that are released from coal fired power stations include trace elements, dioxins, PAHs and volatile organic compounds. The assessment of air discharges should review emission factors (e.g. USEPA emission factors - AP 42) from coal power stations for these contaminants and include these scenarios in air dispersion modelling, where relevant.

Trace elements with a known tendency to volatilise include arsenic, boron, selenium and mercury (AIE 2005). New Zealand coals contain high concentrations of boron by world standards. A typical case is for a coal with a low boron content (16 µg/kg) giving a vapour phase concentration of 350 $\mu g/m^3$ representing the release of 24% of the available boron. This boron may be released to the atmosphere or adsorb to fly ash particulates (in which case it will end up at the ash disposal area).

Experiments carried out by the AIE on New Zealand industrial coals reported that mercury consistently reached the flue gas in the gas phase (AIE 2005). A small amount was associated with the fly ash and cyclone ash, with some degree of enrichment compared to the 78 ppb (µg/kg) levels at which it was found in coal. The level of arsenic found in combustor gas was higher than expected. Selenium behaved as expected with substantial enrichment in the fly ash samples.

6.3 Discharge of contaminated water to land

To discharge water containing contaminants to land, by way of seepage from treatment ponds used to hold and/or treat leachate and wastewater from a solid waste disposal area, coal storage area and coal conveyor, and wastewater from the operation of a coal -fired power station.

The ash disposal area will be lined but it appears that the treatment ponds will not be. The risk of environmental contamination is therefore transferred from one site to another. The environmental contaminants contained within the treatment pond could include metals, boron and nutrients. The contaminants that may migrate from the treatment pond to groundwater include boron, which is water soluble, and nutrients.

By world standards, many New Zealand coals contain high levels of boron (Table 6.1). For comparison, boron concentrations in world coal regions are shown in Table 6.2.

Table 6.1: Boron concentrations – New Zealand coal regions

New Zealand coal region	Boron in coal (mg/kg or ppm)
Waikato	140-1010
Buller	30-90
Reefton	330-380
Greymouth	10-260
Otago	370-770
Southland	19-295

Source: Lindsay *et al* (2001). Boron in New Zealand coal seams.

Table 6.2: Boron concentrations – world coal regions

World coal region	Boron in coal (mg/kg or ppm)
USA	1-200
Australia	1-300
Germany	2-236
Poland	7-56
South Africa	11-109

Source: Lindsay *et al* (2001). Boron in New Zealand coal seams.

Boron remaining in ash is susceptible to leaching after disposal by ponding or burial, causing potential contamination of groundwater. Overseas, it has been reported that up to 80% of boron in coal is discharged into the atmosphere in vapour form during combustion, but retention in ash is greatly enhanced as the alkali content of the coal increases (Lindsay *et al* 2001). Combustion studies of New Zealand alkali-rich coals show most boron to be retained in the bottom or fly ash.

Seepage from the treatment pond will impact on local groundwater resources that are of drinking water quality and are used for stock watering. Contaminated groundwater may also impact on freshwater wetlands in the area.

Solids will settle on the base of the treatment pond, which will require remediation at the completion of the project to remove and dispose of metal enriched sediments.

6.4 Discharge of solid waste and leachate onto and into land

To discharge solid waste and leachate onto and into land at a solid waste disposal area.

The quantity of coal ash to be managed over the lifetime of the project is unknown. It depends on the ash content of the coal type, which was unspecified at the time of the assessment. New Zealand coal is known for its low ash content (3-5%) although up to 8% has been reported in lignite. Variations in the ash content of coal are related to site-specific formation processes and geological history. Samarin (1997) reports that the ash content of different coals can vary from just a few percent to well over 20% by mass of coal.

The proposed ash disposal area is estimated to cover 50 hectares based on coal with 12.4% ash content. This site will not be remediated at the completion of the project. The ash disposal area will be covered with topsoil, contoured and grassed.

The Hazardous Activities and Industries List (HAIL) is a compilation of activities and industries that are considered likely to cause land contamination resulting from hazardous substance use, storage or disposal. The HAIL should be used for identifying sites for inclusion on local government Land Use Registers (*Contaminated Land Management Guidelines No.4: Classification and Information Management Protocols*, MfE in preparation). This list includes coal and coke yards, power stations and any other facility or activity that stores, uses or disposes of hazardous substances, in sufficient quantity that intentional or accidental discharge of the substance could be a risk to human health or the environment.

This area therefore will be registered as contaminated land, which severely restricts any future land uses (including grazing). It will require a site management plan to prevent exposure to contaminants within the landfill by all pathways (air, water, and soil) and ongoing monitoring for an indefinite period. Long-term projections about the integrity of the liner under increasing stress for the life time of the project and maintenance of the leachate collection system post-closure should also be considered.

This is contrary to New Zealand Government Policy to implement remediation or clear management programs for all high-risk contaminated sites by December 2015. The project could run until 2043 (including 3 years for construction).

7.0 Conclusions

The proposal to repower the Marsden B power station using pulverised coal combustion for electricity generation is based on inappropriate technology (i.e. non-renewable resources), inadequate lifecycle analysis of options and encourages cumulative industrial growth in the local environment.

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.

Coal-fired power stations produce more waste types than other forms of electricity generation. These wastes include potential discharges to air (local and regional impacts), the marine waters of Bream Bay and Whangarei Harbour, land (approximately 50 hectares), freshwaters (Ruakaka River) and groundwaters. Potential discharges present risks to human health, natural coastal environments, recreational activities, fishing (including intake water for the Aquaculture Park) and groundwater supplies.

The quantity and quality of the coal burned will determine the air emission types and concentrations, quality of the cooling water to be discharged and quantity and quality of the coal ash for disposal to land. It is difficult to determine the appropriate control technologies and assess their efficiency, and subsequent environmental impacts, when these factors are unspecified. The plant design (including treatment options) should be finalised prior to granting of resource contents for individual discharge permits.

Disposal of coal ash from the power station will create a contaminated site that covers 50 hectares. The coal ash is expected to leach trace elements, which will be collected in a settlement pond prior to discharge to Bream Bay. Long-term predictions about the integrity of the liner and maintenance of the leachate collection, system post-closure, have not been addressed.

This project therefore is considered to be unsustainable in terms of resources and waste production, contaminant discharges to air, water and land, and availability of 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.

8.0 References

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