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Environmental Performance Indicators for Energy Sector Industry

**A thesis presented in fulfilment of the requirements
for the degree of**

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Abstract



Mounting evidence regarding the degradation of our environment and a growing sense of shared responsibility has provided the impetus to develop multilateral environmental agreements to address global environmental problems. Concerns regarding unsustainable energy consumption and production patterns have also underscored the need to improve environmental monitoring.

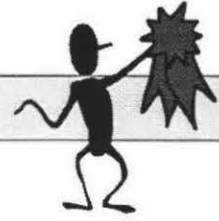
This research provides an analysis of the role and status of environmental performance indicators for energy sector industry in New Zealand. The environmental indicators considered are those that are directly aligned to energy consumption and production patterns.

In order to be able to identify and isolate the range of issues associated with energy consumption and production patterns, it is necessary to understand both the factors that influence energy use and the effects that arise. Factors that can be utilised as environmental indicators include, energy efficiency, energy intensity, energy fuel mixes and energy prices, and the carbon dioxide emissions associated with energy use.

Much progress has been made at a national and international level in the development and use of environmental indicators for energy sector industry. The UN, OECD, and Natural Resources Canada all utilise the above-described environmental indicators to assess energy consumption and production patterns. This progress provides useful insight for the MfE in the development of their national energy indicators.

The MfE's energy indicators when introduced will prove a fundamental monitoring tool for policy makers in New Zealand. Environmental indicators will enable policy makers at either a local, national or international level to be able to accurately monitor and evaluate the environmental consequences associated with energy consumption and production patterns (including those of energy sector industry). From this monitoring, policy makers will be able to assess the effectiveness of their environmental policy frameworks. In doing so, policy makers will avoid misinterpreting or inappropriately responding to their environmental policy frameworks or obligations.

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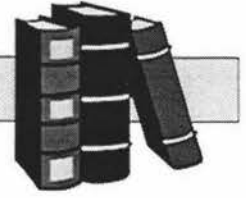
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My sincere thanks to all

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Definitions



Consumer energy (observed and calculated), end use energy, energy-sector industry, primary energy, secondary energy, total final consumption, total primary energy supply and useful energy are terms that are used throughout this document. The following provides an interpretation of these terms, as used within the context of the agencies or individuals listed below:

Consumer energy (calculated) = total primary energy +/- total energy transformed (to another type of energy, e.g. gas to electricity) - non-energy uses (primary energy used for other purposes e.g. bitumen for roads, natural gas as feedstock to produce methanol and ammonia urea).

Statistics New Zealand

Consumer energy (observed) = agriculture consumer energy + industrial consumer energy + commercial consumer energy + domestic consumer energy + transport consumer energy

Statistics New Zealand

End use energy is similar to secondary energy but does not include non-energy uses or uses and losses by the energy industry itself.

Minister of the Environment, Canada

Energy sector industry (for the purposes of this thesis) is defined as including energy generators, transformers and consumers within the industrial sector, and excludes the residential, commercial, agricultural and transport sectors.

Kissick

Primary energy sources include non-renewable sources such as coal, oil and gas and renewable sources such as hydroelectricity, wood, solar and wind energy.

Canterbury Regional Council

Primary energy is delivered energy plus losses incurred in converting energy resources into purchased heat and electricity.

International Energy Agency

Primary energy is energy as it is first produced. “Primary Energy” represents the total requirement for all users of energy in Canada, including energy used by the final consumer, intermediate uses of energy in transforming one energy form to another (e.g. coal to electricity), energy used by suppliers in providing energy to the market (e.g. fuel for pipeline compressors), and also imported energy minus exported energy.

Environment Canada

Primary energy is the total requirements for all uses of energy, including energy used by the final consumer, non-energy uses, intermediate uses of energy, energy in transforming one energy form to another and energy used by suppliers in providing energy to the market.

Natural Resources Canada

Secondary energy is the energy available for use by the residential, commercial, and industrial sectors and for transformation into other forms of energy. Secondary energy also includes hydrocarbons, like oil, that is used for non-energy purposes, such as petrochemical feedstocks. Secondary energy is less than primary energy because of losses in conversion and distribution.

Environment Canada

Secondary energy is energy used by final consumers for residential, agricultural, commercial, industrial and transportation purposes.

Natural Resources Canada

Total final consumption is the sum of consumption by the different end-use sectors. In final consumption, petrochemical feedstocks are shown under industry, while non-energy use of such oil products as white spirit, lubricants, bitumen, paraffin waxes and other products are shown under non-energy use, and are included in total final consumption only. Backflows from the petrochemical industry are not included in total final consumption.

International Energy Agency/OECD

Total primary energy supply is the amount of energy available for use in New Zealand for energy conversion and end use. Primary energy = indigenous production + imports – exports +/- stock change – international transport.

Statistics New Zealand

Total primary energy supply is formally defined as indigenous production + imports - exports - international marine bunkers \pm stock changes. In the Outlook, however, the regional TPES exclude marine bunkers, whereas the world TPES includes international marine bunkers.

International Energy Agency/OECD

Useful energy is delivered energy minus losses assumed to occur in boilers, furnaces, water heaters and other equipment in buildings; used for estimates of heat provided in space and water heating and cooking.

International Energy Agency

Abbreviations

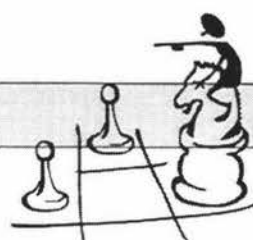


ANZMEC	Australian and New Zealand Minerals and Energy Council
APEC	Asia-Pacific Economic Co-operation
ARC	Auckland Regional Council
ARMF	Auckland Regional Monitoring Forum
ASM	Annual Survey of Manufacturers
BPRC	Bay of Plenty Regional Council
C/kWh	cents per kilowatt hour
CCC	Christchurch City Council
CDES	Century Drilling and Energy Services
CEPA	Canadian Environmental Protection Act
CESD	Commissioner of the Environment and Sustainable Development (Canada)
CH ₄	Methane
CIEEDAC	Canadian Industrial Energy End-Use Data and Analysis Centre
CIPEC	Canadian Industry Programme for Energy Conservation
CMA	Crown Minerals Act, 1991 (New Zealand)
CMG	Crown Minerals Group (New Zealand)
CO ₂	Carbon Dioxide
CPFE	Consumption of Purchased Fuel and Electricity
CRC	Canterbury Regional Council
CSD	Commission on Sustainable Development (United Nations)
DUS	Delta Utility Services
EC	Environment Canada
ECNZ	Electricity Corporation of New Zealand
EECA	Energy Efficiency and Conservation Authority (New Zealand)
EIR	Electricity Industry Reform Act, 1998 (New Zealand)
EPI	Environmental Performance Indicator
ESC	Economic and Social Council (United Nations)
ESMU	Energy Statistics and Modelling Unit (New Zealand)
EU	European Union
EWCC	Energy Wise Companies Campaign (New Zealand)
EWCPP	Energy-Wise Councils Partnership Programme (New Zealand)
FCCC	Framework Convention on Climate Change
FCP	Fletcher Challenge Paper

GC	Government of Canada
GDC	Gisborne District Council
GDP	Gross Domestic Product
GEMS	Global Environmental Monitoring System
GEO	Global Environmental Outlook
GJ	Gigajoule
GRID	Global Resource Information Database
GRP	Gross Regional Product
GWh	Gigawatt hours
HASNO	Hazardous Substances and New Organisms Act, 1996 (New Zealand)
HBRC	Hawke's Bay Regional Council
HFCs	Hydrofluorocarbons
ICE	Industrial Consumption of Energy Survey (Canada)
IEA	International Energy Agency
IEP	International Energy Programme
IERDP	Industry Energy Research and Development Programme (Canada)
MCC	Manakau City Council
MDC	Marlborough District Council
MEA	Multilateral Environmental Agreement
MEPS	Minimum Energy Performance Standards
MfE	Ministry for the Environment (New Zealand)
MMTI	Minerals and Metals Technologies Initiative (Canada)
MoC	Ministry of Commerce (New Zealand)
MoE	Minister of the Environment (Canada)
MWRC	Manawatu-Wanganui Regional Council (Horizons-m.w.)
N ₂ O	Nitrogen Oxides
NAPCC	National Action Programme on Climate Change (Canada)
NCC	Nelson City Council
NEUD	National Energy Use Database (Canada)
NRC	Northland Regional Council
NRCan	Natural Resources Canada
NTREE	National Round Table on the Environment and Economy (Canada)
NZG	New Zealand Government
NZGECA	New Zealand Government Executive Coalition Agreement
NZGO	New Zealand Government Online
NZRC	New Zealand Refinery Company
OECD	Organisation for Economic and Co-operation Development

OEE	Office of Energy Efficiency (Canada)
OPEC	Organisation of Petroleum Exporting Countries
ORC	Otago Regional Council
PCE	Parliamentary Commissioner for the Environment (New Zealand)
PFCs	Perfluorocarbons
PJ	Petajoule
PSR	Pressure-State-Response Model
QRES	Quarterly Report on Energy Supply and Demand (Canada)
RER	Regional Environmental Report
RES	Regional Energy Strategy
RMA	Resource Management Act, 1991 (New Zealand)
RNB	Resources and Networks Branch (New Zealand)
RPS	Regional Policy Statement
SEC	Specific Energy Consumption
SER	State of the Environment Report
SF ₆	Sulphur Hexafluoride
SIC	Standard Industrial Classification System (Canada)
SNZ	Statistics New Zealand
SOE	State Owned Enterprises Act, 1986 (New Zealand)
SRC	Southland Regional Council
TAI	The Aspen Institute
TCC	Taranaki Combined Cycle (Power Station)
TDC	Tasman District Council
TEC	Total Energy Consumption
TES	Total Energy Supply
TFC	Total Final Consumption
TOE	Tonnes of Oil Equivalent
TPES	Total Primary Energy Supply
TRC	Taranaki Regional Council
TWB	The World Bank
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VA	Voluntary Agreement Programme (New Zealand)
VCR	Voluntary Challenge Registry Programme (Canada)
WBCSD	World Business Council for Sustainable Development

WCC	Wellington City Council
WCRC	West Coast Regional Council
WRC	Wellington Regional Council
WRC-EW	Waikato Regional Council (Environment Waikato)



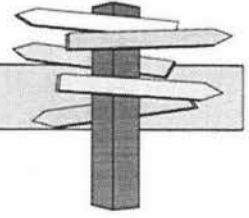
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Executive Summary



Historically, governments have been primarily concerned with ensuring that adequate and secure supplies of energy exist. However, mounting evidence regarding the degradation of our environment, and a growing sense of shared responsibility has provided the impetus to develop wider institutional structures in which to address global environmental problems. In particular, concerns regarding unsustainable energy consumption and production patterns have underscored the need to improve environmental monitoring.

This research provides an analysis of the role and status of environmental performance indicators for energy sector industry in New Zealand. The environmental indicators considered are those that are directly aligned to energy consumption and production patterns.

In order to be able to identify and isolate the range of issues associated with energy consumption and production patterns, it is necessary to understand the factors that influence energy use and the impacts that arise, but also the effectiveness of relevant policy frameworks. This demands that policy makers face two ways: inwards towards activities that are occurring at a local or sectoral level, and outward towards national and international environmental frameworks and obligations.

In response to the above-described need organisations such as the UN and OECD have developed environmental indicators for energy. Environmental indicators provide a simple, but timely and analytically valid means of integrating a host of information to reveal trends or changes in a particular environmental condition.

Many countries are adopting the use of environmental indicators. Whilst there are currently no national environmental indicators for energy in New Zealand, the MfE is well on the way towards collating its inaugural toolbox of national environmental indicators, including those for energy under the aegis of the Environmental Performance Indicators (EPI) programme.

Whilst the MfE's indicator for CO₂ emissions is a climate change indicator, it will be as relevant to energy and energy sector industry, as the national energy indicators that the MfE will eventually develop. However, this indicator captures just one of the many effects that can arise from the activities of energy sector industry. Of particular concern also should be indicators that can measure the intensity of energy use, how efficiently energy is being utilised, the distribution of energy types,

and energy prices. Each of these measures has been internationally recognised as having the potential to be utilised as an environmental indicator.

Whilst the development of the MfE's inaugural energy indicators will not be idealistically perfect, the process of indicator development is iterative, and thus perfection is not a realistic expectation either. Impedance's that currently inhibit the development of the MfE's energy indicators include gaps in existing information, inconsistent approaches in the collection of energy-environment information and low level reporting requirements impeding the wider use of some energy data. Coincident with indicator development is the need for an integrated environmental network system to co-ordinate, collate and systematically draw together and transfer indicator data between the various stakeholders.

Opportunities also exist to improve the process of developing national energy indicators. The MfE should target large energy sector industries in New Zealand for input to indicator development to both improve the supply of information to industry regarding the EPI programme and to improve the feedback from industry on the EPI programme.

A comparative case study of Canada shows a clear commitment by the Canadian Government to implement energy efficiency programmes and regulations, and to monitor the effects of its energy use. New Zealand whilst moving at a much slower pace appears to be adopting a similar approach to that of Canada, however further improvements can be made. These include, establishing EECA as a governmental organisation and improving the affiliation between EECA and the MfE to ensure energy is firmly placed within the context of its environmental effects.

Much progress has been made at a national and international level in the development and use of environmental indicators for energy sector industry and this provides useful insight to the MfE in the development of their national energy indicators. National energy indicators when introduced, will prove a fundamental monitoring tool for policy makers in New Zealand. By developing and using environmental indicators, policy makers at either a local, national or international level will be able to accurately monitor and evaluate the environmental consequences associated with the actions of energy sector industry (and other energy sectors). From this monitoring, policy makers will be able to assess the effectiveness of their environmental policy frameworks. In doing so, policy makers will avoid misinterpreting or inappropriately responding to their environmental policy frameworks or obligations.



The Research Project and Environmental Performance Indicators

In 1992, economist Robert Solow encapsulated the justification for the development of environmental performance indicators for sustainability when he stated: *“Talk without measurement is cheap. If we – the country, the government, the research community – are serious about doing the right thing for the resource endowment and the environment, then the proper measurement of stocks and flows ought to be high on the list of steps toward intelligent and foresighted decisions”*.

1.0 Introduction

This section serves two purposes. Firstly, it provides an overview to the research project conducted and the methodologies used to achieve the purpose of this research. Secondly, this section serves to provide an introduction to environmental performance indicators¹, including what they are, what attributes they should possess, the limitations associated with their use, and finally how environmental indicators are categorised. This introduction then sets the scene for further discussion on the application and use of environmental performance indicators at an international, national, and local level, including how environmental indicators can (and have) interacted with a range of statutory and non-statutory environmental policies and objectives.

1.1 Overview to Research Project

The purpose of this research is to provide an analysis of the role and status of environmental performance indicators for energy sector industry in New Zealand. The environmental indicators considered are those that are directly aligned to energy consumption and production patterns. Within this report, energy sector industry is defined as *“...including energy generators, transformers and consumers within the industrial sector, and excludes the residential, commercial, agricultural and transport sectors”*.

The hypothesis that was tested by conducting this research was:

New Zealand policy makers with energy-environment responsibilities at either a local,

¹ Environmental performance indicators or environmental indicators are interchangeable terms and are taken as having the same meaning.

national or international level should utilise environmental performance indicators that account for the activities and effects of energy sector industry in order to avoid misinterpreting or inappropriately responding to their environmental policy frameworks.

This research will argue that well-formulated environmental performance indicators support the ability of a country to more fully understand the impacts associated with its energy consumption and production patterns. Furthermore, this research will argue that environmental indicators enable policy makers at either a local, national or international level to more accurately evaluate, effectively develop, and respond to environmental policy frameworks that are influencing the way in which New Zealand's energy resources are being utilised by energy sector industry. Finally, this research will demonstrate that flaws exist in the way in which energy information is both gathered and administered in New Zealand. Whilst there are currently no national environmental indicators for energy, recognition of these existing flaws will create opportunities for improvement in the development and future implementation of energy indicators and will promote more informed monitoring and administration of the energy sector industry in New Zealand.

The objectives identified in support of this research were twofold, namely:

- (a) To identify and evaluate the status of energy-related international, national, local and corporate environmental obligations and initiatives for energy sector industry in New Zealand. The specific issues covered at these various levels are discussed further below.
- (b) To provide, as a comparison, a case study of the energy sector in Canada. This includes an identification of the approaches that have been used by governmental and non-governmental bodies for energy sector industry, and their relevance to the New Zealand situation.

The methodologies employed to conduct this research primarily involved the identification and review of various pieces of literature that relate to energy, industry and the environment. A hierarchical approach to identifying the legislative and policy framework that is relevant energy-environment information was used. This approach was considered important because the identification and evaluation of a country's progress towards meeting its environmental commitments for energy essentially requires facing in two directions: inward to the particular goals or objectives for each locality and outward to national and international commitments.

Section 1 provides an introduction to environmental performance indicators, including what they are, what attributes they should possess, the limitations associated with their use, and finally how environmental indicators are categorised.

Section 2 provides an overview of the energy-related legislative and policy frameworks that exist at an international that affect energy sector industry in New Zealand. This section includes an identification of the relevant multilateral environmental agreements (MEA) and institutional structures that New Zealand is party to and how MEA are monitored and reported on. It also includes the findings of the international institutions that are engendered with responsibilities for evaluating and monitoring a New Zealand's performance. This cohesive approach to establishing the "international scene" was considered important as it enables the reader to fully understand the multifaceted activities that exist at a global level. This includes the roles of the various parties involved, their obligations and commitments and how these both interact with, and impact upon, activities that occur nationally in New Zealand.

Section 3 provides an overview of the energy-related legislative and policy frameworks that exist at a national level in New Zealand, including how these frameworks are administered. Two of the most pervasive changes that have impacted upon energy sector industry have been the legislative reforms such as the introduction of the Resource Management Act (RMA) and energy sector reforms such as the deregulation of the electricity sector. Thus, this section identifies and discusses the various acts, regulations, and other energy related strategies and initiatives that are relevant to energy sector industry, that have been introduced by Government.

Section 4 provides an overview of the energy-related legislative and policy frameworks that exist at a central government level in New Zealand. Central government agencies provide leadership and direction for the energy sector by communicating the Government's aspirations into environmental policies and programmes. This section identifies relevant programmes that agencies such as the Ministry for the Environment (MfE), the Ministry of Commerce (MoC) and the Energy Efficiency and Conservation and Authority (EECA) have initiated in order to improve the way in which energy is managed and/or communicated within New Zealand.

Section 5 provides an overview of the energy-related policy and administrative frameworks that exist at a local governmental level in New Zealand. Regional authorities are required under the RMA to promulgate Regional Policy Statements (RPS) for their particular region to communicate how they will manage those issues that they have deemed to be significant. All of the regional authorities have addressed energy as a significant issue in their respective RPS. In addition to identifying the policies, objectives and methods of the various RPS, contact was also made with each of the sixteen regional authorities to seek feedback on the progress they have made towards enacting the energy section of their RPS.

Section 6 provides a sectoral analysis of the range of energy-environment monitoring and reporting that is currently conducted by energy sector industry in New Zealand. At the sectoral level, it was

decided to survey the main energy sector industries in New Zealand to determine the types of energy monitoring that are currently being conducted, how these results are being communicated externally, and to whom. In addition, the survey sought to seek feedback from industry to determine the inter-relationships that exist between industry and those organisations that have energy-environment responsibilities within New Zealand.

Section 7 provides a comparative case study of the energy sector in Canada. Section 7 has not attempted to capture all of the immense number of governmental, non-governmental, research, university, industry and interest groups that deal with energy in Canada. Rather, this section is intended to provide a brief overview to some of the key environmental legislative systems, initiatives, and forums that operate within Canada, including the types of environmental indicators that are used to monitor the performance of energy sector industry, and their relevance to New Zealand. Canada was chosen for comparative purposes primarily for two reasons. Firstly, Canada has a range of well-established national frameworks for environmental performance indicators for energy (including those for industry). Secondly, Canada has worked for a number of years to further refine their informational databases that support the range of environmental information and data that is currently being gathered.

Section 8 draws together and discusses the findings in each of the above described sections, whilst conclusions to the research conducted are detailed within **section 9**.

1.2 What is an Environmental Performance Indicator?

Indicators have come to mean different things to different people. The term “indicator” traces back to the Latin verb *indicare*, meaning to disclose or point out, to announce or make publicly known, or to estimate or put a price on (Adriaanse, et. el., 1995). The Collins Dictionary defines an indicator as meaning “*something that provides an indication, especially of trends, or to be [or give] a sign or symptom of, or to imply*”. As commonly understood however, an indicator is something that provides a clue to a matter of larger significance or that which makes perceptible a trend or phenomenon that may not otherwise be immediately detectable. For example, the observance of a drop in barometric pressure on a barometer may indicate that a storm is imminent, or an increase in a persons body temperature may indicate the onset of a viral infection. Thus, an indicator provides an estimation of a trend that extends beyond what is actually measured to a larger phenomenon of interest (Adriaanse, et. el., 1995).

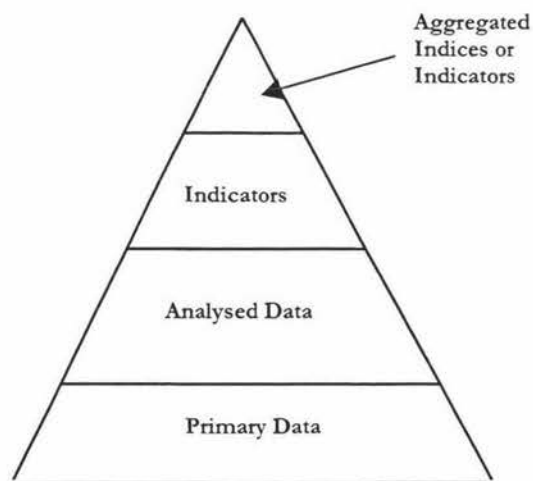
The Organisation for Economic Co-operation and Development (OECD) defines an environmental indicator as being: “*a parameter, or value derived from parameters, which points to, provides information about, or describes the state of a phenomenon/environment/area, with a significance extending beyond*

that directly associated with a parameter value" (OECD, 1994). Environmental indicators are therefore aspects or parameters of the environment that can be accurately monitored, in a timely manner, to reveal trends or changes in a particular environmental condition.

Whilst environmental indicators are derived and developed from statistics or primary data they do in themselves merely represent data collection. This is because environmental indicators are derived from the analysis of a larger information pyramid, whose base may be comprised of primary data (derived from monitoring and data analysis), but whose structure is comprised of more detailed and complex attributes. A conceptual model of such an information pyramid is shown in Figure 1.

By clearly understanding all the factors and attributes that influence the range of discrete environmental data and information, a well-structured information pyramid can enable individual data to be multiplied together to produce aggregated indicators or indices as the analyst moves up the information pyramid.

Figure 1: The Information Pyramid



Source: Adriaanse, et. el. 1995, Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development

Environmental indicators can be used at an international, national or local level as a tool for assisting in state of the environment reporting, measuring environmental performance, and reporting on progress towards sustainable development. This is because environmental performance indicators provide a means of gauging progress by integrating environmental data and information to produce an overall picture of the environment.

Environmental indicators can also provide early notice if an emerging problem(s) or an improvement(s) in the environment is occurring. By raising the level of awareness in the state of the

environment, governmental agencies can, by earlier identification and prioritisation of environmental issues and risks, make better and more informed decisions. Environmental indicators can provide a link between what is observed and the reasons for what is observed. However, the ultimate challenge for policy makers and environmental analysts is to improve these linkages in order to achieve the sustainable management of our earth's resources.

1.2.1 What Environmental Performance Indicators Can and Should Achieve

Environmental performance indicators need be able to communicate information about the environment, and about the human activities that affect it, in a manner which draws attention towards determining whether the quality or state of the environment is improving or worsening. There exists a plethora of literature derived from a range of technical experts, that describes the attributes that a good environmental performance indicator should possess, including:

- *indicators should be **reliable, reproducible and analytically sound**;*
- *indicators should **quantify and simplify** information so its significance is more readily apparent, and so information about complex phenomena can be easily communicated and understood by a wide audience;*
- *indicators should be **timely** to ensure that the conveyance of information that is provided to decision makers is meaningful;*
- *indicators should be **policy relevant** so that the information can be easily interpreted in terms of environmental trends or assessing progress towards particular policy goals or objectives.*

Environmental indicators need to be theoretically well founded in both scientific and technical terms. For example, a water quality indicator may incorporate measures such as the macroinvertebrate community index (MCI) to determine the health of a stream. The MCI methodology, that quantifies both the numbers and types of in-stream biota has been scientifically developed by the Cawthron Institute and has proven to be a reliable, reproducible and analytically sound biological measure. Because it is also widely used around New Zealand as a biological measure of stream quality, it is therefore more likely to gain consensus in terms of its validity for use.

Environmental indicators also need to be measurable, meaning that the data required to support the indicator should be readily available or be able to be sourced at a reasonable cost. However, demanding perfection prior to adoption of an environmental performance indicator is an unrealistic expectation that is certain to lead to disappointment. This is because often there are gaps in the types of information that is gathered. For example, the OECD in their latest publication of "OECD Environmental Indicators" that released in 1998 identified three groups of indicators that they intend to develop and use as a core set (OECD, 1998). Firstly there are those indicators that are immediately

measurable because all the data required for the development of the indicator is available. Secondly, there are group of indicators that the OECD have identified need additional efforts before they can be presented. Thirdly there are a group of environmental indicators that the OECD have identified can only be measured in the long term, due to the absence of data. Thus, it needs to be recognised that the development of environmental performance indicators is an iterative process, that should improve over time as analysts gain better access to, and understand the implications of, the information that is gained from using environmental performance indicators.

Environmental indicators should also be simple enough so that information is able to be easily communicated in order to achieve a general understanding and wide acceptance by public, and not just business or industry specialists or governmental bodies. This is particularly important because whilst the public may not necessarily need to understand all the scientific and technical considerations which go into developing an indicator, they do need to know that there is general consensus among credible experts that the indicator is valid. For example, most people would not fully understand the Dow Jones stock market index or Consumer Price Index, but they accept both of these indicators as a measurement of the economy because economists and those people who report on the economy consider them creditable.

In certain instances it may also be appropriate to design the environmental indicator such that it enables individuals to relate the indicator to things that they value or with which they can easily identify. For example, rather than reporting the contaminants in the drinking water as parts per million (or ppm) an indicator for water quality might be more easily understood by the public, if the contaminant level is identified along with what this means for the consumer, that is "safe" for drinking.

Environmental indicators also need to be able to communicate their information in a timely manner. This means that the frequency that information is gathered which pertains to an indicator, must be appropriate for the issue that the indicator is intended for. For example, temperature variations that may be used as an indicator for climate change need to be able to capture the range of seasonal variations that occur over the period of several years and just those changes that occur over a single year.

Of equal importance is the ability of the indicator to be able to communicate its findings within a time frame that ensures society can also appropriately respond to any observed changes. Obviously timeliness is important, as if the indicator cannot communicate its findings within an appropriate time period the ability to action change prior to irreparable environmental damage is lost!

Environmental indicators should also be policy relevant. This means that the indicator should not only be technically relevant but also easily interpreted in terms of both environmental trends and progress towards environmental policies or objectives. Thus, a key determinant in the development of an environmental performance indicator is the link that occurs between the measurement of some environmental condition(s) and the practical policy options available (Adriaanse, et. el, 1995) to address this condition. This linkage is a fundamental attribute of an environmental indicator as the trends observed can help policy makers understand whether the observed changes are in the desired direction or not, and hence whether their environmental policies are effecting a desired outcome. For example, if an indicator of industrial energy intensity shows that energy intensity continues to increase over time then policy makers may need to look at stronger policy instruments to either stabilise or decrease energy demand.

Finally, whilst the overarching purpose of an environmental indicator is to steer action, indicators may be suitable for one function but totally inappropriate for another. As such there is no universal set of indicators that can be unilaterally applied to all situations for all countries. This is because there are many differences between countries. For example, New Zealand has a temperate climate in comparison to Canada and therefore energy usage for heating will be much less than that for Canada, which suffers a severe cold climate during winter. Thus, because of the specificity of indicators, comparability of indicators between countries is only a requirement in so far as the comparison is necessary within the context of an international policy process (Bakkers et. el, 1994). For example, the monitoring of national compliance to obligations such as multilateral agreements requires an internationally comparable indicator, but the decision making on a national water indicator can take place on the basis of a country's own specific indicator set.

1.2.2 Limitations to the Use of Environmental Performance Indicators

An awareness of the limitations² that exist with environmental indicators is necessary to avoid their misuse and misinterpretation. Such limitations include:

- environmental indicators often need to be supplemented with other qualitative and quantitative data;
- environmental indicators need to be reported in an appropriate context;
- highly aggregated environmental indicators often require merging “unlike” data.

Environmental indicators provide analysts with one tool that can be used for conducting evaluations or assessments on the environment.

² Limitations associated with the use of environmental indicators are also discussed further in section 2.4.6.

However, to avoid the misuse or misinterpretation of information gained from an environmental indicator, environmental indicators also need to be supplemented with other qualitative and scientific information. For example, a change in the observance of a country's energy demand may be affected by a host of variable factors including energy prices, technology and/or energy efficiency. In order to attribute the change to a particular cause it is necessary to isolate and examine each of the contributing factors.

Environmental indicators also need to be reported and interpreted in the appropriate context, taking into account variations that may exist in ecological, geographical, social, economic and structural features (Michel, 1997). This can pose some difficulty in terms of comparative analysis, particularly at an international level as the relevance of a particular indicator may vary depending on a country's situation and the context in which the indicator is used. To assist in overcoming this issue, organisations such as the OECD utilise their core indicators in conjunction with a specific country's national indicators and additionally supplement these indicators with other environmental data and information to provide a more detailed picture of a particular country's situation. However, despite undertaking these measures, the OECD has also found that there is no single method of standardization when comparing indicators across countries (OECD, 1994) as outcomes generally depend on the chosen denominator (for example, GDP, population, land area) as well as on national definitions and the measurement methodologies used.

Many debates also often exist between technical experts regarding the use of highly aggregated environmental indicators. For example, Carpenter (1997) suggests that highly aggregated indicators are *"merely an attempt to create an ecological equivalent of gross national product"*. This is because highly aggregated indicators usually require a comparable weighting system to be applied to the indicator to create "like" units. For example, the International Panel on Climate Change (IPCC) use a weighting system for greenhouse gases which apportions the global warming potential (GWP) of a particular greenhouse gas to that of its CO₂ equivalent. This means that one gigagram of methane with a GWP of 21 is equivalent 21 gigagrams of CO₂.

Whilst aggregated indicators most certainly enable a more simplistic presentation of information they can also demand that weighting systems be applied to data of "unlike" characteristics. For example, an indicator for 'composite pollution' may require aggregation of a large number of unlike quantities of environmental data including the disposal of solid wastes, dispersion of air pollutants, climate change, and acidification. As it is not possible in all instances to apply an accurate weighting system, some aggregated indicators may need to be based upon a compromise between the need for completeness of data and the need for simplicity in methodology and data collection.

Often, highly aggregated indicators also require a further level of detail or breakdown in order for the indicator to be applied at a regional or sectoral decision making level. For example, highly aggregated national indicators such as energy used per unit of gross domestic product can hide major regional differences in energy consumption or energy efficiency that may only be revealed by more extensive analysis at sub-national or sectoral levels.

1.2.3 Indicators Come in Different Categories

There are three major categories for environmental indicators: - **individual** indicator sets, **thematic** indicators and **systematic** indicators. **Individual** indicators are comprised of sets of environmental indicators that have been developed using the least amount of data aggregation. As a result, individual indicator sets can result in a large list or “menu” of indicators being developed. The United Nations (UN) is an example of an organisation that has developed and used individual indicator sets.

In terms of information reduction, **thematic** indicators represent a mid-size approach to environmental indicators. Thematic indicators involve developing small sets of indicators for each of the major issues in environmental policy. A number of countries including Canada and the Netherlands have adopted this type of approach for their national reporting (TWB, 1997). Within the primary structure of a thematic indicator, is the breakdown of a causality chain that further supports individual indicators for pressure, state, response, or impact. The overall structure in which the indicator collection is grouped may also vary depending upon what approach is used. In Canada for example, a systems approach at a highly aggregated level is used for the development of a thematic indicator for life support systems which incorporates indicators of climate change, stratospheric ozone, toxics in the environment and biodiversity (EC, 1996).

Sometimes in order to keep indicators as simple as possible, a single measure is selected for each major environmental issue. This type of approach produces an environmental indicator that is referred to as either an **aggregate** or **systematic indicator**. These types of indicators are also sometimes referred to as **portfolio** or **synoptic** indicators (Rump, 1996). However, as previously discussed in section 1.2.2 (limitations to the use of environmental indicators), aggregate indicators are perhaps the most ambitious type of indicator because not only do they require a large amount of information reduction but often they also demand aggregation of data with dissimilar characteristics.



The Global Context

Increased interdependencies among nations and a growing sense of shared responsibility has provided the international community with the impetus to develop wider institutional structures in which to address the consequences associated with the degradation of our global resources.

2.0 Introduction

One main method available under international law that enables individual countries to cooperatively work together on global environmental issues is **multilateral environmental agreements**. Multilateral environmental agreements (MEAs) are developed within an international framework and may take form as either legally binding (“hard” law) or non-legally binding (“soft”) agreements.

MEAs can provide an important directive to the development of legislation within a country, particularly when that country does not have overall responsibility or accountability for addressing the environmental problem. MEAs can also provide a more pragmatic approach for responding to global environmental issues such as greenhouse gas emissions, than unilateral action by a particular country. This is because whilst unilateral action by a country may provide an example of good environmental practice to other countries, it may also prove ineffectual if voluntary adoption by the other countries does not occur as a result of it (Hoel, 1991). This can result in economic or social disadvantage for the country that takes unilateral action to improve their environmental performance if other countries do not follow suit. In addition, further disadvantage may result for the country that has taken unilateral action, should they then try to negotiate a cooperative agreement with other countries to achieve a similar outcome at a later date. This is because it may reduce the bargaining position of that country which has already unilaterally reduced its emissions relative to other countries (Sharp, 1994). MEAs thus provide a fairer “playing-field” in which to develop frameworks for agreed cooperative responses.

Because the international community is increasingly negotiating treaties involving nations with a diverse range of interests and varying levels of economic development this has also led to the

recognition that the primary rules embodied within a MEA must often be based on common but differentiated responsibilities (Sands, 1994). Recognition of these differences in economic and social standings between developed and developing countries is necessary as these differences can influence ability of a country to promote a desired environmental change.

There are many issues that can influence the success of a MEA. Examples include the ability of the signatories to the MEA to provide mechanisms for transfer of technologies and the provision of financial resources, particularly from developed to developing countries. There is also a need for the transparent and harmonised reporting and collation of data between parties. These elements are all essential to build the capacity and confidence necessary to encourage compliance of all parties to the MEA (Sands, 1994).

Churchill (1995) also purports that other measures such as “carrot” and “stick” approaches can act as important compliance mechanisms in international environmental agreements. “Carrots” include financial aid to help compliance, while “sticks” include denial of benefits under the agreement and suspension of voting rights, and in exceptional circumstances, trade sanctions (Churchill, 1995).

In order for MEAs to come into force, a treaty between the international parties must first be signed. Once this occurs, the individual parties may affect the treaty by ratifying it in their respective country, thus making provision for the MEA to be adopted into their particular legislation as “hard” or legally binding law. However, as previously mentioned, not all MEAs are legally binding and in some instances MEAs may be adopted internationally as “soft” law or, “in principle”.

2.1 New Zealand and its Multilateral Environmental Agreements

New Zealand is party to a host of multilateral environmental agreements (MEAs). These MEAs can be broadly categorised into areas which comprise of the following: the protection of the marine environment and resources; Antarctica; fishing; whaling; hazardous substances; conservation of natural resources; arms control and nuclear pollution.

International discussions held during the United Nation’s Rio Earth Summit in 1992 culminated in a number of binding and non-binding multilateral environmental agreements being formed between member countries of the United Nation’s. Those of particular relevance to this research topic include the Rio Declaration, Agenda 21 and Framework Convention on Climate Change. Each of these multilateral environmental agreements is discussed separately within section 2.3.

2.2 International Institutional Structures

Two important organisations that New Zealand has accepted international environmental obligations from include the Organisation for Economic Co-operation and Development (OECD) and the United Nations (UN). The OECD and the UN represent a means for progressive codification and development of environmental law but are not (in themselves) an “international government” per se. Rather, organisations such as the OECD or UN provide an important forum in which New Zealand and other participating countries can help resolve international conflict and formulate policies and/or legally binding codes on matters that effect the international community.

Both the OECD and the UN also provide evaluation and guidance functions to measure the performance of their member countries international commitments. They achieve this via a range of methods including the development and use of **environmental performance indicators**.

Environmental performance indicators provide one means of integrating a host of environmental data and information to produce an overall picture of the environment. Environmental indicators also form part of and support other monitoring functions, such as measuring and reporting on whether a particular country, or an international organisation as a whole is making progress towards achieving a goal such as the sustainable development of energy resources. Therefore, for the purposes of this research it was considered appropriate to not only assess the role of environmental indicators but also how environmental indicators are reported including the findings that has resulted from their application.

Accordingly, information pertaining to the OCED and UN has been structured as follows:

- (a) a description of the structure and functions of the international organisation is provided. This also includes, where relevant, any relevant sub-bodies of the international organisation which may have energy-environment responsibilities.
- (b) A description of the work conducted by the international organisation on environmental indicators;
- (c) A description of the application of environmental indicators within the context of state of the environment reports (or other reporting) conducted by the international organisations on their member countries.

2.3 Rio Earth Summit

In 1992, New Zealand attended the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. This conference (also referred to as the “Earth Summit”) produced five key documents on sustainable development issues. Two of these: the

Framework Convention on Climate Change and the Convention on Biological Diversity³ have legal weighting in New Zealand because they have been signed and ratified into New Zealand legislation. The other three key documents: the **Rio Declaration**, **Agenda 21** and the Forest Principles are non-legally binding agreements and provide the basis for direction as “soft-law” in New Zealand.

2.3.1 The Rio Declaration on Environment and Development

In some instances countries may consider it more appropriate to cooperatively work on a global environmental issue in principle, or in a non-legally binding manner. The **Rio Declaration on Environment and Development** is based on the principles of sustainable development and is an example of a non-legally binding multilateral environmental agreement. The principles encapsulated within the Rio Declaration involve managing resources in a way that provides for our needs as well as providing for their protection – both for their inherent value, and to preserve mankind’s future interests in them. The obligation of the Rio Declaration is to “*conserve, protect and restore the health and integrity of the Earth’s ecosystem*” and it is framed in such a way to recognise that countries have different abilities and methods available for them to draw on when dealing with environmental problems (MfE, 1999a).

The Rio Declaration has a number of guiding principles on sustainable development that broadly include (MfE, 1999a):

- (a) *Intergenerational equity - that there should be equity between the rights and needs of the current generation and of generations to come.*
- (b) *Precautionary approach – that a lack of full scientific certainty of the causes and effects of environmental damage should not be a reason for delaying action to prevent such damage.*
- (c) *Polluter pays – that polluters should bear the cost of pollution, and that the costs of environmental damage should be reflected in cost/benefit analyses of actions affecting the environment.*
- (d) *Responsibilities – which the world community has a common responsibility for protecting the global environment and countries that pollute more, should do more for environmental protection than those that pollute less.*

The culmination of the range of multilateral agreements that resulted from the UNCED Earth Summit in 1992 heralded somewhat of an “environmental milestone” for the international community as a whole. In particular, by globally embracing the concept of sustainable development, the developed international community has introduced new challenges for policy makers, industry and society primarily because of an existing high reliance on non-renewable sources of energy such

³ The Convention on Biological Diversity and the Forest Principles are not considered directly relevant to this research topic and are therefore not considered further.

as fossil fuels. By comparison, the developing community is not left unaffected by the above constraints but is also posed with dealing with the economic and social constraints related to access to commercial energy sources within their countries and the future anticipated growths in energy consumption patterns.

2.3.2 Agenda 21

Agenda 21 provides a framework for countries to implement the principles of sustainable development and provides another example of a non-legally binding multilateral agreement. Agenda 21 was prepared as a result of the 1992 UNCED and embodies the concepts of sustainable development in the Brundtland Commission report and the United Nations Perspective Document for the Year 2000 and beyond. Agenda 21 is a 40-chapter document that has gained significant status as a consensus document by a number of countries.

Agenda 21 is a framework that is intended for use by government's, local authorities and individuals. Some of the main themes of Agenda 21 include (MfE, 1999a):

- (a) *Reforming policies – to bring together environmental and economic issues. This calls for environmental considerations to be built into policy making from the start rather than as an ad-hoc add-in.*
- (b) *Control of wasteful consumption and production – Global degradation specifically pinpoints industrialisation as being the most significant contributor of environmental degradation due to wasteful consumption and production.*
- (c) *Technological improvement – promotion of the greater use of environmentally sound technologies that use resources more efficiently and generate minimal levels of waste.*
- (d) *Integrating trade and environment – to make trade and environment mutually supportive. This recognises that as trade can be adversely affected by the unjustifiable use of environmental concerns as technical barriers, so trade can adversely affect the environment if it leads to unsustainable production or unsustainable use of resources.*

Implementing the principles of Agenda 21 within New Zealand has been made simpler than for a number of other UN countries primarily because of environmental legislation such as the Resource Management Act, 1991 (RMA). The RMA accords well with Agenda 21, despite the fact that the RMA principles are a refinement of the concept of sustainable development and a diverse number of central and local government plans, statements and papers reference the principles of Agenda 21.

2.3.3 The Framework Convention on Climate Change, the Berlin Mandate and the Kyoto Protocol

The **Framework Convention for Climate Change** (FCCC) is an example of a legally binding MEA that has been formed between countries to commit to enact an international response to address a global environmental problem, namely greenhouse gas emissions or “global warming”.

The FCCC is a key document that was adopted by consensus at UNCED or the “Earth Summit” by UN member countries. The primary objective of the FCCC is *“to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system”*. In addition this objective required that *“...Such a level should be achieved within a time frame sufficient to allow eco-systems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”* (UN, 1999b).

Developed countries which are party to the FCCC are referred to as “Annex 1 countries” whilst developing countries are referred to as “non-Annex 1 countries”. This distinction is important because the FCCC recognises that developed and developing countries have common but differentiated environmental objectives. Developed countries have economies in transition and therefore they have more onerous responsibilities than non-Annex 1 Countries in terms of carbon dioxide (CO₂) emission limitation objectives.

Non-Annex 1 countries by comparison are required to monitor and report their emissions, and may adopt policies and measures, but are not bound to emission limitation objectives. The rationale for this distinction is that the Annex 1 countries have, in the course of their development, already consumed a large amount of fossil fuel and cleared substantial areas of their forests, and therefore have contributed most of the increased levels of CO₂ into the atmosphere.

Thus, because the global climate system has only a limited amount of ecological “space” in which to absorb these emissions without adverse effects occurring, the premise is that the remaining “space” should be allocated to those countries that have not yet had the opportunity to develop the standards of living for their inhabitants. Conversely, those countries that have utilised most of the available space have a responsibility to limit their consumption of the remaining space by limiting their emissions.

The FCCC itself contained no legally binding targets or timetables, however the general interpretation was that developed countries should reduce their emissions to 1990 levels by the year 2000. As a result Annex 1 countries agreed to implement a number of issues to achieve the objective of the FCCC.

These included (MfE, 1999a):

- (a) *Adopting national policies to mitigate climate change through limiting anthropogenic emissions of greenhouse gas emissions and protecting and enhancing our greenhouse gas sinks and reservoirs;*
- (b) *Reporting detailed information on greenhouse gas inventories, national actions, and projected human induced greenhouse gas emissions and removal by sinks, according to time frames set in the FCCC;*
- (c) *Taking into account climate change considerations, in relevant social, economic and environmental policies and actions;*
- (d) *Promoting, and cooperating in, relevant scientific and technological research and exchange information in such areas (including transferring technology to developing countries);*
- (e) *Providing additional financial resources to meet the agreed full costs incurred by developing countries in complying with their obligations under the FCCC;*
- (f) *Promoting public awareness of, and education about, climate change issues.*

In April 1995, at the first conference of the Parties to the Convention it was decided that the existing commitments were inadequate to achieve the objective of the Convention. In response to this decision the **Berlin Mandate** process was initiated. The Berlin Mandate was aimed at setting in place legally binding commitments for Annex 1 countries. Such commitments included identifying policies, measures, targets and timetables to control CO₂ emissions beyond the year 2000. Further negotiations at the third conference of the parties to the FCCC lead to the **Kyoto Principle**, which was agreed in December 1997. The Kyoto Protocol is a legally binding protocol under which some 38 industrialised countries are required to reduce their collective emissions of greenhouse gases by 5.2 percent. The 5.2 percent reduction in total developed country emissions is based upon the sum of distinct targets for each of the countries as shown in Table 1.

Table 1: Country Commitments for Greenhouse Gas Emissions Under the Kyoto Protocol: Period 2008-2012

UN Member Country	Target for (collective) greenhouse gas emissions at 1990 levels
Switzerland and the European Union ⁴	A reduction in emissions by 8 percent.
United States	A reduction in emissions by 7 percent.
Canada, Hungary, Poland and Japan	A reduction in emissions by 6 percent.
Russia, New Zealand and the Ukraine	A net stabilisation of emissions (zero increase).
Norway	Increases in emissions by up to 1 percent.
Australia	Increases in emissions by up to 8 percent.
Iceland	Increases in emissions by up to 10 percent.

⁴ The European Union proposes to achieve its target by distributing different reduction rates to its member countries.

Importantly, this third conference of the Parties to the FCCC re-emphasized that the risks from climate change were not solely due to emissions of carbon dioxide (CO₂), and rather “other” non-CO₂ greenhouse gases also significantly contribute to increased concentrations of greenhouse gases in the atmosphere (MfE, 1998a). “Other” species include methane, nitrous oxide, perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆).

New Zealand signed the Kyoto Protocol on climate change in May 1998, however this Protocol will not become legally binding in New Zealand until the required number of countries ratify it. This is because the Kyoto Protocol only enters into force when “*on the ninetieth day after the date on which not less than 55 parties to the Convention, incorporating Annex 1 Parties which accounted in total for at least 55% of the total carbon dioxide emissions for 1990 from that group, have deposited their instruments of ratification, acceptance, approval or accession*”. Should this become ratified New Zealand’s new, legally binding target will be to stabilise emissions of the six main greenhouse gases at 1990 levels, in aggregate, by the first commitment period, namely 2008-2012 (Upton, 1998a).

2.4 Organisation for Economic Co-operation and Development

The Organisation for Economic Co-operation and Development (OECD) consists of a “*club of like-minded countries*” (OECD, 1999a), whose membership totals some 29 countries, including New Zealand. Unlike the UN, countries that are party to the OECD are generally rich, producing some two thirds of the world’s goods and services (OECD, 1999a). However, despite this, the OECD indicate that “richness” in itself does not provide exclusivity, and rather membership is essentially only limited only by a country’s commitment to a market economy and a pluralistic democracy (OECD, 1999a).

The OECD’s functions include the review of domestic and international commitments of participating countries to determine individual trends, policies and countries performances as well as the use of peer pressure to improve them (OECD, 1998a). The efforts of the OECD are also directed at promoting programmes to promote sustainable development, with emphasis on developments in domestic and international policy, as well as on the integration of economic and environmental decision making (OECD, 1999a).

The core activities that are addressed by the OECD are wide ranging and include two important branches that address issues that relate specifically to the environment and energy. **Environmental issues** fall under the responsibility of the **Environment Directorate**, whilst **energy** is the responsibility of the **International Energy Agency** and the Nuclear Energy Agency. As New Zealand has no nuclear power this latter agency is not considered further.

2.4.1 Environment Directorate

The work of the Environment Directorate is orientated towards the principles of sustainable development and is based upon a recognition that environmental, social and economic activities need to be fully integrated. Accordingly, the mission of the Environment Directorate is to (OECD, 1999a):

- *Assist governments of OECD member countries to define and pursue environmental policies that are both effective and efficient;*
- *Encourage the full integration of environmental, economic and social policies;*
- *Promote common and harmonised environmental policies and strategies by OECD countries, where economic distortions such as trade barriers might otherwise occur;*
- *Monitor the environmental performance of OECD countries in implementing domestic policies and international commitments;*
- *Support the international community in its pursuit of sustainable development through co-operation with international organisations and non-member economies.*

One of the key outputs of the Environment Directorate is the regularly conducted provision of **State of the Environment (SOE)** reviews of its member countries. SOE reviews are a fundamental deliverable of the OECD and provide a means of comparative analysis of member countries performance, both individually and collectively. Continual assessment of the performance of OECD member countries, particularly in terms of their international commitments such as Agenda 21 and the FCCC, is seen as important given that OECD countries remain the principle consumers of the world's natural resources (Geyer-Allély, Eppel, 1997).

SOE reviews are orientated towards providing an individual country with a review of their trends, policy commitments, institutional arrangements and routine capabilities for carrying out national evaluations. SOE reviews are also an important facet of the OECD's functions as they establish baseline conditions of environmental performance for a particular member country and for the OECD as a whole. This is because the information gained from an SOE can prove influential internally for promulgating policy changes, as well as externally for promoting international dialogue between member countries. For example, if a particular member country's SOE review is poor; the SOE review may be utilised to impart peer pressure from other OECD countries to improve a particular country's performance. This is an empowering and basic function of internationally focused organisations such as the OECD (OECD, 1998a).

In order for each SOE review to be comparable it is necessary for the OECD to apply a consistent approach to their assessments. This means that practically speaking, there must be international harmonisation of environmental information and data that is collected from member countries in

order for the OECD to be able to comparatively monitor environmental changes and assess environmental performance. One method that the OECD has developed to assist in addressing the issues of comparability of information is the use of **environmental performance indicators**.

Environmental performance indicators are aspects or parameters of the environment that can be monitored in a timely manner to show trends or sudden changes in a particular environmental condition. The OECD defines an environmental indicator as: *“a parameter, or value derived from parameters, which points to, provides information about, or describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value”* (OECD, 1994).

2.4.2 The Pressure-State-Response Framework and Environmental Indicators

The OECD consider that there are three fundamental criteria that must be recognised in the development of environmental performance indicators: that any defined indicators needed to be **policy relevant, analytically sound and measurable** (OECD, 1994). Work by the OECD on environmental indicators has led to the development of (Avèrous, 1997):

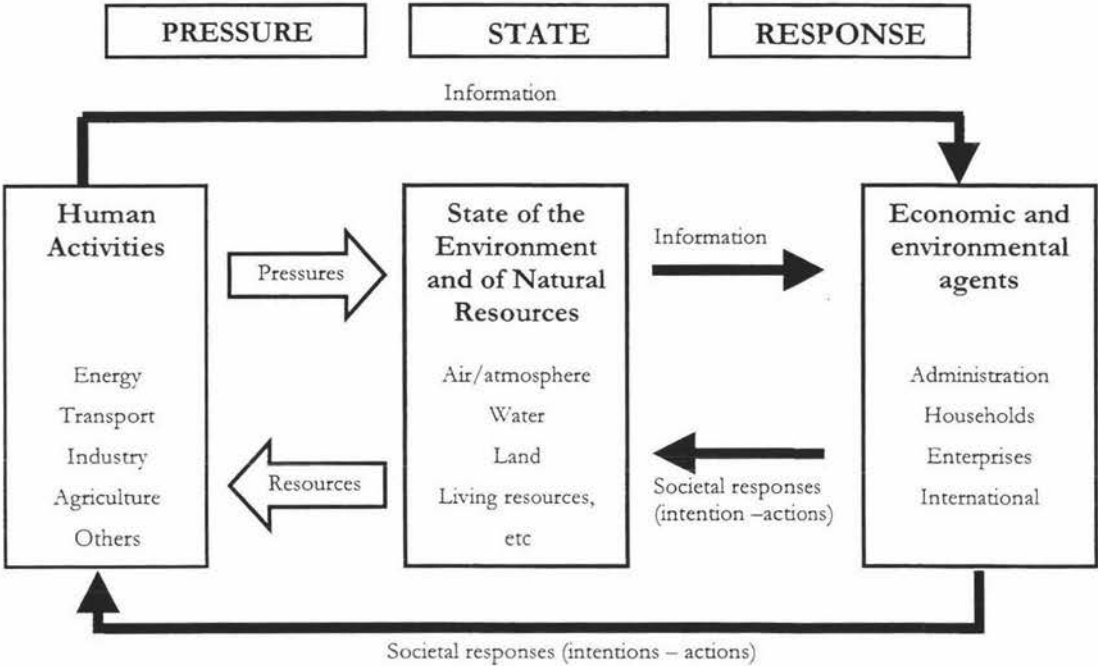
- *a common terminology and conceptual framework (called the Pressure-State-Response framework);*
- *the development of and agreement on core indicators;*
- *the measurement and publication of indicators;*
- *their regular use in OECD analytical work and environmental performance reviews.*

The pressure-state-response (PSR) model is the common harmonised framework which has been adopted for use by OECD member countries and the OECD to monitor environmental performance (OECD, 1999a). It has become increasingly widely accepted and internationally adopted because it has a number of advantageous attributes. These include:

- (a) the PSR model is policy relevant as it links the environment with economic activities and agents (Avèrous, 1997);
- (b) the PSR model is easily understood and robust (Avèrous, 1997);
- (c) the PSR model has the ability to be applied at national, regional or community levels, at a sectoral level, or at a level in an individual industrial firm (Adriaanse, et al, 1995);
- (d) the PSR model has the ability to be easily adapted to meet individual monitoring requirements. For example, in the development of New Zealand’s national environmental indicators, the Ministry for the Environment has adapted the framework to place particular emphasis on defining indicators for the state of significant ecosystems, incorporating sectoral contributions to environmental pressures and societal responses (MfE, 1996b).

The pressure-state-response framework (as is shown in Figure 2) was developed by the OECD and is based on a concept of causality (OECD, 1994). **Pressure** indicators indicate the cause of an environmental problem and are characteristic of the environmental stresses (or pressures) that may be placed on the environment by human activities. These pressures may result in changes in the quantity or quality of natural resource(s). Examples of environmental pressures include the release of contaminants into air or the depletion of natural resources through extraction.

Figure 2: The Pressure-State-Response Model



Source: Organisation for Economic Co-operation and Development, 1994: OECD Environmental Indicators.

Pressure indicators are not only descriptive but can also provide direct feedback on whether policies meet the stated objectives and are useful in formulating policy targets and in evaluating policy performance (Adriaanse, et al. 1995). This is because pressure indicators measure **policy effectiveness** more directly as they can provide measures of whether emissions increase or decrease or whether human exposure to hazardous conditions grows or shrinks.

Subsequent changes that occur as a result of activity's alter the quality or condition of the environment and are referred to as **state** indicators. State indicators are **indicative of changes** or trends that are occurring in the physical or biological state of the environment. Examples include measures of urban air quality, or stocks of fish.

Response indicators measure the efforts taken by society or an organisation to improve the environment or mitigate degradation that may be occurring. Response indicators also reveal

progress towards regulatory compliance or other governmental efforts, but don't directly reveal what is happening to the environment. Thus, the human responses to changes include any organised behaviour that may be aimed to reduce, prevent or mitigate the undesirable changes that may be occurring.

2.4.3 The OECD's Core Environmental Indicators

The OECD's Environmental Indicators programme is focused principally on the development of sets of indicators to facilitate the integration of economic and environmental decision making at national, international and global levels and to provide a tool for environmental performance evaluation (OECD, 1994).

The purpose of the OECD's Environmental Indicators programme is to provide a toolbox of indicators that can be used by OECD member countries to evaluate their environmental performance both individually and as a whole. This is not to say however that the OECD promotes their indicators as being a "universal set" that can be unilaterally applied as a whole. Rather the OECD recognise that while data from the majority of OECD countries has been used in the development of the OECD's core indicators, there is nevertheless differences that exist between member countries. This means the core indicators will be of varying relevance for differing countries and different contexts (OECD, 1994).

In 1991, the OECD published a preliminary "core" set of state of the environment indicators (OECD, 1991) that were developed around the pressure-state-response (PSR) process model. These "core" indicators were based upon environmental data collected by the OECD from its member countries.

In 1994 the OECD revised their list of core indicators to include nine "sink-orientated" indicators to deal with various issues of environmental quality including: climate change, ozone layer depletion, water quality, waste, and air quality.

Two energy measures were incorporated into the 1994 core indicators to assess **climate change**. These energy measures were incorporated to recognise the anthropogenic nature (such as the burning of fossil fuels) of certain gas emission sources such as CO₂, methane and nitrogen oxides. The measures reported in the 1994 core set as an indicator of climate change were **carbon dioxide emissions (from energy use and industrial processes)** and **energy intensity**⁵.

⁵ Measured as total primary energy per unit of activity or output. Activity or output is usually expressed per unit of GDP (Gross Domestic Product) or per capita.

In addition to the nine “sink-orientated” indicators, the core set of indicators also contained a number of “general” or “source-orientated” indicators. There were two “general” energy related indicators included. The first was an indicator for **industrial production**. This indicator was included because it was considered an important determinant of economic activity and environmental effect as industrial production provides an indication of the structural changes that can arise from changing uses in energy within the industrial sector.

Energy supply by source was also developed for use as a general indicator. This was also considered an appropriate general indicator because changes that result in the structure of a country’s energy supply over time were considered to have a major influence on a country’s environmental performance and thus the ability to achieve sustainability in their development.

The OECD continues to revise their core environmental indicators. The latest release by the OECD is a publication produced in 1998 entitled *“Towards Sustainable Development: Environmental Indicators”*. It is a refinement of much of the work conducted to date by the OECD on developing environmental indicators. The continual revising of the OECD’s core indicators reflect that fact that the OECD consider that none of the environmental indicators are necessarily final or exhaustive in character, and rather they are all viewed as being dynamic in nature.

2.4.4 1998 Core Set of Environmental Indicators

The 1998 core set of environmental indicators now averages some 50 indicators (OECD, 1998b) that cover issues that reflect the main environmental concerns in OECD countries. Such concerns include: climate change, ozone layer depletion, air quality, waste, water quality, water resources, forest resources, fish resources and biodiversity. Socio-economic indicators have also been included (as shown in Figure 3) in the core set of environmental indicators to reflect the major concerns of OECD member countries to **sectoral issues** such as **energy** and also environmental accounting.

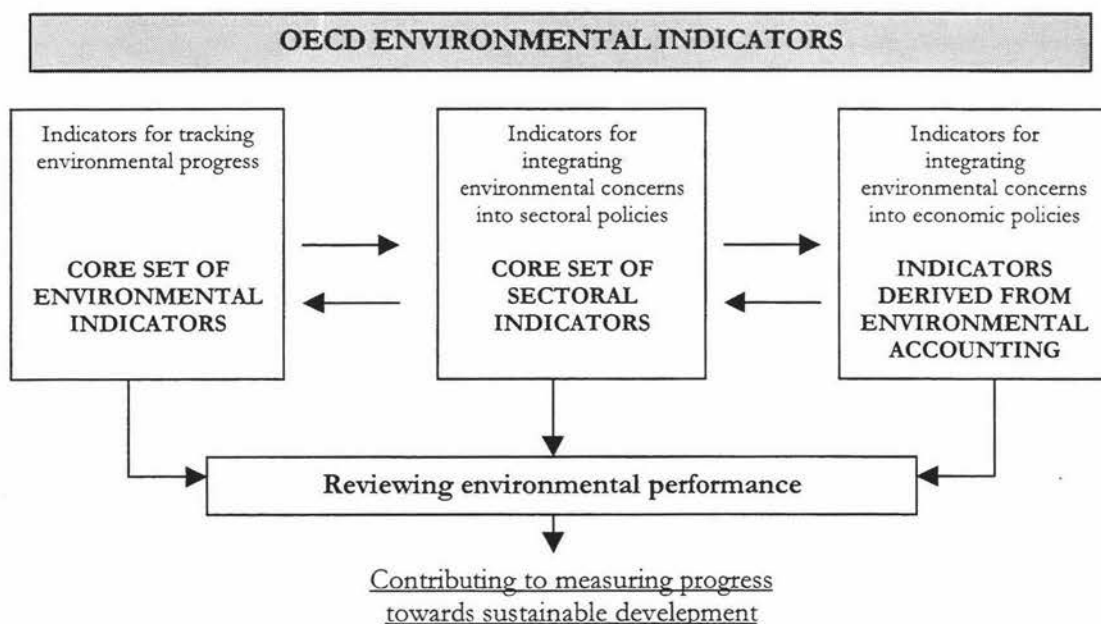
2.4.5 Sectoral Indicators

The OECD defines **sectoral indicator** sets as being *“those that are not restricted “environmental indicators” per se, but [are] also concerned with the wider linkages that exist between the environment and the economy, [but] placed within the context of sustainable development”*. (OECD, 1998b). The basic framework for these sectoral indicators (as shown in Figure 4) is once again is derived from the PSR model but has been adjusted to account for the specificity of the sector of interest.

Sectoral indicators are intended to promote the integration of environmental concerns with sectoral policies and practices and also for monitoring resource use and emission intensities in the various

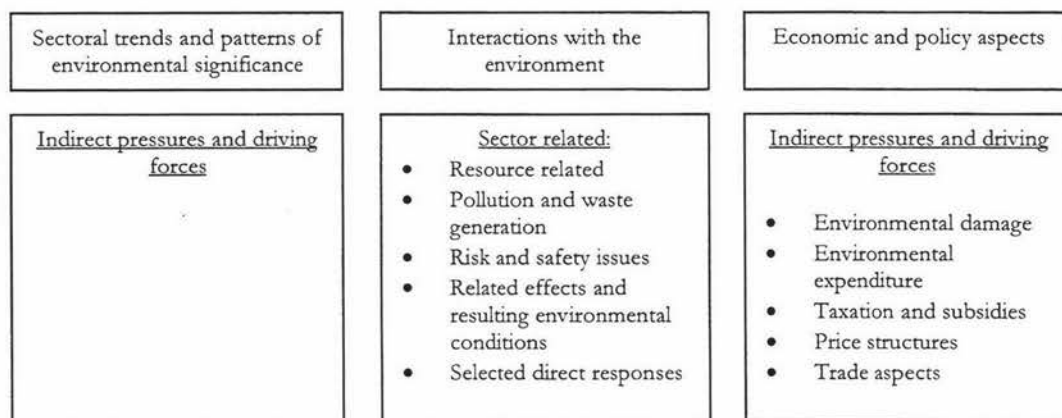
economic sectors. In the development of the sectoral indicators the OECD has placed particular emphasis on issues such as **energy**, transport and agriculture.

Figure 3: Integration of Socio-Economic Indicators with the OECD Core Environmental Indicators



Source: Organisation for Economic Co-operation and Development, 1998: OECD Environmental Indicators.

Figure 4: Framework of OECD Sets of Sectoral* Indicators



* Framework applied by the OECD to the transport and energy sectors as at 1998.

Source: Organisation for Economic Co-operation and Development 1998: OECD Environmental Indicators.

In the 1998 OECD publication entitled *“Towards Sustainable Development: Environmental Indicators”*, sectoral indicators are confirmed for a number of socio-economic issues including energy-environment. **Energy-environment indicators** were developed by the OECD in recognition of the fact that energy is a major component of OECD countries in terms of both the sector itself and

as a factor input to all other economic activities (OECD, 1998b). The energy-environment indicators attempt to capture the range of environmental effects that arise from energy production and also use issues that are related to the extraction, transportation and the use of fossil fuels. Because of the range of effects that arise from the extraction and use of energy, overlap obviously exists between the energy-environment indicators and other environmental indicators such as those for air, water resource use, and waste generation.

The energy-environment indicators also attempt to measure the various structures of a country's energy supply such as the demands from industry, transport or households; energy policies and energy pricing as well as the intensity of energy use, along with any changes that may occur with energy over time⁶.

The OECD has identified three indicators for measuring energy trends of environmental significance: **energy intensities**, **energy mix** and **energy consumption**⁷. The energy-environment indicator for **energy intensity** is aimed at measuring trends that occur in energy intensity. It is expressed as **energy supply per unit of GDP** and **energy supply per capita**. These indicators are intended to reflect, at least in part, changes that may result in a country's energy efficiency. This is primarily because energy efficiency is a key policy option that has been identified by many countries for reducing atmospheric pollutants.

Using these energy intensity indicators the OECD has found that energy intensity per unit of GDP has generally decreased for OECD countries since the 1980's, despite wide variations in individual countries measurements. However, the decrease in energy intensity per unit of GDP is considered primarily attributable to factors such as energy conservation measures or economic structural changes, rather than a decrease in energy supply which by comparison, has shown an overall increase in per capita terms (OECD, 1998b). The OECD also notes the existence of wide variations between OECD member countries and attributes these to differences in national economic structure and geographical factors such as climate. For example, the energy supply per capita for OECD member countries ranges from a low of 1 Toe (tonnes of oil equivalent) to a high of 8 Toe.

The energy-environment indicator **energy mix** is expressed as **primary energy supply by source as a percentage of total energy supply**. Energy mix is identified as a key determinant because it is closely related to consumption and production patterns of energy sources. The energy supply mix has a major effect on environmental performance because the environmental impact of each energy

⁶ The OECD in its 1998 publication also proposed a fourth indicator "risks", to further enhance monitoring the state of environment due to the pressures that arise from energy use and consumption.

⁷ Energy intensities and energy mix indicators had sufficient data for incorporation into the 1998 revision of OECD environmental indicators, whilst the latter (energy consumption) was not presented.

source differs greatly (OECD, 1998b). Using this energy mix indicator the OECD has found that growth in total primary energy supply during the 1980's and 1990's has been accompanied by changes in fuel mixes. Specifically the shares of solid fuels and oil fell, while those of gas and other sources rose. In application of this indicator the OECD once again notes the existence of wide variations between OECD member countries, but that the trend is particularly apparent for OECD countries that are in Europe.

There are three energy-environment indicators that have been identified for monitoring the response to aspects such as economics and policy. These indicators include: **energy prices and taxes**, **energy subsidies** and **environmental expenditure**. Only the indicator for energy prices is presented in the 1998 publication. The indicator for **energy prices** is expressed as **trends in real energy end-use prices** and as **selected energy prices for industry and households**. Energy end-use prices have the ability to influence the overall energy demand and fuel mix, which in turn largely determines the environmental pressures caused by energy activities.

In addition, governmental signaling of appropriate end-use prices for energy can also influence the extent to which environmental costs are internalised. Using the energy prices indicator the OECD has found wide variations in price elasticity by end-use sector. However, historical and cross-country experience also suggests that the overall price effect on energy demand is strong and that increases in energy prices have reduced energy use and hence its environmental effect (OECD, 1998b). The OECD once again notes the existence of wide variations between OECD member countries, but that there is a general downward trend in real end-use energy prices for most OECD countries.

2.4.6 Limitations to Use of Environmental Indicators

Whilst the OECD uses environmental indicators in the assessment of environmental performance it needs to be recognised that there are a number of guiding principles and limitations that exist with their use⁸. Such principles and limitations⁹ include:

- indicators provide but one tool for use in the evaluation of environmental performance;
- indicators need to be used in the appropriate context;
- indicators need to be internationally standardised and relevant for comparison;
- indicators need to be measurable, timely and have an appropriate level of aggregation.

The OECD recognise that indicators themselves also do not provide a mechanical measure of environmental performance and that rather they are but one tool to use when conducting

⁸ The principles and described limitations also exist with the EPI's developed by the UN.

⁹ Limitations to the use of environmental indicators are also discussed in section 1.

evaluations on its member countries (OECD, 1998b). This means that the information gained from environmental indicators often needs to be supplemented by other qualitative and scientific information in order to avoid misinterpretation when assessing a particular country's performance (Avèrous, 1997).

Environmental indicators must also be reported and interpreted in the appropriate context, however this poses some difficulty for the OECD as it means that the relevance of a particular indicator will vary depending on a country's situation and the context in which the indicator is used. To overcome this issue the OECD utilises the core indicators in conjunction with a specific country's national indicators and data to provide a more detailed picture of the country's situation.

Because the OECD focuses on producing national indicators for use in international work this implies not only the use of nationally aggregated indicators, but also an appropriate level of comparability is used amongst the various OECD member countries. This poses some difficulty for the OECD, as there is no single method of standardization when comparing indicators across countries (OECD, 1994) as outcomes generally depend on the chosen denominator (for example, gross domestic product, population, land area) as well as on national definitions and the measurement methodologies used.

Measurability issues such as the quality of the underlying data and timeliness issues are also important considerations in the use of environmental indicators and must be taken into account to avoid misinterpretation of indicators (OECD, 1998b). The OECD consider that within its member countries measurability¹⁰ still varies greatly, meaning that some indicators are immediately measurable whilst others need further work before they are suitable for publication, whilst timeliness of the underlying data affects both its usefulness and relevance as an indicator.

In addition to the above, much care is also needed in interpreting energy-environment indicators in terms of their relevance to actual energy and environmental policies. For example, energy consumption may vary with levels of total energy use, but also with the composition of energy use by energy source. This means that an observance of an improvement in the overall levels of pollution from reduced energy consumption may not necessarily be directly proportional to a reduction in energy use. This is because pollutants such as CO₂ vary directly with the amount of energy consumed, while reductions in other emissions such as nitrogen oxides, carbon monoxide or volatile organic compounds may result from technological changes rather than decreased consumption rates.

¹⁰ The OECD consider most indicators of societal responses have a shorter history than indicators of environmental pressures, and many indicators of environmental conditions are still in development, both conceptually and in terms of data availability.

To keep indicators as simple as possible they are usually limited to several selected measures for each major environmental issue. This often results in a large degree of aggregation being required. For example, emissions of greenhouse gases may be combined through appropriate weightings based on the physical properties of the gases and models of their lifetimes in the atmosphere to yield a single indicator of “equivalent” emissions. Thus, the manner in which the data is aggregated must use a comparable weighting principle and be representative of the selection of contributing substance(s) in order for the environmental indicator to be meaningful.

However, in instances, the selection of contributing substances for a given indicator may also need to be based upon a compromise between the need for completeness and the need for simplicity in methodology and data collection. Often using highly aggregated national indicators also means that further level of detail or breakdown may be needed, particularly when the indicators are required to be applied at a regional or sectoral decision making level. This is because the national indicators may hide major regional differences (OECD, 1998b) which may only be revealed by more extensive analysis at sub-national or sectoral levels.

2.4.7 The OECD’s State of the Environment Review – International Context

As previously mentioned, the OECD regularly conducts State of the Environment reviews on its member countries. The following provides a synopsis of the 1996 collective review conducted by the OECD on its member countries. Because of the potentially wide ranging effects associated with the energy sector a synopsis of the OECD’s 1996 general findings in terms of progress made and the adequacy of policies for meeting environmental challenges is provided below.

The OECD released a report entitled “*Environmental Performance in OECD Countries: Progress in the 1990’s*”. This report collates the OECD’s findings from the twelve individual environmental performance reviews that were conducted on its member countries (excluding New Zealand) and from the environmental data collected for all the OECD member countries¹¹ (OECD, 1996). The OECD then drew together these finding into a broad¹² number of conclusions about the progress made in environmental management by the OECD member countries.

In its report, the OECD considered that environmental policies carried out in the 1980’s and first half of the 1990’s have clearly contributed to improving the state of the environment¹³. Progress made in the 1990’s by OECD member countries has been brought about by effective

¹¹ Including New Zealand.

¹² Wide diversities in economic, social, political and environmental conditions exist between OECD member countries.

¹³ The policies implemented by OECD member countries have not in themselves posed significant economic difficulties (in particular by causing distortions in international trade or detrimental effects in employment) in member countries.

environmental policies, by early integration of environmental concerns in sectoral policies and by strengthened international co-operation (OECD, 1996).

2.4.7.1 Effective Environmental Policies

The OECD found that consolidation and enhancement of environmental policies by OECD member countries has resulted in significant improvements in water pollution mainly through better regulation of point source discharges and construction of better water treatment facilities. Emissions of a few main air pollutants (for example, SO_x) also declined primarily due to strengthening standards and enforcement's being placed on point source discharges.

However, the OECD consider that the benefits gained from regulating large point sources of air and water pollution are, or soon will be, practically exhausted or greatly reduced (OECD, 1996). This will necessitate shifting the focus to smaller-scale or diffuse sources such as small businesses, service industries, transportation or agriculture to best achieve further gains.

2.4.7.2 Early Integration of Environmental Concerns in Sectoral Policies

The OECD considers that the limited implementation of national environmental plans by its member countries have occurred due to economic pressures. Despite this, integration of environmental and industrial policies has been proven to be able to be carried out without endangerment to competitiveness or employment. In particular, the manufacturing industries (and specifically the chemical industries) have successfully proved this, but few others have modified the thrust of their sectoral policies to enable significant changes or reforms (OECD, 1996).

Early integration of environmental concerns into sector policies is considered relevant for the energy, transport and agriculture sectors because the OECD consider it is these sectors that have the potential to have the greatest impact on environmental conditions (OECD, 1996, Avèrous, 1997).

2.4.7.3 Strengthened International Co-operation

The OECD found that strengthened international co-operation has progressed particularly in respect of ozone depleting substances, abatement of some emissions, trans-frontier movements of wastes and endangered species. However, the OECD also consider substantial efforts are still needed to meet international commitments on climate change (OECD, 1996).

2.4.7.4 Towards Sustainable Development: Fostering the Integration of Government Policies

The OECD also consider that much stronger integration of sectoral and environmental policies than has been achieved to date by the OECD member countries is required if member countries are to meet their environmental commitments. For example, there is a continued increase in the use of fossil fuels by OECD member countries, which aside from posing significant health risks, hinders the ability of member countries to meet their international commitments under the FCCC (OECD, 1996, IEA, 1997).

Moving towards sustainable development will require OECD member countries to develop more economic and environmentally focused policies that are explicitly aimed at achieving specified environmental results (or “results-orientated policies”). One means of achieving this is for government’s to more fully utilise the dynamic forces that exist in the economy and society by preparing, in consultation with its stakeholders (including industry), longer-term plans which clearly set out quantitative environmental goals, targets and actions.

Furthermore, the OECD considers that progress towards sustainable development by OECD member countries will require significant changes in production and consumption patterns. The OECD consider this can be achieved by government’s leading by example (that is “greening” their own operations), expanding consumer awareness, use of life cycle analysis and extending producer responsibilities (OECD, 1996).

Stronger co-operation among the various levels of government is also seen as being a necessary component to the success of sustainable development. In addition, monitoring of environmental performance of these various levels of government, especially when they have much autonomy in carrying out their environmental policies would assist in creating a more “level playing field”. This is because it would not only inform stakeholders on the state of environment but would also promote a democratic debate on the environment (OECD, 1996).

2.4.7.5 Towards Sustainable Development: A Greater Role for Market Forces

The OECD also considers that meeting environmental commitments demands strategies that are aimed at ensuring sustainable development in the context of market-based economies. This requires the removal of distortions caused by externalities and subsidies and the provision of the right price signals to promote internalisation of externalities. Examples include implementing the polluter pays or the user pays principles or the use of other economic instruments to internalise any externalities.

Use of societal instruments such as education and consumer information are also recognised as being able to assist to change demands in environmentally damaging goods and services and promote higher environmental goals. However, there also needs to be sufficient time given for the private sector to adapt to the changing environmental requirements to enable the private sector to seek more cost effective approaches and to develop innovations in the technology it uses to produce its goods and services (OECD, 1996).

2.4.7.6 Improving the Cost Effectiveness, Openness and Accountability of Environmental Policies

The OECD has found that in an attempt to seek out more cost-effective approaches several member countries have moved from process orientated environmental policies to results orientated environmental policies. Many member countries have introduced a mix of instruments (regulatory, economic and societal instruments) to deal with difficult environmental issues (OECD, 1996). The OECD consider that further emphasis is need on preventative approaches, integrated pollution control, and place-based and ecosystem management, whilst making full use of voluntary agreements (OECD, 1996).

The OECD also consider that difficult decisions that will have to be taken in coming years will need to be supported by well thought out, broad based consultative and awareness raising strategies (OECD, 1996). This will require openness in decision making, full access to environmental information and more meaningful consultation with stakeholders (including industry).

The OECD also found in its 1996 review that tracking progress through the development of environmental data and indicators has already proven its value (OECD, 1996). It follows then that the availability of more meaningful environmental data and indicators and well-synthesized information should lead to a further improving democratic debate, and to better accountability of public authorities and the various parties that interact with them.

2.4.8 The OECD Environmental Performance of New Zealand

The OECD's environmental performance review programme for its member countries was established in 1991 and is a key element of the OECD's environmental work. A principle aim of the programme is to assist OECD member countries in improving their environmental management. These systematic, independent and periodic reviews are organised and conducted, in a way similar to the OECD's economic reviews, by a team assembled by the OECD and consisting of environmental experts from each of three or four member countries, as well as experts from the OECD. Reports are drafted by the team and then peer reviewed by the OECD's group on

environmental performance. This latter group is composed of officials from member countries who have responsibility for national policy development and implementation.

In 1996, the OECD reported on New Zealand's environmental performance. This report also addressed energy. The general findings of this review recommended that consideration be given to increasing efforts to improve energy efficiency in all sectors, as well as setting ambitious quantitative targets for environmentally-related energy objectives, including energy efficiency¹⁴ (EECA, 1997a).

2.4.9 International Energy Agency

The International Energy Agency (IEA) is an autonomous body that is affiliated within the OECD. The IEA was first established in 1974 following the first oil crisis, in 1973, in response to the increasing power being wielded by Organisation of Petroleum Exporting (or OPEC) countries. The legal basis for the IEA is an "Agreement on an International Energy Programme", the heart of which was to provide a collective emergency response for major disruptions to international oil supplies (IEA, 1997a). However, the IEA also has a wider brief, which includes advising on (IEA, 1997a):

- (a) *the increasing significance of energy/environment issues;*
- (b) *energy conservation;*
- (c) *renewable sources of energy; and*
- (d) *energy research and development*

The basic aims of the IEA are (IEA, 1997a):

- *To maintain and improve systems for coping with all supply disruptions;*
- *To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;*
- *To operate a permanent information system on the international oil market;*
- *To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;*
- *To assist in the integration of environmental and energy policies.*

The IEA has a set of "Shared Goals" which are based upon the concept of sustainable development and summarise IEA member's overall approach to energy policy.

¹⁴ Because the review conducted by the OECD was corroborated by the subsequent findings of the IEA (reported in 1997) review of New Zealand's energy policies, further detail has provided under the same entitled section in this report to avoid repetition.

These goals are (Solsbery, 1997):

1. *Diversity, efficiency and flexibility within the energy sector;*
2. *Energy systems should have the ability to respond promptly and flexibly to energy emergencies;*
3. *The environmentally sustainable provision and use;*
4. *Encouragement of more environmentally acceptable energy sources;*
5. *Improved energy efficiency;*
6. *Continued research, development and market development of new and improved energy technologies;*
7. *Undistorted energy prices enable markets;*
8. *Free and open trade;*
9. *Co-operation among all energy market participants.*

The IEA now carries out a comprehensive programme of energy co-operation among twenty-four of the OCED's member countries. By increasing the transparency, efficiency and shared information between IEA members, the IEA seeks to improve the functioning of the global energy markets and through effective communication, the IEA considers it can establish the framework conditions most conducive to effective market performance (Solsbery, 1997).

2.4.10 The IEA's Approach to the Development of Energy Indicators

In 1997 the IEA released a publication entitled "*The Link between Energy and Human Activity*". This publication provided a distillation of a companion publication "*Indicators of Energy Use and Efficiency*", and was aimed at examining the development of end-use "energy indicators" and their relevance to policy making (IEA, 1997). These publications also include indicators that are corroborated by the work most recently presented by the OECD for the sectoral energy-environment indicators developed for use at a national or international level and also those used by the IEA for their review of member countries performance.

However, the above-described publications by the IEA also importantly provides further background into why a rationale programme design for energy indicators should be derived from discrete data gathered from the "grass roots", rather than solely relying on aggregate measures. In particular, the IEA consider that the application of aggregate measures for energy (such as energy use to GDP) in themselves, are problematic, as they rely on the adoption of a uniform approach for the generation of the aggregate indicator. Often however, aggregate measures are of limited use and pose many problems in terms of their interpretation, as the underlying data and assumptions used by analysts may not have been uniformly applied at either a regional, national or international level (IEA, 1997a).

This is not to say that the IEA does not consider aggregate measures in themselves useful. Rather, the IEA consider that 'useful' energy indicators should also be able to relate issues such as energy consumption to measures of output in ways that provide a better understanding of the finer details that occur at the levels of discrete energy activities. This suggests that an aggregated energy indicator should be able to be derived from, and link to, disaggregated data so that the analyst can clearly understand the inter-relationships that occur, as opposed to the generation of misleading numbers calculated from aggregate data. For the above stated reasons, further description on the IEA's approach to developing energy indicators is now provided.

Energy indicators must uncover good information on several fronts simultaneously. Specifically energy indicators need to look at (IEA, 1997a):

- *how energy use occurs within the mix of human activities it supports;*
- *the quality of its use and the characteristic of devices through which it passes, as well as the utility and comfort its consumption yields;*
- *how much energy get used for given tasks (energy intensities compared to output);*
- *its efficiency in the technical sense (which stresses conservation of inputs); and*
- *how different fuel types, and therefore different emissions, relate to energy use or intensity.*

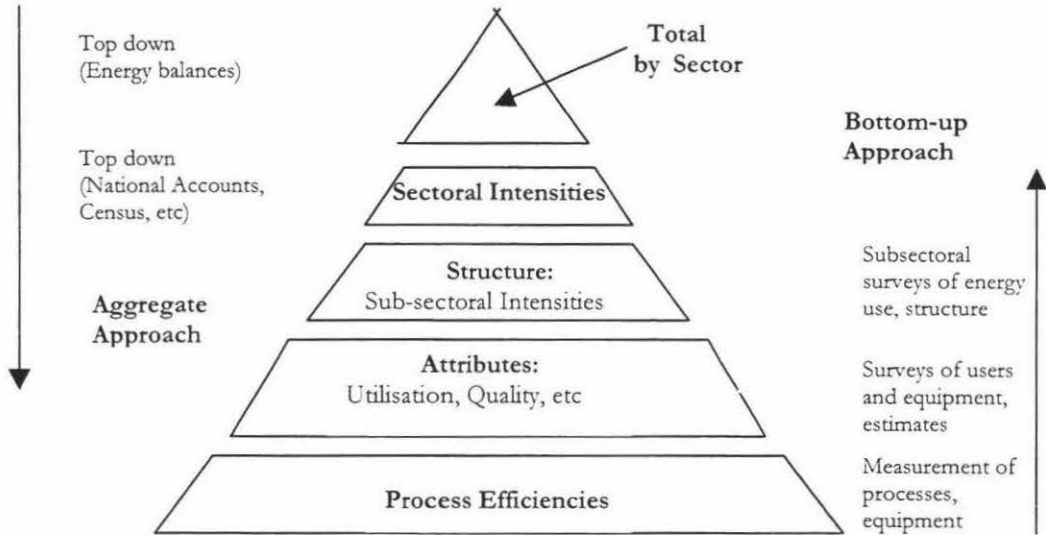
Whilst aggregate indicators provide a more simpler means of comparing a large volume of data, they cannot in themselves provide the detail required to determine how for example, energy is influenced by factors such as efficiency, income, technology, or structural changes in the mix of goods and services.

Thus, the IEA consider a combination of bottom-up and top down approaches to the development of energy indicators is necessary to fully understand how energy consumption and use is affected by issues such as efficiency, intensity, activity and actual energy use. This means simply, in order to build up the "big-picture" or aggregate energy indicator, it is necessary to understand all the smaller "building-blocks" or the range of discrete activities that provide the finer detail on which the aggregate measure is based. To demonstrate how the most detailed data and indicators can combine into a hierarchy of energy indicators, the IEA provide by way of example, an **energy indicators pyramid** (as is shown in Figure 5).

The bottom of the energy indicators pyramid represents extreme disaggregation of data, whilst comparatively the top of the pyramid indicates extreme aggregation. The energy indicators pyramid shows how the bottom up approach, which builds the aggregates, and the top down approach which starts with them, comes together conceptually. The higher level aggregates match, but the

indicators method is the result of much deeper disaggregation and uncovers more information (IEA, 1997a).

Figure 5: The Energy Indicators Pyramid



Source: After K. Blok, University of Utrecht; IEA, 1997: *The Link Between Energy and Human Activity*.

The pyramid provides a general concept for indicator development and could easily present a different set of “labels” for each measurement task. For example in Figure 5, the top level of the energy pyramid which presents the aggregated indicator “total by sector” could have represented “ratio energy use by GDP”. Similarly in this instance, the second level of the energy pyramid might then have contained the “energy intensity of each major sector”, and the third level of the energy pyramid might have depicted the sub-sectors or end-uses that make up each sector, and so on. Similarly, the levels within the indicator pyramid may vary depending on the detail of information that is being sought and thus may comprise of more levels than that shown in Figure 5.

With each descent of a level within the pyramid there is also a more detailed requirement for data and a requirement for more complex analysis to re-aggregate back the data to a higher level within the pyramid. However, the benefits of utilising such an approach clearly outweigh the disadvantages of more intensive data and analysis requirements because as each descent is performed it clearly brings the analyst closer to the wide range of factors that can influence energy, such as efficiencies, intensities, activities, and actual energy usage. This in turn assists the analyst in understanding the descriptive, structural and causal changes that occur with energy use. For example, by measuring energy use and its changes by sector **descriptive** indicators may be revealed. Similarly, by measuring how the activities or products associated with that energy use (such as the production of steel or heating homes) **structural** indicators may be revealed. Combining these indicators with energy uses provides further insight into **energy intensities** (that is, energy use per unit of output)

which can then be related to **energy efficiencies**. In addition, further analysis by **index decomposition** can also help establish how these same elements affect total energy use and CO₂ emissions over time.

By relating changes in indicators to variations in income, energy prices, demographic structure and other macro-economic elements or policies can produce **causal indicators** that show which forces stimulate energy use, which restrain it and which evoke more efficiency. For example, by adding primary fuel mix to each end use, one can relate changes in structure and efficiency, as well as the fuel mix itself, to changes in carbon emissions, to produce a kind of consequential indicator (IEA, 1997a).

Armed with sound energy information, analysts and legislators can know how and why energy use changes and/or remains stable and can begin to frame policy strategies and programmes to meet the range of concerns that surround the consumption and use of energy. One such concern that is most acute relates to the environmental problems associated with the production, transformation, distribution and consumption of energy, particularly in relation to fossil fuels and CO₂ emissions.

For example, the IEA found that IEA countries have achieved a remarkable reduction in the amount of carbon they released for a unit of production or consumption between 1973 and 1993. However, the IEA also found that the forces underlying reductions in carbon emissions (such as energy efficiencies and fuel switching of primary sources) have weakened significantly (IEA, 1997a). The net effect of this result is that carbon emissions for IEA countries are now rising, not falling.

Thus, as energy demand continues to grow, experts and authorities will need to seek strategies to moderate growth and particularly the demand for hydrocarbons. Such strategies if they are to succeed will need to accurately distinguish among the many human and social sources of demand, tailoring energy efficiency to reality rather than to a stylised, aggregate measure of reality which conceal more than they reveal (IEA, 1997a). Thus, if aggregated energy indicators are to be used with confidence they need to be well linked and interface effectively with, the discrete data from which they are drawn.

2.4.11 The IEA's 1997 Review of New Zealand's Energy Policies

The IEA utilises a number of economic and environmental indicators to support other qualitative and quantitative data and observations it makes when conducting reviews of its member countries. Those identified by the IEA as being "key" indicators in the New Zealand 1997 review included (IEA, 1997b):

- *Gross Domestic Product or GDP (billion 1990 US\$);*

- *Population (millions);*
- *Total Primary Energy Supply (TPES)/GDP;*
- *Energy Production/TPES;*
- *Per capita TPES;*
- *Oil supply/GDP;*
- *Total Final Consumption (TFC)/GDP;*
- *Per capita TFC; and*
- *Energy-related CO₂ emissions.*

In their 1997 review of New Zealand's energy policies, the IEA found that New Zealand was continuing to make impressive progress in developing market orientated energy policies within the context of broader economic and institutional reforms (IEA, 1997b). Many of the basic restructuring and regulatory reform measures the government had indicated would be implemented for the New Zealand energy sector had been completed at the time of the IEA's review. Such measures included the restructuring of the electricity industry to create a competitive wholesale market; opening up the gas sector to competition; the inclusion of energy price deregulation into policy; corporatisation; and the lifting of trade restrictions.

Others such as implementing measures to deal with natural monopolies and the potential for anti-competitive behaviour were in a transitional stage, but have since been implemented. The IEA considered that the above measures (had or soon would) contribute towards enabling more cost-effective pricing throughout the supply chain, more efficient investment decisions, increased efficiency and lower operating costs. This would ultimately mean lower prices for most consumers and enhanced opportunities for cogeneration and non-traditional renewables (IEA, 1997b).

The IEA also raised a number of concerns about the way in which certain aspects of the restructured industry would operate. A number of these concerns such as enabling the potential for effective competition in electricity generation to occur have subsequently been addressed by the Government's privatisation and split of the Electricity Corporation of New Zealand (ECNZ) into three privately owned generators: Genesis Power, Meridian Energy, and Mighty River Power. Government (in recent legislation amendments to the Commerce Act in January 1999) has addressed other issues identified by the IEA, such as the potential for abuse of market domination. These amendments have attempted to provide sufficient transparency to identify anti-competitive behaviour, ensure fair access to the networks and to promote cost reduction and efficiency over the longer term.

Within the gas sector, the IEA found that uncertainties that exist over the rate of depletion of the Maui gas field and new commercial gas discoveries meant that the Government could do little more to increase the attractiveness of the licensing and royalty regime in place. They therefore considered that the market based policies being pursued by the Government provide the best framework for encouraging the economically efficient development of energy resources and fuel choices in the future (IEA, 1997b). With respect to competition within the gas industry, the IEA considered that the Government could encourage the limited retail competition further by encouraging access to the pipeline networks either through regulatory or via non-regulatory means, such as the codes of practice purported by the gas industry.

Within the oil sector, the IEA found that the degree of industry concentration and the level of retail prices relative to other IEA countries raised significant concerns about the strength of competition in the New Zealand wholesale and retail oil product markets. Such concerns included the oligopolistic pricing behaviour of the four main oil companies Mobil, BP, Shell and Caltex. During 1998 and 1999 this has been lessened to some extent by the entry of other competitors such as Challenge and Gull Petroleum into the New Zealand market.

In terms of energy sector reforms the IEA found that paradoxically, the success of the Government's market based economic reforms was making challenges such as meeting commitments under the FCCC more difficult. This is because the impressive rates of GDP growth which have recently occurred in New Zealand have driven a rapid increase in the use of energy – particularly in the transport sector and in electricity applications – resulting in an increase in overall greenhouse gas emissions.

Along with New Zealand, the IEA consider that rising levels of greenhouse gas emissions associated with increased energy use are a challenge shared by many other IEA countries. In respect of addressing the issue of rising greenhouse gas emissions in New Zealand, the IEA in particular raises concerns over New Zealand's reliance on economic instruments to reduce CO₂ emissions.

In principle, the IEA view the use of economic instruments to raise the cost of fossil fuels relative to other sources of energy as being a positive approach for government's to adopt because they can encourage energy efficiency and fuel switching as a least cost approach option. However, the IEA also consider the exclusive unilateral adoption of economic instruments such as carbon taxes or tradeable permits need to be balanced with other measures (such as voluntary agreements) to avoid the risk of negative spin-offs such as carbon leakage occurring (IEA, 1997b). Unilateral adoption of economic instruments is therefore seen as being undesirable because unless other countries adopt a similar approach, the gains in emissions for a country would likely be offset by corresponding

increases in emissions elsewhere through migration of energy-intensive industry to countries without economic instruments.

Legislation such as the Resource Management Act was also recognised by the IEA as a means of providing sound basis for addressing local environmental issues including those related to energy. This is because the RMA focuses on control of environmental outcomes rather than measures and therefore the RMA allows for flexibility in the choice of technology and ensures consistency in applying constraints across all end-use and production sectors. However, the IEA also recognised a number of difficulties in using the Act to implement climate change commitments. These included (IEA, 1997b):

- *The decentralisation of most of the responsibility for implementing the Act to regional authorities makes it very difficult to ensure a consistent approach to addressing greenhouse gas emissions throughout the country, which could lead to activities being moved from one region to another to take advantage of regulatory differences;*
- *Tackling small and mobile sources (of greenhouse gases) might be possible under the Act but would involve high transaction costs;*
- *If regional authorities were empowered to use economic instruments these would be less effective and more costly to administrate than a single national instrument.*

For the above reasons the IEA considered that the resource consent process was not the most appropriate mechanism for addressing carbon emissions and that the requirement for resource consents to take account of carbon emissions should therefore be lifted to a higher governmental level.

To address the above issues the IEA's report recommended a number of specific measures that could be adopted to further enhance New Zealand's performance. These included (IEA, 1997b):

- *Taking stronger action to reduce CO₂ emissions to 1990 levels including further measures to address market barriers to efficient energy use, voluntary programmes and economic instruments such as a carbon tax;*
- *Expanding and improving the effectiveness of voluntary agreements, for example, through closer interaction with technical assistance and advice programmes and through more specific pledges and targets, such as energy audits;*
- *Carefully assessing and taking into account international competitiveness of tradable good industries in formulating a carbon charge;*
- *Lifting the requirement in the Resource Management Act for resource consents to take account of carbon emissions.*

In practice however, despite the Government indicating a number of economic instruments that they consider may be appropriate for achieving New Zealand's commitments under the FCCC, no statutory measures have been implemented to date, other than the limited controls afforded under legislation such as the RMA. Rather, measures for New Zealand achieving commitments under the FCCC to date have been reliant on non-statutory methods such as the Voluntary Agreements programme and various energy efficiency initiatives under the directives of the Energy Efficiency and Conservation Authority (EECA).

In particular, the IEA recognised during their review in 1997 that there was scope to expand and improve the effectiveness of Voluntary Agreements (VA) programme. Suggested improvements included tying the VA programme more closely together with the Energy Wise Efficiency programme for industry and/or research and development activities.

Other improvements identified by the IEA for the VA programme included the requirement for industry to provide more detailed emission reduction pledges and targets, including commitments to conduct energy audits. A number of these recommendations have subsequently been supported by findings conducted by Jamieson/Pool (1999b) on both the VA programme and the Energy Wise Companies Campaign (EWCC).

Whether New Zealand eventually ratifies the Kyoto Protocol is however, still uncertain. Government has indicated a preference for use of the most cost-effective means for dealing with environmental problems. Specifically Government has stated that "*whether New Zealand ratifies the Protocol depends largely on a satisfactory international emissions trading regime being put in place...[as] trading will allow countries to achieve their emission reductions at least cost*". (Upton, 1998a). Thus, New Zealand is currently advocating a global least cost approach to CO₂ emissions. This involves promoting the use of economic instruments such as CO₂ emission trading to achieve this.

2.5 United Nations

On the 24th October 1945, 51 countries that were committed to preserving peace through international co-operation and collective security established the United Nations (UN). Today, nearly every nation in the world belongs to the UN, some 185 countries in all (UN, 1999a). The wide-ranging functions of the UN include the promotion of human rights, protection of the environment, fighting disease, promotion of development and reduction of poverty. The UN undertakes this in co-operation with more than 30 affiliated organisations known together as the UN system (UN, 1999a).

When countries become members of the UN, they agree to accept the obligations of the UN charter, an international treaty, which sets out the basic principles of international relations. According to this Charter the UN has five purposes. These are (UN, 1999a):

1. *To maintain international peace and security;*
2. *To develop friendly relations among nations;*
3. *To cooperate in solving international problems;*
4. *To promote respect for human rights; and*
5. *To be a centre for harmonising the actions of nations.*

The UN has six main organs. These include the General Assembly, the Security Council, the Economic and Social Council, the Trusteeship Council, the Secretariat and the International Court of Justice.

The UN has played a crucial role in building international consensus on action for development and has been responsible for formulating a number of key developmental objectives such as sustainable development and environmental protection as was encapsulated during the UNCED or 1992 Earth Summit (1999a).

The UN also regularly evaluates the performance of its member countries international commitments, which includes those arising from the 1992 UNCED. For example, the Commission of Sustainable Development (a branch of the ESC) monitors the implementation of Agenda 21.

2.5.1 Economic and Social Council

The Economic and Social Council (ESC) underlies the overall authority of the General Assembly and coordinates the economic and social work of the UN. As the central forum for discussing international economic and social issues and for formulating policy recommendations, the ESC plays a key role in fostering international co-operation for development (UN, 1999a).

Subsidiary bodies such as the Commission on Environmental Protection carry out work for and report back to the ESC. Embodied within the responsibilities of the ESC is the United Nations Environment Programme (UNEP). This programme is intended to provide *“leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations”* (UNEP, 1997).

The UNEP provides an integrative and interactive mechanism that enables inter-governmental, non-governmental, national and regional bodies to consider and coordinate action within the UN on the problems of the human environment. In recognition that the environment is a system of

interacting sub-systems, the UNEP provides a mechanism to facilitate and manage an integrated approach through all these sectors of activity. In considering that the environment and development must be mutually supportive, the UNEP advocates the concept of environmentally sound development (UNEP, 1997).

One of the most important functions of the UNEP is the promotion of environmental science and information. The UN system wide research and synthesis of environmental information has generated a variety of state of the environment reports and created worldwide awareness on emerging environmental problems, some of which have led to international agreements being formed. Informational transfer is achieved via subsections of the UNEP such as the Global Environmental Monitoring System (GEMS), Global Environmental Outlook (GEO) and the Global Resource Information Database (GRID).

In 1995, following recommendations by the CSD to develop indicators for sustainable development, the CSD proposed a framework similar to that of the OECD pressure-state-response model. However the CSD also recommended that pressure indicators be modified and expanded to include **broader driving force indicators**. The CSD considered that the incorporation of broader driving force indicators were important because they could more accurately portray the economic, social and institutional driving forces that can place pressure on the environment and on sustainable development (CSD, 1995). The CSD indicators programme resulted in the production of a series methodology data sheets that provide guidance to the reader on the indicators significance, how it is calculated, its scientific background and potential data sources (TWB, 1997). These data sheets serve as guides for countries interested in building their own capacity in the measurement and reporting of indicators. The work by the CSD has succeeded in bringing together many international organisations – ranging from various UN bodies to non-governmental organisations – to lend their expertise to the programme (TWB, 1997).

2.5.2 The UN's Environmental Indicators for Consumption and Production Patterns

Changes in consumption and production patterns result from the choices and activities of a wide variety of individuals and organisations including business, industry, households, and governments. The challenges faced by policy makers in response to changing consumption and production patterns is to optimize resource uses, minimize negative environmental and social impacts of consumption and production patterns, and to stimulate and facilitate trends towards more sustainable patterns (UN, 1998). One means that the UN has identified in measuring progress of sustainability in production and consumption patterns is via the use of environmental indicators. This is because well structured environmental indicators can reveal trends in sustainable

development and if appropriately developed these types of indicators can also influence effective policy-making and provide a means of evaluation of progress of its member countries to meeting targets such as FCCC.

Under the Commission's work programme on "*Indicators for Sustainable Development and the Work Programme on Changing Consumption and Production Patterns*", the UN has developed a preliminary core set of indicators for consumption and production patterns. This preliminary set includes indicators of resource use, as well as indicators for covering **consumption of energy**, water, materials and land use.

The UN objective was to identify a core set of indicators for changing consumption and production patterns and thus link issues such as energy use to the objectives of Chapter 4 of Agenda 21. All of the indicators selected for energy consumption were also chosen because the UN considered that data was readily available for use in the short term (UN, 1998).

The UN identifies two broad categories for indicators: **key resources** and **consumption clusters**. The distinction between key resources and consumption clusters is (UN, 1998):

- (a) *indicators of key resources are aimed at resource use and environmental impacts (for example, energy); and*
- (b) *indicators of consumption clusters reflect consumer and producer choices (for example, mobility, food or recreation).*

Five (provisional) core indicators were identified for energy. **Annual energy consumption per capita (toe) contributor** was identified as an indicator because within industrialised countries, the UN consider increased energy consumption is a major contributor to global warming (UN, 1998). This focus of this indicator is on primary energy sources and thus the indicator can be disaggregated by energy type (for example, coal, hydro, nuclear, fossil fuels, and other renewables) to further determine the contribution of various energy sources to global warming.

The UN's indicator for energy consumption reflects the fact that the main environmental concern identified by UN that is associated with growing energy consumption is mostly related to fossil fuel usage, namely the continuing rise of atmospheric CO₂ concentrations contributing to global warming. Industrialized countries today account for about 70 percent of CO₂ emissions (UN, 1998), and of this percentage, industry accounts for a large part of global energy use. Specifically, five energy-intensive sub-sectors, (namely iron and steel, chemicals, petroleum refining, pulp and paper, and cement) account for roughly 45 percent of all industrial energy consumption (UN, 1998).

Intensity of energy use (toe/unit of production) monitors the energy use per unit of production or service. Once again this indicator can be disaggregated into selected sectors. Such

sectors identified by the UN include agriculture, production for food processing, transport, manufacturing and service sectors.

Share of renewable energy in total energy consumption (percentage) is aimed at monitoring the use of renewable energy sources. For this reason, the UN considers that this indicator has an important communicative value for its member countries. The UN also consider that countries should not associate nuclear energy as a renewable energy source in the context of this indicator primarily because of the effects associate with nuclear energy such as its hazardous waste by products. Renewable sources of energy considered acceptable by the UN for incorporation into this indicator include fuel wood, wind, solar and biomass (UN, 1998).

Energy prices (US\$ per unit of energy) was selected by the UN as a core indicator for consumption and production patterns as in combination with disposable income, (US\$ per unit of energy) energy prices reflect the "affordability" of energy. This indicator is aimed at monitoring the extent to which energy becomes more or less costly over time. This indicator also reflects the margins at which prices increase to influence consumption. The UN consider that it is difficult to develop an indicator (or meaningful proxy for monitoring the internalization of external costs) for energy pricing primarily because problems arise due to data-availability and comparability among countries (UN, 1998).

Emissions of greenhouse gases (annual emission level in gigagrams of CO₂ equivalent) is a production and consumption indicator that is aimed at monitoring the contribution of fossil fuels to global warming. Once again, this indicator can also be broken down by sector (for example, industry, transport, agriculture, and construction) in order to identify priority policy targets such as those that UN member countries have under the FCCC. The UN also consider that an indicator of CO₂ emissions per unit of primary energy can be used for approximating decarbonization (UN, 1998) and thus this indicator can assist the UN in understanding whether its member countries are in fact reducing their greenhouse gas emissions.

2.5.3 Review of Changing Consumption and Production Patterns for UN Countries

In 1999, the UN released a report entitled "*Comprehensive Review of Changing Consumption and Production Patterns*". A major finding of this report was that most industrialized countries have continued progress in reducing energy and material consumption per unit of production (UN, 1999c), as seen by a reduced energy and material consumption per unit of GDP.

The UN attributes this decline to a continuing shift from manufacturing-based to service-based economies. However, the UN also found that an improvement in efficiency per unit of production has been offset by increases in the volume of production and consumption, leading to continued increases in total energy and materials consumed. This means if present trends in energy and fossil fuel consumption continue, by 2010 global energy consumption and CO₂ emissions will rise by almost 50 per cent above 1993 levels (UN, 1999c). As a result, the UN member countries generally agree that further increases in energy and material efficiency in production processes will need to be combined with shifts in consumption patterns towards goods and services that are inherently less energy and resource intensive if greenhouse gas emissions are to be stabilized (UN, 1999c).

By comparison, developing countries, which contain some 80 per cent of the world's population, consume only about one-third of the world's energy. The UN considers that this phenomenon occurs primarily due to a lack of access to commercial energy sources, particularly in rural areas. Despite the economic and social constraints that access to commercial energy sources has placed on developing countries, if current trends in energy consumption continue the UN also consider the share of consumption of the world's energy by developing countries will grow to about 40 percent by 2010 (UN, 1999c).

The UN also found that economic policy instruments are increasingly being used in both developed and developing countries to promote sustainable consumption and production. Such instruments include taxes, tradeable permits, deposit-refund systems and other market-based mechanisms (UN, 1999c). The UN also found that in a number of instances these incentives were most effective when combined with regulatory and social instruments. For example, material and waste taxes have been established in a number of member countries to encourage more efficient use of resources and to discourage the use of certain substances and/or disposable products. However despite the use of these policy instruments the UN has also found, that in many cases, taxes have been too low to have a significant impact on producer or consumer behaviour, and thus these policy instruments have served mainly as a revenue raising measure (UN, 1999c).

A major obstacle identified by the UN that hinders the implementation of a tax regime that favours sustainable consumption and production is the political opposition to taxes. This arises because often governments are concerned that by pioneering the introduction of a tax regime they will risk the international competitiveness of their country. One means of overcoming this issue is by explicitly linking new or increased environmental taxes with equivalent tax reductions in other areas (UN, 1999c). For example, the UN has found that Germany, the Netherlands, Norway and Sweden by shifting taxes from labor to natural resources in order to promote employment have enabled an improvement in resource efficiency and a reduction in pollution to occur (UN, 1999c).

The use of tradeable emissions quotas has also proven quite successful in a number of UN member countries. For example, the United States has used a tradable emission quota for reducing SO₂ emissions and tradeable water rights to promote efficient use of water resources (UN, 1999c). In addition, the Kyoto Protocol also provides for emissions trading as well as other flexible economic mechanisms to ensure that global greenhouse gas reduction targets are met while allowing countries flexibility in making the necessary changes to production and consumption patterns (UN, 1999c).

The UN considers that further study is needed on the practical effectiveness of economic instruments as a means of changing consumption and production patterns. This will require surveys and case studies over a period of time to examine their impact under different social and economic conditions, their political feasibility, the speed at which producers and consumers adapt to such incentives, and their effectiveness in combination with other policy instruments (UN, 1999c). The use of sound environmental indicators will obviously contribute an important element to conducting such studies.

Another major obstacle identified by the UN that impacts on the ability of member countries to achieve sustainable consumption and production practices is the use of environmentally damaging subsidies. Subsidies have a wide range of applications within a number of UN member countries including energy consumption, coal production, water and motor vehicle transportation. The use of subsidies has long been viewed as being undesirable by organisations such as the UN and OECD (UN, 1999c, OECD, 1996, IEA, 1997). This is because subsidies provide little economic incentive for efficient and sustainable use of energy and natural resources. While the UN has found that in recent years there has been a reduction in the number of subsidies used by its member countries, they also consider that subsidy reduction has occurred more for economic or political reasons than for environmental protection (UN, 1999c).

Governments can play a major role in promoting eco-efficiency at the industry, household and governmental levels by implementing policies to promote eco-efficiency and cleaner production (UN, 1999c). By setting clear targets and making eco-efficiency part of a comprehensive policy package, governments can promote eco-efficiency by the use of: environmental regulations; economic incentives; support for the development of substitutes for environmentally-harmful materials and processes; and the encouragement of life-cycle analyses of the environmental impact of products. Governments can also promote eco-efficiency at industry and/or sectoral levels by encouraging the adoption of environmental management and accounting systems, by business or industry performance reporting, and extended producer responsibility. Environmental indicators can play an important role in assisting in the measurement of the successfulness of such strategies.

2.5.4 New Zealand's Reporting to the UN on Agenda 21 for Energy and the FCCC

Highlights reported to UNCED¹⁵ by New Zealand in terms of achievements made towards meeting the principles of Agenda 21 for energy are primarily based upon a number of actions and strategies that the Government has introduced to promote energy efficiency. For example, actions such as the establishment of the EECA provides an example to the UN and its member countries of the way in which the New Zealand Government has directed its environmental management towards the principles of Agenda 21.

In its communications, New Zealand has indicated that it has focused its policy measures on reducing the rate of growth of carbon dioxide emissions. New Zealand has also indicated that carbon sequestration by (planted) forests remains a central part of New Zealand's approach to mitigating carbon dioxide emissions (NZG, 1997). However, New Zealand's policy approach also recognises the importance of other greenhouse gas emissions, in particular those such as methane that arises from the agricultural sector.

New Zealand's greenhouse gas inventory covers emissions of the greenhouse gases carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, sulphurhexafluoride as well as the indirect greenhouse gases carbon monoxide, nitrogen oxides and non-methane volatile organic compounds (NZG, 1997). The relative contributions of different greenhouse gases are calculated using global warming potentials (GWPs¹⁶).

A summary of New Zealand's contribution to emissions and removals of greenhouse gases for the period 1990 and 1995 is shown in Table 2. Expressed according to the GWPs, New Zealand's three main greenhouse gases are CH₄¹⁷, CO₂ and N₂O¹⁸. In contrast to most developed countries however, New Zealand's most significant greenhouse gas emissions arise from methane, rather than carbon dioxide emissions. Fossil fuel combustion, fugitive fuel emissions and industrial processes account for most of New Zealand's CO₂ emissions, with the transport sector being the single largest contributor.

¹⁵ The energy and atmosphere related information supplied by New Zealand to the UNCED is based mainly on information that is also required to be provided by New Zealand under its commitments to the FCCC.

¹⁶ GWPs have been accepted by the international community as a means of comparing the effects of different greenhouse gases. GWPs present the radiative forcing impacts of greenhouse gases relative to CO₂. For example, using 1995 IPCC figures over a 100-year period, one tonne of CH₄ traps as much heat as 21 tonnes of CO₂. The GWPs have uncertainties of ±35 percent. Therefore, data derived using GWPs should be regarded as indicative only.

¹⁷ Methane emissions primarily arise from ruminants (sheep, cattle, deer and goats).

¹⁸ Nitrous oxide emissions are primarily attributed as arising from agricultural soils. Examples of contributing sources include the application of synthetic fertilisers, animal wastes and animal waste management systems.

Table 2: New Zealand Contribution to Emissions and Removals of Greenhouse Gases for the Period 1990 to 1995

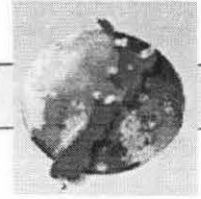
EMISSIONS AND REMOVALS OF GREENHOUSE GASES IN NEW ZEALAND IN 1990 AND 1995 PRESENTED IN CO₂ EQUIVALENT FORM USING 100 YEAR GWPS^a.							
	CO₂ emissions	CO₂ removals	CH₄	N₂O	HFCs	PFCs	SF₆
1990	25475	-20571	35868	14880	Negligible	585	478 ^c
1995	27368	-13490	34335	14446	182 ^b	195	4302 ^c

Notes:
(a) IPCC 1995 Global Warming Potentials (GWPs) are CO₂ = 1, CH₄ = 21, N₂O = 310, HFC 134a = 1300, PFCs (CF₄) = 6500, and SF₆ = 23900.
(b) Reported emissions of HFCs are potential rather than actual emissions. Release of most HFCs to the atmosphere is likely to take place over a number of years, rather than all occur in the year of importation.
(c) SF₆ emissions have been revised since publication of New Zealand's second national communication. Problems with the methodology used resulted in an over-estimate of potential emissions. Estimates of actual rather than potential emissions are reported here.
(d) PFCs are largely from aluminium smelting and are CF₄ and C₂F₆ in the ratio 10:1. Therefore the Global Warming Potential (GWP) for CF₄ has been used.
(e) 74% of the HFC emissions are HFC 134a, hence the choice of GWP for HFCs.

Source: MfE/NIWA, 1997: New Zealand's Second National Communication under the FCCC.

CO₂ was approximately 36 percent of total greenhouse gases in 1995, while N₂O emissions was approximately 19 percent of total greenhouse gases in 1995 (MfE/NIWA, 1999). CO₂ emissions arising from industrial processes contributed 2.7 gigagrams (or 2.7 kilotonnes), which was an increase of 0.4 gigagrams from 1990. By comparison, methane contributed approximately 45 percent of New Zealand's total greenhouse gas emissions in 1995 (NZG, 1997). Overall the inventory data for New Zealand shows that relative to 1990, CO₂ emissions are increasing, methane and perfluorocarbon emissions are decreasing, and nitrous oxide and sulphurhexafluoride emissions remain relatively stable. Policy measures indicated by Government to address the rate of growth of CO₂ emissions include: voluntary agreements, legislative and regulatory reform of the energy sector, energy efficiency and renewable energy measures, the use of the Resource Management Act and specific transport sector measures¹⁹ (NZG, 1997).

¹⁹ All of these policy measures except those for the transport sector are discussed further within sections 3, 4 and 5 of this report.



The National Context

New Zealand has undergone significant reforms in its environmental legislation since the 1980's. Significant restructuring of the energy sector has also occurred since the mid-1980's in an attempt to promote a competitive market and increase energy efficiencies within the energy sector. These reforms have been able to occur over a relatively short time period primarily due to the fact that New Zealand has no written constitution or federal system of provinces, and therefore is totally reliant on the executive branch of Government to enact changes to legislation.

3.0 Introduction

New Zealand is a parliamentary democracy with general elections being held every three years. Almost all legislation relating to the conduct of business and the operation of companies in New Zealand is enacted by Parliament but is administered by national governmental agencies. This means that national political parties do not play a large role in the local government process.

Before restructuring of the energy sector, the Minister of Energy controlled energy policy as most major forms of energy (such as electricity, gas and coal), with the exception of imported oil, were Government owned. Energy prices were regulated by the Government whose main aim was to make energy affordable, both for social and economic reasons and to stimulate economic growth. Since restructuring, the Government has taken various steps to distance itself from direct involvement in the energy sector and while there is still a Minister of Energy there is no longer an energy ministry. The Ministry of Commerce (MoC) now handles the research and advisory functions for energy policy in New Zealand and planning in the energy industry is now left to the market.

The Resource Management Act was enacted in 1991 and is the principle statute for the management of natural and physical resources and the environment in New Zealand. The Resource Management Act is New Zealand's preeminent legislation for resource law and all other resource-related laws must adhere to its goals and intent.

A significance difference between the RMA and previous resource law is that the RMA is orientated towards regulating the effects that the resource use may have on the environment instead of how resources are used. Energy is included within the definition of natural and physical resources under the Resource Management Act. However the role that local government authorities have in terms of managing energy is generally only limited to controlling the effects associated with energy supply and use.

3.1 New Zealand Government

The New Zealand Government consists of three different branches:- the **Legislature** (Parliament), the **Executive** (including ministers and governmental departments) and the **Judiciary**. Power to govern is divided between these three separate branches. Each branch performs a separate, but not exclusive role, and this prevents any single branch from acting against the basic constitutional principles of the country (NZGO, 1999a).

Parliament consists of a single “House of Representatives” whose members are elected every three years by universal right or privilege. A New Zealand Government is formed after an election generally by the party or coalition, which can command a majority of votes in the House of Representatives. For example, the Government elected in 1996 was a coalition government²⁰ formed between members of the National and New Zealand First Party. However, minority government’s can also be formed if a party or coalition can command a majority on votes of confidence.

Collectively the Ministers of the Crown form the executive arm of Government. These ministers must also be Members of Parliament and are appointed by the Governor General on the advice of the Prime Minister. The principal decision making body of this executive arm is Cabinet, which is chaired by the Prime Minister and consists of approximately 20 Ministers including the Prime Minister. Decisions made by Cabinet are usually reached by consensus rather than by voting, with each of the Ministers being given the right to express their views on each issue for discussion. This convention, known as “collective responsibility” is an essential element of the Cabinet system (NZGO, 1999b). The Cabinet’s role includes making decisions on policy issues, and the ratification of international treaties and agreements.

Not all Ministers become members of the Cabinet. Ministers outside of Cabinet can still hold specific areas of responsibility (referred to as “portfolios”). Ministers may be assisted with their portfolios by Deputy or Associate Ministers or by Parliamentary Under Secretaries. Ministers’ powers are derived from the common law powers of the Crown and from legislation which confers

²⁰ This coalition was subsequently dissolved and replaced by minority National-led Government.

powers upon Ministers generally, or upon a particular Minister (NZGO, 1999c). Ministers are also supported in their work by their departments, who provide information and advise to their relevant Minister, and to the Government as a whole, on the development of policy.

The Judiciary is the third branch of Government. Independence of the Judiciary is an important facet of the New Zealand Constitution as it ensures that judges are free from political interference (NZGO, 1999d). The responsibility of the Judiciary is to interpret and apply laws that have been made by Parliament, in cases that come before the courts. The Judiciary comprises of 71 courts including the Court of Appeal (the highest Court in New Zealand), three High Courts, 42 District Courts and 14 combined High and District Courts (NZGO, 1999d). In addition there are a number of specialised tribunals, committees and boards, which act as either as licensing or reviewing bodies, or as dispute or appeal bodies. Their function is to monitor, regulate or enforce certain legislation. An example of this type of specialised tribunal is the Waitangi Tribunal, which was established to hear claims from Maori relating to the Treaty of Waitangi.

3.2 Parliamentary Commissioner for the Environment

The Parliamentary Commissioner for the Environment (PCE) is appointed by the Governor-General²¹ on the recommendation of the House of Representatives and holds the appointment for a period of five years.

The functions of the PCE include (OPCE, 1997):

- *an **environmental inquiry** role where the PCE can examine any matter where he/she considers the environment has been or may be affected;*
- *an **environmental ombudsman** role where the PCE can investigate concerns about the performance of public authorities in handling environmental management issues;*
- *an **environmental systems guardian** role where the PCE can check the capability of an environmental management regime (including institutional arrangements, legislation, policies and generation of necessary knowledge) to ensure that the quality of the environment is maintained or improved;*
- *an **environmental auditing** role where the PCE can audit the environmental management performance of public authorities against their statutory powers, functions and duties;*
- *an **advisory** role, including advice on remedial action, if appropriate; and*
- *an **informing** role, ensuring environmental management information is disseminated to decision-makers and interested parties.*

²¹ The PCE is independent of the executive arm of Government and may only be removed or suspended from office by the Governor-General.

The focus of the Parliamentary Commissioner for the Environment (PCE) is on the performance of agencies and the processes established by Government for managing the environment. The PCE is responsible for reporting directly back to Government and for ensuring that the legislative system and the practice of public authorities is beneficial to the environment, and hence the advancement of sustainable management.

The PCE has no regulatory power per se, and therefore cannot overturn any decision of a public authority or direct a public authority to act in a particular way. Neither does the PCE have any formal power to ensure that his/her advice or recommendations will be accepted, or that they will be acted on immediately or at some time in the future. Despite these limitations the role of the PCE is important as it enables a broader view to be taken of issues that pertain to environmental planning and management of public authorities. For example, the PCE has the power to make recommendations to public authorities through mechanisms such as commenting on draft reports before they are made publicly available for comment. The PCE also can at his/her discretion, choose which concerns will be investigated and these concerns are largely prioritised on the basis of their wider environmental implications (Williams, 1999).

Because of the above-described principles and functions that are provided by the PCE, the existence of the role of a PCE was subsequently endorsed by the OECD in their review of New Zealand in 1996 (OECD, 1996). It is also of note that a number of other countries have since followed New Zealand's lead and similarly constituted environmental commissioners. These include Australia's Capital Territory, the European Commission in Brussels, Germany, Netherlands; Canada's provinces of British Columbia and Ontario, and the Federal Government in Canada (OPCE, 1997).

3.3 Governmental Policy Directive for Energy and Environment in New Zealand²²

Political parties, as part of the electoral process develop particular environmental policy directives. After the 1996 election, with the formation of a coalition between National and New Zealand First, the Executive Coalition Agreement was developed.

The Coalition Government's 'statement of general direction' in respect of Energy was similar to the pre-reformed Ministry of Energy's, that being to provide energy services at the lowest cost to the economy as a whole. The only significant difference alluded to in the Government's statement was

²² The policy directives described within this section were those that were relevant up to the change in government in late 1999. This section is intended to provide examples of the types policy directives that are formulated by government in New Zealand. It should be noted however that obviously as political parties change so may the thrust of their various policy directives.

that provision of these energy services was provided “...consistent with sustainable development” (NZGECA, 1996). Policy initiatives identified in support of the above statement included no privatisation of Electricity Corporation of New Zealand (ECNZ), Contact Energy and TransPower; overhauling energy pricing; and improved efficiency and conservation. The legislative implications of this policy agreement would see appropriate changes to regulation under the Electricity Act to implement changes to fixed line charges and to ensure non-discriminatory access over spur lines (NZGECA, 1996a).

By comparison, the Coalition Government’s ‘statement of general direction’ for the environment was consistent with the principles of sustainability. The key initiatives identified by the Coalition Government also contained a number of initiatives that had direct relevance to energy sector industry. These included:

- statutory disclosures of environmental impacts by companies;
- promulgation of progression on climate change and energy issues (including a reduction of greenhouse gas emissions);
- enforcement of controls of atmospheric discharges under the RMA;
- and a requirement for Regional Councils to implement a monitoring system for air quality (NZGECA, 1996b).

With the collapse of the National/NZ First Coalition, some of these policy details were changed, such as the privatisation of Contact Energy in 1999. However, the thrust of the major policy initiatives remained intact.

3.4 New Zealand Legislation

There are three types of New Zealand legislation:- Acts of Parliament (also referred to as statutes), statutory regulations and other subordinate legislation. Acts of Parliament are laws that are passed in New Zealand as public, local or private acts. Public Acts, such as the Resource Management Act, 1991, are of a general application and are the most common form of legislation. By comparison local acts affect a particular locality whilst private acts are formed for the particular interest or benefit of a person or body.

Statutory regulations consist of laws made by the Governor General, Ministers of the Crown, and certain other bodies. Other subordinate legislation includes laws made by various governmental agencies, local bodies, and other authorities. These latter laws may include the development of standards, for example, for control of air or water quality, or the development of a Regional Plan with specified rules to address these same issues.

The following pieces of legislation have contributed to major reform in the energy sector:

- The Environment Act, 1986;
- The Resource Management Act, 1991;
- The Commerce Act, 1986;
- The Electricity Industry Reform Act, 1998;
- The State Owned Enterprises Act, 1986;
- The Gas Act (1992) and Gas Regulations, 1993;

Each of these Acts is now briefly discussed below.

3.4.1 The Environment Act 1986

The introduction of the Environment Act established the Ministry for the Environment (MfE) and the Parliamentary Commissioner for the Environment (PCE). The MfE, a central governmental organisation, is the primary national agency responsible for the overview and monitoring of environmental policy in New Zealand. The MfE is engendered with a policy advisory role and a reporting function that allows it to review all government department proposals that may have significant environmental impacts enabling these to be reported back to Government. The MfE also has limited regulatory, planning and advocacy powers. A more detailed description of the roles and responsibilities of the MfE are provided in section 4.1 of this report.

The functions of the MfE as set out in the Environment Act 1986, are (MfE, 1999e):

1. *To advise the Minister on all aspects of environmental administration, including*
 - (a) *Policies for influencing the management of natural and physical resources and ecosystems so as to achieve the objectives of the Environment Act 1986;*
 - (b) *Significant environmental impacts of public or private sector proposals, particularly those that are not adequately covered by legislative or other environmental assessment requirements currently in force;*
 - (c) *Ways of ensuring that effective provision is made for public participation in environmental planning and policy formulation processes in order to assist decision making, particularly at the regional and local level;*
2. *To solicit and obtain information from any source, and to conduct and supervise research, so far as it is necessary, for the formulation of advice to the Government on environmental policies;*
3. *To provide the Government, its agencies, and other public authorities with advice on:*
 - (a) *The application, operation, and effectiveness of the Acts specified in the Schedule to the Environment Act 1986 in relation to the achievement of the objectives of the Act;*
 - (b) *Procedures for the assessment and monitoring of environmental impacts;*
 - (c) *Pollution control and the co-ordination of the management of pollutants in the environment;*

- (d) *The identification and likelihood of natural hazards and the reduction of the effects of natural hazards;*
- (e) *The control of hazardous substances, including the management of the manufacture, storage, transport, and disposal of hazardous substances;*
- 4. *To facilitate and encourage the resolution of conflict in relation to policies and proposals which may affect the environment;*
- 5. *To provide and disseminate information and services to promote environmental policies, including environmental education and mechanisms for promoting effective public participation in environmental planning;*
- 6. *Generally to provide advice on matters relating to the environment.*

By comparison, the focus of the Parliamentary Commissioner for the Environment (PCE) is on the performance of agencies and the processes established by Government for managing the environment. The PCE reports directly back to Government and is charged with the responsibility of ensuring the legislative system and the practice of public authorities is beneficial to the environment and hence the advancement of sustainable management (Williams, 1999).

Section 16 of the Environment Act defines the PCE functions. Briefly, the PCE powers are those deemed necessary to carry out his functions and include wide powers to obtain information (sections 18 and 19 of the Environment Act). The PCE also has the power to obtain information under the Environment Act 1986 but this must be understood in the context of obligations that the PCE has to maintain the confidentiality of that information (sections 20 & 22a of the Environment Act)²³. A more detailed description of the role of the PCE is provided in section 3.2 of this report.

3.4.2 Resource Management Act 1991

The **Resource Management Act** (RMA) was enacted in 1991 and is the principle statute for the management of natural and physical resources and the environment. The RMA is New Zealand's preeminent legislation for resource law and all other resource-related laws must adhere to its goals and intent. A significance difference between the RMA and previous resource law is that the RMA is orientated towards regulating the effects that the resource use may have on the environment instead of how resources are used.

The RMA is designed to allow communities and regions to take a broad, comprehensive approach to resource management. It achieves this by establishing an integrated framework for the management of land, air, water and control of discharges into the environment whilst providing for

²³ More detail on the PCE is given under a separate heading in this section.

national, regional and local territorial levels of responsibility.

Section 5 of the RMA outlines its purpose, namely “...to promote the sustainable management of natural and physical resources” (RMA, 1991). Thus, the central concept of the RMA is concerned with the management (including the use, development and protection) of natural and physical resources in a way or at a rate that “... enables people and communities to provide for their well being while sustaining the potential of resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; safeguarding the life supporting capacity of air, water, soil and ecosystems; and avoiding, remedying or mitigating adverse effects” (RMA, 1991).

Sections 6, 7, and 8 of the RMA provide further guidance and direction on the manner in which resources are to be managed. The RMA outlines the principles that must be either recognised or provided for; given particular regard to; or taken into account by bodies who exercise functions and powers under the Act. These principles include:

- **matters of national importance**, such as the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development;
- **other matters**, such as the efficient use of and development of natural and physical resources; and
- consideration of the principles of the **Treaty of Waitangi**.

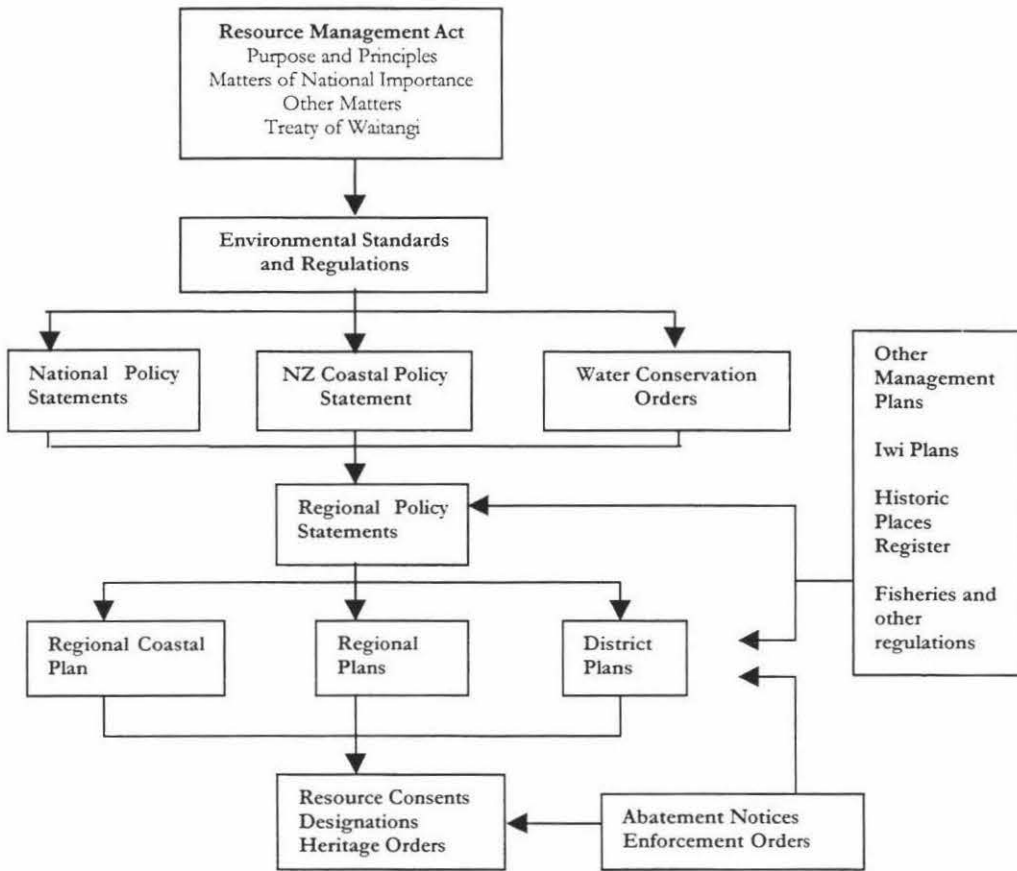
Although the emphasis of these sections of the Act are on sustaining natural and physical resources and protection of the biophysical environment, the Act recognises that the use and development of resources can and should take place. That is, provided that the activity(s) occur within defined environmental constraints (as outlined within policies and plans) and other provisions contained within the Act.

The RMA also sets out functions, powers and duties of territorial and regional authorities and central government. The specific roles and functions of central and local government are discussed further in sections 4 and 5 (respectively) of this report.

The RMA enables Regional and District (or territorial) Councils the primary responsibility for the management of natural and physical resources in their areas, subject to the requirements of central government as exercised through the instruments available under the Act or through other legislation. Such instruments include national environmental standards, national policy statements, the New Zealand Coastal Policy Statement, water conservation orders, regulations, call-in and other powers. This hierarchical approach to administering the Act allows the balancing of a wide range of

interests and values and enables central and local government to carry out their functions within a framework that enables integrated resource management (as is shown in Figure 6).

Figure 6: RMA Framework for Integrated Resource Management



Source: Taranaki Regional Council, 1994: Regional Policy Statement for Taranaki.

Whilst **energy** is included within the definition of natural and physical resources under the RMA, minerals are excluded from that part of the definition of sustainable management which relates to sustaining the potential of resources to meet the reasonably foreseeable needs of future generations (RMA, 1991). This limits the extent of the role that local government authorities can have in terms of energy management to generally only controlling the adverse environmental effects associated with energy supply and use.

Legislation covering minerals is dealt with partially outside the RMA, in large because the Government owns most naturally occurring mineral resources. While Government remains responsible for granting mining rights to companies, the environmental effects of mining fall under the jurisdiction of the regional and local authorities, which have the authority to grant permits and set conditions. A number of other special environmental programs also fall outside the scope of the RMA. These include programs on climate change, hazardous substances, and waste management.

While these programs are all generally in accord with the purpose of the RMA, that being of sustainable management of resources, government authorities may be required to use a combination of independent targets along with RMA-mandated standards to achieve their objectives.

3.4.3 Commerce Act 1986

The main purpose of the Commerce Act is to promote competition in markets in New Zealand. The MoC (whose role and function are more fully discussed in section 4.2) is responsible for administration of the Commerce Act.

The Commerce Act essentially identifies and prohibits certain conduct that is considered anti-competitive. The Commerce Act also enables the provision for other conduct (which is not specifically identified in the Act) whose purpose or effect is anti-competitive to be prohibited. By prohibiting anti-competitive behaviour, the Act lends itself to facilitating gains in economic efficiency across the economy as a whole. This is because it allows for improvements in efficiency to occur and thus the Commerce Act theoretically should enable the economy to produce more output with the same level of resources. This in turn should result in an enhancement of the welfare of New Zealanders as a whole.

To promote competition in markets in New Zealand, the Commerce Act contains both structural and behavioural prohibitions. Structural prohibitions within the Commerce Act include provisions that prevent anti-competitive conduct. In addition the Commerce Act also contains behavioural provisions to prohibit the misuse of market power (section 27, 36 and 47 of the Commerce Act).

Section 27 of the Commerce Act prohibits anti-competitive agreements among firms. Such agreements include contracts, arrangements or understandings that substantially lessen competition. Section 36 of the Commerce Act regulates the use of a dominant position, held by a single firm in a market, while section 47 prohibits the acquisition or strengthening of a dominant position in a market.

Amendments made to the Commerce Act in February 1999, resulted in an increase in the level and range of penalties available; an increase in the likelihood of determining offences; provision for greater scope for interim relief; and an increase in the incentive for private actions to be taken. Government is also proposing further changes to the Commerce Act (Contact, 1999), which may include a review of Section 36 and Section 47 to determine whether these provisions require enhancing (Contact, 1999).

3.4.4 Electricity Industry Reform Act 1998

The Electricity Industry Reform (EIR) Act was enacted in 1998 and is a continuation of the electricity industry reforms that commenced in the 1980's. The MoC is responsible for administration of the EIR Act.

The EIR Act provides for the corporate separation of line businesses from generation and retail businesses such that they operate as separate businesses without cross-subsidisation. Corporate separation was required to be completed by April 1 1999. This means a company operating in one of these sectors cannot own more than ten percent of business in another sector. Furthermore, ownership separation is required to be completed by no later than January 1 2004. The EIR Act also allows for the possibility of price controls on line function services by regulations.

3.4.5 State Owned Enterprises Act 1986

All state owned enterprises are regulated pursuant to the State Owned Enterprises Act (SOE) but are currently incorporated under the Companies Act. Treasury administers the SOE Act. SOE are required to operate as an efficient business in so far that they are as profitable and efficient as comparable businesses that are not owned by the Crown. There is also a requirement for SOE to also be a good employer and to exhibit a sense of social responsibility. All SOE are required to produce a "*Statement of Corporate Intent*" consistent with these above described overriding objectives.

3.4.6 Gas Act 1992 and Gas Regulations 1993

The MoC administers the Gas Act. The Gas Act enables any person to supply gas to any consumer but requires every person who supplies gas, or provides, maintains or operates any gas pipelines to notify the Minister of Energy within one month of commencing operation. By comparison, the Gas Regulations 1993 impose a number of requirements on persons supplying or distributing gas, which includes complying with a specified uniform standard and pressure of supply for gas, and certification for any gas work carried out. The Gas Regulations Act 1993, also require gas distributors to keep records of the location of their distribution system and to design, construct, maintain and operate the system in a manner which, as far as practicable, achieves continuity of supply, safety and satisfactory operation. Compliance with this regulation is considered to be achieved via compliance with a specified Code of Practice for Gas Distribution (Contact, 1999).

3.5 Strategies for Integrating the Environment with Energy Sector Industry in New Zealand

Another key mechanism that the Government has used in an attempt to achieve environmental commitments on either a national or international scale is the use of strategies. Strategies cannot be

inconsistent with existing legislation, but can provide a more specific direction on how to achieve the purposes defined within legislation such as the RMA.

A number of key strategies were introduced by Government²⁴ to better integrate energy sector industry with the environment. The **Environment 2010 Strategy** is a long-term strategic environmental plan for New Zealand, which outlines the Government's broad goals, vision and direction for achieving environmental and economic sustainability. The responsibility of translating the visions of the Environment 2010 strategy primarily lies with the MfE and specific details, including the methodologies used to implement them are further outlined in section 4.1 of this report.

In 1994, the Government introduced a **CO₂ Policy Package**. This package was seen as providing the Government with a means of achieving its international commitments under the FCCC. The CO₂ Policy Package was aimed at encouraging industry, along with other CO₂ emitters to reduce their greenhouse gas emissions and focus on energy management via a range of non-statutory and statutory measures. The CO₂ Policy Package essentially consists of two non-statutory components:- **voluntary agreements** and **energy efficiency** programmes, and one statutory component, namely **energy sector reforms**. The VA programme is administered by the MoC whilst Energy Efficiency programmes are administered by the EECA. Each of these initiatives is discussed further in section 4 of this report.

The CO₂ Policy Package was expected to achieve a reduction in the anticipated growth of New Zealand's gross CO₂ emissions, from 20 percent down to 16 percent (MfE, 1996a). This growth was calculated using 1990 emissions as the base year and estimating the emissions in the year 2000. The Government anticipated that the remainder of reductions required to meet their 1990 target levels would then be met through carbon absorption in new-forest plantings (MfE, 1996a), or through the introduction of a low-level "tax". Furthermore a low-level carbon tax was promulgated by Government (Treasury, 1997) as an option if the policy measures proved insufficient to achieve a net stabilisation of CO₂ emissions at 1990 levels by the year 2000, however this did not eventuate.

In January 1999, the Government also released a **CO₂ Policy Options Statement**. This statement set out the Government's preferred long-term policy package for 2008-2012 to achieve New Zealand's Kyoto Protocol target under the FCCC. Within the CO₂ Policy Options Statement the Government identified three proposed options for the pre-2008 policy instruments.

²⁴ Government policies and strategies referred to throughout this report are those of the National-led Government elected in 1996.

These were (MoC, 1999a):

- Option 1: an early start to forward trading of 2008-2012 emission units enabled by setting the long term policy framework in place as soon as possible. This option essentially leaves it to industry to judge when it is most cost-effective for them to reduce emissions (prior to 2008), based on their expectations about the future cost of their emissions.*
- Option 2: a "pilot" emissions trading programme (for large energy sector emitters with possible linkages to other sectors) together with a low-level carbon charge (for other CO₂ emitters), before implementing a comprehensive domestic emissions trading programme closer to 2008. This option puts an explicit cost on emissions or requires emission reductions prior to 2008 with a trading regime or both.*
- Option 3: a low-level carbon charge (for the energy sector), before implementing a domestic emissions trading programme closer to 2008. This option also puts an explicit cost on emissions or requires emission reductions prior to 2008 with a trading regime or both.*

Selection of policy instruments to enable New Zealand to meet its first commitment period (2008-2012) under the Kyoto Protocol is difficult in comparison to other developed countries because the cost of substantially reducing CO₂ emissions in New Zealand's energy and industrial processes sector is high. This arises primarily due to the dominance of agricultural methane and nitrous oxide in New Zealand's profile in comparison to other Annex-1 countries, and also because of New Zealand's high proportion of hydroelectric power in the energy mix (Upton, 1998b).

The Government has stated its primary objective is to meet its initial and future international emission reduction commitments at least cost (MfE, 1999f) and favours an emissions trading regime as the preferred economic tool for achieving CO₂ reductions. However, despite the economic theory associated with an emission trading system, there are also enormous practical difficulties with such a system (Robertson, 1998). Issues that the Government (and the wider international community) must consider are wide ranging. Such issues include determining the method and criteria that should be used to allocate permits, how emissions will be measured/monitored, how to allocate for economic growth in certain sectors, and how to enforce the system once it is in place.

Whilst a final decision is yet to be made on what policy option(s) are to be used, what is certain, is that if New Zealand does not meet its commitments under the FCCC this will most certainly affect its credibility in terms of future international negotiations.

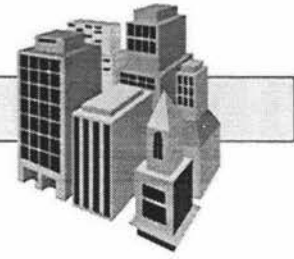
3.6 Energy Sector Reforms

The foundations of the competitive electricity market date back to 1987 with the formation and subsequent corporatisation of the ECNZ by the Minister of Energy. Reform of the distribution and retail supply sector began in 1992 with introduction of legislation such as the Electricity Act, the Gas Act and the Energy Companies Act that deregulated the electricity distribution function from franchise and generation functions. The Government's broad stated objectives for deregulating the energy sector included:

- (a) encouraging additional competition at the wholesale level;
- (b) increasing the overall efficiency in the electricity industry; and
- (c) ensuring New Zealand has the capacity to generate the electricity required to meet its expected requirements and ensuring the country has alternative energy sources for generation to satisfy most electricity supply shortfalls during all of the most severe periods of drought in the main hydro catchment areas.

Deregulation of the energy sector was seen as providing the foundations on which competition in electricity supply could be based. By deregulating the energy sector the Government considered that they could establish a more flexible and competitive wholesale market and thus create an overall benefit for the economy as a whole. To further reduce ECNZ's dominant position in electricity generation the Government introduced further measures by introducing the EIR Act in 1998. This Act had three broad consequences:

- (a) it implemented the Government's intention to split ECNZ into three separate generating companies;
- (b) it ensured that from January 01 2004, any entity operating an electricity distribution network cannot be involved in electricity retail (or generation) or vice versa; and
- (c) the Act fosters the introduction of a low-cost option to allow small consumers to switch electricity suppliers should they chose.



Central Government Context

Central governmental organisations such as the Ministry of Commerce and the Ministry for the Environment provide leadership and direction for the energy sector by establishing the policy and legislative framework for action. The establishment of the Energy Efficiency and Conservation Authority is also another key step that has been taken by Government to improve the way in which energy is used in New Zealand.

Each of these organisations, to varying extents, collects and collates data that relates to energy sector industries within New Zealand. Thus, these organisations along with Statistics New Zealand (the author of the *“New Zealand Official Yearbook”*) hold valuable energy information that can assist in the development of environmental indicators.

4.0 Introduction

The Government promotes its energy policy objectives by facilitating structures that can enable well functioning commercial systems, that remove legal or structural barriers to innovation, that promote or adopt efficient energy practices, and which analyse the resource potential, cost and feasibility of renewable energy. Government conducts these practices through a range of central and local governmental organisations and agencies that are often collectively referred to as the public sector.

Central governmental bodies, accept as part of their responsibilities the provision of a national environmental policy framework. To achieve this framework, a key task of Central government is to define the desired environmental outcomes of New Zealander’s and then translate these aspirations into environmental policies and programmes. Central government also has a responsibility for facilitating the implementation of environmental policies and programmes (whilst ensuring that property rights and entitlements are defined and enforced) through consultation, education and funding arrangements.

4.1 Ministry for the Environment

In 1986 the Environment Act established the Ministry for the Environment (MfE). The MfE, along with the Department of Conservation and the Parliamentary Commissioner for the Environment (PCE) are now the central agencies responsible for environmental management within New Zealand.

The MfE carries out many of the statutory functions of the Minister of the Environment, under the Resource Management Act (RMA). The MfE is responsible for reporting to Government on the state of the New Zealand environment and the way in which environmental laws and policies work (in practice), including recommending action that they may consider necessary to improve environmental management.

The significant areas of policy that the MfE are responsible for include resource management, land, air and water quality, waste, hazardous substances and contaminated sites, protection of the ozone layer, and climate change (MfE, 1999b). However the MfE also advise on the environmental implications of other governmental policies, such as the Treaty of Waitangi settlements as well as contributing to interdepartmental work on biological diversity, marine environmental issues, **energy** and transport (MfE, 1999b). In addition, the MfE is responsible for carrying out regular stocktakes of progress towards the goals of the **Environment 2010 Strategy** and reporting these findings back to Government. The MfE has a key responsibility to consult with local government, along with resource users and managers and others likely to be affected by changes in policy or legislation, and to provide them with information and advice to assist them (MfE, 1999b).

Under the RMA, the Government has two complementary means for expressing and applying its resource management policies: **national policy statements** and **national environmental standards**.

4.1.1 National Policy Statements and National Environmental Standards

The responsibility for development of National Policy Statements for the environment and National Environmental Standards lies mostly with the MfE. Policy statements express national goals and objectives for the environment and its sustainable management and are descriptive, rather than prescriptive in nature. They cover issues such as resource protection, use, and development. National policy statements may deal with general issues, such as New Zealand's obligations in enhancing the global environment, or they may deal specifically with a particular issue or site. The only national policy statement the Government is required to develop under the RMA is a Coastal

Policy Statement, dealing with national priorities for the management of the country's coastal environment. This is the responsibility of the Minister of Conservation.

Unlike policy statements, national environmental standards are prescriptive, and are promulgated as regulations. They apply to the entire nation meaning that regional and local plans and policies cannot be inconsistent with them. National environmental standards are technical standards that relate to the use, development and protection of natural and physical resources and may address issues including soil, water or air quality.

4.1.2 Environment 2010 Strategy

In July 1995 the Government adopted the “*Environment 2010 Strategy*”. The *Environment 2010 Strategy* is a non-mandatory strategy and therefore its success is dependent upon on the actions taken by central and local government, iwi, industry, non-government organisations, communities and individuals (MfE, 1994).

The strategy itself is not a specific plan but rather provides a broad strategic overview of the Government's vision, principles and goals for the environment to the year 2010. The broad vision for the New Zealand environment to 2010 is to create “...a clean, healthy and unique environment, sustaining nature and people's needs and aspirations” (MfE, 1994). In addition to identifying the nations highest priority environmental issues and listing broad goals in each area, the strategy establishes a framework to ensure that central and local government, non-governmental organisations, iwi, industry and communities adopt a common approach when developing their individual policies and plans.

The strategy also discusses key management principles and tools to help New Zealanders achieve environmental and economic sustainability within the context of the RMA. For all of the reasons described above, the strategy is an important document for New Zealander's because it provides a formative direction to the way in which New Zealand intends to manage its environmental resources. However, the strategy is also important because it enables Government to address the international aspects of policy that the RMA cannot, for example, issues related to global warming.

To provide direction in achieving this vision of the Strategy, the Government identifies eleven guiding principles within the Strategy. These principles are aimed at integrating environmental issues with societal and economic ones and include (MfE, 1994):

- *sustainably managing natural and physical resources;*
- *applying the precautionary principle, i.e. taking the conservative approach with ideas that have not been proven;*

- *defining environmental bottom lines;*
- *internalising external environmental costs;*
- *specifying property rights to achieve sustainable outcomes;*
- *ensuring that "least cost" policy tools are adopted;*
- *ensuring that social and environmental goals are mutually supportive;*
- *following full cost pricing principles in pricing public utility infrastructure;*
- *considering local, national and international dimensions of sustainable resource management in determining publicly funded research priorities;*
- *defining the limits of resource use and substitution;*
- *protecting our international competitiveness.*

Many of the market based principles the document identifies such as the internalisation of environmental costs and the precautionary principle are consistent with approaches used internationally. These market based principles are also consistent with recommendations and findings of organisations such as the OECD as being efficient economic tools to use to promote integration of economic and environmental decision making (Youngman, 1997, Avérous 1997, OECD, 1996). However, some of the principles described in the Environment 2010 strategy such as the provision of environmental compensation and the use of property right approaches may prove more problematic in their application, as they infer that a greater weight should be placed on economic outcomes than on environmental sustainability.

There are **eleven priority environmental issues** that the Government has listed within the Strategy in a section entitled "Agenda for Action", and each of the issues has a specified corresponding goal. The eleven priority issues address:

- maintaining clear, clean breathable air;
- managing the environmental impacts of energy services;
- managing the environmental effects of transport;
- reducing the risk of climate change;
- restoring the ozone layer;
- managing land resources;
- managing water resources;
- protecting indigenous habitat and biological diversity;
- managing pests, weeds and diseases;
- managing pollution, waste and hazardous substances;
- enabling sustainable fisheries.

The Strategy also contains an “Environmental Management Agenda”. In laying out this agenda for New Zealand’s future, the strategy clearly shows a commitment by central government to the principles of a comprehensive and integrated approach to environmental management. This is demonstrated in the document by the Government’s six key environmental management goals, namely (MfE, 1994):

- *the integration of environmental, social and economic policies;*
- *the establishment and maintenance of a coherent framework of law;*
- *a sharpening of policy tools;*
- *a build up of the information base;*
- *promotion of education for the environment, and*
- *the involvement of people in decision making.*

On an annual basis the MfE also compiles an **Environmental Stocktake** (or summary) of the responses taken by central government to the Strategy. These stocktakes also outline any remaining and new risks and further work that the Ministry considers are required to achieve the vision of the Strategy.

A current limitation identified by the stocktakes is that the Ministry cannot investigate all the ways in which departmental outputs are advancing the Strategy goals or currently analyse the overall state of progress towards the goals. This is because the MfE consider that there is currently limited consistent national environmental data and few quality standards by which the Ministry can measure the health of the environment (MfE, 1998d). Because of this, evaluation of progress towards meeting the vision of the Strategy is limited to using the data available and [often] ad hoc measures of environmental quality and improvement (MfE, 1998d). To assist in overcoming this problem the MfE is currently working on developing a national set of environmental indicators.

4.1.3 The State of New Zealand’s Environment

In October 1997 the MfE released “*1997 The State of New Zealand’s Environment*”. This report was the first national report on the state of the New Zealand environment and provides an overview of the state of the natural environment and the pressures on it. More importantly this document also provides a benchmark for future environmental reporting within a national context for New Zealand.

Energy is addressed within the “*1997 The State of New Zealand’s Environment*” report under a section entitled “*Production and Consumption Patterns*”. In the initial discussion of this section the MfE introduces some common terminology that is used to describe the nature in which energy (the Joule) and power (the watt) are measured. The MfE also clarifies the forms in which energy is

converted from its initial state (primary energy) into a more convenient state (consumer energy). These latter distinctions are particularly important because the conversion of energy from one state to another can result in irrecoverable losses. For example, only 10 percent of the primary energy in geothermal steam is actually converted into electricity, a secondary energy form. Understanding where and why these losses occur is important because it helps us appreciate that total energy consumption may actually be much greater than the actual end use depending on the form in which it is eventually used.

Much of the data presented in the section entitled "*Production and Consumption Patterns*" in the 1997 State of the Environment Report for New Zealand is drawn from monitoring information gathered and energy forecasts provided by the MoC. The MfE also provide energy policy and environmental information to further complement this information. A brief overview of the key highlights of this report including some of the key indicators presented for energy is now provided.

New Zealand has an abundance of natural energy resources and utilises a range of renewable and non-renewable energy sources to meet its energy needs. In the "*1997 The State of New Zealand's Environment*" Report, renewable sources of energy in the form of flowing water and geothermal steam are listed as dominating New Zealand's renewable primary energy supplies. Wood, wind, biofuels and direct sunlight are also listed as providing other potential emerging sources of renewable energy in New Zealand (MfE, 1997a).

Whilst some of these renewable forms of primary energy are used directly, most are converted into secondary energy forms. For example, primary energy sources are converted into mechanical (combustion engines) and/or electrical energy (via turbines used in thermal or hydroelectric power plants). This is particularly prevalent in New Zealand as observed by the high proportion of hydroelectric facilities that are used for the generation of electricity.

However, whilst water itself may take the form of a renewable resource, the distinction between water being a renewable and a non-renewable resources in terms of its use of an energy source for the generation of electricity is not always so transparent. This is because whilst the act of passing water over a turbine is a renewable activity, the practical limitations associated with hydroelectric facilities and the wide ranging environmental effects associated with their installation and operation may not necessarily be sustainable in terms of either future growth or expansion. As such the use of water for hydro-generation facilities is often excluded by organisations such as the IEA from their estimates of renewable energy sources.

Hydro-facilities currently account for some 80 percent of New Zealand's electricity generation depending on water inflows and electricity demands (MfE, 1997, SNZ, 1998). However if hydro

sources are excluded from renewable energy sources, renewables (mainly geothermal and biomass) actually only account for some 14.8 percent of New Zealand's energy supply. Despite this significant reduction, New Zealand's use of renewable resources still compares favourably internationally, to the IEA average of 3.9 percent (IEA, 1998).

The main non-renewable sources of energy used in New Zealand include oil, natural gas and coal. New Zealand has abundant sources of coal supplies (approximately 8.6 billion recoverable tonnes). Comparatively, gas and oil supplies are dominated by use of the Maui field, a field that is moving towards the end of its exploitable life²⁵. Oil currently provides around 32 percent of New Zealand's total primary energy supply, gas around 27 percent and coal around seven percent (MfE, 1997a). Combined, these fossil fuels accounted for about two-thirds of New Zealand's primary energy supply as presented by the indicator used in the "1997 *The State Of New Zealand's Environment*" report for **consumption of primary energy**. This indicator when considered in relation to a further indicator of **primary energy consumption per person** revealed that overall New Zealand's energy consumption has increased markedly since the 1950's. This growth (from 1980-1990's) is partly attributed to the development and expansion of a number of energy-intensive industries including aluminium smelting, steel making and the Taranaki based petrochemical industries which were all part of the Government's "Think-Big" strategy (MfE, 1997a).

As a result New Zealand's energy intensity has only really started to decrease since the 1990's (as revealed by the indicator **energy use and economic growth** (GDP)). By comparison energy intensity began decreasing in most other OECD countries since the 1970's oil crisis. The reduction in energy intensity in New Zealand is attributed to several factors, namely (MfE, 1997a):

- *a shift from energy intensive industries to less energy-intensive economic activity;*
- *technology uptake in a growing and increasingly competitive economy;*
- *a shift to fuel mixes which contain a relatively greater proportion of efficient fuels such as electricity;*
- *higher and increasing real energy prices;*
- *increased environmental awareness;*
- *policy measures to protect the environment; and*
- *an increased uptake of energy efficiency.*

To further analyse the consumption of energy within New Zealand, the MfE used an indicator of **energy consumption by sector** to illustrate and highlight changes that had occurred within the various energy sectors.

²⁵ The Maui field is expected to reach the end of its exploitable life by around 2004-2008.

This indicator revealed that energy consumption increased in all sectors between 1980 and 1995, with the greatest growth occurring in the transport sector.

The proportion of industrial energy consumption declined slightly in comparison to the agricultural and transport sectors, despite an actual increase of approximately 75 petajoules in energy consumption by this sector (MfE, 1997a).

In 1997, the MoC forecast that consumer energy would be likely to grow by around 45 percent between 1995 and 2020²⁶. Total consumer energy demand is also expected to increase by 1.5 percent a year, with growth strongest in the transport sector at 1.8 percent per year (MfE, 1997, MoC, 1997). To meet this additional demand, it is considered that new sources will be required (MfE, 1997a).

The MoC also predict that energy prices are expected to rise, with electricity prices growing the fastest because of the declining gas supply and the rising cost of building new power stations. Fossil fuels for power generation, transport and heating are also anticipated to become more expensive, as are oil prices, whilst coal prices are anticipated to remain stable (MfE, 1997a).

Whilst a range of broader, more aggregate measures were used to assist in the interpretation of the above described findings, a key determination of the *"1997 State of the New Zealand Environment"* report was the need for much better environmental information to show national trends and to provide a better information base for making decisions about environmental management (MfE, 1997a). Specifically, a lack of reliable environmental information was cited as being the main barrier to effective environmental reporting in New Zealand (MfE, 1997a). To assist in addressing this issue, the MfE (in corroboration with a number of other key agencies and organisations) initiated the **Environmental Performance Indicators** programme to develop a national set of environmental indicators.

4.1.4 Environmental Performance Indicators Programme

Obligations to collect information on the state of the environment are clearly outlined in the RMA. Under section 35 of the RMA, local authorities are required to gather information needed to carry out their specific functions. Local authorities are required under the RMA to monitor: the state of the environment in their area; the suitability and effectiveness of any policy or plan for their area; the exercise of any delegated functions, duties, and powers; and the exercise of resource consents in

²⁶ This prediction assumes a 3 percent GDP growth per year and new gas discoveries sufficient to provide around 90-100 PJ a year from 2010.

their area (MfE, 1999d). In addition, section 24 of the RMA, also requires the Minister for the Environment to monitor the effect and implementation of the RMA.

Despite the fact that there is a great deal of environmental information already being collected across New Zealand by a wide range of agencies, businesses, institutes and iwi's there currently still exists a number of deficiencies and/or differences²⁷ in the ways in which environmental information is gathered and reported (MfE, 1997, 1999d). Without addressing these deficiencies and/or differences translating the results of environmental effects at a local level and between local, national or international levels is problematic. This is because it is difficult to compare or have available consistent or complete sets of data for comparison or collation at a higher than local level.

To address this issue the MfE initiated the Environmental Performance Indicators (EPI) programme to develop a "toolbox" of environmental indicators for use in New Zealand. By drawing on and repackaging the wealth of existing environmental information (in particular that information pursuant to section 35 of the RMA) the programme is seen as providing a means to (MfE, 1999d):

- *summarise information on environmental trends at national and local levels*
- *help integrate environmental information management across resource issues, across administrative boundaries, and across science/policy boundaries*
- *promote more effective sharing of existing approaches, technologies, and knowledge between agencies*
- *improve access to and availability of environmental information for all resource managers, resource users, and the public at large.*

The EPI programme is directed towards developing a set of nationally standardised environmental indicators that can help assess the state of the environment and monitor outcomes of environmental policies and key legislation such as the **Resource Management Act** and the Government's **Environment 2010 Strategy**.

The regional, district and city councils are identified as having an important role to play in development and use of the EPI programme (MfE, 1999d). This role includes participating in selecting and implementing indicators, using agreed methods to monitor and analyse particular data, and using the data to meet management and reporting responsibilities (MfE, 1999d).

The EPI programme intends to build on much of the existing monitoring by local authorities,

²⁷ Deficiencies and/or differences identified by the MfE include: significant gaps in coverage over issues, including those over space and time, an unavailability of data, inaccessibility to data, inconsistent interpretation and application of data across local boundaries and resource users, and lack of linkage to policy objectives in RPS, regional and district plans.

central government agencies and iwi. The MfE also recognise the EPI programme may also require 'new' monitoring where it becomes apparent that existing information bases have gaps²⁸. For this reason, the MfE has decided to introduce its indicators in two stages. Stage one indicators have been chosen where current monitoring can provide data immediately, whilst stage two indicators are intended to be developed where gaps are identified in existing monitoring.

The MfE, along with many other countries has adopted the OECD's pressure-state-response model (PSR) as a framework for indicator development. However, like many other countries, the MfE have also decided to refine or modify the model due to its limitations²⁹. New Zealand has specifically modified the OECD's PSR model by incorporating the eleven priority issues³⁰ identified in the "*Environment 2010 Strategy*". This will enable the national indicators for New Zealand to be orientated towards focusing on indicators of the state of natural and physical resources and ecosystems and health, including indicators of community perception (MfE, 1996b).

The MfE identify a number of features that they consider are important determinants in the development of "ideal" or good environmental performance indicators. Such attributes include those also identified by the OECD, namely that indicators need to be simple and robust, policy relevant, and analytically valid. The MfE also consider that New Zealand's national environmental indicators need to be cost effective and easily understood (MfE, 1996b, 1998c). However given that it is unlikely that a single indicator to possess all of the above-described attributes, the MfE indicate that their focus for the programme will be to align with the Environment 2010 Strategy goals and the relevance of indicators to these priority issues (MfE, 1996b, 1998b). The MfE consider that in achieving this they will ensure that the indicators selected are as balanced as possible to the coverage and representative of the issues listed in the Environment 2010 Strategy. The generic process that the MfE has adopted in developing indicators is shown in Figure 7.

The toolbox of environmental indicators address the following issues: land, air, fresh water, climate change, ozone, marine environment, biodiversity, waste (including hazardous substances), transport, energy, pests, weeds and diseases, urban amenity and landscape values, toxic contaminants, and Maori. Work is now well underway with the EPI programme.

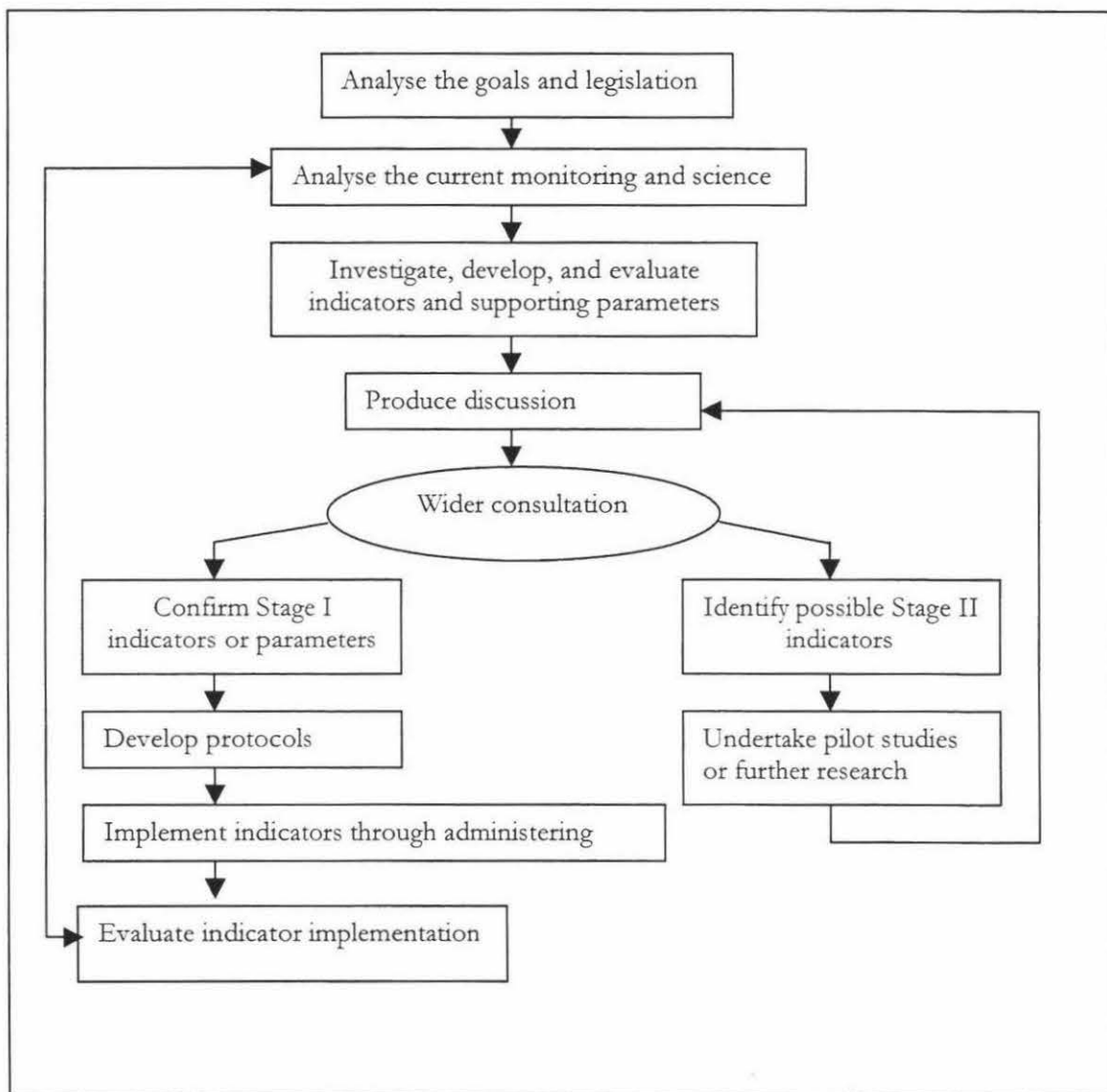
²⁸ The MfE consider many of these "gaps" are unlikely to be identified until the later stages of the EPI programme (MfE, 1999).

²⁹ The OECD model implies simple relationships exist in the interaction between human activity and environment, but in reality the real world is much more complex. Ecological relationships are rarely simple, and often there are difficulties in determining the natural variability of these systems. As a result there has been a number of refinements and/or modifications to the OECD's PSR model.

³⁰ No formal comparative risk analysis was undertaken to quantify or formally rank the priority issues identified in the Environment 2010 Strategy, however they were found to be consistent with issues of national significance identified in other national comparative risk analyses such as those conducted by the USEPA (MfE, 1996b).

The MfE has worked with a wide range of different people and organisations to develop and confirm indicators and has made progress towards moving into an implementation phase and the use of indicators for environmental reporting.

Figure 7: Generic Process for Developing Indicators



Source: Ministry for the Environment, 1998: Environmental Performance Indicators, Proposals for Stratospheric Ozone and Climate Change Indicators.

Achievements by the MfE made in respect of the EPI programme have included (MfE, 1999g):

- *piloted and initiated implementation of the air, fresh water and land indicators;*
- *piloted and initiated implementation of the ozone and climate change indicators;*
- *confirmed indicators for the marine environment, and biodiversity (including fresh water, terrestrial, and marine biodiversity);*
- *confirmed indicators for waste, hazardous waste, contaminated sites, and some toxic contaminants;*

- *developed draft indicators for transport;*
- *developed a discussion document on a proposed way forward with indicators of urban amenity values;*
- *developed a discussion document on a proposed way forward with Maori input into the EPI programme;*
- *recommended a system for future state of the environment reporting in New Zealand;*
- *completed a needs analysis of all users of the EPI information management system;*
- *provided advice on the institutional and policy arrangements for the preferred EPI information management system;*
- *piloted and trailed the preferred information system for air, ozone and climate change indicators.*

The Ministry's aim is to have a tool-box of core environmental performance indicators (including those for energy) available for use by the year 2000 (MfE, 1999d) to help in assessing the state of New Zealand's environment and the success of its environmental policies and laws. The MfE has indicated that it intends to develop a proposed set of **indicators for energy** by June 2000 (MfE, 1999d).

In terms of energy sector industry, because there is significant overlap of environmental effects that arise from the generation and use of energy by industry, a number of the indicators already developed by the MfE including those for climate change, fresh water, air, and waste. These indicators are also relevant to and interact with the activities of energy sector industries. For example, the **total emissions** indicator for climate change is a climate change policy indicator that measures New Zealand's net annual emissions of greenhouse gases. This particular indicator has been aggregated from a matrix of all the greenhouse gas that is modeled from New Zealand's national communications to the IPCC.

Energy sector industry feeds into this information as a contributor to the generation of these emissions and information pertaining to industry is provided via participation in Government initiated programmes such as the VA programme.

Other climate change indicators, such as the indicators that measure physical climate change (namely monthly average New Zealand temperatures and atmospheric concentrations of CO₂, CH₄ and N₂O) are less directly relevant in terms of their application to energy sector industry. This is because whilst these "state" indicators provide useful information in terms of measuring climate change, it is not possible to attribute specific underlying changes in their measurements to natural or anthropogenic causes. As such the climate change indicators are generally identified as being more appropriate national, rather than regional indicators (MfE, 1998c).

4.2 Ministry of Commerce

The Ministry of Commerce (MoC) is the Government's primary adviser on the operation of markets³¹ in New Zealand. The function of the MoC is based upon the broad recognition by Government that the future prosperity of New Zealand is dependent upon the achievement of economic growth through the ability of businesses to be internationally competitive.

The role of the MoC is to provide advice to Government on overall business and economic performance, the operations of specific markets (such as energy), regulations to improve the operation of these markets and consumer issues.

The MoC also develops policy on allocation and pricing of Crown minerals, deals with Treaty settlements involving natural resources and participates in a number of international energy-related forums with bodies such as the International Energy Agency. The MoC also manages a number of key energy related strategies of the Government, namely the **Voluntary Agreements** programme which was outlined in Government's **1994 CO₂ Policy Package**.

Within the MoC is the Resources and Networks Branch (RNB). The RNB consists of two directorates, the Resources Directorate and the Networks Directorate. These directorates have further subgroups (such as the Energy Policy Markets Group) and have distinct responsibilities for providing policy advice on resource management and network industries. The work of these directorates is focused at both an international level (which include regulatory issues such as energy security or climate change) and at a national level.

The Networks Directorate provides advice on energy markets that include electricity, gas and oil. The Networks Directorate also publishes energy statistics and forecasts (via the Ministry's Energy Modelling and Statistics Unit (EMSU)), and administers the electricity, gas and information disclosure regimes. The EMSU compiles statistical information on, and prepares projections of, energy supply and demand and greenhouse gas emissions from the energy sector. This work is required to fulfill New Zealand's international reporting obligations (such as to IEA) and to aid domestic policy development. Statistics for production, consumption and reserves on coal, electricity, gas oil and renewables are collected both by direct and indirect methods. For example, electricity, gas and oil data is collected directly from participants within the relevant industry, whilst coal and renewables data is collected indirectly via Statistics New Zealand (SNZ) and the Energy Efficiency and Conservation Authority (EECA).

³¹ The scope of this research has restricted the discussion of the MoC's roles and functions in relation to the energy-environment only.

By comparison, the Resources Directorate groups are responsible for providing advice from an economic perspective on resource use and environmental and conservation issues at both an international and national level.

Such environmental issues include (MoC, 1999a):

- *undertaking analysis of the effectiveness and efficiency of current and proposed environmental legislation, particularly the compliance cost imposed on business and the costs to the wider community;*
- *focusing on the implementation of the RMA, Hazardous Substances and New Organisms Act (HASNO), and the Ozone Layer Protection Act (OLPA);*
- *participating in interdepartmental policy development in relation to the Crown's environmental obligations such as the FCCC.*

Finally, while the allocation of Crown-owned minerals, including fuel minerals, is the responsibility of the Minister of Energy under the Crown Minerals Act (CMA) 1991, the Crown Minerals Group (GMG), a subgroup of the Operations and Risk Management Branch, is responsible for managing the Crown Mineral Estate. Their role is to ensure efficient allocations and charges are obtained for prospecting, exploration and mining rights. The CMG is also responsible for ensuring that a fair financial return is returned to the Crown.

4.2.1 Voluntary Agreements Programme

Voluntary initiatives of various types are a common feature of environmental and energy policies in most developed countries and are often successfully applied to energy efficiency and greenhouse gas reduction efforts at a low cost to both industry and Government (Jamieson, Pool 1999b).

The Government introduced the Voluntary Agreements (VA) programme as part of its CO₂ Policy Package in 1994. It was a non-legally binding agreement that was formed between Government (represented by the MoC) and various industries within New Zealand to reduce industrial emissions of greenhouse gases. The VA programme had no penalty imposed on it for non-performance. Rather participation in the programme was an acknowledgment of an industry's willingness to participate within the framework of the Minister for the Environment's policy statement of 21st July 1994 and the joint Ministerial statement of 4 August 1995 to reduce carbon dioxide emissions.

Unlike the "softer" process measures such as those made under the Energy-Wise Companies Campaign (refer to section 4.3.2 for further discussion), the VA programme was concerned with "hard" measures of CO₂ emitted and industry physical outputs. Thus, the VA programme was intended to specifically target the small number of large energy-intensive companies and sectors. A list of the participants in the VA programme including the CO₂ emissions reductions as identified

in their various voluntary agreements and the approximated projected CO₂ mitigation in tonnes is included in Appendix 1.

The 23 signatories to the VA programme include most of New Zealand's large energy-using industries as well as the main electricity, gas and coal producers. These signatories are:

- ACI New Zealand Glass Manufacturers,
- BHP New Zealand Steel (steel production),
- Coal Research negotiated contracts (miscellaneous coal consumers)
- The Cement Industry,
- (*prior to separation*) Electricity Corporation of New Zealand (electricity generation),
- Carter Holt Harvey (timber processing/pulp and paper manufacturing³²),
- The Dairy Industry,
- New Zealand Dairy Group (dairy processing),
- The Meat Industry,
- Methanex (methanol and synthetic gasoline production),
- New Zealand Aluminium Smelter/Comalco (aluminium smelting),
- New Zealand Sugar Company (sugar manufacturer)
- New Zealand Refinery Company (oil refining),
- Petrochem (ammonia urea plant),
- Solid Energy (coal production),
- The Natural Gas Corporation of New Zealand (gas production and distribution),
- Shell Todd Oil Services (oil and gas production),
- Winstone Wallboards (wood panel production).

The primary responsibility of the implementation of the VA programme was entrusted to the MoC. The MoC were charged with producing a 'framework definition' that laid out the Government's requirements for VA's and for taking a lead role in implementing and monitoring the programme. In addition to this, EECA also provided assistance to the VA programme by initiating a joint industry/Government Technical Working Group to develop and agree on a general methodology for the potential signatories to use in calculating their emissions targets and savings (Pool, Jamieson, 1999a). This work resulted in the development of a *Technical Guideline* that was based upon energy accounting methods developed in Canada for the Canadian Industry Programme for Energy Conservation (CIPEC), but modified for use in New Zealand (MoC, 1995, Pool, Jamieson, 1999a).

³² The Tasman Pulp and Paper Mill (owned by Fletcher Challenge) was also targeted as part of the VA programme, but an agreement between this company and the Government was not finalised.

However, some signatories, such as ECNZ, found the *Technical Guidelines* impracticable to use because of their unique circumstances. For example, ECNZ considered that in order to develop a meaningful measure of output they had to accurately factor out the effects of weather changes from year to year. To address these issues, the MoC agreed that application of the *Technical Guideline* would not be mandatory so long as other methods used did not produce a more favourable outcome than if the standard methodology outlined in the guideline had been used (Pool, Jamieson, 1999a).

Twenty-three VA's were subsequently signed between 1995 and early 1998 between the MoC (on behalf of the Government) and the company or industry signatories listed above. The signatories also included several smaller emitters (for example, from glass manufacturing) who opted to voluntarily participate in the VA programme.

The basic commitment by VA signatories was to mitigate on-site CO₂ emissions or those under their direct control and report these against a (weighted) 1990 base year equivalent emission level. The programme requires VA signatories to focus on the negotiation of specific emission targets, identify how their CO₂ targets would be achieved or planned and to monitor and report their progress against these targets. There was also a requirement for signatories to accept independent validation (by EECA) of the 1990 base year data and of subsequent data and the annual reports. All VA's also contained provisions for re-negotiation if changing circumstances made the targets unachievable.

At the time the VA's were signed, signatories anticipated a 32 percent growth in their physical outputs between 1990 and 2000. However, due to slow growth since 1994, the signatories actual CO₂ emissions in 2000 are now likely to increase much less than the 14.4 percent projected when the agreements were signed (Jamieson, Pool, 1999b). To 1998, the results from the VA programme indicate that 1,696,000 tonnes of CO₂ emissions have been mitigated by the VA signatories. In other words, had the VA signatories produced their 1998 physical outputs using their 1990 plants' CO₂ emission factors, then they would have emitted an additional 1,696,000 tonnes of CO₂ (Jamieson, Pool, 1999b). However, despite these "CO₂ savings", it is not clear whether this result can be directly attributed to the VA programme itself. These "savings" may have arisen because industry has been motivated by other factors, such as cost savings, or due to other competitive reasons such as the threat of a carbon tax.

A major factor that inhibits attributing particular causal factors and the wider use of data gathered from the VA programme is the limited reporting requirements placed on VA signatories. Currently, VA signatories are under no obligation to do more than report progress (for example, tCO₂ per unit of output) and in some instances that is all that is provided (pers. comm. Jamieson, 1999).

Because underlying information such as fuel use and product data is currently only required to be made available for audit purposes and not for analysis by the Ministry under the VA programme, the data collected from the VA signatories does not in all instances provide a good disaggregated measure of energy use.

Without Government placing more detailed reporting requirements on the signatories it will continue to be difficult to attribute any specific changes in industrial energy use to the VA programme itself. This is because under the current reporting requirements it is impracticable to combine the signatories reported results to show an overall out-turn for the programme as a whole (Jamieson, Pool, 1999b). However, the MoC estimate this (using a number of assumptions) because of the lack of data available.

Despite the problems that exist with the VA programme, the experience of the programme has confirmed that this type of commitment programme is appropriate for the large energy-intensive industries for which it was intended. In addition, the programme has also shown that industries can, and do, deliver ongoing efficiency improvements in a voluntary context as seen by a decrease in the tCO₂ per unit of output reported by the VA signatories (Jamieson/Pool, 1998b). However, if voluntary initiatives are to make a serious contribution to meeting more ambitious national and international targets in the period leading up to the first Kyoto commitment period, a new generation of programmes that are more stringent and effective will be needed. Such measures may include ensuring better harmonisation of reporting by utilisation of a consistent and mandatory accounting methodology or improving the information base upon which negotiation of targets is established (Jamieson/Pool, 1998b).

4.3 Energy Efficiency and Conservation Authority

In 1992 the Government established an independent agency called the Energy Efficiency Conservation Authority (EECA). Its primary role was to improve the way New Zealand uses energy through a range of practical initiatives that promote energy efficiency and new renewable energy sources to contribute to better business performance, productivity and competitiveness and also wider economic, social and environmental benefits for New Zealanders as a whole.

EECA's major functions are to (EECA, 1999b):

- *Develop, implement and promote strategies for energy conservation;*
- *Advise the Government and the New Zealand energy industry on matters relating to the development, implementation and promotion of conservation strategies;*
- *Monitor known energy sources, their use, and the investigation of potential sources and applications, together with the economic, social and environmental impacts, in both the short and long term.*

EECA seeks to achieve the above-described functions wherever possible through partnerships and alliances, acting as a catalyst for greater uptake of energy efficiency throughout the economy. EECA also provides the Government and the wider energy industry with policy advice and analysis on energy efficiency and renewable energy issues, as well as monitoring and analysing trends in energy use and potential new sources of energy.

EECA is also charged with the responsibility for implementing a number of Government initiatives, including the **Government's 10-point strategy for Improving Energy Efficiency**, the **Energy Saver Fund**³³, the **Energy Wise Companies Campaign** and the **Energy-Wise Councils Partnership Programme**.

Other ways in which EECA also translates the information it gathers on energy uses in New Zealand is through the **EECA Energy Use Database**. The EECA Energy Use Database provides detailed quantitative information on the processes which convert delivered energy types to various end-uses, across 33 sectors encompassing the entire New Zealand economy (EECA, 1998). Much of this information is communicated through its publications such as the **Energy Wise Monitoring Quarterly**. This publication aims to (EECA, 1998):

- *Report on the progress of energy efficiency in various sectors;*
- *Disseminate energy efficiency information and trend analyses;*
- *Assess and explain short and long term fluctuations in energy use; and*
- *Foster public debate on energy efficiency issues.*

The Government's 10-point strategy for improving energy efficiency, the Energy Wise Companies Campaign and the Energy Wise Councils Partnership Programme are now discussed further.

4.3.1 The 10-Point Strategy for Improving Energy Efficiency

The Government's 10-point strategy was launched in 1994 and is focused on implementing a range of practical measures to increase energy efficiency and encourage the development of non-traditional energy sources. A number of the strategies identified are of particular relevance for energy industries, including (EECA, 1999b):

- *The development of minimum energy performance standards for a range of domestic and industrial technologies, including hot water systems and electric motors;*
- *Programmes to improve energy use in existing applications, including hot water use, commercial lighting, and industrial and variable speed drives;*

³³ The Energy Saver Fund is a domestic sector initiative and is therefore not discussed further.

- *Implementation of a “Best Practice” programme to assist industry to improve energy management techniques;*
- *Partnerships between EECA and industry, schools and hospitals to improve energy use these sectors;*
- *Assessment of New Zealand’s overall research and development needs for new forms of renewable energy such as wind, biomass and solar power;*
- *Assistance with the proving of new energy efficient and renewable energy technologies, and increased provision of information to industry, architects, engineers and local authorities on the means of achieving energy efficiency and sustainable energy use;*
- *A project to improve the collection and evaluation of data about energy use and the potential for savings.*

4.3.2 Energy-Wise Companies Campaign

In August 1994, and prior to the VA programme, the “Energy Wise Companies Campaign” was launched. The Energy Wise Companies Campaign (EWCC) was focused on process orientated issues (such as energy efficient practices and technologies) and was aimed at promoting a commitment to energy efficiency and establishing effective partnerships between the Government and private sector. Unlike the VA programme, the EWCC was not specifically targeted at any organisations of a particular size or type although EECA did target a number of higher profile industries to raise and establish the campaign’s initial membership of about 50 organisations. The main features of the EWCC are (1999b):

- (a) *a public commitment to energy management by company chief executives through endorsement of a common charter of principles namely:*
- *The establishment of a corporate policy on energy efficiency;*
 - *Establishing targets for improved energy performance;*
 - *Reporting energy performance changes and improvements to employees and, where appropriate shareholders;*
 - *Monitoring and evaluating energy usage levels;*
 - *Improving awareness of energy efficiency among employees;*
 - *Establishing accountability for energy management;*
 - *Considering economic investment opportunities in energy efficiency;*
 - *Ensuring energy efficiency considerations are taken into account in major (new or retrofit) building and factory construction projects;*
 - *Incorporating energy management into wider business or quality improvement processes.*
- (b) *support from and participation of energy suppliers;*
- (c) *endorsement of the campaign by the Ministers of Energy, Commerce and Environment;*
- (d) *support from major business, consumer and environmental organisations;*
- (e) *practical information;*

- (f) *advisory and secretariat support from EECA;*
- (g) *annual awards to companies making the most significant improvements in energy efficiency.*

The EWCC now represents a high proportion of New Zealand's industrial and commercial energy use having recruited over 700 organisations since the inception of the programme. Incorporated into these 700 organisations are 29 regional, district and city councils that have also joined the EWCC. These authorities account for approximately 38 percent of all local authorities within New Zealand that have responsibilities under the RMA.

Participation by regulatory authorities in this programme is seen as appropriate as the EWCC provides resources and information that is equally applicable to councils as it is to business. However, full or immediate implementation of the key principles (as shown in bullet point (a) above) was not considered a requirement of membership or seen as being a practical response for some of the smaller organisations that elected to participate in the programme (pers. comm. Energy Efficiency and Conservation Authority).

EECA requests the members to voluntarily report on an annual basis, the progress they have made towards implementing the principles, and currently some 200-250 organisations do so. Analysis of the results reported by companies who have voluntarily reported on their progress indicate that up to 60 percent of all of the key principles have been taken up. This is substantially higher than that reported for a control sample of non-members (Jamieson, Pool, 1999b). In addition an ongoing improvement rate in energy efficiency of four percent per annum is reported as being achieved by the member companies (Jamieson, Pool, 1999b).

Like the VA programme, the EWCC has positively demonstrated that such programmes can deliver ongoing efficiency improvements within a voluntary context. However, despite the demonstrable successes of these programmes, capitalisation of some of the common features that exist between them and/or better integration between the two programmes is also seen as creating further opportunity to enhance their overall effectiveness.

4.3.3 Energy-Wise Councils Partnership Programme

The Energy-Wise Councils Partnership Programme (EWCPP) was launched in July 1997. The purpose of the EWCPP is to improve energy efficiency, energy conservation and enhanced renewable energy supply and use, consistent with sustainable management of natural and physical resources.

The EWCPP is therefore an agreement between central government (through EECA) to develop, trial and refine a number of principles which include (EECA, 1999a):

- *Implementation of the EWCC's Charter of Key Principles in their own internal energy management systems;*
- *Inclusion of energy efficiency objectives and performance measures in their Annual Plans;*
- *Ensuring that improved energy efficiency and enhanced, appropriate renewable energy supply and use are explicitly considered in Council policy development and planning activities, particularly as part of decision making processes relating to transport, water supply and waste management;*
- *The development of an urban that contributes significantly to energy conservation, energy efficiency and sustainability;*
- *Establishing or confirming criteria for project evaluation, such that energy efficiency, energy conservation and appropriate renewable energy projects are assessed on equal terms with other projects in a way which considers the financial, environmental and social costs and benefits from improved energy efficiency and the greater use of appropriate renewable energy;*
- *Identifying mechanisms to address energy efficiency and renewable energy issues in their wider communities;*
- *Preparing and exchanging reports between member Councils on their own case studies of energy efficiency and renewable energy initiatives;*
- *Preparing and exchanging reports on benchmark energy performance data and progress made to improve energy efficiency and renewable energy initiatives; and*
- *Sharing their experience with other Councils and support EECA in the facilitation of the Partnership to improve energy efficiency and renewable energy in the local government sector.*

The EWCPP currently consists of eight Councils that are derived from City, District and Regional Councils and it is a pre-requisite of the Energy-Wise Councils Partnership that member councils are also Energy-Wise Companies Campaign members (pers. comm. Energy Efficiency and Conservation Authority). Participants in the EWCPP include (EECA, 1999a):

- *Auckland Regional Council;*
- *Auckland City Council;*
- *Canterbury Regional Council;*
- *Christchurch City Council;*
- *Hamilton City Council;*
- *Nelson City Council³⁴;*
- *Waitakere City Council; and*
- *Wellington City Council.*

³⁴ Nelson City Council is a unitary authority with responsibilities for both regional and district functions.

EECA view Council partnership as important because of the fact that energy use pervades most aspects of Councils' activities in their provision of community services and by their environmental planning and management, such as those functions delegated under the RMA (EECA, 1999). Such an example includes considering energy efficiency in consenting applications.

The EWCPP recognises that Councils are in a position to promote improved energy efficiency, energy conservation and the greater supply and use of appropriate renewable energy sources throughout their communities. However, participation in the EWCPP also has potentially wider implications for Councils because it can assist them in their efforts to achieve the objectives of national and international legislation and agreements such as the Resource Management Act, Agenda 21, the Framework Convention on Climate Change. Despite these advantages approximately only 13 percent of regional authorities and seven percent of territorial authorities are members of the EWCPP. Attributing factors to this low participation include³⁵:

- (a) The EWCPP appears to be directed towards high energy use territorial authorities;
- (b) General unawareness of EWCPP programme;
- (c) Organisational reluctance to commit to energy audit, waste audit;
- (d) Awaiting presentation from EECA on EWCPP
- (e) Not considered a high priority;
- (f) More cost than benefit to the region;
- (g) Already involved in the EWCC

4.4 Statistics New Zealand

Statistics New Zealand (SNZ) is the major source of official statistical information within New Zealand. SNZ annually compiles statistical information (including that for energy use) into a *'New Zealand Official Yearbook'*. In doing this SNZ enables a robust and consistent chronicle of New Zealand's economic and social progress to be officially recorded for the benefit of all New Zealander's.

SNZ gathers a myriad of energy statistics. The following provides a synopsis of some of the key energy indicators that are used in the *'Energy and Mineral Section'* of the *'New Zealand Official Yearbook'*. These include indicators of (SNZ, 1998):

- *Total Primary Energy Supply;*
- *Energy Intensity;*
- *Total Energy Consumption;*
- *Fuel Share;*

³⁵ All regional authorities who were not a member of the EWCPP were asked to provide comment as to the main reasons for their organisation not participating in the EWCPP. Refer to Appendix 3 for a full list of responses.

- *Sector Consumption of Electricity;*
- *Annual per capita end-use.*

and comments shown in *italics* next to the indicator are SNZ's findings for the year ended September 1998.

Total Primary Energy Supply (TPES) is the amount of energy available for use in New Zealand for energy conversion and end-use. *The amount of energy available in New Zealand for energy conversion and end use in New Zealand was 683.71 petajoules (PJ). Renewables such as hydropower, wood and wind contributed 207 PJ or 29 percent to New Zealand's total primary energy supply in 1997. Hydro and geothermal contributed more than half of this energy supply. Total biomass (wood and wood products) and animal products provided the next largest renewable contributions. "Wastes" and biogas and wind provided small contributions. By comparison oil, which includes condensate, crude oil and oil products accounted for 230 PJ (33 percent) of primary energy (SNZ, 1999).*

Energy Intensity is determined by measuring the energy use per dollar of GDP. *SNZ report that despite New Zealand having one of the highest energy intensities of the OECD countries, New Zealand this indicator has been steadily decreasing since 1992 (SNZ, 1999).*

Total energy consumption (TEC) differs from total primary energy supply in that it excludes energy transformation losses and non-energy uses. Non energy uses include the manufacture of methanol or ammonia/urea from natural gas. *TEC for 1998 was 420 PJ (SNZ, 1999).*

Consumer Energy is the energy used by final consumers. Consumer energy is monitored in two ways, as actual consumer energy (including that consumed by the agricultural, industrial, commercial, domestic and transport sectors) and as calculated consumer energy. Calculated consumer energy is equivalent to the total primary energy supply minus the total transformation (or conversion) losses minus non-energy uses. *New Zealand's consumer energy is dominated by oil, comprising 204.27 PJ per year (48 percent), with electricity 112.40 PJ (27 percent), coal 31.84 PJ (8 percent), gas 31.39 PJ (8 percent), and renewables such as geothermal, wastes and wood making up the remainder. Domestic transport dominates the consumer energy use of petroleum products, with 170 PJ (or 84 percent) of oil consumption used for transport, 71 percent of this for road transport. Annual per capita end use of petroleum products is 54 GJ (or about nine barrels or 1,430 litres). By comparison, for the year to March 1998 the main end users of coal in New Zealand were electricity generation (including cogeneration) 40 percent, iron and steel 26 percent, other industry (mainly cement, lime and plaster, meat, dairy products, forestry and timber products) 24 percent, commercial 8 percent and residential 2 percent. (SNZ, 1999).*

The **fuel share (or mix)** looks at how electricity demand is met in New Zealand. *Around 75 percent of New Zealand's electricity demand is met by renewable resources, mainly hydro (about 67 percent in 1997) and geothermal (5 percent). Over two-thirds of hydro electricity is generated in the South Island, and all geothermal electricity is generated in the North Island. The balance is met by natural gas (22 percent), coal, wind and landfill gas (SNZ, 1999).*

Despite the industrial sector having the highest **sector consumption of electricity** the residential sector paid almost twice the amount per kilowatt-hour (kWh) for electricity than the industrial sector. However, this appears to be a typical phenomenon for industry in most developed countries. *(Industry was the largest electricity-using sector for 1998. This consumption is primarily attributed to the aluminium smelter, iron and steel works, and several pulp and paper mills and large dairy factories. These industries accounted for some 45 percent of electricity usage in 1997 compared to the household sector (35 percent) and commercial applications (20 percent). By comparison **annual per capita end use** was 31 GJ (SNZ, 1999).*

In addition to the indicators presented within the *New Zealand Official Yearbook.*, SNZ also provide comments on the policy frameworks for energy, research and development funding, future energy scenarios, and the developments within the energy sector.



The Local Context

Energy is included within the definition of natural and physical resources under the Resource Management Act. However, the extent of the role that local government authorities have in terms of energy management is limited by section 5(2)(a) of the Act. This means that local functions are generally limited to controlling the adverse environmental effects associated with energy supply and use.

Regional authorities are required under the RMA to prepare Regional Policy Statements to articulate the key issues and priorities for their particular region by interpreting sustainable management and applying it to their regions biophysical and socioeconomic characteristics.

5.0 Introduction

The second tier of government that operates within New Zealand is that of local government. Local government consists of both regional and local (or territorial) authorities, however in some instances, such as in the Nelson District, the Council may be a unitary authority and conduct both regional and district responsibilities. As with Government, the members of local government are also democratically elected every three years.

The Resource Management Act (RMA) completely restructured regional and local governmental agencies and laws that related to the environment. It divided local governmental units into sixteen regions, based on watersheds and their ecosystems, and districts, based on communities and their surrounding areas. Local government now carries much of the day to day responsibility for environmental management within New Zealand and this in part allows for the integration of policy both politically and administratively within each district.

Under the Resource Management Act, regional, district and/or city councils are required to develop resource management policies and plans. A full listing of the regional authorities within New Zealand, including the status of their respective Regional Policy Statement is included in Appendix

2. Section 32 of the RMA also requires these authorities to find the most cost-effective means of achieving sustainable management of resources in their communities.

Regional councils are charged with coordinating, and setting policy for resource management, including water and soil conservation, and transport. Regional authorities are required under the RMA to prepare Regional Policy Statements (RPS) to articulate the key issues and priorities for their particular region by interpreting sustainable management and applying it to their regions biophysical and socioeconomic characteristics.

In addition to the RPS, they can also prepare Regional Plans however there is no mandatory requirement to do so. Regional Plans are intended to deal with specific resource issues that a Council may consider require more detailed policies. All regional policies and plans must be consistent with and reflect national policy statements and standards, and must uphold the principle of sustainable management.

By comparison, District (or territorial) authorities are based on communities and their surrounding areas, and each is required under the RMA to also promulgate its own District Plan. District Plans must be consistent with the relevant RPS for that area. District Plans have policies relating those areas for which district authorities have responsibility, namely the integrated management of the effects of land use, subdivision, the control of noise emissions, and the effects of activities on the surface of water in rivers and lakes.

For the purposes of this research Regional Policy Statements have been considered but District Plans have not. This is for the following reasons:

- (a) District Plan cannot be inconsistent with the Regional Policy Statements;
- (b) The range of energy sector industries considered within this research, are already established activities. It is therefore unlikely that any of these industries will come under the ambit of controls designated to territorial authorities unless an industry undertakes an activity that requires a new land use consent;
- (c) Should the situation described in (b) arise, the conditions applied to land use consents (with the exception of noise) are generally quite static in nature. By comparison, the functions designated to regional authorities (for example, discharges to air and water) are more conducive for capturing, if only via indirectly, the range of effects that arise from energy use. For example, a regional authority may impose reporting requirements on air discharge permits to include:
 - (i) a provision for industry to regularly report on their annual emissions; and/or
 - (ii) a requirement for industry to provide information pertaining to any voluntary agreements that the industry may have to reduce carbon dioxide emissions; and/or

- (iii) methods that the industry has taken to reduce or mitigate the types of emissions released from their industry. By default this latter issue often also captures the ability of an industry to improve their energy efficiency.

Thus, the functions designated to regional authorities, be they via the use of methods specifically described in the energy section of the RPS or indirectly via other sections of the RPS that inter link with energy use (for example, discharges to air or water) are more likely to capture the types of data that supports aggregated measures of energy consumption and use.

It should also be noted that no regional authority has, or plans to, develop a regional plan that specifically address energy (Refer to responses from all regional authorities in Appendix 3).

5.1 Regional Policy Statements

As previously mentioned, the purpose of a RPS is to provide an overview of the resource management issues for a particular region. Section 62 of the RMA requires a Regional Council to set out the significant resource management issues for their region.

All of the sixteen regions that have either adopted or are in the process of adopting their RPS under the RMA, have identified **energy** as being a **significant resource management issue** for their region.

Section 62 of the RMA also ensures Regional Councils in developing their RPS take a consistent approach. Section 62 requires a RPS to include **objectives, policies, methods of implementation and anticipated environmental results**. However 'objective', 'policy', 'method' and 'anticipated environmental result' are not defined within the Act and are left to the discretion of the particular regulatory authority to determine.

Objectives essentially comprise of a desired result and provide justification for inclusion of a particular topic. In developing their RPS, a Regional Council is also required to consider the policies and methods that will be used to achieve their identified objectives. Policies are courses of action that will be used to achieve the desired result whilst the methods are the practical action by which the policy will be implemented. An explanatory note is usually also included to indicate the principle reasons for inclusion of the objectives, policies and methods. Finally, the anticipated environmental results are outlined so that the community can identify with the outcomes that they can expect to see or experience as a result of the implementation of the policies and the methods.

The following provides a synopsis of each of the sixteen regions individual approaches to energy within New Zealand, as outlined in their respective RPS. Feedback from the various regional authorities is also included throughout the text to provide status in respect to the specific energy issues, policy objectives, and methods outlined in their respective RPS for energy sector industry. A complete summary of the responses sought from the various regional authorities is included in Appendix 3.

Approximated values for energy generation and consumption for each region are also provided for comparative purposes. However, it should be noted that:

1. All primary energy and electricity consumption and generation figures reported within this section, are approximated, averaged, annual values for the period 1996 to 1998;
2. The proportion of electricity generated from hydro-electric facilities varies with rainfall and thus the figures reported are representative of the typical amount of electricity generated during the period 1991 to 1997;
3. Electricity generation facilities discussed within the context of this section are from sources that produce greater than 1 petajoule (PJ)/annum only;
4. Primary energy sources, such as biomass, wood and waste, which cannot be specifically allocated to a region are reported in this section as 'other', and are discussed separately.
5. Assumed efficiencies for electricity generation are: geothermal (10 percent), thermal (34 percent), hydro and wind (100 percent) and cogeneration (30 percent). This is consistent with the efficiency figures used by Statistics New Zealand (SNZ) in the preparation of their annual official yearbooks.
6. Industrial energy consumption figures are approximated values for the 1998 calendar year and include the following fuel sources: gas, coal, oil, electricity, wood and geothermal. The figures reported in this section differ from those reported by SNZ in their "*1998 Energy Balance*" because petrochemical and refining energy usage is included as industrial consumer demand. SNZ treats these energy demands as *Non-Energy Use* and *Losses/Own Use* respectively. The figures reported in this section for industrial energy consumption have excluded the energy used for generating electricity (consistent with the "*1998 Energy Balance*") however, energy used for electricity generation via cogeneration facilities has been included. A summary of the approximated industrial energy consumption figures for industry, by region, along with the "*1998 Energy Balance*" is included in Appendix 4.

5.1.1 Northland

Northland has one Regional Council: Northland, and three District Councils: the Far North, Kaipara and Whangarei. The Northland RPS became operative on the 31st March 1999.

Located within the Northland region, is the Marsden Point Oil Refinery, a nationally important energy processing facility. This facility is New Zealand's only oil refinery and refines approximately five million tonnes (NZRC, 1996) of imported and locally sourced crude oil on behalf of four major New Zealand Oil Companies, namely BP, Caltex, Mobil and Shell.

With the exception of the Ngawha geothermal facility, there are limited primary energy sources that are currently utilised within the Northland region. The Ngawha geothermal field supplies approximately three petajoules (PJ) per annum of primary energy (CDES, 1999) which is used for electricity generation.

The Northland region accounts for approximately 3.7 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately three percent of New Zealand's total electricity usage. Consumer energy used by the industrial sector in the Northland region is approximately 21 PJ or nine percent of New Zealand's total industrial energy consumption.

Significant energy related issues that have been identified for the Northland region include (NRC, 1999):

1. *The high degree of reliance in Northland on non-renewable fossil fuels and the environmental effects of their use, particularly greenhouse gases.*
2. *The high degree of reliance on energy imported into the region and public support for greater self-sufficiency, using the renewable resources of the region, such as solar, wind and water resources.*
3. *The desire for greater energy efficiency and associated conservation measures.*
4. *The impacts of high voltage transmission on the landscape and possible effects on human health.*
5. *The potential conflict between the use of geothermal and other water resources for energy generation and their cultural, spiritual and ecological values.*

To address these issues the Northland RPS identifies three objectives in respect of energy. The first objective recognises the energy production potential of Northland's natural resources and recognises that their possible use needs to be allowed for in resource management decision making. The second objective is linked to the first in that whilst it recognises some "new" energy sources are desirable for the region some are not. For example, the Northland RPS prohibits energy production from nuclear sources. Finally the third energy objective recognises that energy efficiency measures must be promoted to conserve non-renewable energy resources and reduce undesirable impacts of energy generation and use.

To achieve these objectives the Northland RPS identifies four policies and a number of methods by which the policies may be implemented. There are three policies that have been identified for energy production, transmission and distribution.

These are (NRC, 1999):

1. *To encourage the use of environmentally acceptable sustaining energy resources;*
2. *To encourage the consideration of alternatives to non-renewable energy sources in resource management making;*
3. *To ensure that energy generation and transmission facilities are sited, designed and operated safely and efficiently and to avoid, remedy or mitigate any adverse effects on the environment.*

and one policy for energy efficiency (NRC,1999), this being:

1. *To ensure that energy efficiency is considered in the development and use of natural and physical resources.*

The methods by which the Northland Regional Council has indicated that the first three policies will be implemented mainly include advice regarding Acts and regulations and the provision for rules in Northland's district and regional plans that do not "restrict" the use of renewable and environmentally sound energy sources. The methods of implementation are also orientated towards ensuring Council does not discourage growth or promote outcomes that are not well justified in terms of other desired environmental results. For example, the Northland RPS prohibits certain activities that the region has deemed unacceptable and has a requirement for applicants to demonstrate that possible alternatives for have been considered.

The methods by which the Northland Regional Council has indicated that energy efficiency will be addressed are similarly focused on the provision of rules within regional and district plans. These rules encourage energy efficiency through a variety of measures with particular emphasis being given to the building, industrial and transportation sectors.

As at December 1999 the Northland Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Northland RPS. In addition, the Northland Regional Council has not adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry (pers. comm. Northland Regional Council)

In achieving the policies, methods and objectives for energy in the Northland RPS, the Northland Regional Council anticipates the following environmental results (NRC, 1999):

- *Increased use of environmentally acceptable, sustainable energy resources.*
- *Enhanced extent to which the adverse effects on the environment of Northland of energy generation, distribution and use are avoided remedied or mitigated.*

5.1.2 Auckland

The Auckland Region has one Regional Council: Auckland, and seven District Councils: Rodney, Franklin, Papakura, District Councils and Auckland, North Shore, Waitakere, and Manukau City Councils. The Auckland RPS became operative on the 31st August 1999. However, as no significant changes³⁶ were made to the energy section of the Proposed Auckland RPS (1998) prior to the RPS becoming operative, the Proposed RPS was considered relevant for the purpose of this research.

The Auckland region is a major consumer of the country's electricity usage, accounting for approximately 24.8 PJ/annum of electricity (DUS, 1999), which is equivalent to approximately 22 percent of New Zealand's total electricity usage. Consumer energy used by the industrial sector in the Auckland region is approximately 27 PJ or 11 percent of New Zealand's total industrial energy consumption.

Currently, there are no primary energy sources in the Auckland region that produce more than 1 PJ/annum. Most of the electricity consumed within the Auckland region is actually supplied from other parts of the country. As a consequence there is a heavy reliance on importation of electricity along with petrochemicals, gas and coal for the region.

Currently, there are two sizable gas-fired thermal electricity generation facilities within the region. These are Southdown, which is operated by TransAlta, and Otahuhu, which is operated by Contact Energy. The Southdown cogeneration facility generates approximately 3.5PJ/annum of electricity (TransAlta, 1999a) providing approximately 13 percent of New Zealand's gas-fired thermal electricity generation. In addition, (and despite a number of commissioning problems), Contact Energy's Otahuhu gas-fired combined cycle power facility has the potential to further contribute approximately 10 PJ/annum of electricity (Contact, 1999). Given the consumption rates in the Auckland region, the continuance of availability of a reliable supply of energy, in both primary and secondary forms is an important cross-boundary issue that is fundamental to the economic and social well-being of the region (ARC, 1995).

Significant energy related issues that have been identified for the Auckland region include (ARC, 1995):

1. *More efficient use needs to be made of energy;*
2. *Because of the high dependence on non-renewable fuels, the present use of energy is not sustainable;*

³⁶ Only minor changes were made to the Energy Chapter - Chapter 5. There was only one change made to the Chapter as a result of appeals. This change was an amendment to the wording of Method 5.4.2.4 so that it reads "The ARC will advocate energy conservation and the adoption of energy efficient practices".

3. *The existing form of urban development in Auckland, including the associated transportation system, is not sustainable in terms of current energy use;*
4. *The production, distribution and use of energy is essential for the development, well being and prosperity of the Auckland Region and there would be major socio-economic impacts should, for any reason, the supply of energy be curtailed. However, the production, distribution and use of energy may have adverse effects on the natural and physical environment and some of these effects may be great;*
5. *The deregulated energy market and the pricing regimes of local energy supply entities do not necessarily encourage the efficient use of energy.*

To address these issues, the Auckland RPS identifies two objectives in respect of energy. The first objective addresses the need for the sustainable use of energy resources, and the efficient use and development of energy resources. The second objective is aimed at avoiding, remedying or mitigating adverse effects of development proposals related to the production, distribution and use of energy.

To achieve these objectives the Auckland RPS identifies policies and methods by which these policies may be implemented. There are three policies that have been identified to address the first objective. These are (ARC, 1995):

1. *More efficient use shall be made of available energy resources by:*
 - (i) *promoting a reduction in the wasteful use of energy;*
 - (ii) *promoting the application of energy efficiency;*
 - (a) *in the manufacture and use of construction materials;*
 - (b) *in building design and site layout;*
 - (c) *in the design and operation of transport vehicles;*
 - (d) *in domestic and residential situations;*
 - (e) *in business and commercial situations;*
 - (f) *in production processes and industrial situations.*
 - (iii) *promoting the application of other relevant energy conservation and efficiency measures.*
2. *Renewable energy sources shall be encouraged by:*
 - (i) *promoting alternatives to the use of non-renewable fossil fuels;*
 - (ii) *promoting energy production from the Region's renewable energy assets, if such production is consistent with the provisions of the RPS.*
3. *An urban form, supported by transportation systems, which improves efficiency and conservation in energy use, shall be promoted.*

The Auckland RPS identifies a wide range of methods that it will utilise to implement the objective and related policies in respect of the sustainable use of energy.

These mainly detail methods that are non-statutory in nature, including:

- Support the role of EECA in providing to all sectors in the community, advice and information on energy efficiency and conservation;
- Endorsement and promotion of EECA's findings in order to increase the public's awareness of renewable energy sources;
- Advocacy and promotion of energy conservation and efficiency measures;
- Leading by example in energy conservation and efficiency practices;
- Advocacy to relevant organisations [for] the adoption of pricing structures that recognise energy efficient practices and energy conservation;
- Establishment of a regional energy forum to bring together energy interest groups of the Region;
- Advocacy to central government to develop a national energy strategy/statement;
- Supporting the proposal by the Ministry of Transport to produce a National Land Transport Policy Statement;

Statutory methods also include the preparation of policies and rules within its District Plans and strategies, for example via mechanisms such as the Auckland Regional Land Transport Strategy.

In addition, the Auckland RPS also identifies two policies to address the second objective. These are (ARC, 1995):

1. *Assessment of environmental effects for energy generating and transmission proposals shall, where necessary, be carried out in accordance with the requirements of the Fourth Schedule of the RM Act and any relevant provisions of the RM Act.*
2. *Nuclear powered ships and the construction of nuclear power stations shall be prohibited within the Auckland Region.*

The above policies are concerned with the avoidance, remediation or mitigation of adverse environmental effects from either the production, conversion or transmission of energy. The Auckland Regional Council considers that the most effectual methods of implementation of these policies is by the resource consent process including the related obligatory considerations under the RMA, namely sections 104 (1)(c) and 88, and by the development of supporting rules within regional and district plans.

As at December 1999, the Auckland Regional Council had not conducted any monitoring or developed any indicators in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Auckland RPS.

In addition the Auckland Regional Council has not:

- (a) adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry;
- (b) established a Auckland Regional Energy Forum;
- (c) adopted any specific measures to lead by example in energy conservation and efficiency practices
- (d) advocated the need for central government to develop a National Energy Strategy except for indicating an intent to do so in the RPS (pers. comm. Auckland Regional Council).

In achieving the policies, methods and objectives for energy in the Auckland RPS, the Auckland Regional Council anticipates the following environmental results (ARC, 1995):

- *There is a sufficient supply of energy to meet the social and economic needs of the Region's population;*
- *More efficient use of energy;*
- *Progressive reduction in the Region's dependence on non-renewable resources;*
- *Avoidance, remediation, or mitigation of any adverse effects of generating and distributing energy.*

5.1.3 Waikato

The RPS for Waikato became operative in February 1999. The Waikato region has one Regional Council: Environment Waikato and twelve District Councils: Hamilton City, Thames Coromandel, Hauraki, Waikato, Matamata Piako, Waipa, South Waikato, Otorohonga, Waitomo Districts and parts of the Franklin, Rotorua and Taupo Districts.

The Waikato region contributes approximately 19 percent of New Zealand's primary energy supply. This is comprised of approximately 30 PJ/annum of coal (Statistics NZ, 1998; MoC, 1999c), approximately 21 PJ/annum of hydro (Statistics NZ, 1998) and approximately 81 PJ/annum of geothermal (WRC-EW, 1998) energy resources.

Within the Waikato region, there are three significant coalmines, all of which produce sub-bituminous coal. Two are operated by Solid Energy and are located on the Huntly and Rotowaru fields, and one is located on the Maramarua field and operated by Glencoal Energy. Currently, these mines account for approximately 35 percent (by energy) of New Zealand's coal production.

The Waikato Region is also a significant contributor to New Zealand's electricity generation and distribution infrastructure (WRC-EW, 1999). Approximately three-quarters of the North Island's electricity generation is supplied from the Waikato region (WRC-EW, 1998).

Approximately 20.6 PJ/annum or 24 percent of New Zealand's hydro-electricity is generated from facilities located along the Waikato River (Statistics NZ, 1998). These include the Arapuni, Araiaitia,

Atiamuri, Karapiro, Maraetai, Ohakuri, Waipapa and Whakamaru facilities (operated by Mighty River) and the Rangipo and Takaanu (operated by Genesis). In addition to this, approximately 11.9 PJ/annum or 38 percent of New Zealand's thermally generated electricity is produced from the Huntly and Te Awamutu power stations (Statistics NZ, 1998) operated by Genesis. Also, approximately 6.7 PJ/annum or 74 percent of New Zealand's geothermally generated electricity is also produced from Contact Energy's Ohaaki and Wairakei geothermal facilities (CDES, 1999).

The Waikato region as a whole accounts for approximately 8.6 PJ/annum or eight percent of New Zealand's total electricity consumption. As with all other regions in New Zealand, Waikato is also heavily dependent on petroleum fuel imports (WRC-EW, 1999). Consumer energy used by the industrial sector in the Waikato region is approximately 20 PJ or eight percent of New Zealand's total industrial energy consumption.

The RPS for Waikato identifies one significant energy related issue that is important for the region, this being (WRC-EW, 1999):

1. *Inefficient energy production and use uses natural resources at a greater rate than is needed and results in unnecessary adverse effects on natural and physical resources.*

To address this issue the RPS for Waikato identifies an objective for energy, which states (WRC-EW, 1999): "*Efficient use of energy within the Waikato region*".

To achieve this objective the RPS for Waikato identifies one policy and a number of methods by which this policy may be implemented. The policy is concerned with energy efficiency and conservation and is aligned to "*..promote efficiency and conservation in the production, transmission and consumption of energy*" (WRC-EW, 1999).

The methods by which the RPS for Waikato has indicated that its policies will be implemented are generally non-statutory in nature and include:

- Advocacy through the provision of information and education for the promotion of energy efficiency, conservation, the adoption of appropriate energy forms and to encourage the use of alternative and/or renewable energy sources;
- Encouragement of inter-agency co-operation for research into available energy sources and technologies.
- Advocacy to central government to prepare a National Energy Strategy;
- Encouragement of the efficient use of energy in the transport sector through the Regional Land Transport Strategy.

The statutory methods that Environment Waikato has indicated it will use for achieving energy efficiency include advocacy for energy efficiency in its regional plans and resource consent applications.

As at December 1999, Environment Waikato had not conducted any monitoring or developed any indicators in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Waikato RPS. Environment Waikato has also not advocated the need for a national energy strategy to central government as outlined in their RPS.

Environment Waikato has however implemented a limited number of initiatives to promote or advocate energy efficiency and/or conservation. Such initiatives include the Environmental Education programme for business and industry entitled “Target Zero Waste” and “Waste Exchange” (pers. comm. Environment Waikato).

In achieving the policies, methods and objectives for energy in the RPS for Waikato, Environment Waikato anticipates the following environmental results (WRC-EW, 1999):

- *Increased efficiency in the production and use [of] energy.*
- *Reduced adverse effects on the environment.*

5.1.4 Bay of Plenty

The Bay of Plenty has one Regional Council: Bay of Plenty and seven District Councils: Tauranga, Western Bay of Plenty, Kawerau, Opoitiki and Whakatane District Councils and parts of the Rotorua and Taupo District Councils. The Bay of Plenty RPS became operative on the 1st December 1999. However, as no changes³⁷ to the energy section of the Proposed Bay of Plenty RPS (1998) resulted from the RPS becoming operative, the Proposed RPS (1998) was considered appropriate for the purpose of this research.

The Bay of Plenty region contributes approximately four percent of New Zealand’s primary energy supply. This is comprised of approximately 1 PJ/annum of hydro (ECNZ, 1998a) and approximately 20 PJ/annum of geothermal (WRC, 1998) energy resources.

The geothermal reserves within the Bay of Plenty region are comprised of a number of small fields and these are utilised for electricity generation as well as direct uses such as for the provision of heat for the Tasman Pulp and Paper Mill (FCP, 1999) operated by Fletcher Challenge.

³⁷ There were no references to the Environment Court on the Energy chapter of the RPS so it remained unchanged from Version9A (Version amended in accordance with Council's decisions on submissions, February 1997).

The Bay of Plenty region consumes approximately 8.5 PJ/annum (DUS, 1999) or eight percent of New Zealand's total electricity. Within the region, over half of the electricity is consumed by the forestry sector such as pulp and paper mills located at Kinleith and Kawerau (FCP, 1999). Consumer energy used by the industrial sector in the Bay of Plenty region is approximately 27 PJ or 11 percent of New Zealand's total industrial energy consumption. By comparison, the region contributes about one percent of New Zealand's hydro-electricity generation from facilities such as Matahina, which is operated by Trustpower.

The Bay of Plenty RPS identifies four energy-related issues that are important for the region. These are (BPRC, 1998):

- *Society's reliance on fossil fuels and the associated effects of greenhouse gas production;*
- *The lack of progress towards the development and adoption of renewable energy sources may lead to energy shortages in the future;*
- *Energy conservation and efficiency is not widely practiced;*
- *Power generation and transmission developments can have significant adverse effects on the environment.*

To address these issues the Bay of Plenty RPS identifies three objectives in respect of energy. These objectives address the efficient use of energy, renewable resource usage and adverse effects associated with the use of energy.

To achieve these objectives the Bay of Plenty RPS identifies a number of policies and methods by which the policies may be implemented. There are four policies in respect of efficient use. These are (BPRC, 1998):

1. *To raise community awareness and understanding of energy issues within the region;*
2. *To advocate energy efficiency considerations in urban land form and building design, and improved energy efficiency in the work and domestic environment;*
3. *To advocate the efficient use of the total energy resource;*
4. *To promote energy efficiency in production process design, construction and operation, and development of energy efficient products and services.*

The majority of methods extend towards utilising non-statutory methods such as:

- Dissemination of information;
- Consultation with agencies and interested groups;
- Leading by example; and
- Encouraging supply authorities, public organisations and major energy users to be more energy efficient to effectuate behaviours in energy efficiency.

In addition, direct methods such as the use of policy development to promote energy efficiency in transport and the use of the resource consent process to promote energy efficiency are also identified as methods that may be used by the Bay of Plenty Regional Council to achieve their policies and objectives.

The Bay of Plenty Regional Council also indicates that it may undertake the following actions to support its objective, policies and methods of implementation (BPRC, 1998):

1. Investigate the feasibility of co-ordinating interested parties to determine regional energy goals and to lobby central government to produce a national policy statement on energy.
2. Consider preparing, in conjunction with district councils, energy suppliers and other relevant organisations, a regional energy use inventory, providing information on energy conservation and efficiency.

There are also five policies in respect of renewable energy resource. These are (BPRC, 1998):

- 1 *To promote the transfer from non-renewable to renewable sources;*
- 2 *To advocate that renewable energy sources within the region be managed sustainably;*
- 3 *To promote the utilisation of solar, wind, waste and other renewable energy resources;*
- 4 *To minimise the use of fossil fuel for energy production;*
- 5 *To reduce fossil fuel use through the promotion of effective public transport.*

There are a number of methods by which the Bay of Plenty Regional Council considers that the policies and objectives can be implemented. The Bay of Plenty Regional Council perceives that there is a need for central government to develop a national policy statement for renewable energy sources and that most effectual role for this Regional Council is to advocate that need. The Bay of Plenty Regional Council also considers that greater integration between local governmental agencies and organisations such as EECA, research institutions and energy sector representatives is needed. Such integration would include the preparation of information on the use and long term viability of renewable energy sources to reduce the reliance on fossil fuel usage (BPRC, 1998). The Bay of Plenty Regional Council also identifies that its role of as a planning authority for transport can also promote the development and use of renewable sources of energy for transport modes.

There are also three policies in the Bay of Plenty RPS in respect of adverse effects. These are (BPRC, 1998):

1. *To ensure that the adverse effects on the environment and the people of the region from the generation and distribution of energy, are avoided, remedied or mitigated;*
2. *To support Government policies prohibiting nuclear propelled ships within New Zealand waters and its placing a moratorium on investigations into the construction and use of nuclear power stations;*
3. *Advocate the use of fuels, which have the least environmental impact.*

The Bay of Plenty Regional Council considers that it is appropriate to rely on resource consent process to provide “full” assessment of environmental effects for applications that relate to energy developments. This is because Council considers that they can directly control any adverse effects that may be associated with the development of energy sources and the production of energy.

As at December 1999 the Bay of Plenty Regional Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Bay of Plenty RPS. In addition, as yet the Bay of Plenty Regional Council has not:

- (e) adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry;
- (f) or adopted a regional energy use inventory;
- (g) or initiated any measures to promote greater integration with local government agencies, EECA, research institutes and/or energy sector industries

as indicated in the RPS. (pers. comm. Bay of Plenty Regional Council).

In achieving the policies, objectives and methods for energy in the Bay of Plenty RPS, the Bay of Plenty Regional Council anticipates the following environmental results (BPRPS, 1998):

- *The efficient and sustainable use of energy resources;*
- *A decreased dependence on energy from non-renewable sources;*
- *Stabilised or reduced emissions of greenhouse gases;*
- *The appropriate use of hydroelectric and geothermal resources;*
- *Less pressure on the environment from the development of new energy projects;*
- *Environmentally sensitive energy development.*

5.1.5 Gisborne

The Gisborne region is a unitary authority having responsibilities for regional and district functions. The RPS for Gisborne was publicly notified in February 1993 but is not yet fully operative. Thus, until the proposed RPS for Gisborne is fully adopted transitional plans developed under previous legislation remain in force.

The Gisborne region accounts for approximately 1.0 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately one percent of New Zealand’s total electricity usage. Currently, there are no primary energy sources in the Gisborne region that produce more than 1 PJ/annum.

The RPS for Gisborne identifies two significant energy related issues that are important for the region. These are (GDC, 1993):

1. *Inefficient use of energy;*
2. *The high degree of dependency of the Gisborne region and its communities on finite, non-renewable, sources of energy.*

To address these issues the RPS for Gisborne identifies two objectives that are aimed at achieving an efficient use of energy and encouraging the progressive development and use of cost-effective renewable sources within the region.

To achieve these objectives the RPS for Gisborne identifies one policy for issue one and three policies for the issue two. These are, respectively (GDC, 1993):

1. *To encourage the efficient use of energy in relation to:*
 - *Urban form, subdivision patterns and lot alignment;*
 - *The design, location and operation of buildings and other structures;*
 - *Transport modes and patterns;*
 - *The use of appropriate energy saving techniques in industrial, commercial and residential situation;*
 - *Waste management, including the minimisation, recovery, reuse, and recycling of solid wastes and other contaminants.*
2. *To support Government initiatives on renewable energy;*
3. *To support energy generation from the region's renewable energy assets where such development is shown to be cost effective, technically viable, and the effects of the development are environmentally acceptable.*
4. *To promote the greater use of cost effective renewable energy sources, in production processes and activities and in the provision of commercial and domestic energy services.*

The methods by which the RPS for Gisborne has indicated that its policies will be implemented include both non-statutory and statutory mechanisms, such as:

- Considering energy efficiency in the development of regional and district plans and ensuring there are no undue barriers to renewable energy developments;
- Consideration of energy efficiency when assessing environmental effects in resource consent applications;
- Advocacy with EECA, the Ministry of Commerce (MoC), research institutions and energy sector representatives to promote the environmental benefits of renewable energy sources;
- Encouragement to government to fund ongoing research into renewable energy technologies;

- Encouragement of inter-agency co-operation with EECA for dissemination of information and education regarding energy efficiency;
- Serving as a role model for energy efficiency and encouraging the public and private sectors to undertake energy audits;
- Advocacy to central government to prepare a National Energy Strategy;
- Encouragement of the efficient use of energy in the transport sector through the Regional Land Transport Strategy.

As at December 1999, the Gisborne District Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policy objectives and methods outlined in the Gisborne RPS. In addition, the Gisborne District Council has not:

- (a) adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry;
 - (b) utilised any methods to act as role model for energy efficiency;
 - (c) utilised any methods to encourage energy audits to be conducted by industry
- as indicated in the Gisborne RPS. Consequently, no energy audits have been conducted by industry as a result (pers. comm. Gisborne District Council).

In achieving the policies, objectives and methods for energy in the RPS for Gisborne, the Gisborne District Council anticipates the following environmental results (GDC, 1993):

- *Increased efficiency in the use of energy; conservation of finite (fossil fuel) resources, cost savings;*
- *A net reduction in greenhouse gas emissions/reduced potential for adverse climate change effects;*
- *Reduced need for construction of further energy generation facilities, with associated financial and environmental benefits;*
- *An increased proportion of renewable energy sources is used with attendant security, economic and environmental advantages.*

5.1.6 Taranaki

The Taranaki region has one Regional Council: Taranaki and three District Councils: New Plymouth, Stratford (in part) and South Taranaki District Councils. The RPS for Taranaki became operative on the 24th September 1994.

Within the Taranaki region there are significant hydrocarbon fields that provide significant quantities of New Zealand's primary energy needs in the form of oil and gas. Given the national and regional significance of these energy sources the RPS for Taranaki considers that the development of these energy sources should be *"..recognised and provided for, subject to appropriate environmental standards and safeguards, but that a national approach to energy production and supply is most*

appropriate" (TRC, 1994). Accordingly, the Taranaki Regional Council has utilised formal submissions, letters and meetings to advocate to central government the need for a National Energy Strategy (pers. comm. Taranaki Regional Council).

The Taranaki region contributes approximately 42 percent of New Zealand's primary energy supply. This includes approximately 105 PJ/annum of oil and condensate, primarily sourced from the offshore Maui field and the on-shore McKee and Kapuni fields. In addition, approximately 193 PJ/annum of gas (Statistics NZ, 1998) is extracted (primarily) from the Maui and Kapuni fields.

There is also a significant base of petrochemical industry within the Taranaki region. This includes the Methanex synthetic fuel and methanol plants located at Motonui and Waitara, the Ammonia-Urea Plant, the Kapuni Production Station, and the Kapuni Gas Treatment Plant.

The Taranaki region also provides approximately eight percent of New Zealand's electricity needs primarily from two large thermal (gas-fired) power stations. TransAlta operate the Taranaki Combined Cycle (TCC) Power Station located at Stratford and Contact Energy operates the New Plymouth Power Station. These facilities produce approximately 10.6 PJ/annum (Contact, 1999) or approximately 41 percent of New Zealand's total thermally generated electricity.

The Taranaki region accounts for approximately 3.2 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately three percent of New Zealand's total electricity usage. Consumer energy used by the industrial sector in the Taranaki region is approximately 103 PJ or 42 percent of New Zealand's total industrial energy consumption.

The RPS for Taranaki identifies one significant energy related issue that is important for the region, this being (TRC, 1994):

1. *Efficiency in the use and production of energy.*

To address this issue the RPS for Taranaki identifies one objective for energy which states: *"To achieve, as far as practicable and appropriate, efficiency in the use and production of energy without compromising the sustainable management of natural and physical resources"* (TRC, 1994).

To achieve this objective the RPS for Taranaki identifies one policy and a number of methods by which this policy may be implemented. This policy states (TRC, 1994):

Efficiency in the use and production of energy by users of natural and physical resources will be encouraged in relation to:

- *energy requirements of urban form, subdivision patterns and lot alignment;*

- *the design, location and operation of buildings and other structures;*
- *transport modes and patterns;*
- *use of appropriate energy saving technologies in industrial, commercial and residential situations;*
- *waste management including minimisation, recovery, re-use and recycling of solid wastes and other contaminants, provided that the energy required to carry out these measures is less than that required to produce new products or materials;*
- *research into, and development of, alternative energy sources and more energy efficient methods (both traditional and alternative) of producing energy.*

The methods by which the RPS for Taranaki has indicated that its policies will be implemented include advocacy to central government regarding the following:

- To provide annual statements explaining how its energy policy framework is performing in relation to energy efficiency and energy supply;
- To facilitate research and development in order for New Zealand to continue to meet its energy needs;
- The implementation of the objectives and methods set out in Agenda 21 relating to energy use and efficiency.

As at December 1999, the Taranaki Regional Council has not conducted any specific or separate monitoring that is specifically related to the energy issues, policy objectives and methods outlined in the Taranaki RPS to monitor regional energy efficiency (pers. comm. Taranaki Regional Council).

The Taranaki Regional Council has adopted the following specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry (pers. comm. Taranaki Regional Council):

- *[Utilisation] of the resource consent process to require regular reporting on air emissions and energy efficiency measures undertaken on site by major air discharge consent holder using fossil fuels;*
- *[Utilisation] of the resource consent process to investigate ways in which to increase the efficiency of use of water in hydroelectric power schemes.*

In achieving the policy, methods and objectives for energy in the RPS for Taranaki, the Taranaki Regional Council anticipates the following environmental results (TRC, 1994):

- *Increased efficiency in the production and use [of] energy.*
- *Reduced adverse effects on the environment.*

5.1.7 Manawatu-Wanganui

The RPS for the Manawatu-Wanganui Region became operative on the 18th August 1998. The Manawatu-Wanganui Region has one Regional Council: Manawatu-Wanganui and eight District Councils: Ruapehu, Wanganui, Manawatu, Tararua, Horowhenua, Rangitikei, and Stratford (in part) District Councils and the Palmerston North City Council.

The Manawatu-Wanganui region accounts for approximately 3.7 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately three percent of New Zealand's total electricity usage. Currently, there are no primary energy sources in the Manawatu-Wanganui region that produce more than 1 PJ/annum.

In addition, the Manawatu-Wanganui region is the location of the recently constructed Tararua Wind Farm. Fully commissioned in April 1999, the Tararua Wind Farm is located on the Tararua Ranges overlooking Palmerston North City and is the largest wind farm in the Southern Hemisphere. It has the capacity to generate some 0.5 PJ/annum of electricity (Walker, White, Botha, 1999).

The RPS for Manawatu-Wanganui identifies three energy issues that are important for the region. These are (MWRC, 1998):

1. *Adverse effects on the environment from the use of energy resources;*
2. *Inefficient use of energy;*
3. *Adverse effects on the environment from harnessing energy sources;*

To address these issues the RPS for Manawatu-Wanganui identifies two objectives in respect of energy. These objectives include promoting the sustainable management of energy resources and to avoid, remedy or mitigate adverse effects of energy generation in the Region.

To achieve these objectives the RPS for Manawatu-Wanganui identifies a number of policies and methods by which the policies may be implemented. There are three policies in respect of the sustainable management of energy resources, identified below (MWRC, 1998):

1. *To promote the sustainable supply and use of energy resources to meet the needs of the regional community;*
2. *To promote the increased use and development of renewable energy sources where practicable;*
3. *To promote efficiency in the use of energy and the implementation of energy efficiency procedures.*

The Manawatu-Wanganui Regional Council identifies a number of methods by which it may implement the above policies.

Such methods include:

- Recognition of the need to promote a comprehensive national energy policy by Government;
- Promotion of the efficient use and management of energy resources (and the adoption and use of renewables, where appropriate);
- Consideration of energy efficiency including the minimisation of adverse effects within the Regional Land Strategy.

In addition to the above there is also one policy in respect of avoiding, remedying or mitigating the adverse effects of energy generation in the Region. This policy states (MWRC, 1998):

1. *To ensure that proposals for developments of energy generation undertake full Environmental Impact Assessments in accordance with the requirements of Section 88(6)(a) and the Fourth Schedule of the [Resource Management] Act prior to consideration by the relevant authorities”.*

The methods of implementation indicated rely upon other methods (from related objectives) within the RPS for Manawatu-Wanganui to achieve this objective. Specifically these include (MWRC, 1998):

1. *To maintain stream flows in rivers and streams at a level that safeguards their life supporting capacity and avoids or mitigates any adverse effects on the environment;*
2. *To avoid, remedy or mitigate the adverse effects of structures or activities in the beds of rivers and lakes.*

As at December 1999, the Manawatu-Wanganui Regional Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policy objectives and methods outlined in the Manawatu-Wanganui RPS. Neither has the Manawatu-Wanganui Regional Council adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry (pers. comm. Wanganui-Manawatu Regional Council).

In achieving the policies, methods and objectives for energy in the RPS for Manawatu-Wanganui, the Manawatu-Wanganui Regional Council anticipates the following environmental results (MWRC, 1998):

- *Availability of energy to meet the needs of people and communities in and outside the region;*
- *Adverse environmental effects from the generation of energy are avoided, remedied or mitigated;*
- *The environmental effects of energy use are avoided, remedied or mitigated through reduced demand for energy.*

5.1.8 Hawke's Bay

The Hawke's Bay region has one Regional Council: Hawke's Bay and four District Councils: Wairoa, Hastings and Central Hawke's Bay District Councils and the Napier City Council. The Hawke's Bay RPS became operative on the 7th October 1995.

The Hawke's Bay region accounts for approximately 3.3 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately three percent of New Zealand's total electricity usage. Currently, there are no primary energy sources in the Hawke's Bay region that produce more than 1 PJ/annum.

The Hawke's Bay RPS identifies five significant energy related issues that are important for the region. These are:

1. *The use of renewable rather than non-renewable energy resources where this is cost effective;*
2. *Inefficient use of energy;*
3. *Provision of an adequate supply of energy to people and communities to enable them to meet their needs;*
4. *Adverse effects on the environment arising from the production, distribution and use of energy; and*
5. *Introduction of the generation of nuclear power in Hawke's Bay.*

To address these issues the Hawke's Bay RPS identifies one objective in respect of energy. This objective is consistent with the recognition that the region is a net importer of energy and therefore there is a "requirement for the region to have a sustainably managed system for supply and distribution of energy within the region" (HBRC, 1995).

To achieve these objectives the Hawke's Bay RPS identifies a number of policies and methods by which the policies may be implemented. There are five policies that have been identified to address energy in the Hawke's Bay region. These include (HBRC, 1995):

1. *To cooperate fully with any Central Government initiatives and policies that seek to promote energy conservation, efficiency and the use of renewable energy resources where practicable;*
2. *To support Central Government's prohibition on the generation of nuclear power in New Zealand as set out in the New Zealand Nuclear Free Zone Disarmament and Arms Control Act (1987);*
3. *To recognise the need to provide an adequate supply and distribution of energy to meet the requirements of people and communities;*
4. *To promote the avoidance, remedying or mitigation of adverse effects on the environment associated with the production, distribution and use of energy;*
5. *To promote energy efficiency through transport planning activities.*

The methods by which the Hawke's Bay RPS has indicated that policy's (1), (2) and (5) will be implemented mainly recognise that initiatives by central government agencies (such as the MoC and EECA) are necessary to ensure a consistent and effective approach to energy management in New Zealand. For example, the Hawke's Bay Regional Council does not consider that it has a role to directly promote energy conservation and efficiency as this is seen as a responsibility of central government (HBRC, 1995).

However the Hawke's Bay RPS also recognises that "...some of these energy initiatives may be more effectively implemented at a regional level", but that cooperation is needed between these two levels to achieve integrated sustainable management of energy in New Zealand (HBRC, 1995). For example, the Hawke's Bay RPS indicates that the methods by which policies (3) and (4) will be implemented by promoting rules within regional and district plans that are supportive for the sustainable supply and distribution of energy within the region. Finally the Hawke's Bay RPS also recognises that another important vehicle by which the Hawke's Bay Regional Council can promote these methods is through consideration of resource consent applications lodged under the RMA with the Council.

As at December 1999, the Hawke's Bay Regional Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Bay of Plenty RPS. The Hawke's Bay Regional Council consider their undertakings in the area of energy are through statutory advocacy, such as making submissions on district plans throughout their region, and by making submissions or comments on national led initiatives. The Hawke's Bay Regional Council is currently reviewing their RPS (public notification March 2000) and indicates that the revised RPS will have no section on energy as a regionally significant issue. This is because the Hawke's Bay Regional Council considers energy to be an issue more appropriately dealt with at a national level (pers. comm. Hawke's Bay Regional Council). As a result the Hawke's Bay Regional Council has not adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry.

In achieving the policies, methods and objectives of the RPS for Hawke's Bay, the Hawke's Bay Regional Council anticipates the following environmental results (HBRC, 1995):

- *Use of renewable rather than non-renewable energy resources where cost effective;*
- *Efficient use of energy;*
- *Avoidance, remedying or mitigation of adverse effects on the environment associated with the production, distribution and use of energy;*
- *The retention of Hawke's Bay as a nuclear-free region;*
- *Provision of an adequate supply of energy to meet the needs of the residents of Hawke's Bay.*

5.1.9 Wellington

The Wellington region has one Regional Council: Wellington and eight District Councils: Kapiti Coast, Masterton, Carterton, and South Wairarapa District Councils and the Upper Hutt, Porirua, Wellington and Hutt City Councils. The Wellington RPS became operative on the 13th December 1994.

The Wellington region accounts for approximately 12.0 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately 11 percent of New Zealand's total electricity usage. Currently, there are no primary energy sources in the Wellington region that produce more than 1 PJ/annum. Thus, the Wellington region is reliant on imports of energy in the form of gas, petroleum as well as electricity to meet its needs. Consumer energy used by the industrial sector in the Wellington region is approximately 7 PJ or three percent of New Zealand's total industrial energy consumption.

The Wellington RPS identifies five energy-related issues that are important for the region. These issues can be summarised as follows (WRC, 1994):

1. *Data on energy sources and sectoral use is not generally available at the regional level;*
2. *There are many players in the energy field;*
3. *There is a high degree of dependence by the Wellington regional economy and by communities in the Region on non-renewable sources of energy;*
4. *Inefficient use of energy in the production and transmission of energy;*
5. *A growing number of adverse environmental effects are being identified as a result of energy production, transportation, transmission, conversion and, particularly, end use.*

To address these issues the Wellington RPS identifies three objectives in respect of energy. The first objective states that energy demand should be moderated in addition to energy being used in an efficient and effective method in production, distribution and use. The second objective is aligned to seek more renewable sources of energy, whilst the third objective seeks to avoid, remedy or mitigate adverse local and global environmental effects of energy production, transportation, transmission, conversion and end use.

To achieve these objectives the Wellington RPS identifies a number of policies and methods by which the policies may be implemented. There are ten policies that have been identified to address energy issues within the Wellington region. Policies 1-3 relate to moderating energy demand and for energy efficiency.

These state (WRC, 1994):

1. *To promote a more efficient match between the characteristics of different energy sources and the required end uses:*
 - *In production processes and activities (including production and transmission of energy);*
 - *In the management of energy needs for commercial buildings and businesses; and*
 - *In domestic energy service requirements.*
2. *To promote a moderation in energy demand and efficient energy use:*
 - *In production processes and activities (including production and transmission of energy);*
 - *In the operation of equipment and appliances; and*
 - *Through the development of energy efficient products and services.*
3. *To promote the consideration and the application of energy efficiency and a moderation in energy demand:*
 - *In building design and site layout;*
 - *In the use of construction materials;*
 - *In the design and operation of transport vehicles and transportation systems; and*
 - *In plans, policies and proposals that influence urban form and the distribution of land uses and activities.*

Policies 4-6 are intended to enable an orderly transition (from predominantly non-renewable) to renewable and environmentally friendly energy sources. These policies state (WRC, 1994):

4. *To promote efficient and effective use and management of all energy resources in the short-term, and the adoption and use of appropriate renewable energy resources for industry, commerce and domestic energy services in the longer-term.*
5. *To promote a movement away from the use of non-renewable fossil fuels as the primary source of motive power for transport in the Region.*
6. *To promote efficient energy production from the Region's renewable energy assets, where the effects of the development are environmentally acceptable.*

Policies 7-9 are intended to deal with the adverse effects of energy production, transportation, transmission, conversion and end use. These policies state (WRC, 1994):

7. *To avoid, remedy or mitigate effects on the atmosphere, including emissions of greenhouse gases that result from energy production, transportation, transmission, conversion and end use, consistent with national standards and international protocols.*
8. *To avoid, remedy or mitigate pollution of soil, water and ecosystems that arise from energy production, transportation, conversion and end use consistent with any standards or rules that may be set for managing such effects.*
9. *To avoid, remedy or mitigate any adverse effects on human health that arise from the production, transmission, transportation, conversion and end use of energy.*

Finally, policy 10 is aimed at meeting information and organisational framework needs for energy management. This policy states (WRC, 1994):

10. *To improve knowledge of energy use and the effects of energy use, and to co-ordinate implementation of national, regional and local policies and actions aimed at achieving the sustainable management of energy.*

The methods by which the Wellington RPS has indicated that its policies (either) will or may be implemented include the following:

(a) Methods for improving energy efficiency:

- Serving as a role model for energy efficiency (e.g. conducting in-house energy auditing);
- Consider energy efficiency in regional plans, transport policy development and in resource consent applications;
- Advocacy, advice, provision of education/information (both internally and from other governmental/non-governmental organisations regarding energy efficiency and conservation, financial or other incentives, energy auditing, and demonstration projects.

The methods indicated will utilise statutory methods such as the use of binding regulations, standards or formal agreements as well as non-statutory methods such as voluntary or informal agreements with for example, trade or industrial associations or manufacturers or business groupings (WRC, 1994).

(b) Methods for making an orderly transition to renewable and environmentally friendly energy sources:

- Promotion of renewable energy sources and energy efficiency through the utilisation through the Regional Land Transport Strategy;
- Promotion of the use of renewable energy sources in industrial, commercial, domestic and transport sectors;
- Promotion and co-ordination of funding for research and development for “environmentally acceptable” energy ventures within the region;
- Distribution of renewable energy information to interested parties.

(c) Methods for dealing with adverse effects arising from energy production, transmission, transportation, conversion and end use:

- Establishment of discharge and environmental standards;
- The use of rules and standards in District Plans

(d) Method for meeting information and organisational framework needs for energy management:

- Establishment of a regional energy forum;
- Assessing the energy characteristics of the region and monitoring energy sources, use, efficiency and effects.

As at December 1999, the Wellington Regional Council has conducted very little monitoring in relation to energy sector industry that is specifically related to the energy issues, policies, objectives and methods outlined in the Wellington RPS. In addition, whilst the Wellington RPS outlines a range of specific methods to promote or advocate energy efficiency and/or conservation to energy sector industry few of these methods have been pursued by the Wellington Regional Council. This is because the Wellington Regional Council does not consider they have a clear mandate to promote energy efficiency. As a result the Wellington Regional Council consider the methods listed merely point out/suggest what “others” could do (pers. comm. Wellington Regional Council). In addition, in accord to the methods outlined in the RPS, the Wellington Regional Council has not:

- (a) actively promoted the use of renewable resources in the industrial sector (except for the promotion of a small wind farm in the Wairarapa);
- (b) promoted and/or co-ordinated the funding for research and development for “environmentally acceptable” energy ventures within the region (with the exception of the wind farm mentioned above);
- (c) established a regional energy forum³⁸;
- (d) assessed the energy characteristics of the region³⁹;

as outlined in the RPS.

The Wellington Regional Council has conducted some superficial analyses in respect of monitoring energy sources, use, efficiency and effects and plans to release these in their State of the Environment Report (pers. comm. Wellington Regional Council). The Wellington Regional Council is also in the process of developing an internal energy policy for the Wellington Regional Council to meet its obligations of being an Energy Wise Company (refer also to section 4.3 within this report).

The Wellington Regional Council has also conducted an in-house audit of their main Council office (approximately six years ago) and as a result approximately 50 percent of the recommendations

³⁸ The Wellington Regional Council decided to hold this method until it had determined via its long terms financial strategy just how much effort and expenditure it wanted to put into energy management as compared with other methods in the RPS (pers. comm. Wellington Regional Council).

³⁹ Whilst the Wellington Regional Council has not specifically addressed the energy characteristics of the region, a number of energy providers have assessed the region’s suitability for renewables. Some of the results of this work has been published by EECA, but other material is not disclosed because of “commercial sensitivity” (pers. comm. Wellington Regional Council).

have been implemented.

In achieving the policies, methods and objectives for energy in the Wellington RPS, the Wellington Regional Council anticipates the following environmental results (WRC, 1994):

- *There is a reduced demand for all forms of energy and public needs for energy services are met;*
- *There is increased efficiency in energy use in all sectors of the economy;*
- *An increasing proportion of renewable energy sources is used;*
- *There is a decreased use of fossil fuels and an increased use of the less environmentally damaging energy sources, including those available within the Wellington Region;*
- *There is a reduction in the adverse effects attributable to the production, transportation, transmission, conversion and end use of energy.*

5.1.10 Nelson

The Nelson District is a unitary authority, having responsibilities for regional and district functions. The Nelson RPS became operative on 10th March 1997.

The Nelson region accounts for approximately 0.9 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately one percent of New Zealand's total electricity usage. Currently there are no primary energy sources in the Nelson region that produce more than 1 PJ/annum. No significant electricity generating activities occur within the Nelson region and there is a reliance on imports of electricity as well as primary energy sources such as petroleum fuels to meet the total energy demands of the region (NCC, 1997).

The Nelson RPS identifies two energy-related issues that are important for the region. These are (NCC, 1997):

1. *Current uses of non-renewable resources are not sustainable;*
2. *The ways and rates at which we are burning fossil fuels is resulting in elevated levels of greenhouse gases which may contribute to significant changes in the worlds climate.*

To address these issues the Nelson RPS identifies two objectives in respect of energy. These objectives address the sustainable use of energy with a transition from renewable to non-renewable sources and the stabilisation of greenhouse gas emissions to 1990 levels and any associated adverse effects being remedied or mitigated.

To achieve these objectives the Nelson RPS identifies a number of policies and methods by which the policies may be implemented. There are four policies in respect of energy.

These are (NCC, 1997):

1. *To promote the use of renewable energy sources of energy;*
2. *To promote energy conservation and efficiency in city form and in the design of developments;*
3. *To encourage energy conservation and efficiency in transportation;*
4. *To promote actions or activities which remedy or mitigate the adverse effects of greenhouse gases.*

The Nelson RPS identifies a wide range of methods that it will utilise to implement its objectives and policies. These include methods that are non-statutory in nature such as:

- Information, education and public awareness;
- Support for the development of local energy initiatives;
- Promotion of public transportation and alternative transportation modes, for example, cycle routes;
- Promotion of energy conservation and efficiency;
- Leading by example in energy efficiency and to utilise the use of renewable energy sources in preference to non-renewable sources;
- Advocacy to central government to develop a national energy strategy;
- Consultation;
- Establishment of carbon dioxide sinks by landscape and amenity planting;
- Internal preparation of an energy audit and an energy management plan and promotion of this concept externally for all businesses, institutions and schools in the Nelson City.

By comparison, the statutory methods indicated include the preparation of Regional Plans such as an Air Quality Plan, the use of the resource consent processes, and the use of economic instruments to achieve the stated objectives and policies. The Nelson district also consider that central government should prepare a National Policy Statement on energy use which establishes clear and consistent objectives and policies at both national and regional levels (NCC, 1997).

As at December 1999, the Nelson City Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policy objectives and methods outlined in the Nelson RPS. In addition, the Nelson City Council has not adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry as indicated in the Nelson RPS (pers. comm. Nelson City Council).

The Nelson City Council has however undertaken an internal energy audit of their facilities and as a result has benefited from energy savings. However, no energy management plan or promotion of this concept externally to [all] businesses, institutions and schools in the Nelson City has been conducted to date externally. The Nelson City Council also indicates that they have not used any

methods to advocate to central government the need for a national policy statement for energy (pers. comm. Nelson City Council).

In achieving the policies, objectives and methods outlined in the Nelson RPS for energy, the Nelson City Council anticipates the following environmental results (NCC, 1997):

- *A reduction in the use of non-renewable energy;*
- *A decrease in the rate of carbon dioxide emissions;*
- *An increase in the amount of carbon dioxide fixation by plants and animals;*
- *Urban form resulting in reduced dependence on non-renewable sources of energy.*

The Nelson City Council has also developed a number of key performance indicators to measure the effectiveness of their stated policies and objectives. These include (NCC, 1997):

- *Increased number of buildings being constructed or refitted to achieve energy conservation, as shown by a sample survey of owners;*
- *A greater number of people using public transport, cycling and walking;*
- *An increase in the area of both production forest planting and amenity planting in Nelson City.*

5.1.11 Marlborough

The Marlborough District is a unitary authority having responsibilities for both regional and district functions. The Marlborough RPS became operative on the 28th August 1995. Energy for the Marlborough District is classified within those issues that have been identified by Marlborough as being significant to “enabling community well-being”. These include policy issues such as air quality management, community health, amenity values and land transport.

The Marlborough region has a high reliance on imports of electricity as well as primary energy sources such as petroleum fuels to meet their total energy demands. The Marlborough region accounts for approximately 1.0 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately one percent of New Zealand’s total electricity usage. Currently, there are no primary energy sources in the Marlborough region that produce more than 1 PJ/annum.

The Marlborough RPS describes, but does not specifically list significant energy related issues for the region. There are three issues that are identified:

1. Avoidance of adverse environmental effects associated with the production and use of energy;
2. Efficient use of energy;
3. Desire for a greater utilisation of renewable energy sources.

The Marlborough RPS whilst recognising that the use of energy is vital to the region, identifies its main role as being to “ensure that the adverse environmental effects of [energy] use and production are avoided, remedied or mitigated” and perceives that the most effective means of achieving this is through the efficient use of energy and renewable energy sources (MDC, 1995).

To address these issues the Marlborough RPS identifies one objective in respect of energy. This objective promulgates the promotion of the “efficient production and use of renewable energy resources...” (MDC, 1995). To achieve this objective the Marlborough RPS identifies two policies and a number of methods by which the policies may be implemented. The policies are (MDC, 1995):

- (a) *Enable people and communities to provide for the efficient use of energy in relation to:*
- *Urban form, subdivision patterns and lot alignment;*
 - *Design, location and operation of buildings and other structures; and*
 - *Use of energy saving technologies in transport, industrial, commercial and residential situations.*
- (b) *Encourage the production and use of renewable resources, consistent with the duty to avoid, remedy or mitigate any adverse environmental effects.*

The methods by which the Marlborough RPS has indicated that these policies will be implemented are through voluntary and non-voluntary measures such as administration of regulations and Acts, encouragement of energy efficient subdivision, dissemination of information and interagency cooperation to research available energy sources and technologies. The Marlborough RPS recognises that by promoting the use of energy efficiency and the use of renewable energy resources, dependence on non-renewable energy sources (fossil fuels) is reduced (MDC, 1995).

A number of energy efficiency measures and initiatives have been undertaken by the Marlborough District Council to promote or advocate energy efficiency and/or conservation. These include (pers. comm. Marlborough District Council):

- (a) Having a designated individual responsible for energy;
- (b) Becoming a member of the EECA’s Energy Wise Companies Campaign (EWCC);
- (c) Engaging EECA to conduct an energy audit of the Marlborough District Councils main administration building;
- (d) Joining a “switch-off” campaign – to reduce energy consumption;
- (e) Conducting energy checks of Council buildings after hours;
- (f) Running air-conditioning units only during normal office hours;
- (g) Keeping energy efficiency “up-front” with employees and ensuring energy is considered when evaluating new works or projects.

In terms of energy sector industry, with the exception of localised issues that arise from power generation or the provision of energy to isolated bays within the Marlborough Sounds, the Marlborough District Council does not consider energy sector industry plays a particularly large role within the District (pers. comm. Marlborough District Council). For example, within the last four years there have been no resource consents lodged for any new renewable or non-renewable energy production activities. The low occurrence energy related industry within the District is not expected to change in the short to medium term, given the recent sale of the generating arm of the local lines company to Trustpower, a North Island based company (pers. comm. Marlborough District Council). As a result, there is no monitoring that is currently being conducted with respect to the specific energy issues, policy objectives, and methods outlined in the Marlborough RPS that is directly relevant to energy sector industry.

The Marlborough RPS also has as one of its methods to “*Advocate to central government the need for a national policy to co-ordinate efficient energy production and use*”.

In achieving the policies, objectives and methods for energy in the Marlborough RPS, the Marlborough District Council anticipates the following environmental results (MDC, 1995):

- *The sustainable management of energy resources;*
- *Improved energy efficiency;*
- *Reduced adverse effects on the environment resulting from production and use of energy.*

5.1.12 Tasman

The Tasman District is a unitary authority, having responsibilities for regional and district functions. The Tasman RPS became operative on 01st April 1998.

The Tasman region has a high reliance on imports of petroleum fuels for transportation and industrial use, and coal for industrial and domestic heating (TDC, 1998). A unique feature within the District is a higher than national proportion demand for fossil fuel consumption, namely diesel. This usage is attributed to heavy haulage transport associated with forestry production (TDC, 1998). The Tasman region accounts for approximately 1.3 PJ/annum of electricity consumption (DUS, 1999) which is equivalent to approximately one percent of New Zealand’s total electricity usage. Currently, there are no primary energy sources in the Marlborough region that produce more than 1 PJ/annum.

The Tasman RPS identifies two energy-related issues that are important for the region. These are (TDC, 1998):

1. *Current uses of non-renewable resources are not sustainable;*

2. *The ways and rates at which we are burning fossil fuels is resulting in elevated levels of greenhouse gases which may contribute to significant changes in the worlds climate.*

To address these issues the Tasman RPS identifies three objectives in respect of energy. These objectives address the use and development of natural and physical resources for the generation and distribution of energy, conservation and efficiency in energy use (including a reduction in dependence in non-renewable use) and eliminating risk of nuclear energy.

To achieve these objectives the Tasman RPS identifies four policies and a number of methods by which the policies may be implemented. The policies include (TDC, 1998):

1. *The Council will seek to provide for the continuation of energy generation, transmission, or use opportunities, while avoiding, remedying or mitigating the adverse effects of such actions on natural, heritage and amenity values of resources;*
2. *The Council will promote the use of energy efficient material, technologies, designs and locations for buildings and developments;*
3. *The Council will prohibit:*
 - (a) *the generation or use of radioactive material;*
 - (b) *the generation of energy from radioactive material or irradiating apparatus; and*
 - (c) *the transport, storage or disposal of radioactive material or waste;*

in the Tasman District except where:

 - (i) *the transport, storage, or use of radioactive material, or the use of irradiating apparatus for medical, educational, or research purposes; or*
 - (ii) *the disposal of radioactive material or waste;*

is undertaken in accordance with the Radiation Protection Act 1965.
4. *The Council is opposed to the presence of nuclear powered or nuclear equipped vessels in the waters of the Tasman District.*

The Tasman RPS identifies a wide range of methods that it will utilise to implement its objectives and policies. These include methods that are non-statutory in nature such as:

- Liaison with organisations/individuals which have energy supply interests;
- Advocacy and promotion of energy efficient methods/design/technologies/locations;
- Leading by example in energy efficient practices;
- Advocacy to Government to keep nuclear energy out of the Tasman District;

Statutory methods primarily include the preparation of policies and rules within its Regional and District Plans to prevent undesirable activities. For example, this includes establishing rules to prohibit nuclear material or technology from establishing within the Tasman District.

In terms of the types of monitoring that is currently being conducted by the Tasman District Council with respect to the specific energy issues, policies, objectives and methods outlined in the Tasman RPS in relation to energy sector industry (pers. comm. Tasman District Council):

- *Data is kept on energy developments requiring resource consents, including effects on natural resources;*
- *Data is kept on building consents for new or altered buildings [including] any energy efficiency features.*

The Tasman District Council has also adopted the following specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry (pers. comm. Tasman District Council):

- *Advice as relevant in building consent and resource consent processes;*
- *Advocacy with water utility service of Council, and with irrigation sector on efficient water use.*

In achieving the policies, objectives and methods for energy in the Tasman RPS, the Tasman District Council anticipates the following environmental results (TDC, 1998):

- *Continuance of energy supply including electricity from either national or local sources;*
- *Protection of significant natural values of water bodies, the coast and other significant resource values;*
- *An increased level of energy efficiency in built development;*
- *Energy efficient building features that contribute to reduced environmental contamination or waste generation;*
- *Continued low or no risk of contamination or other environmental damage from radioactive sources.*

The Tasman District Council has also developed a number of key performance indicators to measure the effectiveness of their stated policies and objectives. These are listed below with comment on what these indicators have revealed to date (pers. comm. Tasman District Council):

- *Assessed significance of changes to water bodies or other sites affected by energy generation, transmission, or use – no systematic assessment of data has been conducted to date and so no response is possible;*
- *Rate of uptake of energy efficiency in built development;*
- *The extent to which energy demand can be reduced, and the production outputs achieved with less energy consumption – no systematic assessment of data has been conducted to date and so no response is possible;*
- *Incidence of radioactivity from nuclear sources or technology present at any time in the Tasman District.*

5.1.13 West Coast

The West Coast region has one Regional Council and three District Councils, these being the Buller, Grey and Westland District Councils. The West Coast RPS is not yet operative and therefore is still in a proposed form.

The West Coast regions economy has historically been based upon the utilisation of the region's natural resources: notably gold, timber and coal (WCRC, 1998). In terms of energy supplies, the region contains extensive bituminous and sub-bituminous coalfields north of Greymouth at the Buller coal fields. These coal fields are operated by Solid Energy and contribute approximately 44 PJ/annum (or approximately six percent) of New Zealand's total primary energy (Statistics NZ, 1998; MoC, 1999c).

It is estimated that there is some 350 million tonnes of recoverable coal resources within the region. These low ash and low sulphur bituminous coal deposits offer future long terms export opportunities (WCRC, 1998). Regional self-sufficiency in electricity requirements has also been recognised as being attainable by the use of these coal reserves. For example, in the 1970's a 480MW coal-fired power station near Westport was considered and as major stocks of natural gas deplete such as the Maui field it is possible that coal fired electricity facilities could become a more attractive prospect for New Zealander's (WCRC, 1998).

The West Coast region takes up approximately 1 PJ/annum or one percent (DUS, 1999) of New Zealand's total electricity consumption and while it has a number of small hydro-electricity facilities within the region it is reliant on the imports of electricity as well as fossil fuels such as petroleum (WCRC, 1998).

The West Coast RPS identifies four energy-related issues that are important for the region. These are (WCRC, 1998):

1. *The need for an adequate supply of energy to meet the demands of the West Coast and to contribute to national energy requirements;*
2. *The use of renewable versus non-renewable sources of energy;*
3. *Adverse environmental effects arising from the production, transmission, distribution and use of energy;*
4. *Inefficient use of energy.*

To address these issues the West Coast RPS identifies one objective in respect of energy. This objective simply requires the promotion of sustainable management of the West Coast region's energy resources.

To achieve this objective the West Coast RPS identifies a number of policies and methods by which the policies may be implemented. There are four policies that have been identified to address energy in the West Coast region. These include (WCRC, 1998):

1. *[To] recognise the importance of an adequate supply of energy resources for the needs of people and communities on the West Coast, provided that this is not inconsistent with other policies in the RPS;*
2. *[To] promote the sustainable management and efficient use of energy within the region;*

3. *[To] cooperate with any Crown initiatives and policies, where practicable, that seek to promote greater energy conservation, efficiency and the use of renewable energy sources including the Government's Voluntary Agreements Scheme for reduction of CO₂ emissions;*
4. *[To] promote energy conservation through appropriate modes of transport, including ride sharing, minivans and coordinated public transport.*

The methods by which the West Coast RPS has indicated that these policies will be implemented are by encouragement through publications or strategies or via the use of regional and/or district plans. For example, the West Coast RPS identifies that it should ensure that there are adequate provisions within district plans for the distribution of energy by allowing for the siting of necessary structures (as permitted activities). Similarly, the West Coast RPS identifies that it will manage adverse effects of energy production, transmission and use through its regional and district plans and resource consent application processes.

The West Coast RPS also identifies a need to promote a consistent approach to the use of energy with neighbouring regions through liaison with other regional councils. The West Coast RC addresses this latter issue by making submissions on district and regional plans on both constituent and neighbouring district and other regional councils (pers. comment. West Coast Regional Council).

As at December 1999, the West Coast Regional Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policy objectives and methods outlined in the West Coast RPS. Neither has the West Coast Regional Council adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry (pers. comm. West Coast Regional Council).

In achieving the policies, methods and objectives for energy in the West Coast RPS, the West Coast Regional Council anticipates the following environmental results (WCRC, 1998):

- *The more efficient use of renewable and non renewable energy sources;*
- *A reduction in the adverse effects on the environment from energy production, use and development;*
- *Reduction in carbon dioxide emissions.*

5.1.14 Canterbury

The Canterbury region has one Regional Council and eleven District Councils, these being the Kaikoura, Hurunui, Waimakariri, Banks Peninsula, Ashburton, Timaru, Selwyn, MacKenzie, Waitaki (in part) and Waimate District Councils and the Christchurch City Council. The Canterbury RPS became operative on the 26th June 1998.

Within the Canterbury region there are a number of large hydro-electricity generation facilities. Approximately four percent or 28.6 PJ/annum (Statistics NZ, 1998) of New Zealand's primary energy is derived from the Canterbury region in the form of hydroelectricity. However, despite the large contribution from hydro, the region is still a net importer of energy as it is heavily reliant on imports of fossil fuels for transport, industrial, commercial and domestic uses (CRC, 1998).

The larger hydroelectric facilities are operated by Meridian Energy and include Aviemore, Benmore, Ohau, Tekapo and Waitaki. These facilities collectively contribute to producing about 33 percent of New Zealand's total hydro-generated electricity. When full, Lakes Pukaki and Tekapo represent nearly two-thirds of New Zealand's total hydro-storage capacity and there is further potential for development, upgrading and enhancement of hydro-electricity facilities within the region (CRC, 1998).

The Canterbury region is also a large consumer of New Zealand's electricity, utilising approximately 13.3 PJ/annum or 12 percent (DUS, 1999) of New Zealand's consumed electricity. Consumer energy used by the industrial sector in the Canterbury region is approximately 7 PJ or three percent of New Zealand's total industrial energy consumption.

The Canterbury RPS identifies two issues in respect of energy that is important for the region. These issues are (CRC, 1998):

1. *The region's dependence on non-sustainable energy sources, and fossil fuels in particular, to meet present and future needs. These energy sources include those that are non-sustainable because of the adverse global and regional environmental effects that result from their production and use.*
2. *The adverse global and regional environmental effects, which result from the production and use of energy. These adverse effects include:*
 - (a) *air pollution*
 - (b) *loss of land*
 - (c) *effects on ancestral lands, sites and other taonga of value to Tangata Whenua*
 - (d) *loss of recreational values*
 - (e) *landscape effects*
 - (f) *human health effects*
 - (g) *effects on natural and physical resources.*

To address these issues the Canterbury RPS identifies one common objective in respect of energy, which is to reduce the regions dependence on non-sustainable energy sources. To achieve this objective, the Canterbury RPS identifies a number of policies and methods by which the policies may be implemented. There are three policies that have been identified to address the first issue for the Canterbury region.

These include (CRC, 1998):

1. *[To] promote the use of energy from renewable sources consistent with sustainable management of natural and physical resources, including the promotion of the substitution of fossil fuels with renewable sources.*
2. *[To] promote energy conservation and efficient energy use.*
3. *To enable existing hydro-electricity infrastructure in the region to be maintained, upgraded and enhanced provided appropriate regional plan rules and consent conditions relating to protection of water quality and quantity are met.*

The policies to address issue two (adverse global and regional environmental effects) are addressed elsewhere in the RPS. For example, air pollution is dealt with in the section of the plan entitled “Air”.

The methods by which the Canterbury RPS has indicated that its policies will be implemented include:

- development of a regional energy strategy;
- through advocacy, promotion and co-operation;
- information provision;
- incentives and transport services
- transport planning
- regional plans
- resource consents
- [to] encourage the preparation of iwi management plans.

The Canterbury Regional Council has conducted monitoring in relation to energy sector industry, that is specifically related to the energy issues, policies, objectives and methods outlined in the Canterbury RPS. The Canterbury Regional Council has been collecting energy use data for the region every two years that is broken down by “domestic”, “transport” and “industry/commerce” (refer also to section 5.3.1 in this report). This data is split into energy types (such as oil, gas, coal, and electricity). Thus, whilst there is no established disaggregated “industrial indicators” as such for the Canterbury region, the Canterbury Regional Council collects ongoing data on annual energy use by industry for the region (pers. comm. Canterbury Regional Council).

The Canterbury Regional Council has also utilised a number of indirect measures to promote or advocate energy efficiency and/or conservation within the region. This includes utilisation of statutory methods such as the resource consent process and indirect methods such as via papers and talks with industry (pers. comm. Canterbury Regional Council).

The Canterbury Regional Council has not developed a Regional Energy Plan, but has for some time scheduled a Regional Energy Strategy (RES). To date little progress has been made with the RES, primarily due to the demands from other more significant issues such as the development of a Regional Air Plan being placed on the Council. The RES is scheduled for release in June 2000 (pers. comm. Canterbury Regional Council).

In achieving the policies, methods and objectives of the Canterbury RPS, the Canterbury Regional Council anticipates the following environmental results (CRC, 1998):

- *More efficient use of energy;*
- *Provision of energy for the region's and nation's current and future needs from the most efficient and sustainable sources;*
- *Reduction in the adverse effects of energy production and use, (including the effects on water resources, reduced carbon dioxide emissions and reduced air pollution);*
- *Substitution of fossil fuels with more sustainable energy sources.*

The Canterbury RPS also identify two indicators that they identify *should* monitor to assess the suitability and effectiveness of the energy section of the RPS, including any need for its review.

These indicators are:

1. *Trends in regional and sectoral energy use and the proportions involving renewable sources.*
2. *Incidents and effects of significant energy shortages.*

These indicators are discussed separately under section 5.3.1 of this report.

5.1.15 Otago

The Otago region has one Regional Council and five District Councils, these being the Queenstown Lakes District Council, the Dunedin City Council, the Central Otago District Council, the Clutha District Council and part of the Waitaki District Council. The Otago RPS became operative on the 01st October 1998.

The use of Otago's natural and physical resources has, since the 1860's supported primary production activities which include mining, farming, horticulture, viticulture and forestry (ORC, 1998). However, the Otago region is also nationally significant in terms of its contribution to primary energy supply in New Zealand. Approximately 15.3 PJ/annum or two percent (Statistics NZ, 1998) of New Zealand's primary energy is derived from the Otago region in the form of hydroelectricity. This accounts for approximately 18 percent of New Zealand's hydro-generated electricity. This electricity is mostly generated from two large existing hydroelectric schemes that are

operated by Contact Energy at Roxburgh and Clyde, and from a number of smaller-sized hydro-generators within the region.

The Otago region utilises approximately 5.5 PJ/annum or five percent (DUS, 1999) of New Zealand's consumed electricity.

The Otago RPS identifies five significant energy related issues that are important for the region. These are (ORC, 1998):

1. *The production and use of energy can have both positive and negative effects on Otago's communities and resources;*
2. *Otago's dependence on non-renewable energy resources is unsustainable long term;*
3. *Wasteful and inefficient use of energy use occurs in Otago; and*
4. *Long term regional benefits from energy developments have not been fully realised in Otago.*

To address these issues the Otago RPS identifies three objectives in respect of energy. The first recognises that the production and use of energy, and the development of Otago's energy resources may cause adverse effects and aims to allow for the avoidance, remedy (including compensation) or mitigation of such effects in order that the quality and life supporting capacity of the environment is not compromised. The second objective establishes a framework for the sustainable and efficient management of the region's natural energy assets and supports, where environmentally appropriate and economically viable, continued production, use and further development of those resources. The third objective recognises by using greater amounts from renewable energy resources this will lessen Otago's dependence on non-renewable energy resources.

To achieve these objectives the Otago RPS identifies a number of policies and methods by which the policies may be implemented. There are four policies that have been identified to address energy in the Otago region. These include (ORC, 1998):

1. *[To] provide for procedures to prohibit the production of nuclear power throughout the region.*
2. *To promote the sustainable management and use of energy through:*
 - (a) *Encouraging energy production facilities that draw on the region's renewable energy resources; and*
 - (b) *Encouraging the use of renewable energy resources, in a way that safeguards the life supporting capacity of air, water, soil an ecosystems and avoids, remedies and mitigates adverse effects on the environment, as a replacement for non-renewable energy resources; and*
 - (c) *Encouraging the sustainable development of Otago's renewable energy resources.*
3. *To promote improved energy efficiency within Otago through:*
 - (a) *Encouraging the use of energy efficient technology and architecture; and*
 - (b) *Educating the public about energy efficiency; and*
 - (c) *Encouraging energy efficiency in all industry sectors; and*

- (d) *Encouraging energy efficient transport modes in Otago.*
4. *To promote the securing of appropriate benefits for Otago's communities from any energy developments within the region.*

The methods by which the Otago RPS has indicated that its policies will be implemented mainly allow for integrated and coordinated management of the energy resources in Otago whilst avoiding undesirable energy production, such as nuclear power. The methods also allow for the promotion of sustainable management, use and development of energy resources by providing for the continued allocation of water resources for existing hydro-electric schemes (in recognition of the contribution these schemes make to the nations energy supplies (ORC, 1998)) and by favouring renewable energy sources. The methods of implementation are aimed at promoting energy efficiency and savings and advocating that the region should receive increased benefit from the use of its natural resources. The Otago RPS also has as one of its methods to "*Advocate to Central Government over the need for a national policy on energy and a sustainable energy management policy*" (ORC, 1998).

As at December 1999, the Otago Regional Council has not conducted any monitoring in relation to energy sector industry that is specifically related to the energy issues, policy objectives and methods outlined in the Otago RPS. The Otago Regional Council has also not adopted any specific measures to promote or advocate energy efficiency and/or conservation to energy sector industry within the region (pers. comm. Otago Regional Council).

In achieving the policies, methods and objectives for energy in the Otago RPS, the Otago Regional Council anticipates the following environmental results (ORC, 1998):

- *Otago's communities are able to meet their present and reasonably foreseeable energy needs.*
- *The management of Otago's energy resources takes into account manawhenua values.*
- *Otago's energy resources (excluding minerals) are managed in a sustainable manner.*
- *The adverse effects on the environment from energy production, use and development are avoided or mitigated.*
- *Nuclear power is not generated in Otago.*
- *There is a relative reduction in the demand for conventional non-renewable sources of energy and cost-effective renewable sources of energy are developed.*
- *Energy efficient practices are adopted and improved throughout Otago.*
- *Energy developments in Otago provide long-term regional benefits.*

5.1.16 Southland

The Southland region has one Regional Council and three District Councils, these being the Southland and Gore District Councils and the Invercargill City Council. The Southland RPS became operative in December 1997.

The Southland region contains a wide range of mineral and energy resources that are nationally as well as regionally significant (SRC, 1997). Commercially, energy related resources that are currently utilised include fossil fuels, water and wood. Oil-based energy sources are currently imported into the region (SRC, 1997).

The Southland region contributes approximately 21.6 PJ/annum or three percent of New Zealand's primary energy supply. This is comprised of approximately 7 PJ/annum of coal (Statistics NZ, 1998; MoC, 1999c) and approximately 14.6 PJ/annum of hydro (Statistics NZ, 1998).

The South Island contains approximately 7.7 billion tonnes (around 90 percent) of New Zealand's total recoverable coal resources. These resources are dominated by huge low-grade lignite deposits (approximately 6.3 billion tonnes), which are primarily located within the Southland coal region (MoC, 1999c).

The Southland region contributes approximately eight percent of New Zealand's coal production (by energy). Major coal fields in the Southland region include the Waimumu (lignite) field, operated by New Vale Coal, and the Ohai (sub-bituminous) field, operated by Solid Energy.

New Zealand's largest hydroelectric power station is operated by Meridian Energy and is located in the Southland Region on Lake Manapouri. It contributes approximately 14.6 PJ/annum or 17 percent of New Zealand's total hydro-generated electricity (Statistics NZ, 1998). However, despite this large contribution to New Zealand's electrical needs the Southland region is not self-sufficient in either electricity or any other form of energy (SRC, 1997).

The Southland region is a large consumer of electricity, utilising approximately 19.8 PJ/annum or 18 percent of New Zealand's total electricity (DUS, 1999). This large consumption is mainly attributed to the existence of New Zealand's largest industrial user of electricity, namely the Tiwai Point Aluminium Smelter, which consumes approximately 17 PJ/annum (Meridian Energy, 1999). Consumer energy used by the industrial sector in the Bay of Plenty region is approximately 19 PJ or seven percent of New Zealand's total industrial energy consumption.

The Southland RPS identifies eleven energy-related issues that are considered important for the region.

These are (SRC, 1997):

1. *The global effects of the emission of greenhouse gases and associated environmental and public health effects;*
2. *The potential for effects on the environment of the use, development, production and transportation of energy resources;*
3. *Energy resources are generally finite in their extent and regard needs to be given to their efficient use and sustainable management, and investigations undertaken into the development of more efficient and alternative technologies;*
4. *Past practices have put vulnerable ecosystems at risk, for example, strip mining, water abstraction or channelisation;*
5. *Concern that energy is being lost or wastefully used, due to energy efficiency and conservation measures not being given enough importance and emphasis;*
6. *Energy use and production practices in the past have not considered the resulting impact on Maori cultural and traditional spiritual values, for example, construction and operation of the Mararoa Weir on the Waiau River causing a loss in Mauri of the River;*
7. *The national importance of the hydro-electric power generation in the Region needs to be given better recognition by the Region;*
8. *Potential adverse impacts of nuclear power;*
9. *The lignite resources of Southland are of national significance;*
10. *There is insufficient knowledge and documentation about the location and extent of mineral and energy resources in the Region;*
11. *Development of areas where mineral and energy resources are located can adversely affect the ability to access and use of those resources.*

To address these issues the Southland RPS identifies four objectives in respect of energy. These objectives address the sustainable management of energy resources, the avoidance, remedy or mitigation of adverse effects of mineral and energy resource development, production, use of transportation, and the promotion of renewable energy resources and the provision of energy resources for use, development and protection.

To achieve these objectives the Southland RPS identifies a number of policies and methods by which the policies may be implemented. There are nine policies that have been identified to address energy in the Southland region. These are (SRC, 1997):

1. *[To] promote the efficient use of all energy resources;*
2. *[To] advocate the development and application of a national energy strategy;*
3. *[To] promote energy conservation;*
4. *[To] recognise, and take into account, any adverse effects on mineral resources or resources suitable for*

energy production;

5. *[To] avoid, wherever practicable, remedy or mitigate the adverse effects of energy production, use, transmission and distribution;*
6. *[To] recognise and provide for Maori culture and traditional spiritual values in relation to energy production and use;*
7. *[To] prohibit nuclear power production within the Southland Region;*
8. *[To] recognise the national significance of the lignite resources of Southland, and their potential as a fuel resource;*
9. *[To] recognise and provide for the use and enhancement of existing hydro-electric facilities.*

The Southland RPS identifies a wide range of methods that it will utilise to implement its objectives and policies. These include methods that are non-statutory in nature such as:

- Information, education and public awareness;
- Promotion of energy conservation and efficiency;
- Advocacy to central government to develop a national energy strategy;
- Negotiation, Facilitation, Mediation and Arbitration;
- Consultation with public (including industry).

Statutory methods such as the preparation of Regional and District Plans, the use of the resource consent processes, involvement by tangata whenua in decision making and the use of economic instruments are all identified as being methods that will be used to achieve the stated objectives and policies. The Southland Regional Council also identifies that the development of other Plans, such as the Regional Land Transport Strategy and other Acts will give support and effect to the RPS.

Energy efficiency and/or conservation is specifically promoted or advocated to energy sector industry within the region via the use of consent procedures, consultation, the provision of information, education and public awareness through the Southland Regional Council's Environmental Education programme. This latter programme has been recognised nationally and has received a "Green Ribbon Award" by the Ministry for the Environment (MfE) (per. comm. Ken Swinney).

By comparison, monitoring conducted with respect to the specific energy issues, policy objectives, and methods outlined in the Southland RPS, that is directly relevant to energy sector industry is generally only limited to monitoring of consent conditions and those effects that arise from the use or generation of energy including air or water quality (pers. comm. Ken Swinney).

The Southland Regional Council has also utilised the MfE's EPI programme to advocate the need for central government to develop a National Energy Strategy (pers. comm. Ken Swinney).

In achieving the policies, methods and objectives for energy in the Southland RPS, the Southland Regional Council anticipates the following environmental results (SRC, 1997):

- *Efficient and sustainable use of energy resources;*
- *Decreased dependency on energy from non-renewable sources;*
- *Development and application of a national energy strategy;*
- *Increase in the stock of energy-efficient buildings;*
- *Reduction of the impact of energy production and use on Maori cultural and spiritual values;*
- *Reduced adverse effects on the environment from the development, production, use and transportation of energy;*
- *Exclusion of nuclear power production from the Region.*

The Southland RPS also identifies a range of monitoring data that they consider will be necessary to collect on a regional basis in order to measure and thus ensure that the mineral and energy objectives are being met. In response to these monitoring needs, the SRC developed a number of key indicators. These key indicators are shown below along with a brief comment in respect to what these key indicators have revealed to date (pers. comm. Ken Swinney):

- *Total regional energy use and the proportions of this, which is based on renewable resources – monitoring of this indicators has not started as it was not considered a high priority;*
- *Trends in regional sectoral demand for energy relative to population and economic activity using energy sectoral demand modeling – the Southland Regional Council has maintained a watching brief on this key indicator to date. Observations include that the population in the region is dropping and there are significant changes occurring in land use (conversions and dairying);*
- *Crisis events related to energy shortages and price shifts – the Southland Regional Council no longer consider this key indicator applicable;*
- *Air quality measurements, including trends in CO₂ and other emissions – information is being gathered through monitoring results supplied as a requirement of consent conditions⁴⁰;*
- *Quality, level and flow in water bodies – Low flow trends are monitored. The Southland Regional Council is currently developing a Regional Water Plan which in part will provide a framework for dealing with water quality;*
- *Trends in consent conditions and compliance – The Southland Regional Council has found that there are very few problems in terms of compliance issues with industry and consider industry tend to be the best performers in terms of consent condition compliance;*

⁴⁰ No specific comment was provided in respect of what this indicator has actually revealed.

- *Transport and land use activities with regard to energy production and use;*
- *Extent of consultation with the public, consumer groups and statutory bodies – The Southland Regional Council consider consultation has been extensive with the public, consumer groups and statutory bodies and view consultation as an extensive and on-going process.*

5.2 Energy Sector Industry and Regional Authorities

Regional authorities are required under the RMA to articulate the key issues and priorities for their particular region within a RPS by interpreting sustainable management and applying it to their region's particular biophysical and socioeconomic characteristics. Whilst RPS are not developed specifically for industry, they are nevertheless, to varying degrees, prepared with this particular sector in mind. Regional authorities can if they choose to further articulate their RPS in specific regional plans. Many regional authorities have elected to do this for issues such as water and air quality. No regional authority has developed a regional plan for energy. In addition, all of the 16 regional authorities have also indicated they do not intend to develop a regional energy plan.

There is an uneven distribution of energy sector industry located within New Zealand. Most large energy sector industries are located within the upper half of the North Island, including Taranaki. Together these industries are jointly responsible for accounting for approximately 81 percent of New Zealand's total industrial energy consumption. Given the presence of industry particularly within the Taranaki, Bay of Plenty, Auckland, Northland, Waikato and Southland, it is therefore reasonable to expect that energy would be considered a significant issue for these regions. In addition to the variance in the regional distribution of energy sector industry, the regions also differ widely in their particular primary energy sources. For example, Taranaki is dominated by the presence of petrochemicals, Bay of Plenty and Waikato by geothermal resources, Westland and Southland by coal, while hydroelectric sources dominate the Canterbury region.

5.2.1 Energy Issues in the Regional Policy Statements

Regional authorities identified a wide range of issues in relation to energy within their RPS. The number of energy issues identified also widely ranged in number from one (within the RPS for Taranaki) to eleven for the Southland RPS. However in considering the energy sections of the various RPS throughout New Zealand three common themes arise. These are:

- 81 percent of the regional authorities generally identify the efficient use of energy (or conversely the inefficient use of energy) as a significant issue for their region;
- 88 percent of regional authorities consider the environmental effects associated with the use of energy resources as a significant issue for their region;

- (c) 75 percent of regional authorities identify a high degree of reliance on the use on non-renewable energy sources (or conversely, a desire for the greater use of renewables) as a significant issue for their region.

With the exception of the Canterbury Regional Council, the Tasman District Council and the Nelson City Council, all regional authorities identified energy efficiency (or conversely the inefficient use of energy) as being a significant issue for their region. Despite the Canterbury Regional Council not identifying energy efficiency as a significant issue for their region, they are nevertheless one of the few regional authorities in New Zealand that are actively monitoring energy usage for their region. The Canterbury Regional Council and the Nelson City Council are also members of the Energy Wise Councils Partnership Programme (EWCPP), a programme that is focused upon energy efficient practices and technologies and thus energy efficiency appears to be very much an embedded ethic with these particular authorities.

In considering the issue of energy efficiency however, while regional authorities are required to deal with the environmental effects associated with the use of energy, they are not required to deal with energy usage per se. This is because except for section 7 (b) of the RMA namely, “...*(b) the efficient use and development of natural and physical resources*”, energy efficiency is not a direct function of local authorities under the RMA. Thus, for example, the issue of whether the actual use of energy by an industry is efficient is relevant only in terms of the environmental effects it generates (MfE, 1993). ‘Effects’ may include discharges of emissions to air or water. However, in exercising their functions, regional authorities may achieve energy efficiency by requiring that an applicant minimise their discharges to air by demonstrating that they have avoided, remedied or mitigated the environmental effects of their air discharges by maximising the efficiency of their production processes.

Thus, in considering the approaches adopted by the regional authorities for the issues of energy efficiency and environmental effects it is likely that the approaches adopted by the various regional authorities merely reflect a slightly different approach to addressing the environmental effects associated with energy usage.

The high degree of reliance on the use on non-renewable energy sources (or conversely, a desire for the greater use of renewables) was generally identified as an issue by those regional authorities that don’t have significant quantities of primary energy sources within their region. The West Coast region, which has significant primary energy sources in the form of coal deposits, also identified this as an issue for the region. Despite having virtually no primary energy sources, the Manawatu-Wanganui did not consider the high reliance of non-renewables to be a significant issue for their region. Conversely, Taranaki, Waikato and Southland, which each have significant primary energy

sources, did not consider the high degree of reliance on the use on non-renewable energy sources to be significant for their region.

5.2.2 Objectives and Policies of Regional Policy Statements

Objectives essentially comprise of a desired result and provide justification for inclusion of a particular topic. All regional authorities had between one to four objectives for energy. Three common themes arise in respect of the energy objectives. These are:

- (a) 81 percent of regional authorities identified as an objective to promote the transition from non-renewable to renewable sources of energy;
- (b) 50 percent of regional authorities identified as an objective the efficient use of energy
- (c) 50 percent of regional authorities identified as an objective the need to avoid, remedy or mitigate the adverse effects associated with the production, distribution and use of energy.

By comparison, policies are courses of action that regional authorities will use to achieve the desired anticipated results promulgated in their RPS. There was a wide range in the number of policies identified by regional authorities in respect of energy. These ranged from a single policy (Taranaki and Environment Waikato) to a maximum of twelve identified by the Bay of Plenty Regional Council. Of these three common themes occurred. These were:

- (a) All regional authorities indicated they would consider, advocate or promote energy efficiency and/or conservation in the development of natural and physical resources.
- (b) 56 percent of regional authorities indicated they would encourage or promote the use of environmentally sustainable energy resources.
- (c) 44 percent of regional authorities indicated they would implement measures to avoid, remedy or mitigate the adverse effects associated with energy use;

The Wellington, Bay of Plenty and Northland Regional Council's identified all of three of these objectives for energy. The inclusion of all three objectives may have been influenced in part by the fact that these authorities also each have large industrial energy consumers located within their region. However, Taranaki, a region that accounts for approximately 42 percent of New Zealand's industrial energy consumption has not adopted a similar approach, which indicates that regions have expressed quite wide ranging viewpoints in respect of energy.

In considering the policies and objectives of the various RPS the main themes that emerge are energy efficiency, the use of renewables and controlling adverse environmental effects associated with energy. However, it also appears that there is not always a consistent correlation between the issues, objectives and policies in all of the RPS. For example, there is good correlation between the issues, objectives and policies of the RPS for Taranaki, Gisborne and Bay of Plenty, but the

correlation was not as apparent for the Auckland, the Manawatu-Wanganui and Hawke's Bay RPS. The correlation, in this context, means that the policies follow from and are directly related to the objectives, which follow from the issues.

5.2.3 Methods of Implementation

Methods of implementation are the practical action that either will or may be taken by regional authorities to enact the policy(s) identified within their RPS. The methods of implementation identified by the regional authorities to address the policies and objectives of their RPS for energy once again varied widely. However, the methods were dominated by non-statutory rather than statutory methods.

Regional authorities generally identified five statutory methods for enacting their energy policies. Of these five statutory methods, the three predominant methods included:

- (a) 69 percent of regional authorities indicated they would allow for the provision of rules in Regional and District Plans to promote energy efficiency;
- (b) 75 percent of regional authorities expressed that they would consider the effects of energy in an applicant's assessment of environmental effects.
- (c) 69 percent of regional authorities indicated they would allow for the provision of rules within Regional and District plans that do not restrict the use of renewable energy resources.

By comparison, regional authorities generally identified thirteen non-statutory methods in respect of energy. Of these, seven predominant methods emerged. These were:

- (a) 81 percent of regional authorities indicated they would utilise advocacy, promotion or provision of information to promote energy efficiency and conservation;
- (b) 63 percent of regional authorities indicated they either would or may utilise advocacy to central government to develop a national energy strategy or policy statement;
- (c) 50 percent of regional authorities indicated they would encourage inter-agency cooperation for research and development, dissemination of information, etc;
- (d) 50 percent of regional authorities indicated they would establish energy forums or liaisons with organisations with energy interests (for example, industry);
- (e) 44 percent of regional authorities indicated they would advocate and promote the use of renewable energy resources;
- (f) 44 percent of regional authorities indicated they would lead by example in terms of energy efficiency and conservation;
- (g) 44 percent of regional authorities indicated they would provide advice regarding acts, regulations, legislation or information regarding energy efficiency.

Of all the non-statutory methods identified by the various regional authorities, the use of advocacy, promotion and/or the provision of information to promote energy efficiency and conservation far outweighed any other identified non-statutory method. However, of the 81 percent of regional authorities that indicated they would implement this method, only 38 percent of regional authorities could provide examples of the specific measures they had used to promote/advocate energy efficiency and conservation for industry. The types of methods used by regional authorities to promote/advocate energy efficiency and conservation also varied widely from presenting papers to conducting environmental education programmes.

5.2.4 Monitoring of the RPS in Respect of Energy Sector Industry

Section 32 of the RMA requires local authorities to find the most cost-effective means of achieving sustainable management of resources in their communities, whilst section 35 of the RMA imposes a duty upon local authorities to gather information, monitor and keep records.

However, despite the wide range of both statutory and non-statutory methods that have been identified by regional authorities for energy very little monitoring is actually being conducted in relation to the energy issues, policies, objectives, and methods of implementation outlined in the RPS that are relevant to energy sector industry. For example, of the 16 regional authorities, only the Canterbury Regional Council indicated that it had energy-environment indicators that are relevant to industry. The Canterbury Regional Council on a biannual basis, collects sectoral and fuel mix energy use data for the region as well as sectoral CO₂ emissions.

5.3 State of the Environment Reports

Within this section, only the energy section of the Canterbury Regional Council's State of the Environment Report (SER) is presented. Canterbury was selected as it currently represents the most comprehensive source of regional monitoring for energy consumption data in New Zealand.

A number of State of the Environment Reports (SER) are now being produced by regional, district and city councils. Currently 69 percent of regional authorities now prepare SER, however, only three regional authorities (or 18 percent) have actually reported on energy within their SER. These are the Canterbury Regional Council, the Taranaki Regional Council and the Wellington Regional Council. In some instances, city councils such as the Manakau City Council and Christchurch City Council are also using energy indicators to monitor their district's energy consumption and production patterns. However for the reasons stated in section 5.0, territorial authorities have not been considered within the ambit of this research.

There is currently limited information available that assists decision makers in understanding the energy demands for the various regions and districts within New Zealand (MfE, 1997, MCC, 1999). As a consequence, local governmental bodies are often reliant on assuming that the trends identified at a national level are similar to those that might be expected to occur at their local level. Whilst some of these assumptions may be relevant to some regions or districts that exhibit characteristics that are similar to those that are displayed at a national level, this is not the case in all instances. For example, the Marlborough District has both a low population base and low incidence of energy sector industries within its region and therefore its energy demands would be quite different to that which is exhibited in the Canterbury region, which has both a higher population and industrial base.

Whilst much environmental data is provided from detailed monitoring to check compliance with permit or consent conditions, some is also provided by conducting wider and more co-ordinated monitoring on the environment. This is referred to as a **State of the Environment Report (SER)**. SER looks at either the extent of the pressures on a resource, or the current state of the resources being managed including key interactions that may occur across resources.

The RMA permits some discretion as to how authorities may develop and apply their monitoring and reporting processes. As a consequence, this provides some latitude for authorities to decide what approaches they may use for SER.

SER has become increasingly important locally, nationally and internationally as it provides a means of gathering information and analysing the various effects that can impact upon the natural and physical environment. SER is also helpful as it assist individuals in making better resource management decisions and provides direction to changes that may need to be made to improve our lifestyles for the benefit of present and future generations. By systematically collecting together information local authorities can monitor and analyse changes in the quality of the environment over time. The information gathered can also assist decision-makers arrive at more informed conclusions. Locally, state of the environment reporting also provides important means of measuring the effectiveness of local policies and plans.

5.3.1 Canterbury Regional Council

The Canterbury Regional Council (CRC) released a "*Regional Environmental Report*" (RER) in 1997. The RER is grouped around a range of key headings, which also includes energy. Within the energy section of the RER the CRC identify a number of key indicators. These are shown in italics below and are followed by a brief description of the CRC findings.

INDICATOR *Location, generating capacity and quantity of electricity supplied from hydroelectric power stations in the Canterbury region per annum;*

INDICATOR *Location, generating capacity and quantity of energy supplied from non-renewable sources per annum;*

INDICATOR *Location, generating capacity and quantity of energy supplied from renewable sources per annum;*

These above three indicators are aimed at gathering information from energy production and supply. **Primary production** energy sources include renewable sources as hydroelectric power as well as wood, biogas, landfill gas, solar and wind energy. As well as renewable sources, non-renewable sources such as coal, gas and oil are also monitored. In the 1995/96 year, Canterbury hydroelectric facilities supplied some 31 percent of New Zealand's total hydroelectric production (CRC, 1997).

Secondary energy sources include all petroleum products (including petrol, diesel, light and heavy fuel oils, and aviation fuels) and those forms of electricity generated from fossil fuels. The CRC estimate that the total amount of secondary energy sources supplied (and in consequence used) within the Canterbury region for 1995 was 33 PJ (CRC, 1997).

INDICATOR *Regional and sectoral energy consumption per annum*

The CRC found that in 1994 the industrial/commercial sector accounted for 25 percent of the region's energy consumption with the transport sector continuing to be the largest consumer of energy within the region. The **total regional energy consumption** was also monitored and was estimated at 49 PJ/annum for 1995. This figure represents around 11.8 percent of the total New Zealand energy consumption (CRC, 1997).

INDICATOR *Regional energy consumption per capita;*

Energy consumption per capita provides a broad indicator of energy use in the region (CRC, 1997). The CRC has found since 1991 energy consumption per capita has increased from 100.8 GJ/capita to 107.1 GJ/capita.

INDICATOR *Ratio of energy consumption per GRP; significant environmental effects of energy generation, supply and use including sectoral contribution towards atmospheric emissions including CO₂, and any discharges to land or water.*

The indicator **ratio energy consumption per Gross Regional Product** shows that the regional economy and energy consumption has continued to grow substantially since 1988, with energy consumption growing at a rate twice of that of the region's economic growth. The CRC mainly

attribute this phenomenon to increased energy intensity associated with growth within the transport sector.

The indicator, **carbon dioxide emissions by sector** is used to monitor significant environmental effects of energy generation, supply and use. The CRC found that in the 1995 year CO₂ emissions from energy activities in Canterbury region totaled some 2.66 million tonnes or 10 percent of New Zealand's total CO₂ emissions (CRC, 1997). Of this total, 82 percent was attributed to the transport sector and approximately 17 percent to the industrial/commercial sector, with the remainder being attributed to the domestic sector.

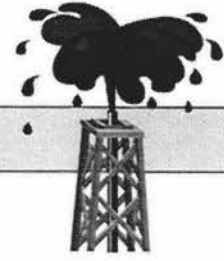
From the application of these indicators, the CRC has found the following key trends are occurring within the Canterbury region (CRC, 1997):

- *Total energy consumption has been increasing at a rate greater than the national average;*
- *Transport has been the most significant consumer of energy within the region;*
- *Regional energy consumption per capita and per GRP has continued to rise;*
- *Carbon dioxide emissions have continued to increase as a consequence of increased energy consumption by the transport sector.*

The CRC provides a stellar example of the application of energy indicators at a regional level in New Zealand. This performance in terms of energy monitoring is attributed to a number of factors, including (pers. comm. Canterbury Regional Council):

- (a) the region has strong energy proponents in Council;
- (b) an integrative focus taken by the CRC to energy and transport; and
- (c) the effect of energy usage on the Canterbury air quality;

Thus, in terms of energy, the CRC in stark comparison to the majority of other regional authorities in New Zealand is far better positioned to both respond to and understand the state of its regional environment. As a result the CRC is also better positioned to evaluate whether it is meeting its functions, powers and duties under the RMA.



Energy Sector Industry

Interactions that occur between industry and government assist both parties to better understand their responses to environmental policies and objectives. These interactions ultimately determine achievement of national and international environmental targets, such as the obligations New Zealand has under the Framework Convention for Climate Change.

6.0 Introduction

As part of the research for this report it was decided to survey a cross section of industry in New Zealand to gauge some insight into the types and frequencies of environmental monitoring that is conducted, how this monitoring is reported, and to whom. This approach was considered to be of use as it provides a means of revealing some of the disaggregated measures of energy that are currently used by large energy-using industries in New Zealand.

6.1 Energy Sector Industry in New Zealand

This section provides an overview of the scope and rationale adopted for the selection of participants in the survey.

For the purpose of this research, energy sector industry is defined as “including energy generators, transformers and consumers within the industrial sector, and excludes the residential, commercial, agricultural and transport sectors”. However, for the purpose of conducting this survey, the definition for energy sector industry was narrowed to including only the larger energy generators, transformers and consumers within the industrial sector, in New Zealand.

The companies that were identified and selected for participation in the survey were primarily derived from the list of signatories⁴¹ to the Government’s Voluntary Agreement (VA) programme. These signatories represent New Zealand’s larger energy-using industries, as well as the main

⁴¹ The Ministry of Commerce (MoC) has previously identified these signatories as contributing over 80 percent of New Zealand’s industrial carbon dioxide emissions.

electricity, gas and coal producers. Refer to Appendix 1 for a list of VA signatories and their commitment reductions.

There are also organisations that participate in VA programme that are relatively small emitters of carbon dioxide (CO₂). These organisations include the *Coal Research negotiated contracts* (a collective negotiated contract of coal users), *ACI New Zealand Glass* and *Winstone Wallboards*. For the purposes of this survey it was decided to exclude these organisations on the basis that they are relatively small emitters of CO₂.

The meat, cement and dairy industries also signed collective agreements under the VA programme. Only the larger of these signatories such as AFFCO and the Alliance Group, Milburn Cement and Golden Bay Cement, and Kiwi Dairies were targeted for inclusion in the survey as they are representative of the larger energy-using industries in New Zealand.

The Electricity Corporation of New Zealand (ECNZ) was also a signatory to the VA programme. ECNZ was also invited to participate in the survey as final corporate separation for this company did not occur till 1 April 1999. ECNZ and the subsequent formation of the new state-owned enterprises are also discussed further within section 6.4.

Fletcher Challenge Energy, Fletcher Challenge Paper, TransAlta and four electricity generation companies⁴² were also identified for participation in the survey. These companies were also included in the survey as they were also considered to be representative of the larger energy-using industries that are currently signatories to the VA programme.

6.2 Survey of Energy Sector Industry in New Zealand

The purpose of conducting a survey was to gauge the inter-relationships that exist between industry and governmental/non-governmental organisations that have responsibilities for energy within New Zealand. The governmental/non-governmental organisations that were specifically identified for gauging industry feedback on included:

- the Ministry for the Environment (MfE);
- the Ministry of Commerce (MoC);
- the Energy Efficiency and Conservation Authority (EECA);
- the company's relevant regional authority(s); and
- any "other" (specified) body that company considered relevant.

⁴² Conditional to participation in the survey, two electricity-generating companies requested anonymity.

Gauging these inter-relationships was seen as a means to understanding the:

- (a) the types of energy and environmental information and/or data that is gathered by energy sector industries within New Zealand;
- (b) the means by which this energy and environmental information and/or data is communicated, and the frequency of communication;
- (c) to whom energy sector industries report to energy and environmental information and/or data to.

The rationale behind selection of participants in the survey has been discussed in section 6.1.

Guidance was drawn for planning, developing and executing the survey from a publication entitled “*SPSS Survey Tips*”. The survey was generally structured into four areas: energy efficiency and conservation; monitoring and reporting; interaction with governmental and non-governmental agencies; and energy consumption. Energy consumption data was solely included in the survey to assess the influence of a company’s environmental monitoring in relation to the overall performance of large energy sector industry in New Zealand. For example, a company with a relatively low energy consumption or generation may utilise and report on a range of environmental initiatives but not be representative of a significant portion of the energy sector.

The survey was targeted at the New Zealand section of energy sector industries only and as such respondents were requested to exclude (for the purposes of their responses) any operations that occurred outside of New Zealand. Each participant was requested to provide their organisation’s name, the location of their main industrial plant, and locations of any other industrial plants within New Zealand.

Contact with the targeted companies was initially established via email, where the purpose of the survey was identified. The companies were then invited to participate in the survey and each participant was given the option of providing information on a confidential basis. The initial contact was followed with phone calls if there was no response. Clarification was sought from the participants regarding any response that was not answered clearly.

All of the completed questionnaires (with the exception of the energy consumption figures⁴³ provided in question 15 of the survey) are included in full in Appendix 5 (Industry Survey Responses).

⁴³ Because of the commercially sensitive nature of the energy consumption data provided by respondents to question 15 of the survey, this information has been kept confidential.

6.3 Survey Participants

The following lists the organisations that were contacted to participate in the survey:

- AFFCO
- four electricity generation companies
- Alliance Group
- BHP New Zealand Steel
- Carter Holt Harvey
- ECNZ
- Fletcher Challenge Energy
- Fletcher Challenge Paper (Tasman Pulp and Paper)
- Golden Bay Cement
- Kiwi Dairies
- Methanex
- Milburn Cement
- Natural Gas Corporation
- New Zealand Aluminium Smelter (Comalco)
- New Zealand Dairy Group
- New Zealand Refining Company
- New Zealand Sugar Company
- Petrochem
- Solid Energy
- Shell Todd Oil Services
- TransAlta

Of the twenty-four companies that were contacted, nineteen respondents agreed to participate in the survey, giving an excellent response rate of 79 percent. Of the remaining industries, Petrochem declined to participate in the study, whilst the two meat companies (AFFCO and Alliance) failed to acknowledge a response despite several attempt at contact. In addition, whilst limited correspondence was held with two electricity generating companies, they also did not formally respond to the survey.

Of the nineteen survey respondents, fourteen organisations are VA signatories whilst five organisations are not. The organisations that are not currently VA signatories include Fletcher Challenge Energy, Fletcher Challenge Paper (Tasman), TransAlta, and two electricity generating companies.

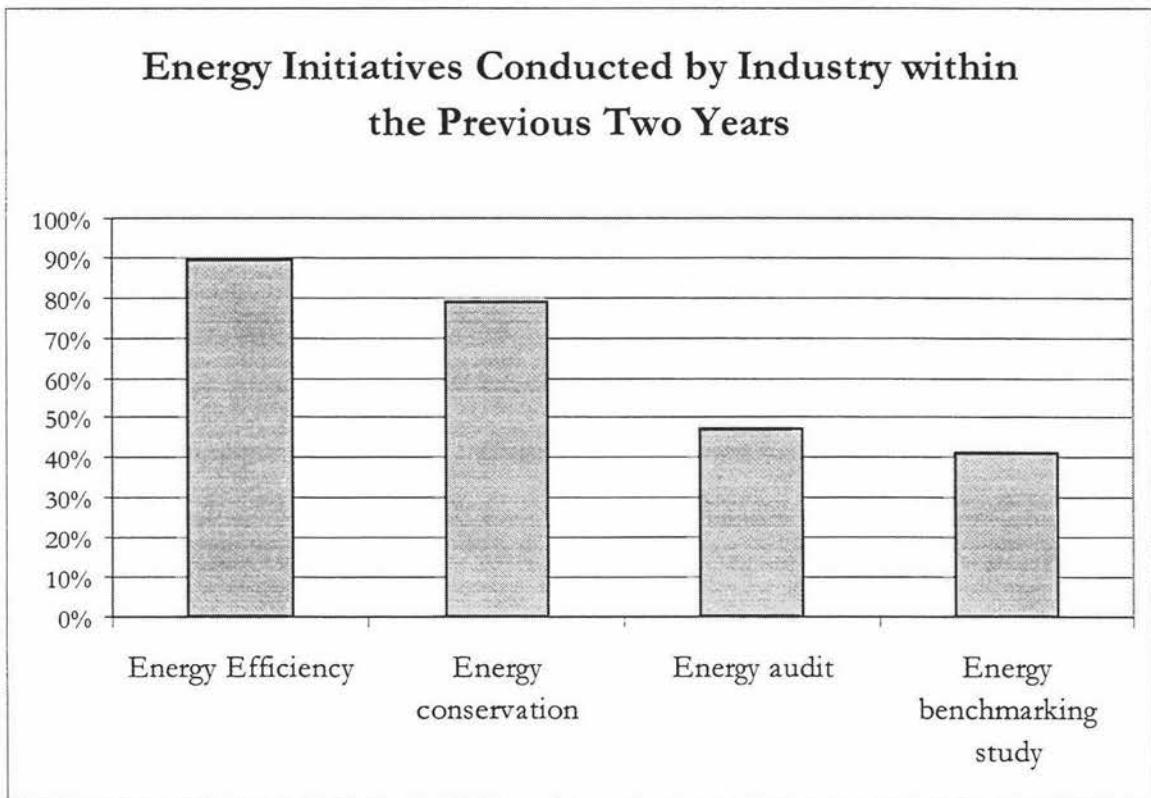
Participation (by the above described organisations) in the VA programme has not occurred because either the organisation was not formed at the time the VA programme was initiated, the organisation was not specifically targeted, or a formal voluntary agreement was not finalised. Incorporation of these “non-VA signatories” in the survey was considered useful however, as these companies are similar in characteristic to the large energy industries that are VA signatories. The non-VA signatories can also provide some insight into whether the reductions in greenhouse gas emissions by industry in New Zealand is attributable to the VA programme, or not.

The findings of the survey are now discussed.

6.3.1 Energy Efficiency

Question 1 of the survey sought to determine if the organisation had undertaken any energy related initiatives within the last two years. Such initiatives included energy efficiency, energy conservation, an energy audit, or an energy benchmarking study. In addition, Question 4 sought to determine what proportion of identified items from the energy audit had actually been implemented if one had been conducted within the previous two years. Figure 8 shows the responses to Question 1 of the survey.

Figure 8: Energy Initiatives Conducted by Industry within the Last Two Years



89 percent of the total respondents have conducted energy efficiency initiatives within the last two years. Of this percentage, all companies that are VA signatories have completed energy efficiency initiatives and 60 percent of respondents that are non-VA signatory companies have also conducted energy efficiency initiatives. This result indicates that large energy related industries are actively pursuing and implementing methods to improve their organisation's energy efficiency. It also indicates that energy efficiency occurs within industry despite the non-legally binding drivers behind the VA programme.

The results also indicate that energy efficiency initiatives are at the forefront of methods used by VA signatories. The VA programme is aligned to achieving CO₂ savings primarily based upon either energy efficiency measures or technological improvements to plant or processes (Jamieson, Pool, 1999a, 1999b).

However, improvements in energy efficiency cannot be specifically attributed to the existence of the VA programme itself, because organisations may have also implemented energy efficiency measures for a range of other reasons. These may include:

- (a) an organisational objective to promote cost savings; or
- (b) energy efficiency may have already been an imbedded attribute of the organisation; or
- (c) the organisation may have responded to the threat of statutory economic instruments being introduced in New Zealand rather than as a desire to specifically pursue energy efficient methods. For example, carbon taxes were previously raised as a potential economic instrument by Government for controlling CO₂ emissions; or
- (d) a desire to demonstrate that more energy-environment activities are being initiated than that that is statutorily required (that is, good corporate citizenship).

Despite the particular drivers behind organisation's implementing energy efficiency measures the results from this survey suggest that the VA programme appears to have contributed to raising the profile of energy efficiency within industrial organisations. This opinion is supported by the fact that 100 percent of the respondents that are VA signatories have implemented some form of energy efficiency initiative. This also suggests that the more industrial organisations that the Government can incorporate into the VA programme, the greater the likelihood of achieving further successes in energy efficiency and therefore "CO₂ savings".

6.3.2 Energy Conservation

79 percent of respondents also indicated that their organisations have conducted energy conservation initiatives within the last two years. 93 percent of the VA signatories have conducted

energy conservation initiatives, whilst only 40 percent of non-VA signatories have conducted energy conservation initiatives.

As seen by Figure 8, energy conservation initiatives were utilised less than energy efficiency initiatives by industry. This may be due to the fact that industries view energy conservation practices as being more problematic to implement. For example, whilst energy usage would be conserved by turning off a boiler when it is not in use, because of the practical limitations associated with start-up, maintenance or fluctuating demand, these pieces of equipment may be left operating at low rates when not in use.

Energy conservation measures by their nature also include those activities that require numerous separate actions by a range of individuals. This means that in certain instances energy conservation measures may be both more time consuming to implement and harder to quantify the actual energy savings, in comparison to energy efficiency measures. For example, energy conservation measures include the turning off of computers and lights when not in use. In considering these particular examples further, it is often difficult to quantify the actual savings in a monetary (or other) term from turning off a light or a computer, and thus harder for industry representatives to communicate the benefits gained to employees to encourage further savings. In comparison, the use of energy efficiency measures by industry generally involves implementing a specific project within a fixed time frame. These projects, such as the installation of a cogeneration plant, can also be quantified easier, in both monetary and energy use terms.

However, given that 93 percent of the respondents that are VA signatories have also implemented some form of energy conservation measure, this suggests that energy conservation may also be a method used by the VA signatories to achieve their commitment reductions in greenhouse gases.

6.3.3 Energy Audits and Energy Benchmarking Studies

Whilst energy audits and energy benchmarking studies are not a substitute for a planned energy management programme, they can and do provide a useful means of conducting a technical review to determine the way in which energy is used by an organisation (EECA, 1996a). As can be seen by Figure 8, only 47 percent of the total respondents indicated that they have conducted an energy audit and only 41 percent have conducted an energy benchmarking study within the last two years.

Of this percentage, less than 50 percent of respondents which are VA signatories have conducted both energy audits and energy benchmarking studies. However, 86 percent of the respondents that are VA signatories have conducted either an energy audit or an energy benchmarking study within the last two years. From these results it appears that energy audits and energy benchmarking

studies may have been less favoured methods than energy efficiency or energy conservation measures used to achieve VA commitments. This is probably due to the fact that most signatories would have identified how they would achieve their commitment reductions in “CO₂ savings” prior to signing their particular VA agreements with the Government.

Energy bench marking studies or energy audits are also quite large exercises for an organisation to undertake. By their nature, these types of initiatives are also quite static, providing a “snapshot” look at performance at a particular time. Thus, in comparison to energy conservation or energy efficiency measures, energy benchmarking studies or energy audits would be carried out less frequently (for example, every five years). This means energy benchmarking studies or energy audits are less likely to arise in comparison to energy conservation or energy efficiency measures if considered over a similar time frame. Given that the respondents were requested to indicate if these initiatives had been conducted within the last two years it is possible that either an energy benchmarking study or energy audit may have been carried out, but not within the last two years.

By comparison, only 20 percent of non-VA signatories have conducted an energy audit and none of the non-VA signatories have conducted an energy bench marking study. It is difficult to attribute particular reasons for this occurrence and unwise to draw many inferences from this result primarily because of the low representation of respondents which are non-VA signatories. It should also be noted that of the non-VA signatory industries surveyed, these companies are also dominated (over 50 percent) by electricity generators. It is therefore likely that energy audits or energy bench marking studies have not been conducted because these types of companies can not easily influence energy consumption. This is because electricity generation is driven by demand from consumers as opposed to being controlled by the actual generators themselves.

Of the total respondents who indicated they had conducted an energy audit within the last two years (47 percent), seven respondents indicated a percentage of the audit items that had been completed, one respondent was unsure and one respondent did not provide information. Of the seven respondents who provided information to Question 4 of the survey it was determined that there was a large variation in the reported completion of audit action items by the respondents. This ranged from a minimum of 15 percent by one respondent to a maximum of 90 percent by another respondent. An overall average of 46 percent was achieved for the seven respondents with most respondents completing around 50 percent of their identified actions.

6.3.4 Monitoring and Reporting

If an organisation doesn't have a clear understanding of how much energy is being consumed within its processes it is difficult to determine or prioritise what improvements are possible. Thus,

monitoring and reporting systems are an integral part of energy management for industry that can assist them in maximising the economic advantage of their energy resources.

Question 2 of the survey sought to determine if any of the energy initiatives conducted in Question 1 of the survey were reported externally, whilst Question 3 of the survey sought to determine to whom these initiatives were reported. 63 percent of respondents indicated that they had reported (either) their energy efficiency, energy conservation, energy audit or energy bench marking study externally.

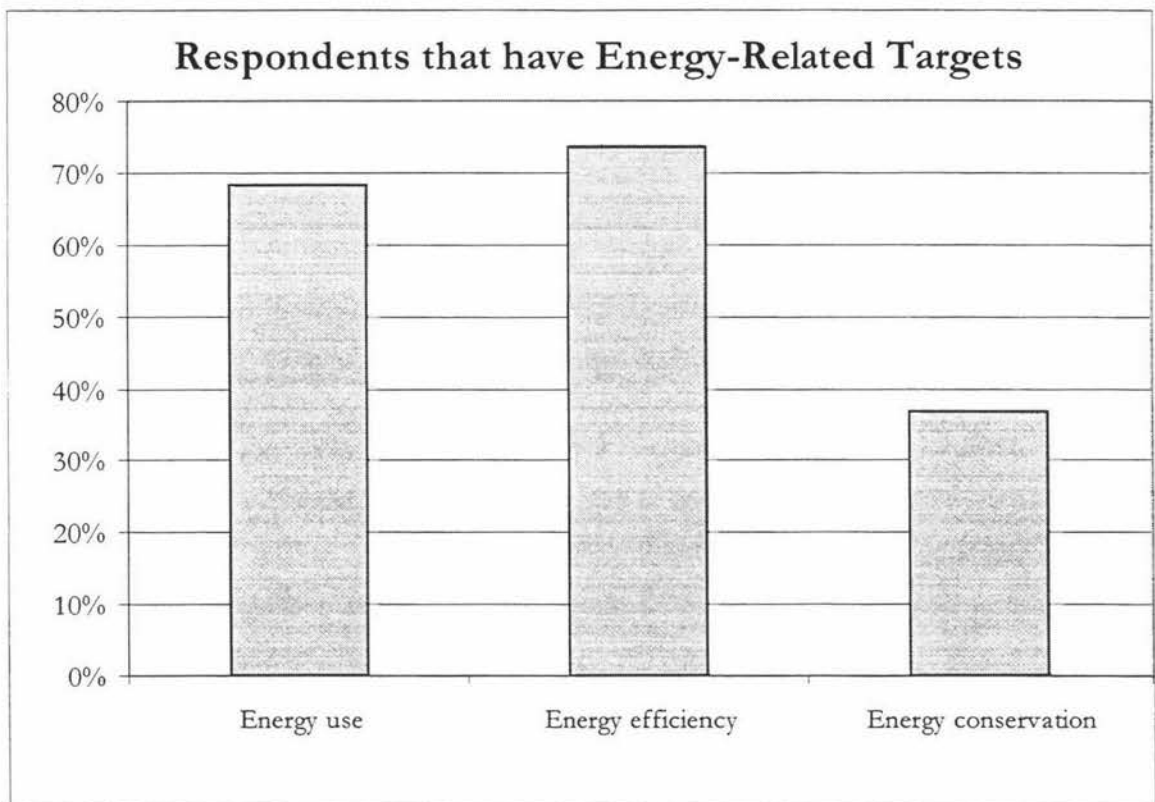
71 percent of respondents who are VA signatories had reported one or more of the energy related initiatives identified in Question 1 externally. Of those that had reported their energy related initiatives externally, 70 percent of the VA signatories indicated that they had reported one or more of their energy related initiatives to the EECA or MoC. This indicates that whilst most energy initiatives are being reported to Government within the context of the VA programme, not all VA signatories appear to be communicating all of energy related benefits that they are achieving. This most probably occurs primarily due to the low level of reporting requirements that is currently placed upon VA signatories as part of the VA programme (Jamieson, Pool, 1999a, 1999b). This also suggests that (within the context of the VA programme) the true benefits in terms of "CO₂ savings" or reductions in greenhouse gas emissions may not be being fully realised within New Zealand.

Respondents also listed a number of "other" recipients, to whom they reported their initiatives. These included regional councils, parent companies, stakeholders and industry associations. This indicates that a proportion of the data, which could be used to support more aggregated environmental performance indicators for energy sector industries resides outside of the statutory reporting channels. Therefore, if central government are to maximise their ability to obtain more disaggregated measures of energy from energy sector industry, they will need to draw on the support of industry representatives to gain easier access this information. Wide consultation with many stakeholders has also been identified as an ethos of the MfE's Environmental Performance Indicators (EPI) programme (MfE, 1998c).

By comparison, 40 percent of non-VA signatories indicated that they reported (externally) one or more of their energy related initiatives, conducted within the last two years. Of the non-VA signatories, both respondents indicated they provided information to the MoC and/or EECA. Once again because of the low participation by non-VA signatories it is difficult to draw inferences from these results.

Whilst monitoring is a process of measuring and recording data, targets are a process by which realistic goals can be set using data and other information to improve the energy use, energy efficiency or energy conservation of an organisation. Targeting is the process whereby benchmarks and energy performance goals are set. Targets are based on monitoring information and should be measurable, achievable and consistent with overall policy and output requirements (EECA, 1997b). Question 5 of the survey sought to determine whether energy use, energy efficiency and/or energy conservation targets are used within industry. The purpose of gauging a response to this question was to determine if organisations have an ongoing commitment to achieving improvements in energy use, energy efficiency and/or energy conservation. Figure 9 shows the responses to Question 5 of the survey.

Figure 9: Industry Energy Related Targets



68 percent of the total respondents indicated they had a target for energy use, 74 percent indicated they had a target for energy efficiency and 37 percent indicated they had a target for energy conservation. The responses to this question also showed that organisations that have a target for energy use also have a target for energy efficiency, indicating that that these two drivers tend to be targeted together.

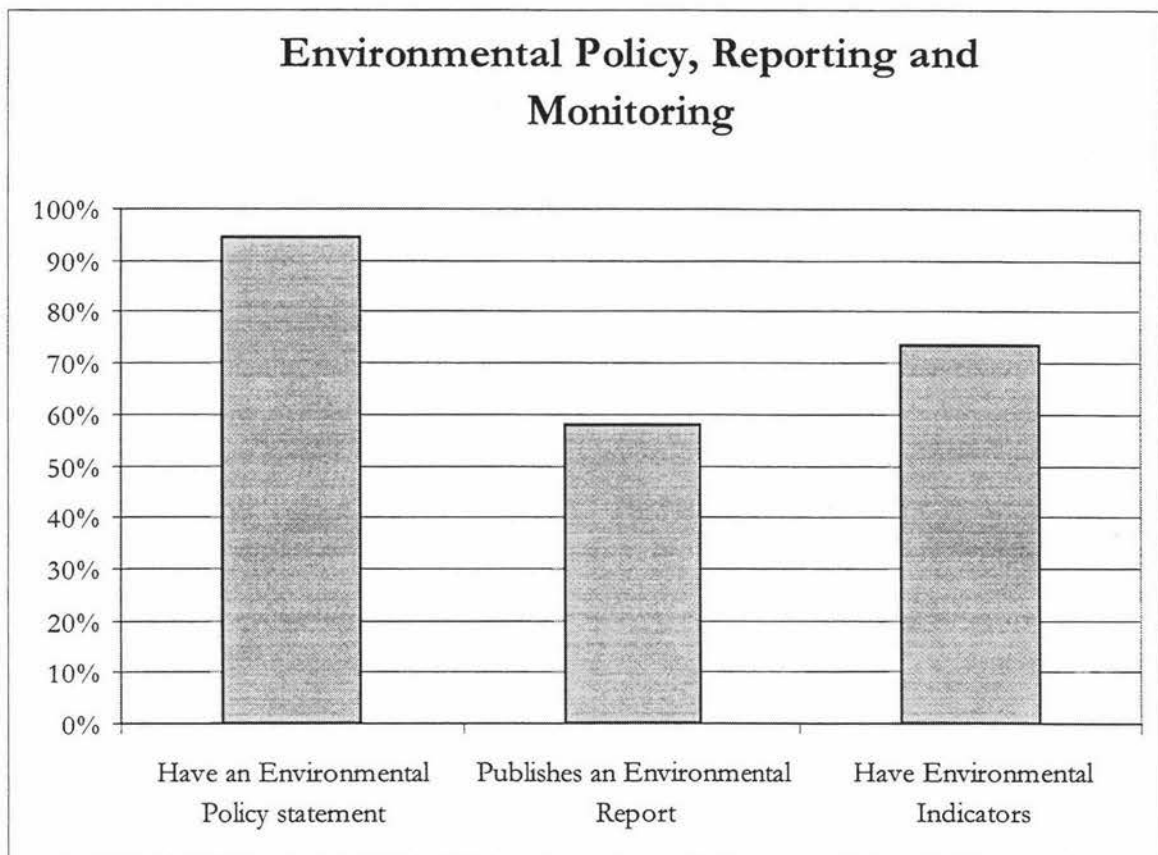
In addition, whilst 68 percent of the total respondents indicated they had a target for energy use, 74 percent of the total respondents actually provided energy consumption data for their company.

This indicates that whilst organisations may not have a target for energy use they may be aware of their energy consumption. Of the five respondents that did not provide energy consumption data, one respondent was unsure, one respondent was a coal producer and three were electricity producers.

37 percent of respondents also indicated that they had a target for energy conservation. Of these respondents, all that have energy conservation targets also have targets for energy use and efficiency. This suggests that organisations that show an interest in their organisations energy use are also orientated towards trying to understand how to conserve and use their energy supplies efficiently. However, once again the lower interest shown by industry in respect of energy conservation in comparison to energy efficiency is probably due to the fact that it is harder for industry to develop targets for energy conservation than it is for energy efficiency.

Question 6 of the survey sought to determine which organisations had an environmental policy statement. Question 7 sought to determine which organisations publish an environmental report whilst Question 8 sought to determine whether an organisation used environmental performance indicators. Figure 10 shows the responses to Questions 6, 7 and 8 of the survey.

Figure 10: Industries that have Produced Environmental Policy Statements, Environmental Reports and/or Environmental Performance Indicators



95 percent of the total respondents indicated that their organisation had an environmental policy statement. Environmental policy statements provide a means for communicating to employees and the organisation's stakeholders the mission, goals and/or objectives of the organisation.

In certain instances some companies have additionally translated their goals or objectives further into specific measurable targets. For example, Appendix 6 includes the Environmental Strategic Plan for BHP New Zealand Steel. This strategic plan describes BHP New Zealand Steel's vision and mission for the environment including the targets and key strategies that BHP New Zealand Steel have identified they will utilise to achieve a high standard of environmental care.

Environmental reports provide an effective means for industry to translate their environmental information to their stakeholders. 58 percent of the total respondents indicated that they publish an environmental report. Of these respondents 90 percent are VA signatories. However, not all organisations that publish their environmental progress publish it within a dedicated report. For example, a number of respondents indicated that their environmental data is published along with their financial data within an annual report.

74 percent of the total respondents also indicated that their company has environmental performance indicators. The use of environmental performance indicators by industry can provide reliable measures of energy use, including any associated environmental effects. These disaggregated indicators can also support and assist in interpreting more aggregated measures of energy that are used at a national or international level. Such measures also assist governmental organisations in determining whether aggregated measures of energy such as those used in the VA agreement (tCO₂ per unit of product produced) are contributing to achieving international commitments to reduce greenhouse gas emissions. This is because disaggregated measures can assist in attributing energy use by industry to actual energy efficiency improvements or changes in energy activities. Such disaggregated measures of energy are commonly used in countries such as Canada (refer to section 7 of this report).

Of the total respondents with environmental performance indicators, 90 percent are VA signatories whilst 10 percent of respondents are non-VA signatories. A summary of the general types of environmental performance indicators that are used by industry is shown in Table 3.

It was difficult to interpret from the responses received, the actual extent of energy-environment related data that is collected by industry on a routine basis. For example, all the respondents from the metals, dairy and cement sectors indicated that they had a target for energy use, but did not consider that they had an environmental performance indicator for energy consumption.

In addition, whilst 31 percent of respondents stated that they had environmental performance indicators for energy consumption, 74 percent of respondents actually provided energy consumption data for Question 15 of this survey. This suggests that 43 percent of respondents do not in fact consider their energy consumption data to be an environmental performance indicator.

Table 3: Industrial Environmental Performance Indicators

SECTOR	CO ₂ Emissions	Air Quality (not including CO ₂)	Effluent Quality	Solid/Liquid Waste Volumes
Metals	✓	✓		
Dairy	✓	✓	✓	✓
Cement	✓	✓		
Gas/Oil Processing	✓	✓	✓	✓
Forestry/Pulp and Paper	✓	✓	✓	✓
Petrochemical/Refining	✓	✓	✓	✓
Electricity Generation	✓	✓	✓	✓
Manufacturing	✓		✓	✓
SECTOR	Incidents/Complaints	Legal/Compliance	Energy Consumption	Energy Efficiency
Metals	✓	✓		✓
Dairy	✓	✓		
Cement	✓	✓		✓
Gas/Oil Processing	✓	✓	✓	✓
Forestry/Pulp and Paper		✓	✓	✓
Petrochemical/Refining	✓	✓		
Electricity Generation		✓	✓	✓
Manufacturing				
SECTOR	Water Usage	Product Recycling	Miscellaneous (sub-sector specific)	
Metals				
Dairy	✓			
Cement				
Gas/Oil Processing	✓			
Forestry/Pulp and Paper	✓	✓	✓	
Petrochemical/Refining				
Electricity Generation			✓	
Manufacturing				

It therefore appears from the responses provided that there is a difference in the perception of what industrial representatives consider constitutes an environmental performance indicator. For example, 85 percent of the total respondents also stated they had environmental performance indicators for legal or compliance issues. Legal or compliance issues include measures such as the number of environmental breaches that have occurred within an organisation. Whilst legal or

compliance measures may constitute a measure of the performance of an organisation, this type of indicator reflects the ability of the organisation to meet its consented requirements, rather than providing a qualitative or quantitative measurement of the environment per se.

Further analysis of the responses to Question 9 of the survey revealed that the environmental performance indicators identified by the respondents are primarily focused on:

- CO₂ emissions (92 percent);
- solid or liquid waste volumes (85 percent);
- legal or compliance measures (85 percent);
- effluent quality (77 percent); and
- air quality – not CO₂ related (69 percent).

(Note: the percentages shown in brackets represent the percentage of respondents with environmental performance indicators that have an indicator for that parameter).

These figures compare with energy related indicators for energy consumption (38 percent) and energy efficiency (31 percent). This suggests that the monitoring conducted by industry is more focused upon the outputs associated with their operations than on inputs. For example, air quality and waste generation are indirect effects that arise from energy use.

The diversity in the types of environmental performance indicators reported also indicates that companies view their operations as having the potential for causing a wide range of environmental impacts that link with a range of issues that are not solely related to energy consumption or energy efficiency. The above results also suggest that industry are currently focusing their monitoring efforts on statutory monitoring requirements (for example, air quality and waste generation), rather than non-statutory requirements. This approach also aligns with the predominantly non-statutory methods that regional authorities have placed upon energy within their Regional Policy Statements (RPS) and also reflects the limited responsibilities that regional authorities have under the Resource Management Act (RMA).

Of the 92 percent of respondents that indicated they had environmental performance indicators for CO₂ emissions, 100 percent were VA signatories. The high incidence of the use of environmental performance indicators for CO₂ emissions is attributed to VA signatory reporting requirements under the VA programme.

The high response rates for solid or liquid waste volumes, effluent quality and air quality (not CO₂ related) by respondents also probably reflects the active administration of these issues by regional

authorities under their statutory obligations, namely the RMA and its subordinate legislation, namely RPS and Regional Plans.

This suggests that if regional authorities were to put an equivalent emphasis on the implementation of the policies, objectives and methods of their various RPS for energy (as they do for water and air issues), then a similar monitoring and reporting emphasis by industry, would probably be placed on energy. Achieving such an objective is also not outside of the responsibilities of local authorities under the RMA. For example, energy efficiency reporting requirements can be incorporated into air discharge consents. This latter example is a reporting mechanism that is actively utilised by the Taranaki Regional Council to ascertain the influence energy efficiency measures have on the environmental effects associated with industrial air discharges. In addition, if more comprehensive reporting requirements were placed on industry this could also assist regional authorities to achieve more in terms of reporting on the progress or effectiveness of their policies, methods, and objectives in their RPS.

6.3.5 Interactions with Organisations with Responsibilities for Energy and the Environment

There is a range of governmental and non-governmental organisations with responsibilities for energy in New Zealand. Question 10 of the survey requested respondents to rate the flow of information/advice from the following organisations to their company:

- MfE;
- MoC;
- EECA;
- their relevant Regional Authority; and
- other relevant organisations.

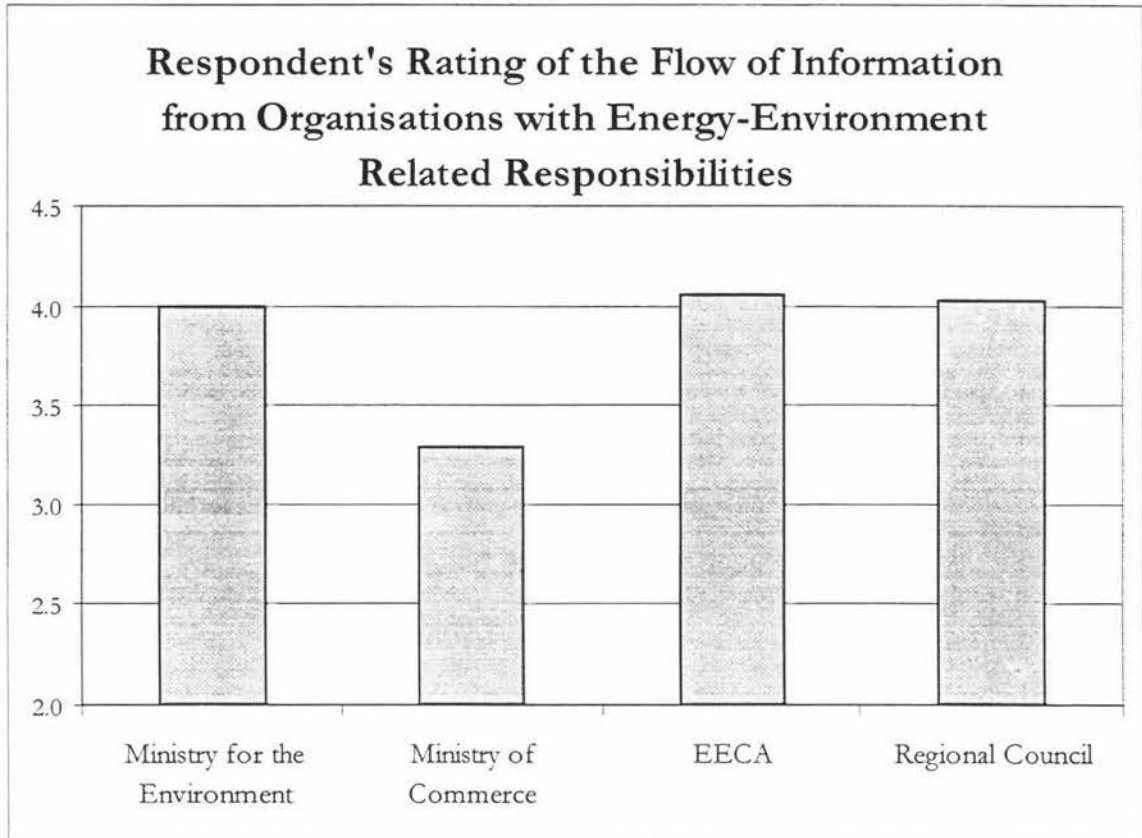
A rated scale was used to indicate the flow of advice/information from the above-described organisations to industry. The rating system that was used was:

- 1 = no information requested from the organisation and none is provided;
- 2 = information requested from the organisation, but none is provided;
- 3 = the organisation provides information, but only when requested;
- 4 = the organisation provides more information than requested;
- 5 = the organisation provides information at own initiative.

Thus, a rating of 1 indicates that there is no flow of information from the organisation listed and therefore no interaction in terms of information transfer between the organisation and industry. By

comparison a rating of 5 indicates that there is high interaction in terms of information transfer between the organisation listed and industry. Figure 11 shows the averaged results from respondents for Question 10 of the survey.

Figure 11: Flow of Information from Organisations with Energy-Environment Related Responsibilities to Industry



On average the respondents rated the MfE, EECA and their relevant regional council as providing more information than requested. By comparison the MoC received an average rating of 3.3 which indicates that they provide information to industry, but only when requested.

On average the group of companies that participated in the MfE EPI programme did not rate the MfE any differently from the total sample group's rating. This indicates that industry should generally be aware of the EPI programme. Question 13 of the survey also supports this opinion as 32 percent of respondents indicated that they had participated in the EPI programme.

The group of respondents that are VA signatories also showed no significant difference in their rating for MoC and EECA when compared to the total sample group. This may reflect industry involvement in "other" energy-related programmes, such as the EWCC. However this response may also reflect the (not entirely apparent) delineation of responsibilities that exist between MoC and EECA. For example, EECA and MoC both have responsibilities under the VA programme.

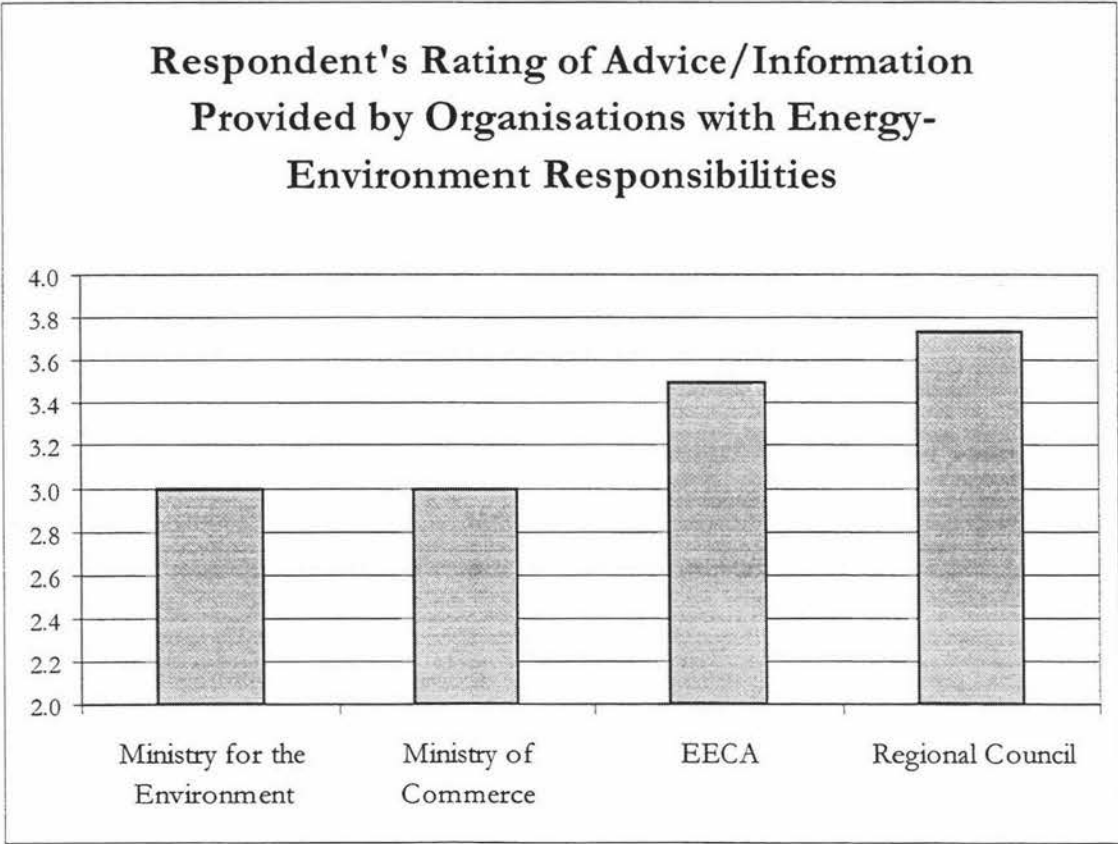
Thus, reporting by industry on their VA commitments may be viewed as being achieved via organisations as EECA rather than the MoC or visa versa.

From the responses to Question 10 it can be inferred that if information is requested by industry from the MfE, MoC, EECA and/or the company's relevant regional authority then it is provided. Whilst this rating is not poor by any means, this also suggests that if industry is unaware of the extent of information that is available, then they may also not be fully utilising the services provided by these organisations.

It should also be noted that respondents rated EECA (42 percent) and their relevant regional authority(s) (37 percent) as providing information at their own initiative, while MfE and particularly the MoC were rated lower than either EECA or regional authorities.

Based upon their responses to Question 10, Question 11 of the survey asked the respondents to rate the advice/information provided by the organisations listed. Figure 12 shows the results of the respondents.

Figure 12: Industry Rating of Advice/Information Provided by Organisations with Energy-Environment Responsibilities



Once again a rated scale was used to indicate the quality of advice/information that was provided from the organisations with energy-environment responsibilities to industry. The rating system that was used was:

- 1 = no advice provided by the organisation;
- 2 = advice provided by the organisation is seldom useful;
- 3 = advice provided by the organisation is sometimes useful;
- 4 = advice provided by the organisation is usually useful;
- 5 = advice provided by the organisation is consistently useful.

Thus, a rating of 1 (no advice provided) indicates that there is little or no interaction between the company and the organisation. Whilst a rating of 5 indicates that there is interaction between the organisation and the company and that the advice provided by the organisation to the company is consistently useful.

The averaged industry response to rating the quality of advice/information for regional authorities (3.7) was highest, followed by EECA (3.5). This indicates that both the company's regional authority and EECA generally provide advice that is either sometimes or usually useful. Of the respondents, two industries rated the same regional authority as providing no advice to them. However, if these respondents are removed from the average then the regional authorities averaged rating is increased to indicate that the advice/information that is provided by regional authorities is usually useful. By comparison, industry respondents averaged rating of the quality of advice/information that was provided by the MfE and MoC (3) was rated as being only sometimes useful to industry.

Thus, Question 11 indicates that industry rate the quality of advice/information provided by regional authorities and EECA higher than for the MfE or MoC. These results may be attributed to the frequency of interaction that occurs between industry and the organisations listed or due to the way in which, information/advice is translated from the organisation to industry.

For example, EECA prepares a wide range of energy information for public distribution. This information is structured and presented in such a way that it is easily understood and in addition, most publications from EECA can be obtained at little or no cost. This means that the information produced by EECA is easily accessible and may appeal to a wider cross-section of individuals.

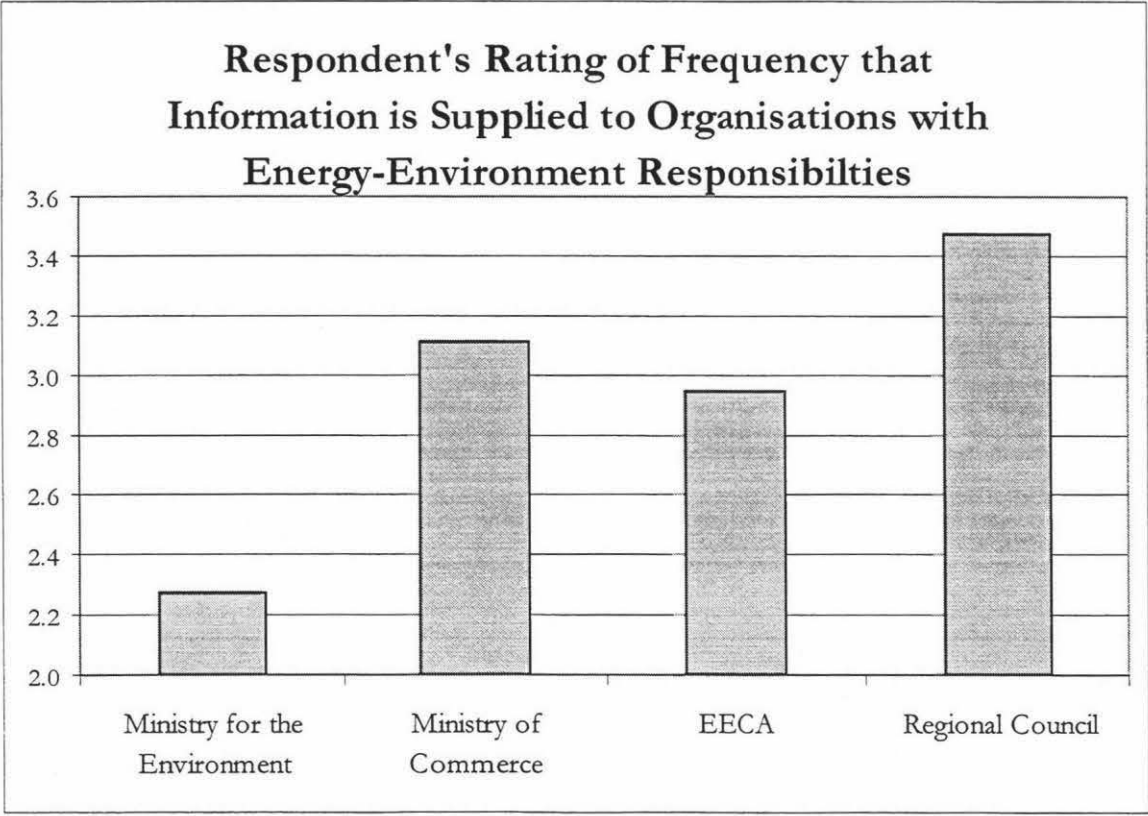
By comparison, the energy data obtained from the MoC for use within this report was taken from the publication entitled "*New Zealand Energy Outlook: February 1997*". This publication had to be purchased and was not particularly readable in comparison to the information supplied by EECA.

In addition, the *‘New Zealand Energy Outlook: February 1997’* contained a number of technical errors that the MoC did not provide errata for, despite being aware of. A number of issues were also poorly explained within the MoC’s energy forecast. Specifically, the classification of the various industries within the energy forecast was not readily apparent or described within the report. For example, Methanex and Petrochem are classified as *‘non-energy use’* industries and the New Zealand Refining Company is classified as *‘losses/own use’*. These factors may mean that types of reports may not hold as wide an appeal for readers.

14 percent of respondents also indicated that in addition to the above organisations they also received energy-environment information from organisations such as their local authority, industry associations or other statutory bodies such as Standards New Zealand. The averaged rating for this group of *‘others’* was 4.7 indicating that information provided by these organisations is usually or consistently useful.

Question 12 of the survey asked the respondents to rate the frequency that energy information is provided from their company to the organisations with energy-environment responsibilities listed in the survey. Figure 13 shows the results of the respondents.

Figure 13: Industry Rating of Frequency that Information is Supplied to Organisations with Energy-Environment Responsibilities



Once again a rated scale was used to indicate the frequency that information is provided from the respondents company to organisations with energy-environment responsibilities to industry. The rating system that was used was:

- 1 = company never provides energy information to this organisation;
- 2 = company provides energy information less frequently than two yearly to this organisation;
- 3 = company provides energy information annually to this organisation;
- 4 = company provides energy information quarterly or twice yearly to this organisation;
- 5 = company provides energy information monthly or more frequently to this organisation.

Once again, the averaged industry response to rating the frequency of provision of information from their respective organisations to regional authorities was highest (3.5), followed by the MoC (3.1), EECA (2.9) and the MfE (2.3). The higher frequency of reporting by industry to regional authorities most probably reflects the statutory reporting requirements that pertain to a particular company's consenting requirements. This means that the regional authorities are probably one of the most useful holders of energy-environment related information that the MfE can draw upon for the development of their national environmental performance indicators.

21 percent of respondents also indicated that in addition to the above organisations they also report to other organisations such as their local authority, or industry associations on energy-environment information. The averaged rating for this group of "others" was 4.5 indicating that information is provided regularly at a frequency of quarterly to monthly intervals.

Every one of the respondents provided some energy-related information to the MoC despite the fact that 26 percent of the respondents are non-VA signatories. However, the frequency that energy related information was provided to the MoC varied somewhat between a maximum of monthly (or more frequently) to a minimum of less frequently than two-yearly. As previously mentioned, this result is probably attributed to the blurring of responsibilities that exist between the MoC and EECA. For example, one respondent who is a VA signatory indicated that they provided energy-environment information to EECA on an annual basis but only reported to the MoC less than every two years.

The responses from this question therefore also suggest that the MfE should look towards MoC, EECA and regional authorities for energy-environment information from industry for the development of national energy environmental performance indicators. The MfE has also identified governmental agencies as being both the "key players" and main clients of the EPI programme (MfE, 1998c).

Question 13 of survey sought to determine the involvement of industry in the MfE's EPI programme to date. Feedback to this question was considered useful as it provides some insight into the awareness of industry in this established programme and also provides an indication of the input that industry has had (to date) in other established national indicators that may affect their organisations. Such national indicators include those developed for air and fresh water.

32 percent of respondents indicated that they have provided input to the MfE's EPI programme. By comparison approximately 95 percent of industry respondents have been involved in the development of their regions RPS or regional plans. This suggests that interaction and inter-relationships that exist between industry and their relevant local authority have been greater than that for industry and central government. This opinion is also supported by the responses provided by the respondents to Questions 10, 11 and 12 of this survey. In these questions industry respondents rated the flow of information/advice both to and from their organisation and to their relevant local authority higher than that for the MfE, EECA or the MoC.

This suggests that in order for the MfE to maximise the amount of energy-environment data gained they should either strengthen their relationships with industry to fully exploit the information that resides with industry, or alternatively, draw on the established relationships that obviously exist between local government and industry. Given however, that also 93 percent of respondents who were targeted by the MoC to join the VA agreements programme, did agree to sign, this also suggests that links established between the MoC and EECA should also be utilised by the MfE to maximise the potential for drawing on established energy-environment information.

6.3.6 Energy Consumption

Question 15 of the survey sought to determine the energy consumption (per annum) for the respondent's organisations. Energy types were broken down into coal, gas, oil, electricity, geothermal, wood and other. The actual energy consumption for each of the respondents has been kept confidential due to the commercial sensitivity of the information provided. Energy consumption data was solely intended to be included in the survey to assess the influence of a company's environmental monitoring in relation to the overall performance of energy sector industry in New Zealand. For example, a company with a relatively low energy consumption or generation may utilise and report on a range of environmental initiatives and therefore may not be representative of a significant portion of the energy sector.

The six largest energy users belong to the pulp and paper sector, metals sector, and petrochemical sectors. These industries also account for 86 percent of the total energy consumption or approximately 76 percent of total industrial energy consumption in New Zealand. Of these three

sectors, 50 percent of respondent have to date, had some involvement in the MfE's EPI programme.

In addition, only two of these respondents indicated they had energy consumption indicators and none indicated that they had energy efficiency indicators despite all respondents indicating that they had either energy consumption or energy efficiency targets.

Despite these findings it is unlikely that any of these organisations would have defined targets without implementing measures to ensure they were meeting their actual targets. Rather, once again, it can be inferred that differing opinions exist between industry representatives as to what constitutes an environmental performance indicator. This suggests that if the MfE wants to fully utilise the resources that are available in industry to enhance their EPI programme, then educational information should be provided to industry prior to seeking their feedback on energy indicator development. This will ensure that there is a consistent understanding between industry and Government regarding the role and purpose of the national EPI programme.

Question 16 of the survey sought to obtain feedback from companies on whether their energy supplier provided information that assisted their company in achieving energy savings. This question was considered relevant as if 100 percent of company's indicate that they received useful advice from their energy supplier, this advice can assist in the efficient use of energy resources. This is because it enables companies to have a sound information base (based on processing inputs as well as outputs) on which to assess the operations of their facilities.

Only 63 percent of respondents felt their energy supplier provided their organisation with energy information that assisted them in achieving energy savings. This response may be influenced (to an extent) by the deregulation of the energy sector, which has resulted in the culmination of a number of privately owned energy providers. Thus, this response rate may reflect the fact that there is little or no incentive (statutory or otherwise) for privately owned energy providers to assist their consumers in achieving energy savings. However, it should also be noted that a number of respondents also felt that Question 16 was not entirely relevant to their organisation. This was particularly true for the electricity sector, which are by their nature, predominantly energy suppliers rather than energy consumers. This said, not all of the electricity generation participants could actually provide energy consumption data for their own operations.

6.4 The Electricity Corporation of New Zealand Limited

The electricity sector has been undergoing significant reforms since the 1980's. The initial formation of Contact Energy in 1995 was established by the New Zealand Government to

introduce competition into the electricity sector. The further separation of the ECNZ into another three separate operating units in April 1999 was introduced to reduce the dominance of ECNZ and Contact Energy. Thus, the last series of electricity reforms to ECNZ, resulted in the dissolution of ECNZ and the transfer of assets to the three new state owned enterprises, namely Meridian Energy, Mighty River Power and Genesis Power.

Prior to separation, ECNZ had over 10 years of operation that began in 1987 with its formation, until its final separation in 1999. It was therefore considered appropriate to include ECNZ in this survey for a number of reasons. Firstly, ECNZ have provided a stellar example of what industries in New Zealand can achieve in terms of energy-environmental management. For example, in ECNZ's final environmental report (produced in 1998), ECNZ list a range of environmental achievements and principles that the organisation had achieved. These include but are not limited to (ECNZ, 1998b):

- *Contributing to decisions, plans and policies – CO₂ Voluntary Agreement programme and the MfE's EPI programme, regional policies and plans developed by regional and local government;*
- *The establishment of a set of environmental performance indicators that have been in use for various periods ranging from two to six years. These indicators are:*
 - *Water to wire efficiency of hydro stations (percentage);*
 - *CO₂ reduction required to achieve voluntary agreement target;*
 - *Proportion of electricity generated from renewable resources;*
 - *Research investment into renewable energy sources and energy efficiency;*
 - *Compliance with the Resource Management Act, 1991;*
 - *Discharges from Huntly Power Station to Air (CO₂, SO₂, NO_x and particulates);*
 - *Ambient air quality at Huntly (maximum SO₂, maximum particulate PM-10);*
 - *River temperature downstream of Huntly Power Station (°C)*

Secondly, it was considered relevant to include ECNZ in this survey as the formation of the subsequent SOE's were relatively new, some having only been in operation for less than a year. Therefore, in comparison to ECNZ, the new SOE's would have had very little time to consolidate their operations or been given the opportunity to participate in Government initiated programmes such as the VA programme. Thirdly, inclusion of ECNZ provides a fairer means of representing the range of environmental and energy related initiatives and monitoring that has been conducted by the electricity sector in New Zealand.

This said, in considering future environmental implications for the electricity sector, a clear challenge exists for these types of industry to establish or maintain, and hopefully surpass the high standards that have previously been set and well documented by ECNZ.

Section 7



Case Study – Canada

The use of an abundant range of both renewable and non-renewable natural resources is prominent in the Canadian psyche because natural resources are responsible for a sizeable portion of the Canadian economy. Thus, the sustainable management of natural resources and multiple uses of resources are critical topics of Canadian culture today.

There is an immense number of governmental, non-governmental, research, university, industry and interest groups that deal with energy in Canada. This section has not attempted to capture all of these groups. Rather, the intent of this section has been to provide a brief overview of some of the key federal based environmental legislative systems, initiatives, and forums that operate within Canada and which have contributed to the development of the national environmental indicators for energy sector industry. Where appropriate and for completeness purposes, some examples have also been provided of the types of actions that several leading⁴⁴ edge energy sector industries have taken in response to the wide range of statutory and non-statutory instruments used in Canada.

7.0 Background

Canada has a huge land mass that is rich in both renewable and non-renewable natural resources. In comparison to its huge land mass, Canada has a relatively small population base (approximately 30 million people). Most of Canada's population is located in urbanised, and in some instances, densely developed settlements that are within 300 kilometres of the United States border. One of the main reasons for this population distribution is due to the severe climates that exist within Canada's northern regions.

Canada's national economy depends very heavily on its abundance of natural resources. Canada is richly endowed with a range of energy supplies including oil, natural gas, coal, hydropower, uranium and biomass. Most of the Canadian oil and gas industry is concentrated within the western Canadian sedimentary basin (Alberta, eastern British Columbia and western Saskatchewan).

⁴⁴ A number of Canadian firms including Dofasco Inc., Suncor Energy Inc., and TransAlta emerged as "international leaders" in each of their economic sectors as ranked by the Dow Jones Sustainability Group Index in September 1999 (SEI, 1999).

However in addition to the large sedimentary deposits in western Canada, there are also significant conventional oil resources in Canada's north and offshore regions (for example, the Hibernia and Terra Nova fields).

At a regional level, the importance of energy is even more pronounced. For example, energy is the single largest source of economic activity in the province of Alberta, accounting for roughly a quarter of the region's total provincial output. Energy is also the single largest area of direct investment spending in the provinces of Newfoundland, Alberta and Saskatchewan, and the second-largest area of investment in the provinces of Ontario and Quebec (Draper, 1998).

The intensity in consumption of energy in Canada is higher than for most other countries in the world. There are several reasons that contribute to Canada's energy intensity: a cold climate, an energy-intensive industrial base (for example, pulp and paper, iron and steel production, mining), a large land mass and low population density, which creates a high demand for transportation services, relatively low energy prices and a high standard of living (MoE, 1996).

The industrial sector is the largest energy-consuming sector in Canada and comprises of a range of manufacturing, mining and forestry activities. The six largest energy-consuming industries within Canada are pulp and paper, mining, petroleum refining, iron and steel, chemicals, and smelting and refining. Together, in 1996 these industries accounted for less than 30 percent of total industrial activity, but used 78 percent of the total industrial energy (NRCan, 1998c).

7.1 Federal and Provincial Governments and the Constitution

Canada is a federal parliamentary democracy. A federal system brings together a number of different political communities under a common Government, for common purposes, but also incorporates separate "provincial"⁴⁵ governments for the particular purposes of each community (GC, 1999).

Canada's parliament is composed of an elected House of Commons, which initiates most legislation, and a nominated Senate. Generally the leader of the party, holding a majority in the House of Commons, holds the position of Prime Minister and leads the Government.

The core legal instrument that brought the federation of Canada together was the **British North America Act** (or **Constitution Act**) of 1867. The Constitution Act of 1867, including its subsequent amendments⁴⁶, and the **Constitution Act of 1982** now provide the basic elements of

⁴⁵ Also referred to as "state" "territorial" or "cantonal".

⁴⁶ Eleven amendments have subsequently been made to the Constitution Act over the period 1867 to 1975.

the Canadian written constitution. Considerable authority is invested in the provincial governments through interpretation of this Constitution and also in terms of provincial legislature and implementation of many national policies and plans.

National parliament has power *“to make laws for the peace, order and good government of Canada”* except for *“subjects assigned exclusively to the legislatures of the provinces”*. By virtue of the Constitution Act 1867, everything not mentioned as belonging to the provincial legislatures comes under national parliament. Whilst this appears to grant national parliament immensely wide powers, interpretation of the constitution by the Courts of Canada have in fact afforded provincial and territorial governments considerable powers in terms of natural resources based on the interpretation of this Act. For example, whilst the “environment” is not specifically addressed within the Constitution, provincial authority is often derived from other enumerated powers, such as jurisdiction over provincial Crown lands, resources, property and civil rights, and local works and undertakings.

Furthermore, the Constitution Act of 1982 gives the provinces and territories of Canada wide powers over their natural resources including the control of export and levying of primary production from mines, oil wells, gas wells, forests and electric power plants (GC, 1999). In exercising these rights, provinces or territories cannot discriminate against other parts of Canada in prices or supplies and the national parliament has powers to legislate on these matters if necessary. Importantly the federal law also prevails, should the provincial (or territorial) and federal laws conflict.

7.2 Environmental Legislation

Canada has also been consolidating and restructuring its environmental legislation since the late 1980s. The most significant recent environmental statutes include the **Environmental Assessment Act**, the **Canadian Environmental Protection Act**, and amendments to the **Auditor General Act** that established a Commissioner of the Environment and Sustainable Development. In addition the introduction of the **Energy Efficiency Act** and its regulations have further advanced environmental considerations into energy production and use in Canada.

The **Environmental Assessment Act** was enacted in 1994 and integrates sustainable development requirements into all federal planning and decision making, spelling out the exact responsibilities and procedures for all federal projects. This act applies to a broad range of situations in which the Federal Government has decision-making authority, including in its roles as a proponent, land manager, financial contributor, or regulator.

Four key regulations have been developed to implement the Environmental Assessment Act. Specific provisions of the act include: environmental assessment legislation; an assessment process for new policy and program proposals; and a program to fund public participation in the assessment process. Environment Canada is responsible for administering the Environmental Assessment Act.

The **Canadian Environmental Protection Act** was enacted in 1988 and is the major environmental statute for Canada, covering human and environmental health and embracing atmospheric, aquatic, and terrestrial concerns. The Canadian Environmental Protection Act (CEPA) consolidates five major laws administered by Environment Canada – those dealing with contaminants, water, air, ocean dumping, and the Department of the Environment. Provisions of the act include:

- the authority to regulate emissions and effluents;
- increased penalties for environmental offences;
- measures to control the life cycle of all toxic chemicals and the introduction of new substances;
- a requirement to collect and publish information on environmental quality;
- authority to fulfill specific international environmental commitments;
- stipulations for consultations with the provincial governments and the public on specific matters

The intent of the CEPA is to address pollution problems at the source, before they occur, by applying such principles as pollution prevention, the ecosystem approach, biodiversity, the precautionary principle, and user/producer responsibility. The Act also authorizes the federal environment minister to enter into agreements with provincial governments in order to reduce duplication of efforts. A parliamentary Standing Committee on Environment and Sustainable Development reviews the administration of this Act.

A Commissioner of the Environment and Sustainable Development (CESD) was created under amendments to the Auditor General Act. The role of the Commissioner is similar to that of the Parliamentary Commissioner for the Environment within New Zealand. The CESD is charged with monitoring the progress of all government departments in fulfilling their responsibilities, and is responsible for reporting to the House of Commons on environmental matters. The amendments to the Auditor's General Act are a legal mechanism to implement Government policy and importantly this has resulted in a requirement for all federal governmental departments in Canada to now prepare sustainable development strategies and action plans.

The **Energy Efficiency Act** was introduced in 1992 and is aimed at achieving two criteria. Firstly it establishes certain standards and reporting requirements with respect to energy efficiency in “energy-using products” and secondly it is aligned to promote the use of alternative energy sources.

The Energy Efficiency Act is supported by **Energy Efficiency Regulations**. These regulations establish minimum energy-efficiency standards for specified products and set out the responsibilities of dealers for these products. For example, the Motor Efficiency Regulation introduced in 1995 defines electric motors as one of the “energy-using” products that must now meet minimum efficiency standards as prescribed by the Canadian Standards Association. Further amendments made to these regulations in 1997 raised the efficiency level for 1-200 horsepower motors by 5 to 10 percent (NRCan, 1998b). Whilst this energy efficiency regulation was focused more on residential and commercial equipment than on products used in the industrial sector, the industrial sector has nevertheless been affected by the expanded and strengthened amendments made in 1997. As a result, NRCan estimates that the annual energy savings from the motor regulations amendment will rise to 16 petajoules in 2010 and of these projected savings, over half are expected to come from the industrial sector (NRCan, 1998b). Natural Resources Canada (NRCan) has responsibility for administering the Energy Efficiency Act and regulations.

Canada is continually revisiting its environmental policy and some of the most influential directives and/or methods for achieving the goals of its environmental policies have also arisen from historical plans, statements and programmes. Some of the more pervasive sources include: the 1990 Green Plan; the 1995 Green Guide to Government; Le Projet de Societe’s “*Canadian Choices for Transitions to Sustainability*” and the National Action Programme for Climate Change.

7.3 Policy Implementation

In terms of the application of energy policy, the constitutional division of power between the federal and provincial governments provides both levels of government with major roles. For example, the Federal Government is responsible for the harmonization of energy policies at the national level, international and inter-provincial trade, and the promotion of regional economic development. Comparatively, power to exercise jurisdiction over the conservation and management of natural resources within their border’s lies with the provincial and territorial governments of Canada (as interpreted through the Constitution). Federal-provincial relations are therefore a priority as without constructive relations, it would be difficult for Canada to advance its priorities such as national unity, the social agenda, and its international commitments on climate change (NRCan, 1998a).

Coordination of federal and provincial policies is mostly through the Canadian Council of Ministers of the Environment (CCME). The CCME brings federal, provincial, and territorial environment ministers together at least twice a year. In terms of energy, other such councils responsible for environmental policies also include the Canadian Council of Energy Ministers.

Consultation involving the Government, interest groups, and the general public also plays a uniquely large role in Canadian environmental policy. One reason for this is that Canada has an exceptionally loose federal structure, and sectoral and regional consultations help to strengthen consensus on national policies. At the core of Canada's consultation processes are forums referred to as round tables. These forums allow all stakeholders involved in specific issues to meet together as equals and propose policy initiatives or directions to the Government. The round tables were first created in response to public meetings held in Canada by the UN's World Commission on Environment and Development (the Brundtland Commission) in 1986.

By 1990, round tables had been established for the Federal Government (called the **National Round Table on the Environment and Economy**⁴⁷ or "NRTEE"), for all provinces and territories, and for many communities. All round tables are similar in their functions and tasks⁴⁸ with the exception that environment or economic ministers generally head provincial round tables, while the NRTEE has an independent chair.

Activities of the NRTEE are organised into a series of programmes, each of which is overseen by a task force or committee made up of one or more NRTEE members and selected representatives from business, government and non-profit organisations (NRTEE, 1999). The responsible task force, or committee, commissions research, conducts national consultations, reports on the areas of agreement and disagreement, and puts forward reasoned recommendations for steps to be taken that will promote sustainability. The full NRTEE then reviews these reports and recommendations prior to approving and releasing them to the public (NRTEE, 1999).

Full meetings of the NRTEE (also called "national assemblies"), are convened up to four times each year to establish priorities for the future and to initiate new programmes.

The NRTEE's programmes focus on the following areas (NRTEE, 1999):

- *Climate change;*
- *Economic instruments including greenhouse gas emissions trading and green budget reform;*

⁴⁷ The NRTEE was enacted into legislation under a new Act in 1994 to serve as a catalyst in identifying, explaining and promoting the principles and practices of sustainable development.

⁴⁸ For this reason the NRTEE is only discussed further.

- *Sustainable development issues for the new millennium;*
- *Health, environment and the economy;*
- *Aboriginal communities and non-renewable resources;*
- *Leadership for environment and development in Canada.*

7.4 Eco-Efficiency Indicators

In 1999, NRTEE in conjunction with the World Business Council for Sustainable Development (WBCSD) published a preliminary set of eco-efficiency indicators for sustainable development⁴⁹. These eco-efficiency indicators provide a general voluntary framework for organisations to use eco-efficiency information to evaluate and communicate performance, set targets and initiate improvement measures. Importantly, the framework also provides a means of identifying common elements for measurement and communication to better achieve harmonisation of information where scientifically and practically appropriate.

To keep the framework flexible and applicable to diverse sectors, and to enable harmonization a two-level approach is used to define the eco-efficiency indicators. These include commonly used generic **core** indicators and business specific **supplemental** indicators.

“Core” indicators describe those indicators that are internationally agreed upon and whilst they may be valid for virtually all businesses, they may not be of equal value or importance for a particular company or necessarily comparable between different businesses (WBCSD, 1999). By comparison “supplemental” indicators may vary in relevance and pertinence from one business to another. Preliminary core eco-efficiency indicators identified include (WBCSD, 1999):

- *Energy consumption;*
- *Materials consumption;*
- *Net water consumption;*
- *Greenhouse gas emissions;*
- *Ozone depleting substance emissions*

Product/service value indicators have also been developed although none of these environmental indicators are identified as being core, as they cannot be validly applied across all businesses. The preliminary product/service value indicators include (WBCSD, 1999):

- *Mass or Number of Products or Services produced or sold*
- *Net Sales*

⁴⁹ It should be noted that the eco-efficiency indicators do not address all three pillars of sustainable development. For example, whilst these indicators strive to improve economic and environmental efficiency, the concept (as developed by the NRTEE and WBCSD) does not pertain to social issues.

The WBCSD has launched a pilot application programme to test the validity of its eco-efficiency indicators concept and to gain practical experience and adapt the eco-efficiency framework where necessary. The eco-efficiency indicators pilot programme has attracted more than 20 companies worldwide from various industrial sectors, including mining, electronics, consumer goods, chemical, petroleum, life sciences, and banking and is planned to be completed in March 2000 (WBCSD, 1999).

7.5 Federal Government Agencies

There are two federal environmental agencies that have key responsibilities for energy-environment issues, **Environment Canada** and **Natural Resources Canada**.

7.5.1 Environment Canada

Environment Canada was created in 1971 through the Department of Environment Act, which combined several federal entities responsible for various aspects of the environment.

Environment Canada, has primary but not exclusive responsibility for the country's environmental policy. This includes directly managing a number of environmental statutes relating to the environment⁵⁰, as well as coordinating the development of federal policies and the actions of other departments with respect to the environment. Environment Canada also shares with NRCan some of the international and national responsibilities pertaining to greenhouse gas emissions. Environment Canada's three main programme areas can generally be divided into atmospheric environment, environmental protection and environmental conservation.

Environment Canada also coordinates its actions with other branches of federal and provincial governments. At the federal level Environment Canada is responsible for leading the development of environmental policies and for providing technical advice on the environmental aspects of government operations. At the sub-national level, Environment Canada coordinates federal and provincial policies through the Canadian Council of Ministers of the Environment.

Environment Canada informs Canadian's of its many activities and their status through publications in **The Green Lane** – a programme incorporated within Environment Canada's internet site (refer to www.ec.gc.ca).

⁵⁰ Including the Environmental Assessment Act, the Canadian Environmental Protection Act.

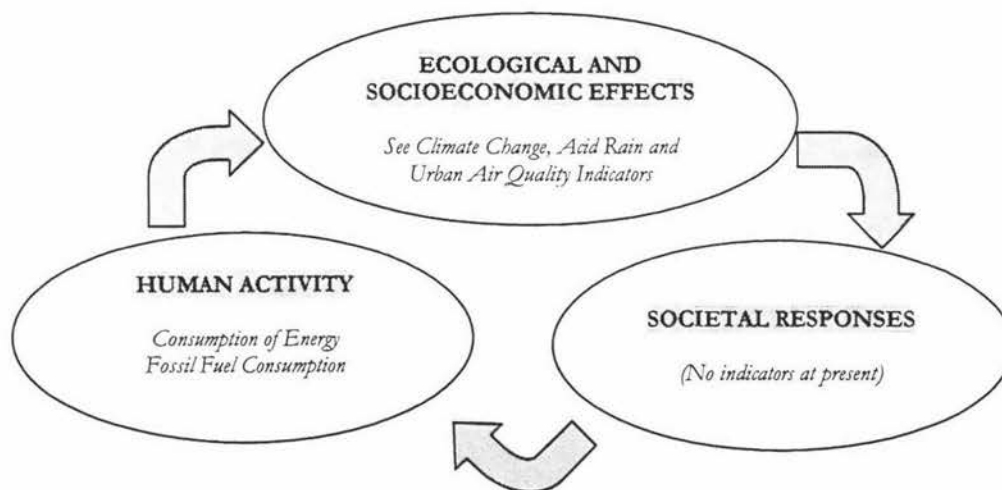
7.5.1.1 National Environmental Indicators

Environment Canada has developed a national environmental indicator series. This indicator series includes indicators for **energy consumption** and **climate change**. The energy consumption indicators are listed under the national environmental indicators as **pervasive influencing factors** whilst the climate change indicators are listed under **ecological life-support systems**. Both of these sets of indicators are discussed briefly below.

7.5.1.2 Energy Consumption

Environment Canada reports on four energy consumption indicators. These are global and Canadian **consumption of energy**, and global and Canadian **consumption of fossil fuels**. Environment Canada presents the indicators for energy consumption by bulletin and by technical supplement. The bulletin outlines the issues for energy consumption and presents the indicator(s) while the technical supplement provides detailed specific information that supports the data presented. Environment Canada lists three factors that are linked and influence energy consumption. These factors are human activity, ecological and socioeconomic effects and societal responses and are shown in Figure 14.

Figure 14: Links for Energy Consumption



Source: Environment Canada, 1997: SOE Bulletin No. 96-3.

As can be seen from Figure 14, the indicators presently used by Environment Canada for consumption of energy and fossil fuel consumption are human activity (or pressure) indicators. These energy indicators are also linked to the ecological (or state) indicators such as those for climate change, acid rain and urban air quality. To date, Environment Canada has not developed national response indicators for energy consumption.

Environment Canada has drawn on a number of data sources for the generation of global and Canadian energy consumption. Nationally these sources include Statistics Canada (which is Canada's official source of energy data), whilst global data has been provided by the Energy Section of the United Nations (UN) (EC, 1997a).

The indicator for Canadian **consumption of energy** includes all forms of primary energy plus secondary net imports of energy. In Canada, the principal forms of primary energy⁵¹ include fossil fuels in the form of coal, crude oil, natural gas and natural gas liquids; and electricity from nuclear power plants and hydro-electric stations (EC, 1997b).

The processing of primary energy produces secondary energy. For example, electricity generation in coal-fired power stations is the production of secondary energy from processing primary energy. Losses from processing primary to secondary energy are also included in the indicator estimates for global and national energy consumption. These losses include uncaptured waste heat and frictional losses and represent an irreversible loss of energy (EC, 1997b).

By comparison, only primary energy production is considered for the **global indicator for energy consumption**, since within the limits of reporting accuracy, imports and exports tend to cancel each other out (EC, 1997b). The indicator for global energy consumption estimates the new supplies of energy (making up primary energy production) that are produced worldwide each year. This indicator is calculated by estimating the total heat content for the production of all primary energy forms, in petajoules, for all countries. Unlike the Canadian indicator for energy consumption, non-energy uses of fossil fuels are not subtracted from global fossil fuel commodities, since the UN energy statistics does not contain data on non-energy uses (EC1997b).

The indicator for **Canadian consumption of fossil fuel** is based on the fossil fuel component of the indicator of total energy consumption, namely coal, oil and natural gas. Other than this specificity, the methodology used to calculate the Canadian consumption of fossil fuel is identical to that used for the indicator Canadian consumption of energy.

The indicator **global consumption of fossil fuel** is an aggregation of the fossil fuel components of the indicator of global energy consumption, namely coal, oil and natural gas. Once again, the methodology use to calculate the energy amounts is identical to that used for the indicator global consumption of energy.

⁵¹ Primary energy is defined as including energy that is produced domestically or imported, but excludes exports.

The last period that the indicators are presented are for the out-turn periods 1996 (for the Canadian indicators) and 1994 (for the global indicators). As there are a number of other sources within Canada that have more recent data and indicators for energy consumption and use, no particular comments have been provided in respect of the findings of these indicators.

Environment Canada have indicated that due to *“limited resources and staff and changing priorities have meant that some of the sectoral indicators (e.g. energy and transportation) are not being updated as frequently in the past”* (pers. comm. Environment Canada, 1999). Environment Canada also indicate *“that in the future they [will] be relying on other departments to take more direct responsibility for these types of indicators as part of the National Environmental Indicator Series”* (pers. comm. Environment Canada, 1999).

7.5.1.3 Climate Change

Environment Canada reports on five climate change indicators. These are global and Canadian **average temperature variations, global atmospheric concentration of greenhouse gases and carbon dioxide emissions from fossil fuel use**⁵² (global and Canadian). As with the sectoral indicators for energy consumption, Environment Canada presents the indicators for climate change by bulletin, which outlines the issues for climate change and presents the indicators and by technical supplement, which provides further detailed specific information in support the data presented.

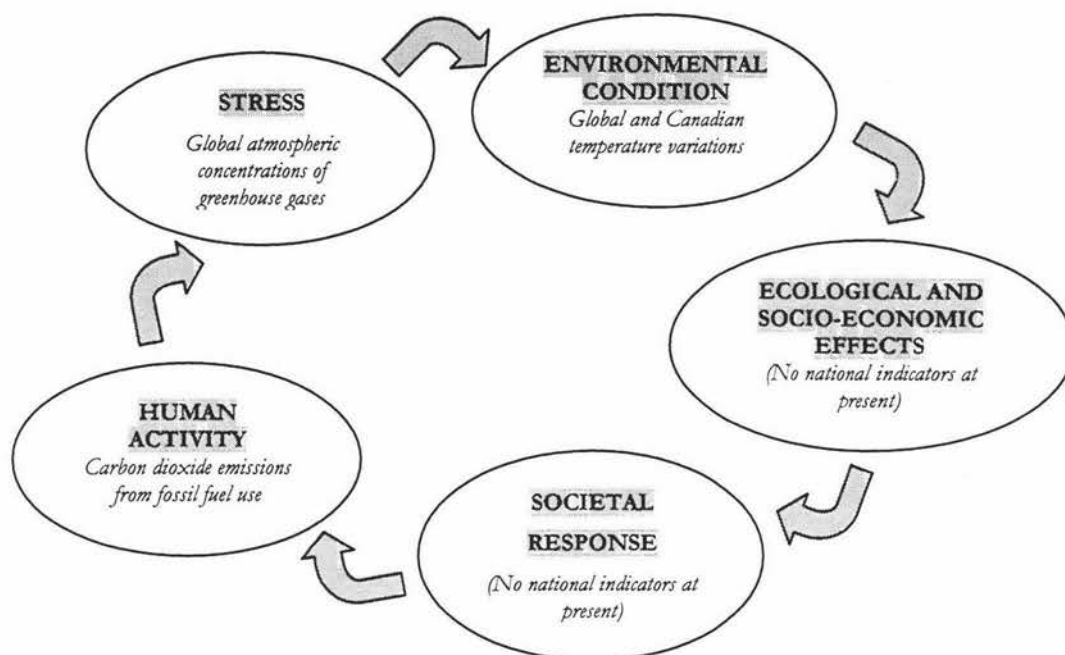
Environment Canada lists three factors that are linked and influence energy consumption. These factors are human activity, ecological and socioeconomic effects and societal responses as is shown in Figure 15.

As can be seen from Figure 15, the indicators presently used by Environment Canada for climate change are both pressure indicators and state indicators. The indicator for human activity (namely carbon dioxide emissions from fossil fuel use) is a pressure indicator. Environment Canada has also developed a stress indicator (namely global atmospheric concentrations of greenhouse gases) and an environmental condition indicator (namely global and Canadian temperature variations). These latter indicators are both state indicators. To date, Environment Canada has not yet developed national environmental indicators that monitor ecological and socio-economic (or response) effects for climate change.

As with the energy consumption indicators, Environment Canada has drawn on a number of data sources for the generation of its climate change indicators.

⁵² Only this latter indicator is discussed in detail as the information that supports can be directly drawn from sectors, including industry.

Figure 15: Links for Climate Change



Source: Environment Canada, 1997: SOE Bulletin 98-3.

Environment Canada, through its website (the Green Lane) shows a monitoring period of 37 years ranging from 1958 to 1995 (EC, 1998a, 1998f) for the indicator **carbon dioxide emissions from fossil fuel use for Canada**. This indicator shows the (estimated) annual emissions arising from fossil fuel in megatonnes (or millions of tonnes) of carbon dioxide. The carbon dioxide emissions from fossil fuel for any given year are calculated from the sum of the individual emissions from each fuel type. This requires apportioning an emissions factor to each fuel type and multiplying the estimated consumption of each fuel type by a carbon dioxide emission factor for that fuel type to derive an individual emission. For example, coal has an emission factor of 88.96, which is applied to convert the energy from coal in petajoules to an equivalent CO₂ emissions value in kilotonnes. The resultant values are then plotted against GDP to give a comparison of annual carbon dioxide emissions compared to GDP. (EC, 1998f).

For the **global carbon dioxide emissions from fossil fuel use** indicator, Environment Canada drew on energy production statistics from the UN. Emissions factors developed by the UN are applied to each fuel type from each country. This is then used to calculate a global total carbon emission value for each year (EC, 1998g). To enable a more direct comparison with the Canadian indicator for carbon dioxide emissions from fossil fuel use, Environment Canada modified the data supplied by the UN slightly by totaling the emissions from solid, liquid, and gaseous fuel and from natural gas flaring. A total carbon dioxide emission figure for each year is then calculated by converting total carbon emissions using a factor of 44/12 (molecular weight of carbon dioxide over

the atomic weight of carbon). Global carbon dioxide emissions from fossil fuel use are then plotted again gross world product (EC, 1998d).

Environment Canada also provides additional two additional indicators in support of the National Indicators for climate change for the “emissions” indicators. This includes **Canada’s carbon dioxide emissions by sector**⁵³ and **Canadian carbon dioxide emissions per unit of fossil fuel consumed**. These indicators enable further disaggregation of the indicator of carbon dioxide emissions from fossil fuel use. This means they provide for a ratio of the total annual emissions of carbon dioxide in tonnes and the total annual Canadian fossil fuel consumption in megajoules which can then be used as a pseudo measure of **energy intensity** (EC, 1998c, 1998e).

7.5.2 Natural Resources Canada

In 1993 the department of Natural Resources (NRCan) was created. This department resulted from the consolidation of two federal entities, namely the Department of Forestry and the Department of Energy, Mines and Resources.

NRCan largely controls natural resource policy and is comprised of a number of sectors, including a dedicated Energy Sector. The Energy sector is divided into seven core groups including: an Energy Policy Branch, and Energy Resources Branch, an Energy Technology Branch, an Energy Technologies Futures, the **Office of Energy Efficiency**, the Office of Energy Research and Development and Management Services.

The Energy Sector group is responsible for gathering, analysing and providing information to the Minister⁵⁴ and to Cabinet on Canadian energy issues. In addition, the key activities of the Energy Sector include development of policies, programmes, research, and international activities in the areas of energy efficiency, renewables and alternatives, and energy resources to further sustainable development within Canada (NRCan, 1998a).

Most of the work conducted by the Energy Sector is carried out in partnership with other government departments and agencies (federal, provincial, territorial, and/or municipal), aboriginal groups, universities and international agencies and the private sector. Some of the private sector parties include (NRCan, 1998a):

- *Conventional energy industries, particularly the oil, gas, electricity and nuclear sectors;*

⁵³ Excludes biomass. Sectors include: agricultural, commercial, industrial, non-combustion sources (such as from lime and cement production), pipelines, power generation (electrical), public administration, residential, transportation and “other”. “Other” includes carbon dioxide emissions from fossil fuel use associated with steam generation, refined products and municipal waste incineration.

⁵⁴ A primary client of the Energy Sector is the Minister of Natural Resources.

- *Renewable energy industries, for example, small-scale hydroelectric producers and solar-power firms;*
- *Industries involved in alternative transportation fuels, including fuel suppliers, vehicle manufacturers and infrastructure providers; and*
- *Manufacturing, construction and other industries with high-energy demands and those working to improve energy efficiency.*

In 1998 the Energy Sector released a business plan entitled "Energy Sector Business Plan 1998-2001". This business plan details the Energy Sector's objectives for the sustainable development and use of energy according to areas of priority for the energy sector. These objectives flow from the ultimate impacts that the Energy Sector is striving to make over the longer term in environmental protection, economic growth and energy security.

These impacts are identified as including (NRCan, 1998a):

- (a) *Environmental Protection – To reduce and manage atmospheric emissions, effluents and wastes resulting from energy development and use, and to help Canada meet its climate change commitments and its environmental, safety and health goals;*
- (b) *Economic Growth – To increase investment in energy development and infrastructure and to decrease costs of energy development and use, while creating and preserving employment;*
- (c) *Energy Security – To ensure secure, reliable access to competitively priced energy supply for current and future generations of Canadians while increasing the flexibility and diversity of the Canadian energy supply system.*

From these above described impacts, the Energy Sector has identified five main areas of business. These include (NRCan, 1998a):

- *Sustainable development;*
- *Energy efficiency;*
- *Renewable and transportation energy;*
- *Energy resources; and*
- *International priorities.*

Pursuing sustainable development (an overarching theme for NRCan) requires government policies, programmes, science and technology to minimise energy's environmental ecological footprint (especially air emissions). In addition it requires an increase in investment in energy development and infrastructure, contributions to the enhancement of jobs, the balance of payments, economic growth and secure supplies of energy (NRCan, 1998a). These demands require a fine balancing act that has become a more daunting challenge for NRCan since the culmination of the climate change conference in Kyoto, Japan. At this conference in December 1997, Canada agreed to reduce its greenhouse gas emissions to six percent below those of 1990, by the years 2008-2012. This

reduction represents a 20 to 25 percent reduction from Canada's "business as usual" projection (NRCan, 1998a). The Kyoto commitments therefore make climate change a real test case for sustainable development within Canada.

As a result, climate change related work now accounts for about 70 percent of the Energy Sectors budget, and more than half of the Energy sector work is directly or indirectly related to climate change policy and analysis. Thus, a large amount of work that is currently being conducted by NRCan is focused towards energy efficiency programmes and science and technology, with the overarching rationale of being able to support the Government's climate change objectives (NRCan, 1998a).

7.5.2.1 Climate Change

In Canada the major energy related greenhouse gases are carbon dioxide, nitrous oxide and methane. However, unlike New Zealand, carbon dioxide is the greenhouse gas of most concern in Canada. Most of the energy related carbon dioxide emissions arise in Canada from transportation, stationary combustion sources such as industrial boilers and residential and commercial space heating, and fossil fuel fired power plants (MoE, 1996).

About 80 percent of total carbon dioxide emissions in Canada result from secondary energy use, that is, by agricultural, residential, commercial, **industrial** and transportation consumers. The remaining 20 percent is mainly attributed to emissions from energy used to produce and deliver energy to the market and to convert energy from one form to another (NRCan, 1998b).

In February 1995, Canada's environment and energy ministers (including federal, provincial and territorial governments) approved the **National Action Programme on Climate Change** (NAPCC). The NAPCC outlines the federal-provincial strategy for achieving the emissions goal for 2000 and beyond. At the federal-provincial conference of First Ministers in December 1997, energy and environment ministers were asked to develop, within two years, a new strategy to meet the Kyoto Protocol targets (EC, 1999a). The Government of Canada also established a Secretariat on climate change to coordinate its planning and responses to climate change. To facilitate this process, in February 1998 the federal budget set aside \$50 million per year over three years to fund this process (NRCan, 1998b). The federal, provincial and territorial governments are also working together to develop an implementation strategy for the Kyoto Protocol by the end of 1999. Specifically the implementation strategy includes (EC, 1998a, 1998b):

- *developing a system to credit industries for taking early action to reduce emissions;*
- *strengthening voluntary action measures;*

- *bringing Canadian experts together at "Issue Tables" to explore various ways of meeting the Canadian commitments to the Kyoto Protocol in all parts of the Canadian economy; and*
- *developing a public education and outreach programme.*

Following the Kyoto meeting in 1997, the Canadian Minister for Natural Resources also established the Office of Energy Efficiency (OEE) to deliver NRCan's existing and new energy efficiency initiatives and also to share information about energy efficiency and enhance the department's leadership role (NRCan, 1998b). NRCan utilises some 18 market related energy efficiency initiatives that target all consumers and emphasize partnerships and economic investments. These initiatives are listed in full in Appendix 7 and utilise a range of policy instruments including (NRCan, 1998b):

- *leadership;*
- *information;*
- *voluntary actions;*
- *fiscal incentives; and*
- *regulations.*

A wide number of these initiatives are aimed at improving energy efficiency and/or the switching of energy sources to those that contain less carbon (such as biomass). This is because NRCan consider that these methods are the most pervasive in terms of reducing carbon dioxide emissions from energy use. A number of these initiatives are relevant to energy sector industry and are discussed briefly further below. These include the **Voluntary Challenge and Registry** programme, the **Canadian Industry Programme for Energy Conservation**, the **Industrial Energy Innovators Initiative**, and the **National Energy Use Database**.

7.5.3 Industry Initiatives

In addition to the range of government facilitated initiatives that are briefly outlined below, a number of Canadian industries have independently instituted a range of additional initiatives to promote reductions in greenhouse gas emissions and/or energy efficiency. For example:

- (a) **Suncor Energy**, a petrochemical company that has significant interests in oil sands, in 1997, initiated its participation in a pilot project developed by the United States Nature Conservancy to acquire and preserve a large area of endangered forests in Belize. This project is aimed at protecting 19,000 acres of unique forested land in Central America that would otherwise be burned and converted to farmland. Suncor's participation in this project will result in the prevention of an estimated 500,000 tonnes of CO₂ from being released into the atmosphere (Suncor, 1998).
- (b) **TransAlta**, an electric energy company with operations in Canada, New Zealand, Australia and the United States, in October 1999 agreed to purchase up to 2.8 million metric tonnes

of carbon dioxide emission reduction credits from farms in the United States (TransAlta, 1999b). This type of agreement is referred to as emission reduction trading system. Under an emissions reduction trading system, a company pays another organisation to reduce greenhouse gases on its behalf. The company making the reduction passes ownership of the reduction over to the purchaser, who uses the reduction “credits” to offset some of its own greenhouse gas emissions. Trading arrangements such as these allow companies flexibility in achieving cost-effective greenhouse gas reductions. In addition, by placing value on greenhouse gas reductions, it also stimulates further actions by industry, communities and individuals (Suncor, 1998).

- (c) **Dofasco**, a steel producer, in the latter part of 1997 signed an Environmental Management Agreement with the Governments of Canada and Ontario. This seven-year agreement between the three parties goes beyond any regulatory requirements for the company and spells out quantitative environmental targets for many parameters including those for greenhouse gas reductions.

7.5.3.1 Voluntary Challenge and Registry Programme

The **Voluntary Challenge and Registry (VCR)** programme was launched in early 1995 as a key part of Canada’s NAPCC. NRCan was charged with managing the VCR programme on an interim basis.

The VCR is orientated towards encouraging companies and organisations to put forth an action plan to outline how they intend to limit their greenhouse gas emissions⁵⁵. The intent of this programme is similar to the Voluntary Agreements (VA) programme managed by the Ministry of Commerce (MoC) in New Zealand.

In 1997 the VCR programme completed a transition from a Government incubated programme to a stand alone private-public partnership (VCRP, 1999a). More than 700 companies responsible for over one-half of the total annual greenhouse gas emissions have now joined the national climate change VCR programme (EC, 1998a). The VCR programme is credited with reducing emissions by 2010 to more than 60 megatonnes below what they would have been (VCRP, 1999a).

One of the most important differences in the structure of the VCR programme in Canada from that of the VA programme in New Zealand is that it encompasses a **Champion Reporting System**. This Champion Reporting system attributes gold, silver or bronze levels of reporting to VCR signatories depending on the detail and information they provide in support of their voluntary

⁵⁵ Current evidence suggests that, despite the efforts of participating companies and organisations in the VCR programme, these initiatives will be insufficient to meet stabilization targets required under the Kyoto Protocol (EC, 1999b).

commitments and including the performance pursuant to this information. The designations of gold, silver or bronze statuses is considered by the VCR administration to raise the profile of the signatories and add more structure and credibility to the registered submissions (VCRL, 1999b). A full list of the reporting requirements for the various designations is included in Appendix 8.

7.5.3.2 Dofasco's Response to Climate Change Under the VCR

Dofasco is one of Canada's largest steel producers and is a gold level signatory to the Canadian VCR programme. In 1998 Dofasco submitted an action plan outlining the voluntary measures that their organisation would take to contribute towards improving their performance in terms of greenhouse gas emissions. Such measures included reducing the specific energy consumption and carbon intensity of their operations.

As with industries that are signatories to the VA programme in New Zealand, Dofasco have adopted 1990 as the base year against which improvements in performance are tracked. Dofasco utilises two performance indicators to measure their climate change responses, **specific energy consumption** and **CO₂ emissions** (absolute).

Dofasco derives the specific energy consumption (SEC) by determining the net energy consumption of fuels (in gigajoules) per tonne of product (in this instance steel) produced. Energy consumption is derived from the total usage of coal-based fuels (coke and coke oven gas), oil, natural gas and electricity from Dofasco's industrial processes.

The energy consumption⁵⁶ from the Dofasco processes are then translated into tonnes of CO₂ emissions (absolute basis) by applying emission factors based on the composition of each energy type used.

Using these indicators Dofasco has found that in 1990 their SEC was 22.84 gigajoules/tonne of steel shipped. By the end of 1997, Dofasco's SEC was 21.2 percent lower than the 1990 level. This is equivalent to an annual improvement rate of three percent per year and also surpasses the company's industrial energy innovator commitments of one percent per year (Dofasco, 1998).

7.5.3.3 The Canadian Industry Programme for Energy Conservation

The **Canadian Industry Programme for Energy Conservation** (CIPEC) has been in operation for over 20 years to promote voluntary improvements in energy use. CIPEC helps 21 industrial task

⁵⁶ Dofasco's indirect CO₂ emissions (for example those associated with the consumption of imported electricity) are also monitored. Steam produced by Dofasco but consumed by a third party is also included in Dofasco's emissions.

forces set and achieve energy intensity improvement targets for their respective sectors. The task forces now participating in CIPEC represent almost 90 percent of Canada's secondary industrial use. Highlights of CIPEC's progress to date include (NRCan, 1999c):

- *Through voluntary measures, participants have decreased their energy use by an average of 0.9 percent per year between 1990 and 1997.*
- *Canada's manufacturing and mining industries are making significant gains in energy efficiency;*
- *Voluntary measures have also helped participating businesses to cut costs and increase profits;*
- *The manufacturing and mining industries' energy management practices are making a strong contribution to Canada's international climate change commitments. NRCan statistics indicate that **energy-use related carbon dioxide emissions** have increased by just 0.5 percent between 1990 and 1997, indicating virtual emissions stabilisation, even though this has been a period of strong economic growth⁵⁷.*

In April 1997, NRCan and the associations participating in CIPEC refocused the program to better align it with the VCR programme and to provide for more active participation and commitment by the associations. This new industry-government partnership is known as CIPEC3 and is designed to support the achievement of enhanced sectoral energy efficiency targets and more vigorous action plans (NRCan, 1999c). NRCan also indicates that CIPEC3 intends to extend its services to include those such as benchmarking, best practice identification, technical information and training in response to needs of the various sector task forces.

Despite these energy improvements, NRCan consider that there are key factors that affect the achievement of better energy savings for the industrial sector. These factors include (NRCan, 1998b):

- *Large and intensive energy users typically focus on energy management in the near term to reduce energy use;*
- *Some capital equipment lasts 35 years or more (for example, boilers, blast and electric furnaces), [and therefore] it takes a long time for a new technology to be incorporated into the stock.*

As a result NRCan consider it will be easier to realise further energy efficiency opportunities by focusing on common products and processes, such as motors and motor systems and by directing their efforts towards industries of similar technologies (for example, mechanical drives and systems, process steam).

7.5.3.4 Industrial Energy Innovators Initiative

The **Industrial Energy Innovators Initiative** is a voluntary alliance between industry and Government that is aimed at improving the energy efficiency of industry in a bid to remain

⁵⁷ NRCan also consider that fuel switching (for example, from hydrocarbons to biomass) has been an important emission-reducing action for Canadian industry since 1990.

competitive and to limit the amount of greenhouse gas emissions. This programme is similar to the Energy Wise Companies Campaign (EWCC) that is administered by the Energy Efficiency and Conservation Authority (EECA) in New Zealand, except that the Canadian programmes focus is more on companies in the mining and manufacturing sectors.

Companies from these sectors are invited to commit to improve their energy efficiency via an exchange of letters between their Chief Executive Officer, the chair of the CIPEC Executive Council, and the Minister of Natural Resources. Once this commitment has been made, the Chief Executive Officer assigns a company "champion" to set up a targeting, planning, implementing, tracking and reporting system. The initiative uses such instruments as third-party financing, training programs for building and plant operators, and NRCan's partnerships with industry to develop and demonstrate relevant new technologies (NRCan, 1998b).

As at July 01st 1999, 250 industrial companies, representing more than 75 percent of industrial energy use, had been recruited as Industrial Energy Innovators and of this more than 181 participants had prepared action plans that describe their proposed energy efficiency projects (NRCan, 1998b, 1999c).

7.5.4 National Energy Use Database

Since 1991 NRCan has set out to harmonise existing energy data into a comprehensive national database that covers all fuels and energy sectors. This National Energy Use Database (or "NEUD") is an initiative of NRCan's Efficiency and Alternative Energy programme, and is one of many environment saving measures launched under the aegis of Canada's Green Plan (NRCan, 1999d).

NEUD was initiated because it was recognised that devising energy efficiency programmes to reduce energy demand required an entirely different "species of data" than that which was traditionally collected and used by econometric top down models to simulate and forecast the path of various energy end-use sectors. NEUD is thus aimed at collecting detailed energy information on energy use at the micro-level – such as those that occur at the level of individual industrial processes. The NEUD encourages the regular collection of data on (NRCan, 1999d):

- *energy consumption at the end-use level;*
- *the characteristics of energy-using equipment and buildings;*
- *the attitude and behavior of Canadian consumers toward energy use; and*
- *the adoption of energy-efficient technologies.*

Broadly, NEUD consists of two parts. The first part is a compilation of NRCan's extensive collection of databases, including survey results, energy end-use models and programme data

related to various energy initiatives. The second part is a compilation of a network of Energy End Use Data and Analysis Centres⁵⁸ devoted to individual end-use sectors (NRCan, 1999d). Centres are responsible for compiling and managing existing stores of information pertaining to their area of specialisation and for working to improve the comparability of data and to develop linkages to related databases in Canada and abroad.

7.5.5 The Canadian Industrial Energy End-Use Data and Analysis Centre

The **Canadian Industrial Energy End-Use Data and Analysis Centre** (CIEEDAC), located at Simon Fraser University in Burnaby, British Columbia, is responsible for the industrial sector component of the National Energy Use Database (see also further discussion on CIEEDAC indicators in section 7.5.9). CIEEDAC was created in January 1993 and is sponsored financially (or in kind) by (CIEEDAC, 1999):

- *NRCan*
- *The Canadian Industry Program for Energy Conservation (CIPEC)*
- *The ministère des Ressources naturelles du Québec*
- *The BC Ministry of Energy, Mines and Petroleum Resources,*
- *BC Hydro*
- *The Ontario Ministry of Environment and Energy.*

In return for financial support, some of the sponsors of CIEEDAC receive raw data, data analysis or expert advice from CIEEDAC. This in turn facilitates the exchange of information among researchers in government, industry and academia.

7.5.6 The Industry Energy Research and Development Programme

The **Industry Energy Research and Development Programme** (IERDP) supports the development of technological innovations, process changes and new products to help improve the environmental performance of Canadian industry. The IERDP focus is mainly directed towards the pulp and paper, iron and steel, cement, oil and gas, and food and beverage sectors.

Activities of IERDP include development of technologies with significant carbon dioxide reduction potential, such as (NRCan, 1999d):

- *learning-based expert systems*

⁵⁸ Five centres have been established at the Simon Fraser University in British Columbia, Université Laval in Quebec, McMaster University in Ontario, the University of Saskatchewan, and the University of Nova Scotia.

- *condensing heat recovery*
- *high-efficiency natural gas substitution technologies*
- *fluidized bed combustion*
- *energy from waste*
- *CO₂ capture and disposal, and*
- *integrated emissions control, heat management and process optimization.*

More than 20 cost-shared projects have been completed or are under way and NRCan estimate these technological solutions implemented to date have eliminated more than three million tonnes of carbon dioxide emissions (NRCan, 1999d).

7.5.7 National Indicators

NRCan has worked closely with several organisations⁵⁹ to develop and improve indicators for industry. Two most recent publications include the *Development of Energy Intensity Indicators for Canadian Industry, 1990 to 1997* and *Energy Efficiency Trends in Canada 1990 to 1996*. Both of these publications provide insight into the use and problems associated with energy indicators currently used in Canada and are discussed further below.

7.5.8 Data Development

At a national level, Canada's official source of energy data is the Quarterly Report on Energy Supply and Demand (QRES) in Canada, which is produced by Statistics Canada. The QRES incorporates data from the Industrial Consumption of Energy Survey⁶⁰ (ICE), which is the main source of industrial end-use data and the Annual Survey of Manufacturers (ASM) which provides another important source of data for both industrial energy use and production.

The ICE survey estimates total industrial energy use categorized into ten industrial sub-sectors, covering all fuels. By comparison the ASM, collects a wide variety of information on Canada's manufacturing sector, including purchased energy use. The ASM permits a breakdown of this information for the manufacturing sector into some 230 "industry" sub-sector groups.

In terms of data needs, NRCan considers that industrial energy use data is needed at two levels. The first requires the collection of data to monitor energy consumption and intensity, in support of the work of CIPEC, which promotes industrial energy efficiency initiatives. In order to achieve this requirement, it calls for a detailed sub-sector breakdown of industrial energy use. The second data

⁵⁹ Including Statistics Canada, CIPEC and CIEEDAC.

⁶⁰ The ICE survey has been expanded from 230 establishments to 2000 to produce energy use detail at a more disaggregated level (NRCan, 1999a).

requirement is aimed at understanding the characteristics of industrial equipment and processes, in order to better understand the evolution of energy consumption at the end-use level. In other words, this enables NRCan to take a more detailed look at why energy consumption and/or energy intensity may be changing.

7.5.9 CIEEDAC – Energy Intensity Indicators

Annually CIEEDAC publish an analysis of energy consumption for Canadian Industry. The latest report entitled “*Development of Energy Intensity Indicators for Canadian Industry 1990 to 1997*”; is the sixth such publication and was released in December 1998. CIEEDAC, along with several other data collection agencies, provide this information to CIPEC to assist them in evaluating their progress in terms of energy conservation.

CIEEDAC’s report examines and compares several sets of publicly available data⁶¹ on energy consumption to generate a single picture of the energy consumption in Canadian industry (CIEEDAC, 1998). This comparison of data sets is necessary, as there are variations, both in how data is gathered and how it is reported by data collection agencies with responsibilities for energy.

To address these variations, CIEEDAC undertakes an initial review of the various data sources for internal consistency (for example, summation of fuel types, total energy consumed by each industry). CIEEDAC then reviews the data in terms of the historical sets of the same types to note any major deviations in energy consumption in a specific industry. Once this is completed CIEEDAC then compares the data sets across types. This is not to say that all the data presented by CIEEDAC is then comparable to CIPEC or other standards used or reported nationally. Rather, CIEEDAC accounts for and documents the types of problems they incur with the use of data from the various sources. Such problems include variations in (CIEEDAC, 1998):

- *the classification and groupings of industry types*
- *reported energy consumption*
- *allocation of fuel types*

By clearly identifying the limitations (such as those described above), CIEEDAC positions itself to recommend actions to the Federal Government and its organisations for better harmonisation of data, and thus hopefully promote better tracking and monitoring for future reporting for energy in Canada.

⁶¹ Data sources include: QRES, ICE, CPFE, AMS and the Annual census of Mines (ACM) survey conducted by NRCan (CIEEDAC, 1998).

There are a number of energy indicators that CIEEDAC report on. These include indicators of **energy intensity** (including physical and economic energy intensities), **energy efficiency**, and **specific energy consumption**. CIEEDAC also identify a number of precautions that should be considered when using **aggregate intensity indicators**, and conversely for **decomposition** of intensity indicators. Each of these is now discussed briefly below.

Energy intensity indicators are defined as unit energy/unit output. CIEEDAC calculates the energy intensity for each industry by dividing energy consumption by production data. Information on production is generally given as physical output of the industry (that is, tonnes of output or number of units produced), or a monetary output, such as the industry's contribution to GDP or the industry's gross output⁶² (CIEEDAC, 1998). The energy intensity indicators are then indexed (1990 = 1) to show changes over time. If the output is in physical units CIEEDAC report this as a measure of **physical energy intensity**. Conversely, if the output is in monetary units (GDP or gross output) CIEEDAC report this as a measure of **economic energy intensity**.

Energy efficiency is defined as unit output/unit energy. This indicator represents the mathematical inverse of energy intensity. Thus, where the value of energy intensity ratio has become smaller, this is interpreted as meaning that industry is more efficient as it is using less energy per unit of good produced.

Specific energy consumption is also calculated by CIEEDAC because CIEEDAC consider changes in the energy intensity indicators can lead to estimates of changes in energy efficiency in the process of production. CIEEDAC have found this approach suitable for assessing intensity where indicators are based on physical units of output and where the relationship between energy consumption and production units is fairly clear (CIEEDAC, 1998). This approach however has not been found favourable using denominators of monetary output. This is because monetary denominators can often be affected by factors such as labour, materials, or capital expenditures, which misrepresent the actual energy intensity of a particular industry (CIEEDAC, 1998).

Aggregation of physical intensity indicators is used to generate a more general, industry wide indicator. Conversely, **disaggregation** is used on economic intensity indicators (also known as **decomposition**) to isolate structural changes from intensity (per unit currency). These types of indicators require much care in their use and interpretation of **aggregate intensity indicators**.

Specifically, problems can arise when the indicators monetary denominator is an aggregate of a

⁶² Gross output is defined as the total value of goods and services produced by an industry, a sum of the industry's inputs plus the change in value due to labour and capital investment.

number of industries. For example, if the product share of the industry's change over time, the intensity, obtained by using the aggregate denominator, could change simply because of shifts in the mix of products or activities. This phenomenon is referred to as the **structural effect** (CIEEDAC, 1998) and requires that both numerator and denominator are clearly defined to avoid any misrepresentation.

Similarly aggregation of physical indicators to generate broader indicators for industry can present a similar problem because often the products generated by the various industries are not additive. Aggregation of intensity indicators is therefore problematic and calls for formulations that are sensitive to shifts in product or activity mix.

From the report on the "*Development of Energy Intensity Indicators for Canadian Industry 1990 to 1997*", CIEEDAC have found that from 1990 to 1997, Canadian industry has shown both an increase in production (18 percent GDP, 21 percent gross output) and increase in energy consumption (16 percent). As a result of the different rates of increase, CIEEDAC found that the energy intensity indicator based on GDP was three percent lower in 1997 than in 1990 and the energy intensity indicator based on gross output was one percent lower (CIEEDAC, 1998).

CIEEDAC also found that for industries where energy intensity indicators based on physical output could be generated, they had often shown declines in energy intensity, indicating improved energy efficiency (CIEEDAC, 1998). This is despite the fact that at a highly aggregated level, there appears to be little or no change in the overall energy efficiency of Canadian Industry.

7.5.10 Energy Efficiency Indicators

Annually NRCan reviews trends in end-use energy efficiency in Canada. The report entitled "*Energy Efficiency Trends in Canada 1990 to 1996*" is the third such annual review conducted by NRCan to determine the contribution of energy efficiency to the evolution of secondary energy use and greenhouse gas emissions in Canada (NRCan, 1997). The relationship between secondary energy use and carbon dioxide emissions is shown in Figure 16.

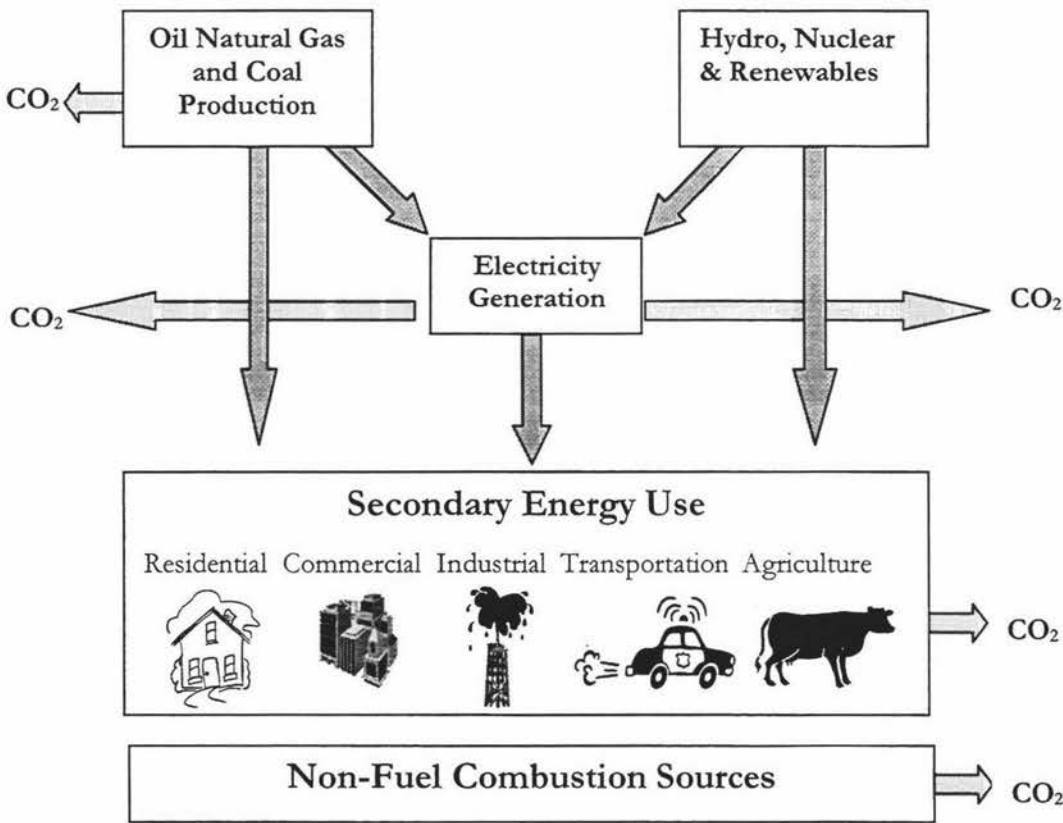
Energy efficiency is an important element of Canada's National Action Programme on Climate Change (NAPCC). By improving the understanding of the relationship between energy efficiency, energy use and greenhouse gas emissions, NRCan considers it can assist policy-makers in developing more effective responses to the issue of global climate change and sustainable development (NRCan, 1997).

The objective of the report *Energy Efficiency Trends in Canada 1990 to 1996* was twofold (NRCan, 1997):

1. *To understand the influence of the factors affecting energy use and emissions;*
2. *Explain the contribution of changes in energy efficiency, using energy intensity as a proxy [measure] to the evolution of secondary energy use⁶³ and greenhouse gas emissions.*

At the secondary level, five main sectors in Canada, namely the agricultural, residential, commercial, industrial and transportation sectors consume energy. All of these sectors (except for the agricultural sector) are considered within these annual reports for energy efficiency trends.

Figure 16: The Relationship between Secondary Energy Use and Carbon Dioxide Emissions



Source: Natural Resources Canada, 1998: *Energy Efficiency Trends in Canada 1990 to 1996*.

7.5.10.1 Types of Indicators

A variety of indicators structured from the most aggregated to the most disaggregated are used by NRCan to explain the role of energy efficiency in the evolution of secondary energy use and

⁶³ These reports deal primarily with secondary energy use and the emissions resulting from their use. Energy use or emissions associated with the production of primary energy are not considered.

emissions. Indicators are categorised into two major types: **factual** and **analytical**. The methodology and data sources used by NRCan for estimating energy use employ the Laspeyres factorisation methodology. This methodology is discussed further in section 7.5.10.2.

Factual indicators are used to describe a situation with respect to either energy use or emissions. Factual indicators either show how much energy is used, where it is used, or the level of emissions in a given sector. NRCan also further categorise the factual indicators into two types:

- **snapshot** indicators to describe a situation at a point in time; and
- **trend** indicators to describe the evolution of a situation over time.

Analytical indicators by comparison are used to explain a situation. Once again NRCan further categorise the analytical indicators into two types: **factorial** and **causal** indicators.

Factorial indicators are based upon an analysis of time series data where the source of change in one variable can be attributed to the principal factors affecting that change. The principal factors that are considered to result in changes in energy use are: activity, structure, weather and energy intensity (NRCan, 1997).

For industry, NRCan has defined **activity** as being measured by **gross domestic product** whilst **structure** is measured by the **sector mix** (for example, pulp and paper, other manufacturing and iron and steel). Shifts in the structure of activity toward more energy-intensive components of activity lead to an increased energy use and gaseous emissions. For example, if the distribution of activity in the industrial sector shifted from construction to pulp and paper industry, an increase in industrial energy use would result, as the former industry is much less energy intensive than the latter (NRCan, 1997). For industry, data gathered on activity measures and sectoral energy use is taken from Statistic Canada's "*Quarterly Report on Energy Supply-Demand*". Refer to Appendix 9 for a full listing of activity measures and sectoral energy use data.

Impacts of fluctuations in the **weather** are also considered because variations in weather conditions can lead to changes in space heating and cooling requirements. This factor is particularly relevant for Canada as it has a cold climate and thus is prone towards larger energy consumption for heating than more temperate climates such as New Zealand.

Energy intensity (energy use divided by activity) is used as a proxy measure for energy efficiency. Energy use is divided by activity to produce a proxy measure for energy efficiency because energy efficiency can only truly be measured at the micro level, by assessing the energy efficiency of particular components, such as a boiler or a motor. As it is impractical to gather data at this level

NRCan have elected to use energy intensity as a proxy measure for efficiency. Despite this, estimated change in energy intensity may reflect a number of variables, such as technological efficiency improvements, energy efficiency improvements, that result from fuel switching and/or behavioural changes and so care is needed in the interpretation of this indicator.

Causal indicators are also used to explain change in a particular variable. For example, energy price is a causal indicator that can explain change in the level of energy use (NRCan, 1997).

NRCan have distinguished between these two types of analytical indicators to emphasize that the principal factors (that is, factorial indicators) affecting change in energy use are strictly and quantitatively related to the change in energy use (NRCan, 1997). By comparison, a causal approach of qualitatively contrasting the trend in causal analytical indicators versus a particular variable can explain cause and effect.

Greenhouse gas emissions data is derived from multiplying the energy use data by emissions factors taken from Environment Canada's "Trends in Canada's Greenhouse Gas Emissions 1990 to 1995" (refer also to section 7.5.1 of this report). However, differences however, arise between the total sector-specific emissions presented by NRCan in their publications of *Energy Efficiency Trends in Canada* and those presented by Environment Canada in their national indicator series. These differences arise from an alternate classification in sectoral definitions, that is, re-allocations of the QRES energy data from one category to another by Environment Canada or NRCan (NRCan, 1997).

7.5.10.2 Methodology and Data Sources for the Energy Use Factorization Analysis

NRCan consider that in the simplest of terms, an energy efficiency index is a statistical indicator that measures energy use, taking into account of changes in energy intensity, structural influences, and economic or physical output. NRCan have utilised the **Laspeyres factorisation methodology** for analysing secondary end use trends. Four important objectives motivated the choice of this methodology (NRCan, 1997):

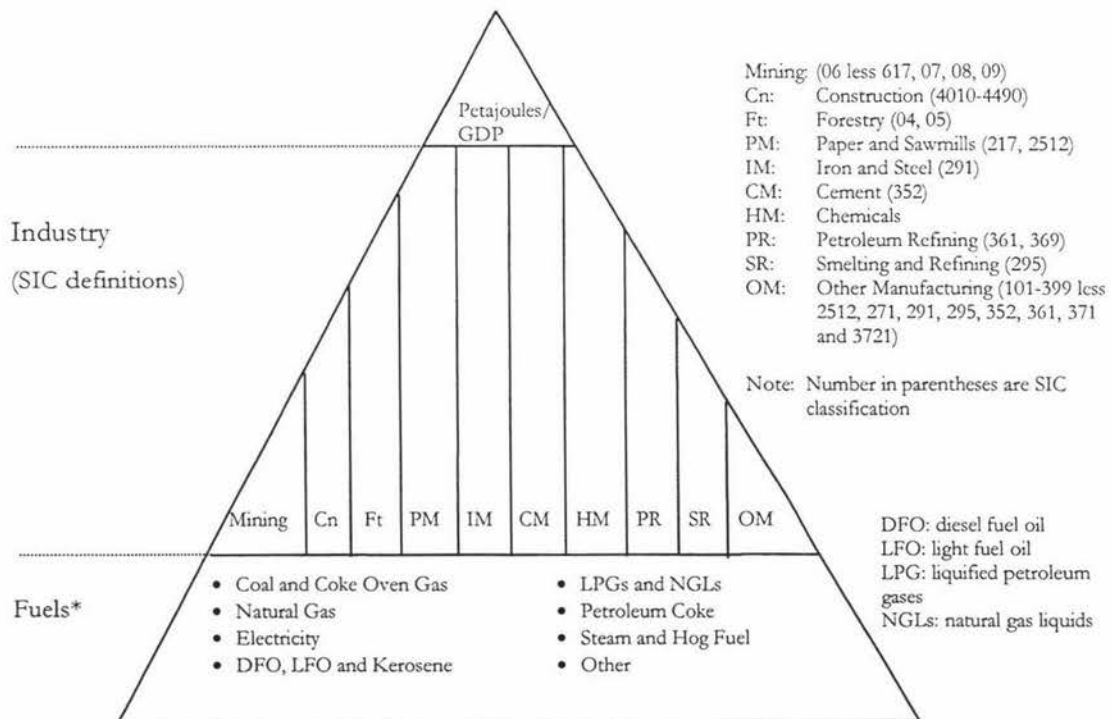
- *interpretation of the index was considered straightforward;*
- *the same index can be applied to all sectors and sub-sectors so that all sectors can be interpreted similarly;*
- *data was available with which to calculate the indexes;*
- *the index is theoretically sound.*

By applying appropriate mathematical derivations, this can lead to the factorisation of a sector's energy index into activity, structure and intensity indexes. Factorisation therefore provides a measure of the influences of each of these indexes on the total energy index as well as the

contribution of the sub-sectors to each of these indexes. Such indicators can therefore be applied to measure energy consumption at the economy wide level and in individual sectors (for example, transportation, commercial), industries (for example, forestry or pulp and paper manufacturing) and specific end uses (for example, refrigeration). The factorisation methodology provides a basis for distinguishing between activity, structure and intensity factors, but the activity measure appropriate for any particular sector may not be applicable to another. As a result, NRCan has used the different activity measures for each sector: Industrial activity is measured as GDP originating from the sector.

Industrial output data for the ten sub-sectors (mining (2), construction (1), forestry (1) and manufacturing (7)) are aggregations of GDP by industry (at 1986 prices). This data is produced by Statistics Canada and is published in "Gross Domestic Product by Industry" (NRCan, 1998c). Statistics Canada uses a **Standard Industrial Classification (SIC)** system to identify industries. A copy of the Standard Industrial Classification system is included in Appendix 10. The combinations of the SIC used by NRCan for their analysis and compilation of *Efficiency Trends in Canada* for the industrial sector is shown in Figure 17, the **Industrial Sector Indicator Pyramid**.

Figure 17: Industrial Sector Indicator Pyramid



Source: Natural Resources Canada, 1997: *Energy Efficiency Trends in Canada 1990 to 1995: A Review of Indicators of Energy Use, Energy Efficiency and Emissions*.

The Industrial Sector Indicator Pyramid shows the factorisation of energy use for the industrial sector in three levels. Level one (at the bottom) defines the sectoral influences at the most detailed level by fuel type. Level two captures the influence of shifting industrial composition. Aggregating over the products of these factors yields the third level, the change in aggregate industrial secondary end use attributable to each of the three components (activity, structure and intensity) in petajoules per unit of output.

Highlights of the Industrial Sector as determined by NRCan using the above described methodologies and indicators reveal the following information for the latest out-turn period available, 1990 to 1996 (NRCan, 1998c):

- (a) Over the 1990-1996 period, **industrial energy use** increased by 11.8 percent for a total increase in energy use of 309 petajoules per annum;
- (b) The growth in industrial sector energy use was largely influenced by changes in the **industrial activity**, the **mix of activity** by industry, the **structure effect**, and **energy intensity**. The impact of these three factors was the following:
- **Industrial sector activity** (measured by GDP) increased 6.5 percent. Had all other factors remained constant over the period and only industrial activity changed, industrial sector energy use would have increased by 171 petajoules per annum;
 - The change in the **mix of activity** (structure) towards more energy-intensive industries has also contributed to increased energy use. Had all other factors remained constant over the period and only the activity mix changed, industrial sector energy use would have increased by 100 petajoules per annum;
 - There was an increase in **energy intensity** from 1990 to 1996. Had all other factors remained constant over the period and only industrial energy intensity changed, industrial sector energy use would have increased by 35 petajoules or 1.4 percent.
- (c) The **carbon dioxide intensity** [CO_2/E] of industrial energy use decreased by 5.5 percent, as industry moved towards a greater use of fuels with a lower carbon content.
- (d) **Carbon dioxide emissions resulting from energy use** in the industrial sector increased by 5.6 percent from 1990 to 1996, as the impact on emissions of increased growth in energy use more than offset the decline in the average carbon dioxide intensity of energy use.



Discussion

For long periods of time national policy makers around the world have tried to identify a set of indicators that could "indicate" a nation's prosperity, well being and sustainability. Traditionally, the primary indicator for welfare and well being has been gross domestic product (GDP) in spite of the general recognition that measures of GDP contain serious flaws.

8.0 Introduction

Each day, many forms of energy are produced, transformed and/or consumed, in a wide range of manners, by many sectors of society. For example, energy in the form of raw natural gas is extracted and processed through industrial plants to produce electricity to heat and light the homes we live in and the office buildings in which we work. In order to be able to determine the implications associated with these various energy demands it is necessary to understand how energy is being used by these various sectors, and what factors influence or motivate their choices in energy use.

Whilst energy sector industry forms but one part of a wide range of energy users in New Zealand, they nevertheless play an important role in influencing New Zealand's energy use. This is because there is a wide range of environmental effects that are associated with the consumption and production patterns of energy sector industry. The burning of natural gas to produce electricity results in the discharge of combustion products to air such as carbon dioxide that heats our planet. The discharge of industrial effluent has the potential to cause irreparable damage to our local waterways. The generation of solid wastes fills our landfills. The selection of energy types, the energy mixes and the manner in which energy sources are used by energy sector industry also influence New Zealand's ability to achieve a sustainable energy environment. Thus, the activities of energy sector industry have wider implications than those that exist at a sectoral or local level and ultimately also impact upon national and international environmental objectives.

In order to understand the motivating forces that cause these wide range of effects, policy makers need to be able to monitor the changes that are occurring within the environment and also the

effectiveness of environmental and energy policies that influence the way in which energy is used. For long periods of time, countries have relied on highly aggregated measures such as energy use to gross domestic product (GDP) for energy policy analysis. However, the ratio of energy use to GDP between countries provides neither an accurate measure of efficiency in the use of energy nor a gauge for how efficiency improves and/or deteriorates (IEA, 1997). This is because economic measures such as GDP often obscure the many factors that may differentiate energy use at a sectoral or micro level.

8.1 The Importance of Internationally Based Forums

Two important internationally based institutions that New Zealand has accepted obligations under are the United Nations (UN) and the Organisation for Economic Co-operation and Development (OECD). Participation in such international institutions are fundamental to New Zealand (and other countries) as they provide a means of jointly formulating environmental policies via the use of multilateral environmental agreements to resolve environmental problems that affect the global community.

However, the scope and functions that are both provided for, and conducted by the UN and OECD are wide ranging in nature. For example, the UN and OECD also engender themselves towards providing important evaluation and guidance functions to their member countries. This enables the international community to enact international environmental responses in a more coordinated, consistent and accountable manner than could be achieved without the existence of such institutions.

8.2 Multilateral Environmental Agreements

Multilateral environmental agreements (MEA) are important international environmental policy instruments that enable the international community to collectively respond to global environmental issues within the context of a more “level playing field”. This is because the successful implementation of a MEA can ensure that no one country is faced with the risks of being exposed to the potential economic or social constraints that may result from unilaterally “greening” their legislation.

MEA such as the Framework Convention for Climate Change (FCCC) and the Kyoto Protocol (which clarifies an expected reduction in CO₂ emissions for Annex-1 member countries over a defined time period) pose a challenging series of issues for Governments, energy sector industry, and the international community as a whole. This is because the ramifications of the FCCC are largely based upon energy policies for addressing carbon emissions. In particular, energy efficiency

has been identified as a key policy option for reducing the atmospheric pollutants (greenhouse gases) that arise from the use of fossil fuels.

Heralding the potential for similar impact are non-legally binding MEA such as the Rio Declaration and Agenda 21. Principle 8 of the Rio Declaration strikes a balance between the need to *“reduce and eliminate unsustainable patterns of production and consumption and [to] promote appropriate demographic policies”*. Agenda 21 also clearly looks towards industrialised countries to lead the initiative to achieve sustainable consumption patterns and industrialisation is specifically pinpointed by the UN as being one of the most significant contributors of environmental degradation due to wasteful consumption and production practices.

Despite resource intensive lifestyles continuing to increase globally, the OECD member countries (which include New Zealand) remain the principle consumers of the world's natural resources. Therefore the international community looks to these countries for achieving improvements and equity in the use of our global environmental resources.

8.3 Introducing Accountability

Forums such as the UN and OECD introduce a sense of accountability for New Zealand (and other countries) by providing important monitoring and assessment functions. For example, New Zealand is a participant in the OECD's regular environmental reviews, including those affiliated organisations to the OECD, such as the International Energy Agency (IEA).

The most recent reviews conducted on New Zealand by the OECD and IEA were carried out in 1996 and 1997 respectively. In terms of energy, both organisations drew similar comparisons of New Zealand's performance. In essence, New Zealand was considered to have made impressive progress in terms of developing market orientated strategies within the context of broader economic reforms (IEA, 1997b). Such strategies have primarily included the establishment of the Energy Efficiency and Conservation Authority (EECA) and energy efficiency programmes (such as the Energy Wise Companies Campaign (EWCC)) and the Voluntary Agreements (VA) programme for large energy using industry in New Zealand.

Many of the findings and recommendations identified by the OECD and IEA for energy have also been enacted since their respective reviews. Such recommendations included the incorporation of further deregulation within the electricity sector and implementing measures to remove natural monopolies. However despite this progress, New Zealand's actual energy efficiency still ranks poorly (that is seventeenth out of twenty-two), in comparison to other OECD member countries.

New Zealand also regularly feeds information back to organisations such as the UN on its commitments under the FCCC and on Agenda 21 for energy (and other issues). Carbon sequestration remains a central theme of New Zealand's approach to addressing greenhouse gases. However, methane has been identified as being the most significant source of greenhouse gas emissions (in terms of CO₂ equivalents), a phenomenon that distinguishes New Zealand from other OECD countries. For example in 1995, New Zealand's CO₂ emissions were estimated at 27,000 kilotonnes compared to 34,000 kilotonnes of methane (in CO₂ equivalents) for the same reporting period. Because of the strong agricultural base in New Zealand, this undoubtedly also impacts upon New Zealand's ability to reduce greenhouse gas emissions via more conventional methods, such as targeting large CO₂ emissions from industrial facilities.

8.4 But is Accountability Synonymous with Credibility?

Whilst there has clearly been a new political momentum towards ratification of the Kyoto Protocol under the FCCC, this MEA has not gained unequivocal credibility amongst society as a whole. At the core of debate is the non-resolution of a number of key outstanding issues. These include the use of forests for carbon sinks and the question of how much action a country must take nationally to reduce its greenhouse gas emissions.

The Kyoto Protocol is expected to achieve a reduction of over five percent in emissions of greenhouse gases by 2010. New Zealand has committed to a net stabilisation of emissions (or zero increase). New Zealand has also signaled its preference for the use of an emissions-trading regime as the preferred tool for achieving CO₂ reductions and its international commitments at least cost (MfE, 1999f).

However, the manner in which commitment reductions can be achieved is viewed by some as merely providing a "loophole" for inaction. For example, Greenpeace sites the use of forest sinks as potentially allowing countries to escape making any tangible reductions in their actual greenhouse gas emissions. By planting forests or through accounting of sinks from existing forests, some countries may be able to evade their obligations to reduce actual carbon dioxide emissions at source. This along with the fact that New Zealand has limited availability of land in which to expand its "forest sinks" means that the Government in the longer term may only end up defrauding itself as this method will not enable unfettered future energy growth. In addition, this approach could also only fix one problem and cause another. For example, planting more "monoculture" forests has the potential to swap one environmental problem for another (that is, soil acidity may then become the issue).

Similarly, unrestricted use of carbon trading is seen as potentially allowing some countries such as the United States (with a committed reduction of seven percent) to avoid significant action in their own country as they can simply buy "carbon credits" from other countries. For example, Russia, whose emissions have fallen dramatically from the baseline year of 1990, due to its economic collapse, is now an easy target source for "CO₂ savings" for countries such as the United States (Greenpeace, 1999). If a carbon trading system was permitted to occur, it could mean that the United States would have to do very little to achieve physical reductions within their own country.

Emission-trading systems can be fraught with a wide range of practical difficulties. Such difficulties include how to allocate and monitor carbon-trading permits, and how to enforce the system once it is in place. Despite these difficulties, carbon-trading systems are nevertheless gaining popularity as an economic tool. For example, in Canada, TransAlta recently established a carbon trading agreement with farms in the United States (TransAlta, 1999b) and Suncor also established an emissions trading reduction agreement with a power company in the United States (Suncor, 1999). Such trading arrangements are viewed as being desirable by some industry as they can allow companies a new sense of flexibility in achieving low cost greenhouse gas reductions. Emission-trading regimes are also viewed as having the potential to stimulate further actions by industries, communities and individuals because a value is placed on actual greenhouse gas emissions.

Whilst the debate on the decision of whether to permit carbon trading or the use of forest sinks continues what is certain is that if either of these methods are adopted then New Zealand may be able to meet its obligations at least cost. However in doing so, New Zealand may gain international accountability but not necessarily win creditability.

8.5 Deregulation, Privatisation and the Globalisation of Energy Market's

The task of defining a governance path and policy instruments that might lead to a more sustainable energy future continues to grow significantly more difficult throughout the world. This is largely because of a general trend towards the deregulation, privatisation and globalisation of markets. In becoming more democratic, governments have taken on a greater responsibility to justify and gain support before taking policy steps, particularly those that might add costs to essential energy infrastructures. Governmental bodies now exercise far less control over domestic and international economic activities than they did a decade ago. Both developed and developing countries are now more reliant on markets than governments to meet their societal needs and as a result the drivers behind societal change may now be more economically than environmentally driven (TAI, 1998).

This means if governments are to enact fewer statutory controls by which to legally force changes in behaviour then they also need to look towards more comprehensive strategies to enact changes in energy consumption and production. Energy consumption and production patterns both affect and are affected by technology development, changing market structures, fuel choices, economic growth and competition, and governance. This suggests that a multi-disciplinary approach to energy may offer valuable insights to policy makers to enact their international and national commitments (TAI, 1998).

To date however, the policy instruments that have been implemented by OECD member countries to promote the sustainable use of natural resources have been somewhat limited (OECD, 1996), and this is also true for New Zealand at a national level. The OECD attribute a reluctance by governments to integrate environmental concerns into sectoral policies for issues such as energy, as being mostly impeded by economic pressures to remain internationally competitive. However, the OECD has also found that environmental and industrial policies can be carried out without endangerment to competitiveness or employment (OECD, 1996).

Nationally, the ability to implement such policy instruments without causing disadvantages to the economy has been demonstrated under the auspices of Government initiated strategies, such as the 1994 CO₂ Policy Package. This strategy was introduced in an attempt to achieve New Zealand's commitment reductions under the FCCC. The strategy was based upon implementing a range of non-statutory and statutory measures to reduce greenhouse gas emissions and improve the energy efficiency of (primarily) industry and other CO₂ emitters. The main non-statutory instruments used included the industrial VA programme and the raising of energy efficiency awareness and management by the establishment of the EECA. Under the aegis of EECA, programmes such as the EWCC were also established.

However, despite progress nationally and internationally, concerns have been expressed by both the OECD and the UN in terms of the predominant reliance on energy efficiency as a vehicle for achieving changes in energy consumption and use. For example, despite OECD member countries managing to significantly shrink the amount of carbon they release per unit of production between 1973 and 1993 this rate of reduction has also now slowed dramatically (IEA, 1997). As a result carbon emissions (in total) are rising, not falling. Environmental indicators used by OECD reveal that actions taken to date by many OECD countries appear to be inadequate in terms of reversing the longer-term growth in overall greenhouse gas emissions. As a consequence, many OCED countries may not meet their reduction commitments without designing and implementing more effective and comprehensive strategy responses (Morlot, Michaelis, 1998). Policy makers will be required to watch the key trends in energy end consumption and use via the assistance of well-

defined environmental indicators to ensure future strategies for greenhouse gas reductions are successful.

8.6 Energy Sector Reforms in New Zealand

The success of the Government's energy strategies have, to an extent, also adversely impacted on New Zealand's ability to achieve its commitments under the FCCC, as observed by a rapid increase in the use of energy within New Zealand (IEA, 1997). In particular, the deregulation of the electricity sector has resulted in a number of significant changes to the energy sector. One of the most notable changes is the surge in construction of thermal electricity generation as part of cogeneration facilities. As a consequence of this activity New Zealand may expect to see more of its electricity supplied from gas-powered rather than hydro-generated stations in the near future (ECNZ, 1998b). However, the construction of newer thermal generation facilities also has resulted in the displacement of generation from less efficient existing thermal generation facilities, such as Huntly or New Plymouth Power Stations.

The Government's creation of a free market environment has also led to electricity being priced coincident with consumer demand. As a result the wholesale prices for electricity have been between 1.5-4.5 cents per kilowatt-hour (c/kWh) for the period July-December 1999 (M-co, 2000). However, despite the more efficient generation and lower than historical average prices in the wholesale electricity prices, retail electricity prices have actually risen.

Many debates continue to surround the retail pricing of electricity in New Zealand. This is primarily driven by the fact that it is difficult to attribute the overall increase in monetary prices to the electricity generators, distributors or retailers. This is because of the market driven pricing and the separation of the traditional regional electricity companies that previously performed both distribution and retailing functions.

What is certain however, is that the industrial sector continues to pay less for electricity than any other sector in New Zealand. For example, the residential sector in 1997 paid on average 11.4 c/kWh for electricity. The residential sector has also faced an increase of 41 percent in electricity prices over the period 1990-97. By comparison, the industrial sector paid on average 6.1 c/kWh, but over the same period only faced an increase of six percent in electricity prices (SNZ, 1998). In addition, during this same period the industrial sector has had the highest increase in electricity consumption (22 percent), proportional to either the residential (11.5 percent) or the commercial sector (8 percent).

Paradoxically therefore, whilst a free market environment has resulted in more competition between the electricity sector and a displacement of less efficient electricity generation, this outcome has also made the situation harder for New Zealand to meet its Kyoto Protocol greenhouse gas obligations.

In response to the observed increase in the use of energy the IEA considered the New Zealand Government would need to introduce stronger economic measures to temper energy usage. Such measures included increasing the effectiveness of voluntary agreements, carbon taxation, and strengthening of the Resource Management Act (RMA). These measures were viewed by the IEA as being necessary in order to assist New Zealand to meet its commitments in reducing its CO₂ emissions to 1990 levels.

8.7 Creating Incentives for Change in Energy in New Zealand

Despite the introduction of significant environmental and energy reforms, including a range of subsequent strategies (for example, Environment 2010 and the 1994 CO₂ Policy Package), to date the Government has taken very little action to create incentives for industry to use a wider range of renewable energy sources. For example, Central Power's decision to proceed with the construction of the Taranaki Wind Farm (located near Palmerston North) was made in December 1997, before the latest electricity reforms were announced and when the New Zealand dollar was some 20 percent higher in value. The anticipated drop in wholesale electricity prices was factored into the project's economic modeling and the capital cost of foreign exchange was fully hedged so as not affect the viability of the project significantly. However, Central Power consider this project would not have proceeded if a similar decision had been made with the parameters now in place for the electricity sector (Walker, et.al., 1999).

In sharp contrast to the New Zealand situation Denmark, for example, has recently embarked upon a huge and ambitious construction programme of large-scale offshore wind farms which may ultimately generate half of their country's electrical power (Lemetais, 1999). Countries such as Austria, Sweden, Denmark, the Netherlands and Germany also enjoy their government's official support for renewable energy forms and as a result wind power is now one of the fastest growing sectors within the renewable area.

Whilst the use of sustainable energy forms is seen as a desirable long term solution to meeting New Zealand's growing energy demands, little incentive exists for industry to place a balanced priority on the use of sustainable energy forms. In particular, the demand in energy from New Zealand's geothermal primary energy sources is accelerating. Contact Energy recently won the right to build a 15 MW geothermal power station on the outskirts of Taupo. This 15 MW station will result in a

draw of up to 20,000 tonnes of geothermal fluid a day from the untapped Tauhara field (The Press, 1999).

The MoC predict that an additional 410 MW of geothermal generating capacity will become economic to develop over the period 1995 to 2020. At an assumed efficiency of only around 10 percent, this has a dramatic effect on geothermal primary energy supply for electricity generation in New Zealand as it increases from 90 PJ/annum in 1998 to around 200 PJ/annum by 2020 (MoC, 1997).

Whilst geothermal resources in New Zealand are vast and apparently inexhaustible, our scientific knowledge and environmental monitoring base is also far from complete. New Zealand already has many reminders (such as the once famous geysers at Wairakei) of what can be lost when fluid and heat are extracted from a geothermal system in an unsustainable manner. Thus, the choices that are made in the use of primary energy sources need to be carefully balanced in an environmental as well as economic context.

8.8 Voluntary Agreements

The Voluntary Agreements (VA) programme and the Energy Wise Companies Campaign (EWCC) are two initiatives that have been introduced to augment changes in the use of energy by energy sector industry (and other companies) in New Zealand. Both programmes have similar drivers that is, to promote energy efficiency and therefore a reduction in greenhouse gas emissions. The focus of the VA programme however, has been specifically directed towards large energy using industries in New Zealand.

To accurately assess how these programmes contribute to influencing New Zealand's energy efficiency and therefore the Government's commitments under the FCCC transparency in reporting by signatories is a fundamental requirement. However the low level of reporting that is currently placed on signatories to both programmes is viewed as being an impedance to understanding what influence these programmes have on energy use (IEA, 1997, Jamieson/Pool, 1999b).

VA signatories are currently under no obligation to do more than report progress (for example, tCO₂ per unit of output) and as a result this inhibits the MoC in attributing particular causal factors to energy consumption and production patterns of energy sector industry. The current low level of reporting requirements that are placed on signatories also inhibits the ability for a cost effective, alternative use of this type of data. For example, more detailed reporting by VA signatories could provide the MfE with a good disaggregated measure of energy use. This information could then be

utilised by the MfE for incorporation into their energy indicators that will form part of the Environmental Performance Indicators (EPI) programme.

8.9 Energy Efficiency – Not just an Initiative, but also a Standard!

Energy efficiency is far from being an embedded psyche in New Zealanders. For example, New Zealanders continue to construct buildings with very little consideration for incorporating appropriate insulation or considering the energy consumption of fixtures such as lights or motors. In large the Government must take responsibility for this outcome. By encouraging the establishment of free markets in New Zealand without suitable incentives for conforming to a minimum standard of performance, the Government has sent a clear signal to the market that cheap is best, despite the manner in which goods/services are provided.

Following a study tour to Canada in 1999, the Parliamentary Commissioner for the Environment (PCE) issued a challenging commentary on the limited range of performance measures and actions that New Zealand has taken to date to promote energy efficiency. The PCE also considered that the measures taken to date by New Zealand contrasted sharply with that of Canada, and clearly reflects the priority the Canadian Government has placed on energy efficiency. (PCE, 1999).

A number of commonalities exist in the frameworks adopted by the Government's of both Canada and New Zealand. For example, the role of the Office of Energy Efficiency (OEE) in Canada is similar to that of the EECA. However, Canada has clearly undertaken more actions to enact changes in energy efficiency. Of particular note is the wider range of Canadian initiatives adopted to address energy efficiency. These include numerous voluntary energy efficiency programmes such as the Voluntary Commitment Reduction (VCR) programme and the Industrial Energy Innovators Initiative (IEII).

However in addition to these voluntary measures, the Canadian Government has also introduced a range of statutory measures such as the use of energy efficiency regulations and standards. By comparison, the PCE considered that New Zealand was moving at a "... *glacial pace [at which Government is moving] to introduce any minimum energy performance standards for appliances or insulation standards for new housing*" (PCE, 1999). The introduction of energy efficiency standards by Government is desirable as it establishes a bottom line in terms of energy efficiency. Such a move also sends a clear signal to free markets that the environmental costs associated with poor production practices will not be born by the consumers.

In January 1999 the Government released a "*Climate Change: Domestic Policy Options Statement*". In October 1999, the Government announced its policy response to climate change. This policy response includes a range of long overdue minimum energy performance standards (MEPS). MEPS are to be introduced for buildings and equipment such as fluorescent lamps, ballast's and domestic hot water heating cylinders. MEPS are seen as a means for assisting the Government to achieve its greenhouse gas reduction targets under the FCCC. So New Zealand is now moving, albeit slowly, towards making energy efficiency a standard, and not just an initiative.

8.10 A National Policy Statement

New Zealand does not have a national policy statement for energy, but this is not due to either a lack of pondering, consideration or debate. Central to an energy policy framework, is how to deal with CO₂ emissions associated with energy use. The MfE as far back as 1993 signaled that a national policy statement for energy would form part of the Government's energy policy framework (MfE, 1993). The Minister for the Environment received a recommendation from the Board of Inquiry into the Taranaki Combined Cycle Power Station to promulgate a National Policy Statement on Climate Change under the RMA. In addition, over 50 percent of regional authorities have stated within their RPS that they consider energy is an issue for central rather than local government. So is there a need for a national policy statement?

National policy statements by their nature are generally an expression by government to utilise policy measures in order to achieve a desired outcome. However, the Government in deregulating the energy sector has signaled to the market that it should control its energy supply and demand. But free markets will not fully take into account the environmental consequences of their choices or the impacts these decisions may have on future generations unless there is an incentive to do so. Thus, if markets are to operate fairly, the Government has to ensure a priority is placed on environmental and not just economic drivers. But should the thrust of this control be within the context of an economic or policy instrument?

The MfE Working Group on CO₂ policy options identified two broad difficulties with using the RMA to implement New Zealand's international commitments under the FCCC (MfE, 1999d). Firstly, the RMA framework provides for regional and district decision-making on local environmental influences and impacts as opposed to those that occur globally. Thus, consistency in approach would be needed to avoid either significant anomalies or inefficiencies if decisions were to be made under the ambit of the RMA. Secondly, the MfE Working Group questioned whether local authorities were empowered under the RMA to use economic instruments. If so, an array of regional instruments was considered to be less efficient than a single economic instrument enacted at a national level. Thus, the Working Group concluded that a national economic instrument would remove the justification for declining a consent application or attaching conditions to consent's in

respect of CO₂. The Working Group also concluded that the rationale for developing and implementing a National Policy Statement would not apply if a national economic instrument was introduced.

However, given that the Government has decided to defer the use of economic instruments prior to 2008 pending the development of policy at an international level, the gap that currently exists between regional and central government for controlling the wider environmental effects of energy are not yet fully bridged.

8.11 The Energy Efficiency and Conservation Authority

The Energy Efficiency and Conservation Authority (EECA) is the Government's principle source of expertise on energy efficiency issues (SNZ, 1998). EECA has a broad mandate of assisting New Zealanders (including energy sector industry) to use energy more efficiently and to seek out alternative sources of renewable energy.

EECA communicates much of the quantitative energy information it gathers on New Zealand's various energy sectors through its Energy Use Database and Energy Wise Monitoring Quarterly. EECA therefore represents a key resource for the MfE to draw upon in the development of their national indicators for energy.

Under the aegis of EECA a number of energy efficiency programmes are also operated. These include the Energy Wise Companies Campaign, the Energy Wise Councils Partnership Programme and the Energy Saver Fund. The programme most relevant to energy sector industry is the EWCC.

The EWCC now has over 700 participating companies that range broadly in both size and activity. Also included in the EWCC are 29 regional, district and city councils. EWCC members, to varying degrees, voluntarily report their progress to EECA on the implementation of the principles of the EWCC. Programmes such as the EWCC have positively demonstrated that organisations can deliver ongoing efficiency improvements within a voluntary context. For example, Jamieson/Pool (1999b) report that up to 60 percent of the principles have been taken up by EWCC companies and an ongoing energy efficiency rate of four percent per annum is being achieved.

However, like the VA programme, the effectiveness of the EWCC is currently impeded by limited reporting requirements that are placed upon its members. This suggests that EECA, like the MoC has not given sufficient consideration to defining, at the inception of its programmes, an adequate level of reporting. However, there are differences in the structures of these two organisations that makes this above assumption not so clear cut.

EECA is currently analogous to an orphan child. In its present framework, EECA whilst a government funded organisation, is not a governmental organisation in its own right. This has two consequences. Firstly, unlike its central government counterparts (such as the MfE or MoC), EECA is not engendered with a policy development role. It therefore lacks the “teeth” with which to enforce a change in behaviour. Rather, EECA is reliant on other drivers (such as cost savings or free access to technical expertise) to entice its clients. Therefore, EECA’s ultimate worth is undermined by a lack of ability to establish enforceable requirements by creating for example, mandatory energy standards.

Secondly, EECA is subject to the whim of being disestablished under the same fiat in which it was originally established. This is a precarious position for EECA to be in, both in terms of its employees and the demands it must respond in order to remain in existence. These demands are by no means insignificant. For example, the Government in enacting its response to climate change has provided EECA with an additional \$150,000 to “*implement some [energy] measures and to undertake assessments of others*” (MfE, 1999h). Whilst this is not representative of the total allocation provided by Government to enact its response to climate change, EECA nevertheless has many tasks to fulfill with very little funding.

So, what does the future hold for EECA? Currently before the Government is the Green Party’s Energy Efficiency Bill. This bill proposes both the establishment of EECA as a governmental body and the reinstatement of the Electricity Act 1992, which would once again allow the Minister of Energy to control domestic electricity prices in New Zealand. The implications of passing or vetoing this bill are significant in terms of influencing the future direction for energy in New Zealand. This is because the Government has been firmly placed in a position that requires it to clearly demonstrate whether it is seriously committed to creating a more energy efficient environment for New Zealand.

8.12 Access to Technical Expertise

Participation in forums such as the UN or OECD enable New Zealand to be the recipient of, and contributor to, an internationally based forum of technical expertise. At the core of functions provided by the UN and OECD are the development and use of environmental indicators. These indicators assist the UN and OECD in monitoring and assessing their member country’s performance in a more comparative and standardised manner. This in turn enables New Zealand to benchmark its environmental performance nationally and to gain feedback on its environmental performance within a broader international context.

Environmental indicators are tools that are utilised to integrate a host of environmental data and information. However, environmental indicators are not used exclusively, rather they form part of, and complement other qualitative and quantitative scientific data that are used to produce an overall picture of the environment. By utilising indicators in the appropriate context and accounting for the limitations associated with their use (as discussed in sections 1.2.2 and 2.4.6) environmental indicators assist organisations such as the UN or OECD to distinguish progress or stalemata in terms of member country's environmental performance and international commitments. These findings are then formally recorded in regular environmental performance reviews.

One of the most pervasive findings identified by the OECD in its joint reviews of its member countries is the need for energy policies to be modified to better take account of environmental constraints and to avoid unsustainable patterns of development. In particular, the ever-growing use of fossil fuels is cited as being the largest impediment to countries meeting their commitments under the FCCC (OECD, 1996). This finding is also consistent with the findings of the UN who have cited unsustainable consumption and production patterns as being one of the factors that have impeded progress of member countries towards sustainable development.

In response to these issues the UN has released indicators on "*Consumption and Production Patterns*" and the OECD has developed sectoral indicators, to support its core indicators, for those issues that they consider require additional attention. Energy-environment indicators are one of these sectoral indicators.

8.13 Environmental Indicators of the UN and OECD

In response to its member concerns, the OECD has developed indicators for energy and the environment. The sectoral indicators for energy-environment are not solely restricted to environmental indicators per se. Rather, these indicators are "*..concerned with the wider linkages that exist between the environment and the economy*" (OECD, 1998b).

Sectoral indicators for energy-environment (also referred to as "socio-economic indicators") have been incorporated into the OECD's core indicator family to assist the OECD in gaining a better understanding of the progress of member countries towards sustainable development, in a more cohesive and consistent framework. Both the OECD's core and sectoral indicators are based around the use of the pressure-state-response (PSR) framework.

The sectoral indicators for energy-environment that were included in the OECD's "*1998 Environmental Indicators*" include indicators for energy intensity, energy mix and energy prices. In

addition, carbon dioxide emissions (from energy use and industrial processes) are also included in the OECD's core environmental indicators under the subset climate change.

The OECD considers that their core and sectoral indicators are primarily intended for use at an international or national level. This is not to say that similar indicators could not be applied at a regional or sectoral level, rather that because these types of indicators provide only aggregated indications of energy, much care and supporting resources are needed to enable their accurate interpretation.

By comparison, the UN Commission on Sustainable Development (CSD) has also established an international work programme on indicators for sustainable development. An important element of this program is the identification of a core set of indicators for *"Changing Consumption and Production Patterns"*. The framework for the development of the UN's indicators is similar to the pressure-state-response model developed by the OECD. However the UN's indicators have been expanded to include driving force indicators to more accurately portray the range of economic, social and institutional forces that place pressures on the environment, including its sustainable use (CSD, 1995). While still in a proposed format, these indicators reflect the UN's attempt to align energy use with the principles of Chapter 4 in Agenda 21.

Five provision core indicators are identified for the consumption of energy: intensity of energy use, share of renewables, energy prices, emissions of greenhouse gases and annual energy consumption per capita. Common to the selection of the above-described indicators was the ability of each of these indicators to be used at a disaggregated level nationally. Importantly, in their selection of indicators, the UN also considered that data should be readily available for use of these indicators in the short term (UN, 1999).

One of the main differences that exist between the OECD's indicators and the UN indicators is the higher incorporation of monetary measures (such as GDP) that the OECD have elected to use to quantify their energy-environment indicators. This approach is consistent with the OECD's main objective behind developing their sectoral energy-environment indicators. This stated objective is to better understand the linkages that exist between the environment, the use of our natural and physical resources and the economy.

By comparison, the UN in the development of their indicators have taken a slightly different tact and leant towards more physical quantification measures such as units of production. This is because the UN consider that the choices producers and consumers make (rather than the costs associated with those choices) more accurately reflects the driving forces behind whether these decisions are aligned to the concept of sustainable development.

Regardless of the driver behind the development of an indicator, similar indicator selection is only really a requirement in so much that it enables comparability within the context of an international policy process. On this basis, indicators such as those proposed for use by the UN for reporting greenhouse gas emissions under the FCCC should be internationally comparable between member countries. Conversely, it would be inappropriate for indicators that are developed for local use (for example, a water quality indicator for a stream) to have the same reporting constraints applied to them.

Despite the differing approaches used by the UN and OECD in the development of their indicators the attributes of the energy measures being monitored are nevertheless very similar in characteristic. These attributes include energy intensity, energy efficiency, energy mixes, energy pricing and carbon dioxide emissions associated with energy use. These indicators are discussed further separately within section 8.15 of this report.

Furthermore, as the IEA have previously demonstrated, what is more important in the development of an indicator is the underlying approach that has been used. That is, a pyramidal approach to building the indicator up from the bottom (most disaggregated data) to the top (most aggregated indicator), rather than from top to bottom.

8.14 The Ministry for the Environment's Environmental Performance Indicators Programme

There is currently limited information available that assists decision makers in understanding the energy demands for the various regions and districts within New Zealand (MfE, 1997, MCC, 1999). To assist in addressing this (and other issues), the MfE in corroboration with a number of other key agencies and organisations, initiated the Environmental Performance Indicators (EPI) programme.

The intent of the EPI programme is to develop a "toolbox" of environmental indicators for use in New Zealand. The MfE are currently in the process of developing national environmental indicators for a range of issues. These indicators will ultimately support and provide a means of responding to the Government's E2010 strategy. However, national indicators will also importantly provide direction and assist local authorities in achieving their responsibilities under the RMA.

The MfE has not yet publicly released indicators for energy however an indicator for climate change ("total emissions") has been developed and is relevant to energy sector industry. This indicator is discussed separately within section 8.15.5.

Co-incident with the preparation of national environmental performance indicators is the development of an integrated environmental network, such as a “clearing-house network” (MfE, 1998c) to co-ordinate and collate the vast amount of indicator data that is gathered a range of stakeholders (for example, governmental organisations, non-governmental organisations and research bodies). Once implemented this network will enable a more systematic transfer of indicator data between the various stakeholders.

Energy indicators will eventually influence the way in which energy sector industry operates in New Zealand. This is because indicators will enable governmental agencies, in the preparation of their Environmental Stocktakes and State of Environment Reports, to utilise energy indicators to assist them in assessing the way in which energy is being used and how this use aligns with their energy and environmental policies.

8.15 Environmental Indicators

This section discusses indicators that have been developed by the United Nations, Organisation for Economic Co-operation and Development, Natural Resources Canada, Ministry for the Environment, Ministry of Commerce and Statistics New Zealand. This section provides by no means an exhaustive list of the range energy indicators that have been developed by these organisations. Rather, it provides useful insight into some of the commonalities and differences in approaches that have been taken by these various agencies in the development of some of the key energy indicators. These include indicators for energy efficiency, energy intensity, energy mix, energy prices, and emissions of greenhouse gases.

8.15.1 Applying Energy Intensity to Energy Efficiency

Energy intensity also importantly provides, at least in part, a proxy measure of a country’s energy efficiency. The OECD, IEA and Natural Resources Canada (NRCAN) have all generally accepted the use of energy intensity as a proxy measure of energy efficiency, subject to the precautions associated with its use. Specifically, much care is needed in the interpretation of energy intensity indicators as they can be easily affected by a host of variables. For example, a shift in the use of energy types, such as an increase in activity in the petrochemical sector and an associated decrease in activity in the construction sector, will influence a country’s energy intensity. This is because the petrochemical sector is far more energy intensive than the construction sector. By comparison, a shift in the use of fuel mixes in a particular sector, for example, the conversion of a coal-fired power station to natural gas may reflect a country becoming more energy efficient.

The use of energy intensity as a proxy measure for energy efficiency is also useful to energy analysts because of the practical difficulties associated with actually trying to monitor changes in a country’s energy efficiency. For example, to accurately measure energy efficiency demands that the analyst

possesses energy information data that exists at the micro level such as knowing the efficiency of individual equipment and processes.

As both the OECD and UN have identified, whilst improvements have been made by member countries (OECD, 1996, UN1998) further effort is still required by many countries to have more meaningful and synthesized environmental data and indicators. In order to have access to this information, analysts need to have in place well structured informational transfer systems. An example of such a system is that used to collect and analyse industrial end-use data is the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC).

Currently, the Ministry of Commerce (MoC), Statistics New Zealand (SNZ) and EECA report a range of national energy data through various publications. For example, the MoC in co-ordination with a range of agencies prepare an annual "*Energy Data File*" for New Zealand. This energy data file provides a collation of the various energy forms that are both used and produced in New Zealand including, coal, oil and gas, renewables, and electricity as well as the energy pricing indexes (MoC, 1999d). The range of sources that contribute to the input of this data file are shown in Appendix 11. Whilst this confirms that there is a large existing energy information base in New Zealand, no organisation in New Zealand is responsible for co-ordinating this plethora of energy information into a collective information base, such as exists in Canada.

Because clear boundaries do not exist in terms of who should be gathering what energy information, the existing information also lacks co-ordination. By clearly understanding individual roles and responsibilities this would make the collection of data more efficient and well defined. It would also ensure that "gaps" do not result, information is gathered in a consistent manner and duplication of efforts is minimised. The current ad-hoc approach is undesirable as it makes the transfer of information less efficient between agencies or organisations that may benefit from receiving particular energy information. Improving the flow of information would improve everyone's understanding of energy consumption and production patterns and therefore place all groups in a better position to respond to undesirable changes that may occur. Thus, environmental performance indicators for energy provide a means of aligning energy consumption and production practices to the environmental concerns that arise from the use of energy.

SNZ in co-ordination with the MoC and other governmental bodies prepare yearbooks that contain a range of statistics, including legislative, environmental, economic and social information (including that for energy) for New Zealand.

SNZ monitor energy intensity expressed nationally as energy use per dollar of GDP. However, SNZ do not state whether the actual energy use is for primary or consumer energy. This differentiation is important, as primary energy figures would be higher than that for equivalent consumer energy figures as energy transformation losses are included in the calculation of primary energy. In addition, the energy intensity figure reported by SNZ for 1997 is not actually stated except in so much that SNZ indicate that "...New Zealand's energy intensity is amongst the highest in the OECD" and that energy intensity has also "... reversed over the last few years". Because the actual figures, trends and comparative performance of other OECD countries are not presented with SNZ's findings it is therefore difficult to gauge what these comments actually mean. For example, whilst the reader is told New Zealand doesn't rank particularly highly in terms of energy intensity, where does New Zealand actually rank in comparison to other OECD countries – seventeenth, twentieth, or last?

Similarly, it is not easy for the reader to understand what factors, such as a shift in the change of energy forms, have actually contributed to a subsequent decrease in energy intensity within recent years. A decrease in energy intensity may be correctly attributed to a decline in the construction of energy intensive industries in comparison to the 1980 think big era. However, this data can just as easily be misinterpreted as meaning that a decrease in energy intensity is attributed to a more efficient use of energy by a particular sector.

The observation in New Zealand's collation and presentation of its energy information also contrasts sharply with the performance of similar organisations within Canada. For example, Statistics Canada regularly reports its energy use data within a Quarterly Report on Energy Supply and Demand (QRES). The QRES also incorporates data from the Industrial Consumption of Energy Survey (the main source of industrial end-use data) and the Annual Survey of Manufacturers (another important source of industrial energy use and production). It is therefore very easy for the public to both access detailed data and to link this data with work conducted by other agencies that have responsibilities for energy.

As previously mentioned, the ease of which energy data is able to be accessed within Canada in part reflects the superior co-ordination of informational transfer systems that exist in comparison to New Zealand. However, this phenomenon is also undoubtedly attributed to the high emphasis that the Canadian Federal Government have placed on energy and the environment. This is reflected in the large proportion of time that is devoted by the OEE and NRCan to understanding the links between energy use and human activities.

Despite the limitations that currently exist regarding access to energy data in New Zealand, SNZ and the MoC are nevertheless key resources for the MfE to look towards for development of their

national environmental indicators for energy. One challenge posed to the MfE in the development of their energy indicators however will be to improve the quality of energy-environment information that is translated to the New Zealand public. This means that the MfE will need to be able to explain and not merely “quote” their results in clear and simple terms. This includes describing what their indicators actually reveal, what factors have influenced changes in energy consumption and production, and whether the policy measures enacted by government either support or contradict any observed changes in energy use.

8.15.2 Energy Intensity

Understanding the range of variables that affect energy consumption and production are important particularly in terms of sustainability. As has been previously mentioned, energy efficiency is identified as a key policy option by countries for achieving their obligations under MEA such as the FCCC. Similarly, the ability of a country to maximise its energy efficiency also reflects a country’s commitment to incorporate the principles of Agenda 21 by utilising its energy resources in a sustainable manner.

Both the UN and OECD have indicators for energy intensity but the approaches used to quantify these measures are slightly different. The OECD monitor energy intensity by two measures, namely tonnes of oil equivalent (toe) per 1000 US\$ or toe per capita. By comparison, the UN propose that energy intensity be monitored by toe per unit of production.

Depending upon the context that this indicator is to be used in, either monetary or physical, both types of measurements may be appropriate. For example, if an analyst was trying to gauge a shift in energy consumption within the pulp and paper sector, then the use of physical measures (such as units of production) may be quite appropriate to monitor changes in production patterns. Within a specific sector, the goods/products produced can be accurately compared across “like producers” to gauge whether one particular company is producing more units of goods/services than another. However, when this type of measurement is compared across different sectors, for example, the pulp and paper sector to the petrochemical sector, then physical measurements are not necessarily comparable. In this instance therefore, the use of a monetary measure such as GDP may be a more appropriate measure to use to “standardize” measurements across sectors, but also at national and international levels to gauge a country’s overall energy intensity.

Energy intensity is a useful indicator because a reduction in energy intensity can also reflect the existence of environmentally sound policies that do not encourage wasteful consumption and production patterns in the use of energy resources. For example, if the energy intensity of a country increases this provide an indication that energy production and consumption patterns are contrary

to stated policy objectives or methods. Therefore the policy instruments in place within a country may be insufficient to promote sustainable practices in energy use.

8.15.3 Energy Mix

Understanding the structural changes in energy supply mixes is important because the energy supply mix can have a major effect on the environmental performance of a country. This is because the environmental effects associated with the use of one energy source can differ greatly to the use of another. For example, the generation of electricity by fossil fuels results in the discharge of greenhouse gases (and other contaminants) to atmosphere, whereas the generation of electricity by wind power does not.

Both the UN and OECD have developed indicators for quantifying a country's energy mix. However, once again slightly different approaches have been used to quantify these measures. The OECD indicator energy mix is qualified two ways: total primary energy supply (TPES) by source and also as a percentage of total energy supply (TES). By comparison the UN proposes an indicator of share of renewables, expressed as a percentage of total energy consumption (TEC).

The UN's proposed indicator uses consumer energy compared to the OECD's indicator which uses primary energy. This means that losses such as transformation will be excluded from the UN's indicator. Therefore, a change to a more efficient energy transformation would not be reflected by an improvement in the UN's indicator. For example, replacement of geothermal electricity generation facilities with wind generation increase the efficiency from 10 percent to 100 percent which would have a large impact on TPES but none on TEC.

In essence however, both the UN's and OECD indicators achieve a similar objective, that is, they both have the ability to translate whether countries are moving towards more sustainable forms of energy use. Whilst the UN's indicator is orientated towards gathering information on the percentage of renewable energy sources a country has, the OECD by incorporation of the indicator TPES by source also achieves a similar outcome. This is because it enables the OECD to determine the contribution of each fuel type. Thus, this indicator provides a disaggregation of fuel type including that of coal, oil, gas, nuclear, commercial renewable and waste and hydro and "other"⁶⁴. As a result both of these indicators provide good indications of a country's contribution to the use of renewable energy sources and thus whether they are moving away from the use of fossil fuels and towards achieving their international commitments under the FCCC and Agenda 21.

⁶⁴ "Other" includes other renewable sources such as geothermal, solar and wind.

There is also potential for differences to arise in the classification of generic descriptors. For example, the International Energy Agency (IEA) exclude hydro from their classification estimates of renewable energy sources, whilst New Zealand does not. The IEA exclude hydro on the basis that this type of generation facility may not be necessarily sustainable in terms of either future growth or expansions. This is because of the practical limitations that are associated with hydroelectric facilities (that is, available sites) and the wide ranging environmental effects associated with their installation and operation.

NRCan in the development of their energy efficiency indicators have also developed an indicator for sector mix. This is an equivalent indicator to that of energy mix utilised by both the UN and OECD, however NRCan have in the development of their energy efficiency indicators further disaggregated this indicator into sectoral types, including that for industry. By monitoring the industrial sector by both sub-sectoral mixes and fuel type, NRCan can assess the shifts in the structure or activity. These changes might lead to more energy intensive industries that could both increase energy use and gaseous CO₂ emissions. Once again, core to enabling NRCan to undertake this analysis, is the energy data produced by Statistics Canada and presented in their QRES D.

SNZ in co-ordination with the MoC also include energy mix in the compendium of statistical data presented in their annual yearbook. In this particular instance, SNZ has defined TPES as meaning *“the amount of energy available for use in New Zealand for energy conversion and end-use”*. In addition, SNZ have disaggregated this data to include contributions by coal, oil, gas, hydro, geothermal and other sources. The energy mix is also discussed by SNZ in their findings as percentage contributions from these fuel types.

Primary energy is a good numerator to use when discussing the implications of fuel mixes as it also takes into consideration “losses” that occur from primary energy use. Thus, if either technological changes or process improvements in energy transformation and/or distribution facilities occurs, then the benefits of this type of measure would be apparent. However, a further differentiation between transformation losses and actual consumer energy is required for this type of analysis.

It appears that SNZ and/or the MoC either do not have available or choose not to present actual transformation loss data from the electricity sector. For example, SNZ use “assumed” efficiencies for gas and coal (34 percent) and for cogeneration electrical generation facilities (30 percent). A geothermal efficiency for electrical generation is also assumed (10 percent) as is hydro and wind (100 percent). However, in these latter two instances actual efficiency data would not change as there are no actual losses associated with the conversion of these energy forms into electricity.

In comparing the absence of actual transformation loss data to the results of the survey conducted and discussed within section 6 of this report, only one out of the four electricity generation facilities that participated in the survey provided energy consumption or transformation loss data for their facility. Thus, it appears that either this data is not readily available for these companies or there is unwillingness to pass on data pertaining to their actual transformation losses. As a result, there is a gap in the accuracy of the data produced by SNZ/MoC in their annual *“Energy Supply and Demand Balance”* for New Zealand. To overcome this and improve the responsiveness of the measure, energy transformation loss data by the electricity sector should be included.

8.15.4 Energy Prices

Price signals play a key role in determining the ability of a country to achieve an efficient allocation of energy resources, by internalising environmental costs. This is because energy end-use prices have the ability to influence a country’s overall energy demands and the choice of fuel mixes it uses. Collectively these choices largely determine the environmental pressures that are caused by energy activities. The OECD has found that despite price elasticities varying considerably between end-use sectors, historical and cross-country experience suggests that the overall price effect on energy demand is strong. Increases in energy prices have decreased the levels of energy use and therefore reduced environmental impacts (OECD, 1993, 1996).

Both the UN and OECD have developed indicators for quantifying a country’s energy prices. The OECD has two energy prices indicators (expressed as an indexed trend in real energy end-use and/or selected energy prices for industry and households). By comparison the UN proposes an energy prices indicator (quantified in US\$ per unit of energy). Once again both of these indicators have a similar intent, that being to monitor the energy prices and the impacts these have on the choice of energy mixes.

NRCan in the development of their energy efficiency indicators database have also developed a range of both aggregated and disaggregated indicators for energy prices for the industrial, and other sectors. Energy prices are expressed as an inflation adjusted cost for energy end use in Canadian dollars, at 1986 prices.

Energy prices are not presented in the annual yearbook produced by SNZ, except for the inclusion of an averaged price for electricity for (residential, commercial and industrial) consumers and an international comparison of electricity prices with other OECD countries. However, the MoC in their publication *“New Zealand Energy Outlook February 1997”* include a measure for price elasticity for both selected sectors (including industry) and for transport fuels. The MoC consider that price elasticity provide estimates of the responsiveness of energy demand to changes in energy prices,

however they also consider that much care is needed in their interpretation (MoC, 1997). In addition the MoC gather information on electricity, transport, non-transport and energy price indexes for collation into an annual *“Energy Data File”*. Once again this indicates that the MoC will be a key resource for the MfE to draw upon in the development of their national indicators for energy.

8.15.5 Emissions of Greenhouse Gases

Understanding the types and volumes of emissions that are related to energy use are important. In particular, the quantification of greenhouse gases helps a country to understand the contribution that the use of fossil fuels is having to global warming. This in turn assists countries in understanding whether they are moving towards or away from achieving their commitments under the FCCC. As a result, environmental indicators that quantify the emissions of atmospheric pollutants from energy use are a key input for government’s in terms of energy consumption and for their energy related environmental policies.

Both the UN and OECD have developed indicators for quantifying a country’s greenhouse gases. The UN has proposed an environmental indicator of emissions of greenhouse gases (quantified as annual level in gigagrams of CO₂ equivalent). By comparison, the OECD has addressed carbon dioxide emissions, from both energy use and industrial processes (expressed as millions of tonnes per unit of GDP and per capita) in its core environmental indicators under the subset climate change.

The main difference reflected in these indicators is that the UN have aligned their emissions of greenhouse gases indicator to the reporting requirements for members under the FCCC. This approach provides an assurance that member countries report their annual emissions in a consistent and co-ordinated manner if this indicator is used by members. By comparison, the OECD indicator for carbon dioxide emissions provides a useful energy intensity measure. This indicator therefore provides useful insight into the linkages that exist between energy use and environmental effects rather than strictly providing a measure of the progress countries are making towards their commitments under the FCCC. Both indicators provide useful measures depending upon the context of which they are intended for use.

About 80 percent of total carbon dioxide emissions in Canada result from secondary energy use, that is, by agriculture, residential, commercial, industrial and transportation consumers, as well as from the generation of electricity. The remaining 20 percent is mainly emissions from energy used to produce and deliver energy to the market (OEE, 1998).

The Canadian Government under the aegis of the National Action Programme on Climate Change (NAPCC) has outlined a federal-provincial strategy for achieving Canada's emissions goal under FCCC. Under the NAPCC, Canada has also committed itself to the development of indicators to measure its progress towards meeting its national objectives in greenhouse gas reductions.

Three key indicators that the OEE present to assist in the interpretation of its energy use and carbon dioxide emissions are secondary energy use by sector and carbon dioxide emissions by sector and changes in carbon dioxide emissions, secondary energy use and carbon dioxide intensity. In addition, all of these indicators are qualified as percentages. Energy use is also considered in relation to the four main factors that have been identified as influencing change in secondary energy use, namely activity, structure, weather and energy intensity.

As previously mentioned the energy information that pertains to the industrial sector for energy is conducted in a much more co-ordinated and consistent manner than is done in New Zealand. For example, CIEEDAC in the preparation of their publications on energy intensity indicators examines and compares several sets of publicly available data on energy consumption to generate a single picture of the energy consumption in Canadian industry (CIEEDAC, 1998). This comparison of data sets is necessary because similar to New Zealand, there are variations in Canada in both how data is gathered and how it is reported by data collection agencies with responsibilities for energy.

One of the drivers indicated by NRCAN from developing their informational bases is to ultimately create more comparable databases and continue to improve the manner in which energy information is currently gathered. New Zealand in comparison has much it can learn from the progress made by Canada in terms of the development made in its national energy indicators, but also the manner in which these activities are administered.

Whilst not strictly classified an "energy" indicator, the MfE as part of the development of their national environmental indicators have adopted a total emissions indicator for climate change. This indicator is a climate change policy indicator that measures New Zealand's net annual emissions of greenhouse gases. This particular indicator has been aggregated from a matrix of all the greenhouse gas emissions that is modeled from New Zealand's national communications to the International Panel on Climate Change (IPCC). Emissions are calculated taking into account a global warming potential (GWP) to derive an equivalent CO₂ emission value. This indicator supports the greenhouse gas emissions indicator proposed by the UN.

Incorporated into these estimates are the CO₂ emissions from the VA signatory industries. VA signatories as part of their reporting requirements to the MoC are generally only required to provide

their annual tCO₂ per unit of output. This means that underlying data (such as fuel or product use) is often not provided, and therefore whilst the information generated by the VA programme has the potential to, it does not yet provide a good disaggregated measure of energy use or CO₂ emissions.

8.16 What's Happening Locally?

There is an uneven distribution of energy sector industry in New Zealand. Most of the large industries are located in mid to upper half of the North Island (that is, Taranaki, the Bay of Plenty, Auckland, Northland and Waikato), and Southland. The six largest energy-using industries belong to the pulp and paper sector, metals sector, and petrochemical sectors. Together these industries are jointly responsible for accounting for approximately 81 percent of New Zealand's total industrial energy consumption.

In addition to the differences in the distribution of energy sector industry the regions also differ widely in their primary energy characteristics. For example, Taranaki is dominated by the presence of petrochemicals, Bay of Plenty and Waikato by geothermal resources, Westland and Southland by coal, while hydroelectric resources dominate the Canterbury region. Given the significant differences that exist in both the distribution and energy characteristics within the various regions in New Zealand, it is reasonable to assume that ranging approaches would be taken by regional authorities in addressing energy within their statutory functions under the RMA.

Energy is included in the definition of natural and physical resources under the RMA. Sections 5(2)(a) and 7(b) of the RMA generally limit the actual extent local authorities can have in terms of energy to controlling the environmental effects associated with the use of energy.

Regional authorities are required to prepare Regional Policy Statements (RPS) under the RMA. Fourteen of the sixteen regional authorities have RPS adopted under the RMA, whilst the remaining two (Gisborne District Council and West Coast Regional Council) are currently working under transitional provisions of the RMA until their RPS are fully adopted.

Regional authorities in developing their RPS are required to articulate the key issues and priorities for their region by interpreting sustainable management and applying it to their particular region's biophysical and socioeconomic characteristics. All regional authorities have identified energy as a significant issue. From the energy sector industries surveyed industry has also had a high involvement in development of their region's RPS and/or plans.

Whilst commonality in approach is not a requirement for RPS, there are nevertheless three common issues that were identified for energy. These were energy efficiency, the desire for greater use of renewable energy sources, and controlling the environmental effects associated with energy use.

Whilst energy efficiency influences the way in which energy is consumed, it is not the responsibility of regional authorities under the RMA to enforce energy efficiency (MfE, 1993). However regional authorities can within their ambit of powers under the RMA, affect energy efficiency through other statutory provisions such as those that occur for air or water discharges. Regional authorities in enacting their RPS have adopted this approach. For example, the Otago and Taranaki Regional Council's indicated that this latter approach is used to enact and fulfill their obligations for energy in accordance with the policies, objectives and methods outlined in their respective RPS.

The RMA also enables regional authorities to develop regional plans. However, there is no requirement under the RMA for regional authorities to have a separate policy on energy. No regional authorities indicate they either have, or intend to develop, a separate plan to address energy. In fact, some such as the Hawke's Bay Regional Council has gone so far as to indicate that energy will be removed from their RPS with its next review.

Section 32 of the RMA requires local authorities to find the most cost-effective means of achieving sustainable management of resources in their communities. By comparison, section 35 of the RMA imposes a duty upon local authorities to gather information, monitor and keep records. All of the regional authorities identified a wide range of statutory and non-statutory methods for addressing energy. Most of the methods identified were non-statutory rather than statutory in nature. For example, the use of advocacy, promotion and/or the provision of information to promote energy efficiency and conservation far outweighed any other method identified. However despite this, less than half of the regional authorities could provide examples of the specific measures they had used to promote or advocate energy efficiency and conservation.

Very little monitoring is actually being conducted that is relevant to energy sector industry in relation to the to energy issues, policies objectives, and methods of implementation outlined in the RPS. For example, only the Canterbury Regional Council has energy-environment indicators that are relevant to industry. Conversely, few regional authorities are reporting on energy as part of the State of the Environment Reports (SER). The Canterbury, Taranaki and Wellington Regional Council's are the only regional authorities that currently report on energy as part of their SER.

This suggests that energy monitoring (such as energy consumption or efficiency) or reporting is not viewed as a high priority for regional authorities. However, energy-effects based monitoring such as

air or water quality clearly is, as is demonstrated by the high use of environmental indicators by energy sector industry for aspects such as air quality, water quality or waste.

8.17 Energy Sector Industry

As part of the research for this report it was decided to survey a cross section of energy sector industry to gauge some insight into the types and frequencies of environmental monitoring that is conducted for energy and the environment, how this monitoring is reported, and to whom.

79 percent of the energy sector industries contacted agreed to participate in this survey. The companies that were identified and selected for participation in the survey were primarily derived from the list of signatories to the Government's VA programme. These signatories represent New Zealand's larger energy-using industries, as well as the main electricity, gas and coal producers.

Information was provided on energy efficiency and conservation, monitoring and reporting, interaction with governmental and non-governmental agencies and energy consumption data. Excepting for the energy consumption data, which was unilaterally kept confidential (due to the commercial sensitivity of this type of information), most respondents were happy to publicly disclose all other information. This confirms that large energy sector industries are generally willing to be transparent in their external communications regarding both energy and the environment. This also demonstrates achieving a higher level of reporting from VA signatories should not be an overly onerous or unattainable task for the MoC to achieve.

Implementation of energy efficiency initiatives appears to be at the forefront of methods that are actively being utilised by energy sector industry. This type of initiative is far more common than the use of energy conservation, energy benchmarking or energy auditing to influence an organisation's energy consumption and production patterns. However, not all of the benefits that are associated with these improvements are being reported externally or fully realised outside of the companies. For example, all industry respondents surveyed indicated that they had conducted (one or more) energy efficiency, energy conservation, energy auditing or an energy benchmarking study within the last two years. However, of these respondents only 63 percent indicated that they reported one or more of these energy-related initiatives externally.

Industry utilises a wide range of environmental indicators to monitor their organisation's performance. The wide range of indicators reported by respondents reflects the diverse potential that energy sector industry can create in terms of environmental impact. The indicators identified by respondents were generally broadly categorised for comparative purposes. Similarities included those for CO₂ emissions (92 percent), solid or liquid waste (85 percent), legal or compliance

measures (85 percent), effluent quality (77 percent) and air quality – not CO₂ related (69 percent). By comparison, only 38 percent of respondents indicated that their organisation has an indicator for energy conservation and only 31 percent had an indicator for energy efficiency.

The low occurrence of energy indicators in comparison to the other types of indicators is attributed to three reasons. Firstly, there appears to be differing interpretations of what constitutes an environmental performance indicator. Secondly, energy sector industry indicators appear to be more aligned with statutory drivers, such as those behind resource consents, namely air quality, water quality or legal compliance. Thirdly, energy indicators (such as energy consumption) tend to be viewed more as economic, rather than environmental indicators.

Industries were also asked to rate their interaction with governmental and non-governmental organisations such as the MfE, the MoC, EECA and their relevant regional authority(s). This included ratings for the flow of information from these organisations to industry, the quality of information provided and also the frequency that industry reports to these organisations.

Industries supply information to their relevant regional council more frequently than the MfE, MoC or EECA. However, the information supplied to regional councils is likely to be aligned to the respondents use of environmental indicators. Therefore, regional authorities will be the best source of energy effects based monitoring data (for example, air quality) but not energy consumption or energy efficiency data. As previously mentioned, neither the MoC nor EECA have complete energy consumption or energy efficiency information supplied by energy sector industry. For this reason, the MfE should target energy sector industries for participation in the development of their national energy indicators.

Conversely, regional authorities could laterally extend their current monitoring programmes to include the energy information “gaps”. The Canterbury Regional Council has to an extent already adopted this approach. Given also, the receptive nature by industry to participate in this survey, the greater interaction that occurs between energy sector industries and regional authorities, and the high incidence of energy efficiency as an issue in RPS, this should not pose either an insurmountable task or inappropriate response for regional authorities.

8.18 The Canadian Example

Huge differences in scale exist between Canada and New Zealand. This is in terms of the physical characteristics of Canada (that is land size and climate), but also in the range of governmental, non-governmental and interest groups that are mandated with energy responsibilities.

Despite these differences, some of the approaches taken by the Government in Canada to produce a framework to guide the actions of the industrial sector in Canada parallel those that have been taken in New Zealand. For example, the Voluntary Challenge Registry (VCR) programme is similar to the VA programme in New Zealand. The establishment of the OEE is similar to EECA in New Zealand. The establishment of the Commissioner of the Environment and Sustainable Development (CESD) is a similar role to that of the PCE in New Zealand.

But in a number of instances these parallel also end. For example, the VCR programme whilst also orientated towards energy efficiency and the reduction in industrial carbon dioxide emissions, places a much greater reporting emphasis on its signatories. The OEE, an affiliated but independent organisation within NRCAN has statutory powers to produce energy efficiency regulations and standards. The incorporation of the OEE within NRCAN has also sent a clear signal to the energy sector that energy usage is not only an economic but also very much an environmental matter.

Many agencies have developed and are using indicators for energy. For example, the National Round Table on Environment and Economy (NTREE) has developed eco-efficiency indicators for sustainable development. Environment Canada has developed national environmental indicators for energy consumption and climate change. NRCAN has energy efficiency indicators for secondary end use and carbon dioxide emissions. CIEEDAC has developed energy intensity indicators for industry. These indicators are drawn from informational bases such as Statistics Canada's Quarterly Report on Energy Supply and Demand (QRES), the Industrial Consumption of Energy Survey (ICE) and the Annual Survey of Manufacturers (ASM).

In instances there appears to be some duplication of efforts in indicator development. For example, Environment Canada's national indicators for energy consumption mirror similar efforts undertaken by NRCAN in the development of their energy indicators. However, in this particular instance Environment Canada has signaled that its efforts in monitoring its sectoral indicators such as those for energy, will most probably diminish due to more direct responsibility for these types of indicators being taken up by organisations such as NRCAN and the OEE. Thus, whilst the demarcation lines for responsibilities may not be clearly separated between NRCAN and Environment Canada, these bodies are fully aware of each others actions and their respective responsibilities. As such the informational databases that ultimately support the national indicators will not be compromised but rather rationalised by a transition in responsibilities.

Where duplication exists there also appears to be a more concerted effort to standardising and accounting for the differences in the way in which information is gathered. For example, since 1991 NRCAN has set out to harmonise its existing energy data into a comprehensive national database

that covers all fuels and energy sectors. This database is referred to as the National Energy Use Database (or NEUD). The NEUD database is continually being refined by organisations such as CIEEDAC, who evaluate and put forward recommendations on how differences in existing monitoring databases can be improved.

Many similarities in the composition and types of indicators can also be drawn from similar types of indicators that have been developed by the UN and OECD. Indicators that have been developed and aligned for monitoring industrial energy use include energy consumption (by type and sector) energy intensity, energy efficiency, and carbon dioxide emissions resulting from energy use.

Some of the key underlying principal factors identified for the Canadian indicators, such as weather are of less relevance to the New Zealand situation, as these factors would be less likely to influence energy consumption patterns in New Zealand. However, once again this reinforces the fact that Canada has considered not only their international obligations (and thus the commonalities in approach required for reporting), but also the geographical and physical constraints that influence energy use at a national and local level within Canada.

Thus, much thought has been put into the development of aggregated measures of energy that are reported at a national level. For example, NRCan has adopted a similar approach to the IEA's energy pyramid for the development of its industrial indicators. NRCan's industrial sector indicator pyramid is based on a factorisation method that defines the sub-sectoral influences at the most detailed level by fuel type.

The voluntary programmes that have been initiated by the Canadian Government in an attempt to influence energy consumption and production patterns are also far more wide ranging than that that currently exists in New Zealand. These include the Voluntary Challenge and Registry (VCR) programme, the Canadian Industry Programme for Energy Conservation (CIPEC) and the Industrial Energy Innovators Initiative (IEII).

The VCR programme is a programme that is aimed at encouraging companies and organisations to put forward action plans that outline how they intend to limit their greenhouse gas emissions. This programme is similar to the VA programme in New Zealand, but has much more comprehensive reporting requirements and a better sense of recognition associated with it. Signatories are awarded gold, silver or bronze levels depending on their degree of reporting and performance.

The CIPEC is a programme that is aimed at industry setting and achieving energy intensity improvement targets and the IEII is a programme that is aimed at improving the energy efficiency

of industry. This latter programme also has similarities with the EECA EWCC, but once again the IEII has much more comprehensive reporting requirements associated with it.

Thus, a number of distinct advantages arise in comparing the way these programmes are administered between the Canadian and New Zealand situation:

- there are more co-ordinated informational systems for monitoring energy use (and its environmental effects) for industry;
- there is a greater emphasis placed on reporting requirements for industry in participating in voluntary programmes and therefore greater transparency in terms of understanding the implications of the data reported by signatories;
- the information drawn from these programmes can be easily accessed by the public to review the performance of industry;
- recognition is awarded to industry for good performance.

Section 9



Conclusion

If New Zealand is to manage its energy consumption and production patterns and meet its local, national and international environmental commitments, then policy makers must be able to clearly understand the range of motivating factors that influence the way in which energy is used and produced. Environmental indicators (including those that are relevant for energy sector industry) will provide one tool for assisting policy makers in understanding the wide range of issues that affect energy use.

In 1998 energy sector industry consumed approximately 56 percent of New Zealand's primary energy and thus whilst this sector forms but one part of a wide range of energy users in New Zealand, it nevertheless plays an important role in influencing New Zealand's future environmental direction.

The ways in which energy sector industry both produces and consumes its energy has the potential to cause a wide range of both local and global environmental effects. In order to be able to understand the motivating forces that leads to choices regarding energy use, policy makers will need to be able to monitor the changes that are occurring within this sector. This monitoring will also help to measure the effectiveness of environmental policy frameworks. To achieve this, policy makers will need to face inwards towards activities that are occurring at a local or sectoral level, but also outward towards national and international environmental frameworks.

In order to determine what has influenced the development of a particular energy indicator, it has also been necessary to understand how indicators interact with the range of environmental and energy related activities that occur around them. Such activities include the formation of multilateral environmental agreements to incite international responses to global environmental problems, the monitoring of environmental performance, the evaluation of various policy frameworks that exist at a range of levels, and how energy sector industry both interacts with, and responds to these influences.

There are currently no national environmental indicators for energy in New Zealand. However, the MfE is well on the way towards collating its inaugural toolbox of national environmental indicators.

Energy indicators will complement and support the range of other indicators that will align with the Government's Environment 2010 Strategy issues. Environmental indicators will also provide assistance to the MfE in the preparation of their environmental reporting and policy assessment functions. In addition, environmental indicators will provide important direction and assistance to local authorities in achieving their responsibilities under the RMA.

The implication of the Kyoto Protocol continues to pose a challenging series of issues for New Zealand. This is because some of the main policy instruments that have, and will continue to be used for addressing the FCCC will be orientated towards industry and the CO₂ emissions that are associated with its use of energy. Therefore, the national environmental indicator developed by the MfE for carbon emissions will be as relevant to energy and energy sector industry, as the national energy indicators that the MfE will eventually develop.

Whilst the issue of CO₂ and global warming is an immense topic, this represents just one of the many environmental effects that can arise from the activities of energy sector industry. In order to enable good information to be uncovered on several fronts simultaneously, it is **necessary to have a sound admixture of energy indicators**. Thus, included in the indicators for energy should be indicators that can measure the intensity of energy use, how efficiently energy is being utilised, the distribution of energy types, and energy prices. Each of these factors has been internationally and nationally recognised as having the potential to be utilised as an environmental indicator.

Environmental indicators provide a means to co-ordinate the host of environmental data that exists. However by the same token, **indicator development is also impeded by existing environmental data**. This lack of data arises for a number of reasons. Firstly, there are "gaps" or information that is not being monitored within existing systems. This is by no means a new revelation. The MfE has previously cited a lack of reliable environmental information as being one of the main barriers to effective environmental reporting in New Zealand (MfE, 1997). However, these "gaps" are also perpetuated by inconsistencies in approaches to energy-environment monitoring. For example, the regional authorities have adopted varying approaches and achieved varying outcomes in terms of energy monitoring. With the exception of the Canterbury Regional Council, regional authorities do not represent a good source of energy monitoring data (such as energy consumption or efficiency) for energy sector industry, but represent an excellent source of energy-effects based monitoring data, such as air or water quality.

Conversely, despite energy sector industries undertaking a significant number of energy efficiency initiatives, the benefits of these initiatives are not always reported externally to organisations such as the MoC or EECA (under the aegis of energy efficiency programmes such as the EWCC or VA programme). This means that these organisations have "gaps" in their data also. Despite these

informational “gaps” however, there is a good environmental-energy-monitoring base upon which the MfE can draw from to develop their energy indicators. Such sources include the MoC, EECA and energy sector industry.

Secondly, the distribution of energy information that is currently being gathered is fragmented between a wide range of agencies and therefore not easily accessible. For example, the MoC, EECA and SNZ all gather various forms of energy-environment related information but there is no existing network that effectively and efficiently co-ordinates this plethora of information. This affects the ease at which stakeholders can access energy-environment information. It also perpetuates inefficiencies and inconsistent approaches. This is because agencies, to varying degrees, by working in isolation of other each other, cannot fully appreciate the vast range of variables that influence energy use.

Thus, co-incident with the preparation of national environmental performance indicators is the need for the development of an **integrated environmental network system**. The MfE have proposed a “*clearing-house network*” to co-ordinate and collate the vast amount of indicator data that will eventually systematically draw together and transfer indicator data between the various stakeholders. The importance of such a network is a fundamental element of the MfE’s indicator programme because it will influence both the eventual quality and quantity of indicator data. The environmental information network therefore should not be overtly comprised by factors such as cost, and rather should be sized to meet the realistic expectations of the activities it is required to undertake.

Thirdly, there exist “flaws” in some existing monitoring approaches, whilst impedance’s in reporting programmes also prevents the interpretation and wider use of existing energy data. Flaws in existing monitoring approaches include the use of “assumed” rather than actual transformation loss data for the electricity sector that is produced by SNZ/MoC. Also, the minimal level of reporting that is currently placed on VA-signatories impedes both the interpretation and wider use of this energy data. As a result the VA programme neither represents a good disaggregated measure of energy use or CO₂ emissions. Achieving a more detailed level of reporting by VA signatories would assist the MoC in assessing the effectiveness of this particular programme, but could also provide the MfE with an accurate disaggregated measure of energy use by the larger energy sector industries. Recognition of some of these existing flaws and impedance’s creates opportunity for improvement in the development of energy indicators.

Whilst the development of the MfE’s inaugural energy indicators will not be idealistically perfect, neither is perfection a realistic expectation. This is because the development of environmental

indicators is an iterative process, that improves over time, as analysts gain better access to, and understand the implications of, the information that is gained from the indicators.

This said, there are additional steps that the **MfE can easily take to improve the development and wider use of their energy indicators**. The MfE should target large energy sector industries in New Zealand for input to their indicator development, for a number of reasons. Firstly, 15 large energy consumers in this sector account for approximately 80 percent of New Zealand's total industrial energy consumption. Secondly, of the companies surveyed, only 32 percent of respondents indicated they have provided input to the EPI programme. In addition, respondents had ranging viewpoints on what constituted an environmental indicator. This creates two opportunities for the MfE: to improve the supply of information to industry regarding the EPI programme, and to improve the feedback from industry on the EPI programme.

Thirdly, energy sector industries represent an excellent source of primary energy-environmental data. Targeting these industries would thus be consistent with approaches advocated by both the IEA and NRCan (that is, a pyramidal approach to the development of indicators from the very bottom upwards). In addition, energy sector industries utilise a wide range of 'other' indicators. These 'other' indicators also have the potential to enhance existing or future indicator development. Given also that most large energy sector industries are VA signatories, targeting these companies would not represent an overly onerous task for the MfE to achieve, in comparison to the potential benefits that both the MfE and industry could gain from this interaction.

New Zealand has undergone significant environmental and energy reforms since the 1980's. However, one structural problem that still exists is the **absence of appropriate instruments** to control the energy market. New Zealand must look to both broadening and sharpening its use of instruments in order to avoid the market adopting a "cheap is best" attitude. The free markets will not fully take into account the environmental consequences of their choices or the impacts these decisions may have on future generations. Therefore, the Government has to ensure a priority is placed on environmental and not just economic drivers, in order for the market to operate in accordance with the principles of sustainable development.

The statutory "gaps" that exist between regional and central government for controlling the wider environmental effects of energy, in particular greenhouse gas emissions also need to be bridged. For example, whilst a national economic instrument has been identified as the preferred option for New Zealand meeting its commitments under the FCCC, the decision on the selection of an instrument has been deferred by Government pending the development of policy at an international level. As a result, regional authorities are left somewhat in an environmental limbo – no national policy statement for energy, but no national economic instrument either.

Despite the obvious physical and administrative differences that exist between Canada and New Zealand, Canada has clearly made a more concerted effort to understand and address the issues surrounding its energy consumption and production practices. At the forefront of this understanding is a clear commitment by the Canadian Government to implement energy efficiency programmes and to monitor the effects of its energy use. Canada's policy responses such as the expansion of its energy efficiency regulations now also guide and influence the behaviour of industry. New Zealand whilst moving at a much slower pace appears to be adopting a similar approach. For example, the introduction of minimum energy performance standards will represent a positive, albeit long overdue demonstration by the Government to enforce a better standard of energy efficiency in New Zealand.

However, New Zealand can still learn much from the Canadian Government's commitment to enacting changes in their country's energy efficiency. The Canadian OEE whilst working under NRCan is also very much an affiliated governmental organisation in its own right. By comparison EECA, (the New Zealand equivalent of the OEE) is charged with many similar tasks but without with the certainty of existence that the OEE has. The emphasis of both NRCan and the OEE is on energy efficiency and climate change. Energy initiatives are therefore undertaken in a manner that very much places **energy firmly within the context of its environmental effects**.

Much progress has been made at a national and international level in the development and use of energy indicators for energy sector industry. This progress provides useful insight for the MfE to draw upon, to assist in the formulation of their energy indicators for use in New Zealand. National energy indicators, whilst not yet introduced, will prove a fundamental monitoring tool for policy makers in New Zealand. This is because in developing and using environmental indicators policy makers at either a local, national or international level will be able to accurately monitor and evaluate the environmental consequences associated with the actions of energy sector industry (and other energy sectors). In doing this, policy makers will be able to monitor the effectiveness of their environmental policy frameworks. In achieving this, policy makers will avoid misinterpreting or inappropriately responding to their environmental policy frameworks or obligations.

New Zealand Voluntary Agreement Signatories and their Commitment Reductions

CO₂ emissions reduction as identified in voluntary agreements

Company/Sector	Target CO ₂ Reduction	Company/Sector	Target CO ₂ Reduction
ACI NZ Glass Manufacturers	16.5%	BHP NZ Steel	13.2%
Carter Holt Harvey	45.8%	The Cement Industry	12.0%
Comalco NZ	4.0%	Petrochem	28.0%
Winstone Wallboards	21.0%	ECNZ	874kt
Lincoln University	15.1%	Canterbury Brewery	18.3%
Skellerup Industries	52.9%	STAR Services	33.4%
University of Canterbury	3.7%	Websters Hydrated Lime	27.6%
NZ Sugar Co	13.0%	Shell Todd Oil Services	10.0%
NZ Refining Co	10.0%	Solid Energy	22.8%
Anchor Products Ltd	21.6%*	Natural Gas Corporation	34.8%
The Meat Industry	20.0%	The Dairy Industry	15.0%

* Dairy production only. The agreement includes a target for the milk collection fleet also. All VAs with percentage targets are reductions in CO₂ emitted per unit of production.

Reference: Ministry of Commerce

New Zealand Voluntary Agreement Signatories and their Commitment Reductions

Approximate projected CO₂ mitigation in tonnes

ACI/NZ Glass Manufacturers	11,500
BHP/NZ Steel	284,000
Carter Holt Harvey	433,000
The Cement Industry	130,000
Comalco NZ	29,000
Petrochem	64,000
Winstone Wallboards	8,500
ECNZ	874,000
Methanex	118,000
Coal Research negotiated contracts	17,500
NZ Sugar Co	34,000
Shell Todd Oil Services	95,200
NZ Refining Co	112,800
Solid Energy	32,900
Anchor Products Ltd	172,000
Natural Gas Corporation	216,000
The Meat Industry	68,000
The Dairy Industry	124,500

With the exception of ECNZ, these are estimates only. The commitments in the agreements are for reductions in CO₂ emitted per unit production. The mitigation achieved (in tonnes) will depend on output levels in the year 2000.

Reference: Ministry of Commerce

Appendix 2

Regions within New Zealand and the Status of their Respective Regional Policy Statements

Regional Policy Statements

- 14 operative Regional Policy Statements
- 2 Regional Policy Statements before the Environment Court

REGIONAL POLICY STATEMENTS	
Operative	Date
Auckland Regional Council	August-99
Canterbury Regional Council	June-98
Environment Bay of Plenty	December-99
Hawkes Bay Regional Council	October-95
Manawatu-Wanganui Regional Council	August-98
Marlborough District Council	August-95
Nelson City Council	March-97
Northland Regional Council	March-99
Otago Regional Council	October-98
Southland Regional Council	December-97
Taranaki Regional Council	September-94
Tasman District Council	April-98
Waikato Regional Council	February-99
Wellington Regional Council	December-94
Environment Court	Notified
Gisborne District Council	February-93
West Coast Regional Council	May-96

Regional Authority Survey Responses

The following Appendix contains copies of responses received by the following regional authorities in respect of their particular Regional Policy Statement:

- Auckland Regional Council
- Canterbury Regional Council
- Bay of Plenty Regional Council (Environment B.O.P)
- Gisborne District Council
- Hawke's Bay Regional Council
- Manawatu-Wanganui Regional Council (Horizons-m.w.)
- Marlborough District Council
- Nelson City Council
- Northland Regional Council
- Otago Regional Council
- Southland Regional Council
- Taranaki Regional Council
- Tasman District Council
- Waikato Regional Council (Environment Waikato)
- Wellington Regional Council
- West Coast Regional Council

The responses were received as either electronic or handwritten form. As such, the responses were translated into a common format for incorporation into this report for presentation purposes only. **All recipients' responses are shown in italics.**

In certain instances some recipients either did not provide responses to certain questions or provided information that was contradictory to information provided by alternate sources (for example, membership information to the EnergyWise Councils Partnership Programme was also provided as a result of correspondence with EECA). In these instances a filenote is shown under the applicable question.

State of the Environment Reporting

Has the Northland Regional Council (NRC) developed a State of the Environment Report (SER)?
No

Does the NRC have established energy-environment indicators that are relevant to industry?
No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies, objectives, and methods outlined in the Northland Regional Policy Statement? Please respond to the following with respect to industry only:

None

What specific measures the NRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

Filenote: Sent email 14.12.99 asking for a response to Q8(not answered in survey). Response from NRC (14.12.99): *For your first question- no, NRC does not undertake specific actions for with regard to energy.... as I said in my last email to you, NRC's resources don't really stretch to energy*

Has the NRC developed a Regional Energy Plan?
No

If you answered no, is the NRC intending to develop a REP, and if so when?
No

Interactions with Central Government

Has the NRC provided feedback to the MfE on their Environmental Indicators Programme?
Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>Yes</i>
Climate Change	<i>Yes</i>	Waste	<i>Yes</i>
Biodiversity	<i>No</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is the NRC a member of the EECA's Energywise Councils Campaign?
No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

Filenote: Sent email on 14.12.99 seeking response to Q14 as it was not answered. NRC answered on the 14.12.99: *Your second question, I didn't answer it as I don't know what the Energywise councils campaign is- I can assume we're not involved, but I cant' really answer why....*

State of the Environment Reporting

Has the Auckland Regional Council (ARC) developed a State of the Environment Report (SER)?

Yes

If you answered yes is this the first SER for your region?

Yes

Does the SER specifically address energy as a significant issue?

Yes

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Auckland Regional Policy Statement? Please respond to the following with respect to industry only.

No

What specific measures have the ARC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

No

Has the ARC developed a Regional Energy Plan?

No

If you answered no is the ARC intending to develop a REP, and if so when?

No

When was the Auckland Regional Energy Forum established?

It has not been established.

Interactions with Central Government

Has the ARC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>No</i>
Climate Change	<i>Yes</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is the ARC a member of the EECA's Energywise Councils Campaign?

Filenote: Email from EECA (26.11.99): "...So all councils which are E-W Councils Partnership members are also E-W Companies Campaign

- *Auckland City Council*
- *Auckland Regional Council...."*

What specific measures has the ARC undertaken to support the role of EECA?

Filenote: *None provided.*

What methods have the ARC used to advocate to central government the need for a National Energy Strategy/Statement?
Only the intent to do so in the Regional Policy Statement.

State of the Environment Reporting

Is the State of Environment Report for Waikato the first SER for your region?

No. A limited version was produced in 1993. It was replaced by a comprehensive report in 1998.

Does Environment Waikato have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Waikato Regional Policy Statement? Please respond to the following with respect to industry only:

No indicators have been developed and no monitoring is undertaken in relation to the measurement of the efficient energy use objective in the RPS.

What specific measures have Environment Waikato used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

Implementation is limited to Environmental Education programmes for business and industry including the "Target Zero Waste" and "Waste Exchange" initiatives.

Has Environment Waikato developed a Regional Energy Plan?

No

If you answered no, is Environment Waikato intending to develop a REP, and if so when?

No

Interactions with Central Government

Has Environment Waikato provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>Yes - verbal comments only</i>
Climate Change	<i>Yes - verbal comments only</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is Environment Waikato a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

EECA have been invited to give a presentation to Council on membership; they have yet to take up this offer.

State of the Environment Reporting

Has the Bay of Plenty Regional Council (BoPRC) developed a State of the Environment Report (SER)?

Yes

If you answered yes, is this the first SER for your region?

No

Does the SER specifically address energy as a significant issue?

No

Does the BoPRC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Bay of Plenty Regional Policy Statement? Please respond to the following with respect to industry only.

None as yet.

What specific measures the BoPRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

None as yet.

Has the BoPRC developed a Regional Energy Plan?

No

If you answered no, is the BoPRC intending to develop a REP, and if so when?

No

Has the BoPRC developed (as indicated in the RPS) a regional energy use inventory?

No

What measure has the BoPRC utilised to promote greater integration with local government agencies, EECA, research institutes and energy sector industries?

None as yet.

Interactions with Central Government

Has the BoPRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>Yes</i>
Climate Change	<i>Yes</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is the BoPRC a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

It appears to be directed towards high energy use territorial authorities.

What methods have the BoPRC used to advocate to central government the need for a National Energy Strategy/Statement?

None as yet.

Filenote: Email sent 14.12.99 re changes to energy section of the Proposed Bay of Plenty RPS. Response from BoP 14.12.99: *Your assumption re the RPS is correct. There were no references to the Environment Court on the Energy chapter so it is unchanged from Version 9.A (Version amended in accordance with Council's decisions on submissions, February 1997).*

State of the Environment Reporting

Has the Gisborne District Council (GDC) developed a State of the Environment Report (SER)?
Yes

If you answered yes, is this the first SER for your region?
No

Does the SER specifically address energy as a significant issue?
No

Does the GDC have established energy-environment indicators that are relevant to industry?
No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, polices objectives, and methods outlined in the Gisborne Regional Policy Statement? Please respond to the following with respect to industry only:
Nil

What specific measures the GDC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:
Nil

Has the GDC developed a Regional Energy Plan?
No

If you answered no, is the GDC intending to develop a REP, and if so when?
No

What methods has the GDC utilised to act as role model for energy efficiency?
Nil

What methods has the GDC utilised to encourage energy audits to be conducted by industry?
Nil

How many energy audits have been conducted by industry as a result?
Nil

Interactions with Central Government

Has the GDC provided feedback to the MfE on their Environmental Indicators Programme
Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>(not answered)</i>	Ozone	<i>(not answered)</i>
Climate Change	<i>(not answered)</i>	Waste	<i>(not answered)</i>
Biodiversity	<i>(not answered)</i>	Marine Environment	<i>(not answered)</i>
Transport	<i>(not answered)</i>		

Is the GDC a member of the EECA's Energywise Councils Campaign?

Yes

What methods have the GDC used to advocate to central government the need for a National Energy Strategy/Statement?

None

State of the Environment Reporting

Does the TRC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Taranaki Regional Policy Statement? Please respond to the following with respect to industry only.

No specific or separate monitoring programme to monitor regional energy efficiency.

What specific measures have the TRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

Resource consent process to:

- (a) *Require regular reporting on air emissions and energy efficiency measures undertaken on site by major air discharge consent holders using fossil fuels*
- (b) *Investigate ways in which to increase the efficiency of use of water in hydro-electric power schemes.*

Has the TRC developed a Regional Energy Plan?

No

If you answered no, is the TRC intending to develop a REP, and if so when?

No

Interactions with Central Government

Has the TRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>Yes</i>
Climate Change	<i>Yes</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is the TRC a member of the EECA's Energywise Councils Campaign?

No

If you answered no to question 10, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

Not considered to be a priority

What methods have the TRC used to advocate to central government the need for a National Energy Strategy/Statement?

Formal submissions, letters, meetings

Consistent with the identified reporting requirements to central government in the RPS, please provide comment on how the TRC's policy framework is performing in relation to energy

efficiency and supply:

Policy framework in relation to energy efficiency and supply is based on advocacy to central government. This is done primarily through formal submissions. Energy efficiency is also considered in resource consent processes involving major air discharge consents and water permits for hydro schemes. Energy efficiency was reported on in the Council's State of the Environment report 1996.

State of the Environment Reporting

Has the Manawatu-Wanganui Regional Council (MWRC) developed a State of the Environment Report (SER)?

Yes

If you answered yes is this the first SER for your region?

Yes

Does the SER specifically address energy as a significant issue?

No

Does the MWRC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Manawatu-Wanganui Regional Policy Statement? Please respond to the following with respect to industry only.

None

What specific measures the MWRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

None

Has the MWRC developed a Regional Energy Plan?

No

If you answered no is the MWRC intending to develop a REP, and if so when?

No

Interactions with Central Government

Has the MWRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>No</i>
Climate Change	<i>No</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>No</i>
Transport	<i>No</i>		

Is the MWRC a member of the EECA's Energywise Councils Campaign?

No

If you answered, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

Not a high priority for us.

State of the Environment Reporting

Has the Hawkes Bay Regional Council (HBRC) developed a State of the Environment Report (SER)?

Yes

If you answered yes, is this the first SER for your region?

No

Does the SER specifically address energy as a significant issue?

No

Does the HBRC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Hawkes Bay Regional Policy Statement? Please respond to the following with respect to industry only:

Our undertakings in the area of energy are through statutory advocacy, such as making submissions on district plans within our region, and making submissions or comments on national-led initiatives. There is no specific monitoring programme for the energy issues, objectives and policies in the RPS. We are presently reviewing our RPS (public notification March 2000) and the revised RPS has no section on energy as a regionally significant issue. It is considered to be an issue more appropriately dealt with at a national level.

What specific measures the HBRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

Filenote: Sent email on 14.12.99 to confirm response in Q7 regarding the types of monitoring, etc meant that HBRC has not implemented any measures to promote or advocate energy efficiency and/or conservation. Response from HBRC (14.12.99) Re: Q 8 - your assumption is correct.

Has the HBRC developed a Regional Energy Plan?

No

If you answered no, is the HBRC intending to develop a REP, and if so when?

No

Interactions with Central Government

Has the HBRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	Yes	Fresh Water	Yes
Land	Yes	Ozone	No
Climate Change	No	Waste	Yes
Biodiversity	Yes	Marine Environment	Yes
Transport	Yes		

Is the HBRC a member of the EECA's Energywise Councils Campaign?

Yes

Filenote: Sent email on 14.12.99 to confirm response in Q13 regarding the whether the HBRC where a member of the EECA EnergyWise Councils Campaign. Response from HBRC (14.12.99)
Re: *Q13 whichever one Elizabeth Yeoman co-ordinates (if she does both get back to me and I will look into it further).*

Filenote: Email from EECA dated 26.11.99: *There are also 29 councils which joined the E-W Companies Campaign before the E-W Councils Partnership, which have not yet joined the E-W Councils Partnership, or consider joining the E-W Companies Campaign as a first step to E-W Councils Partnership membership. These councils are.....Hawke's Bay Regional Council....".*

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

Filenote: *No response provided.*

State of the Environment Reporting

Has the Wellington Regional Council (WRC) developed a State of the Environment Report (SER)?

Yes

If you answered yes to question 1, is this the first SER for your region?

No

Does the SER specifically address energy as a significant issue?

Yes

Does the WRC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Wellington Regional Policy Statement? Please respond to the following with respect to industry only:

Very little monitoring of energy-related matters. Our focus, given limited resources for monitoring, has been on water, soil and air (which is indirectly related to energy). Our Transport department has done some work on petrol use etc. in its transportation modeling work for the Regional Land Transport Strategy.

What specific measures the WRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

The Regional Policy Statement identifies a range of Methods. However, few of the methods have been actively pursued by the Council because we do not have a clear mandate to promote energy efficiency and certainly, we cannot control the behaviour of others. Because of this, quite a few of the methods merely point out/suggest what others could do.

Filenote: On 14.12.99 I emailed for further clarification regarding the responses in Q7 and Q8. WRC replied on 14.12.99: *On your other question about "environmentally friendly energy sources, there are 2 methods (not 3). The first of the 2 (Method 4) is about the Regional and Transport Strategy. The Regional Council is responsible for the Strategy, and so the wording says that we "will" pursue this Method. The second Method is about actions that anyone could take - it is not a method that specifically requires the Regional Council to implement it. The wording therefore talks, in an organisationally-neutral sense, about what might happen. For example, the piece you mention in clause 2 refers to promoting and funding environmentally acceptable energy ventures. On this second method, the Regional Council has not taken an active role, but I think that a number of energy-related businesses have sought to establish and promote such ventures (the wind farm proposals fall into that category).*

Has the WRC developed a Regional Energy Plan?

No

If you answered no, is the WRC intending to develop a REP, and if so when?

We are in the process of developing an Energy Policy for the Council, so that we meet the obligations of being an Energy Wise company.

Filenote: Sent email to WRC on 03.12.99 asking if they were in fact going to develop a regional energy plan?. WRC responded on 03.12.99: *If you mean a regional plan prepared under the Resource Management Act, no, we are not preparing one. I don't think any regional council has produced such a thing, but I know that Canterbury has produced an energy strategy leaflet. Presumably, they may be working on some sort of plan, but I doubt that it will be under the Resource Management Act. It's more likely to be anon-statutory document. The*

policy we are working on is really just an organisational thing for us, at this stage, consistent with our being an Energy Wise company.

If you answered no, is the WRC intending to develop a REP, and if so when?

We are in the process of developing an Energy Policy for the Council, so that we meet the obligations of being an Energy Wise company.

Filenote: Sent email to WRC on 03.12.99 asking if they were in fact going to develop a regional energy plan?. WRC responded on 03.12.99: *If you mean a regional plan prepared under the Resource Management Act, no, we are not preparing one. I don't think any regional council has produced such a thing, but I know that Canterbury has produced an energy strategy leaflet. Presumably, they may be working on some sort of plan, but I doubt that it will be under the Resource Management Act. Its more likely to be anon-statutory document. The policy we are working on is really just an organisational thing for us, at this stage, consistent with our being an Energy Wise company.*

Has the WRC conducted an in-house energy audit?

Yes

If you answered yes, what proportion of the recommendations have been implemented?

The audit was conducted about 6 years ago, on just our main Council office. About 50% of the recommendations have been implemented.

How has the WRC promoted the use of renewable energy sources in the industrial sector?

No active promotion. We have supported the development of the small wind farm in the Wairarapa.

What "environmentally acceptable" (wording from the RPS) energy ventures has the WRC funded/promoted/coordinated?

I'm not sure where your quote comes from exactly, but as noted above, we supported the wind farm in the Wairarapa. We also opposed a wind farm at Baring Head for a range of reasons, mainly relating to the suitability of that particular site and its important landscape and heritage values.

What discharge/environmental standards do the WRC have that are relevant to industry?

There is a whole range of standards in the regional plans, for discharges to air, water etc.

Have the WRC energy characteristics of the region been determined?

Not by the Council, but a number of energy providers have assessed the Region's suitability for renewables. Some of the results of this work has been published by the Energy Efficiency and Conservation Authority, but other material is not disclosed because of "commercial sensitivity".

What monitoring is conducted by the WRC in respect of energy sources, use, efficiency and effects?

Very little – some superficial analysis in the soon to be released State of the Environment report.

Has a regional energy forum been established for the Wellington region?

No – the Council decided to hold on this Method until it had determined via its Long Term Financial Strategy just how much effort and expenditure it wanted to put into energy management as compared with various other methods in the Regional Policy Statement.

Interactions with Central Government

Has the WRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>No</i>
Climate Change	<i>Yes</i>	Waste	<i>No</i>

Biodiversity	Yes	Marine Environment	No
Transport	Yes		

Is the WRC a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

We are an Energy Wise company, and we are on the circulation list for Energy Wise Councils.

State of the Environment Reporting

Has the Nelson City Council (NCC) developed a State of the Environment Report (SER)?

No, but a draft is nearly complete expect release early 2000.

Filenote: Sent email on 14.12.99 asking if energy will be addressed as a significant issue in this report? NCC responded 22.12.99: *No because we are a way off dealing with this issue. It is mentioned but is not a major part.*

Does the NCC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Nelson Regional Policy Statement? Please respond to the following with respect to industry only:

None

What specific measures the NCC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

None related to industry

Has the NCC developed a Regional Energy Plan?

No

If you answered no, is the NRC intending to develop a REP, and if so when?
Not on the work programme. Council is a member of the Energy-Wise Council's partnership and has an in-house energy task force developing internal and external initiatives on energy efficiency awareness.

With respect to energy efficiency, please provide examples of how the NDC has "led by example".

Has commissioned an energy audit for its own operations and made savings as a result.

Filenote: From email sent to NCC on 14.12.99. In Q.11 I asked "with respect to energy efficiency, please provide examples of how the NCC has led by example". Your response was that the NCC has commissioned an energy audit for its own operations and made (not unspecified) savings as a result. But in Q12 I asked if the NCC had conducted an energy audit. Your response was no. NCC responded 22.12.99: *I found out that although when I came here a year ago I had been told an energy audit had been done, it had not (sorry, I answered you questions over a few days and didn't spot the discrepancy). Some dedicated staff set up a energy task force and implemented measures in house by drawing on EECA information e.g. the Council has made saving by installing different lamping in its streetlights (saving 16%)*

Has the NCC conducted an energy audit?

No

Filenote: see comments above.

If you answered yes, what proportion of the recommendations have been implemented?

Filenote: see comments above. NCC responded 22.12.99: Because *there was not a formal audit.*

Has the NCC prepared an energy management plan?

No

Interactions with Central Government

Has the NCC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>No</i>
Climate Change	<i>No</i>	Waste	<i>No</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>No</i>		

Is the NCC a member of the EECA's Energywise Councils Campaign?

Yes

What methods have the NCC used to advocate to central government the need for a National Energy Strategy/Statement?

None

State of the Environment Reporting

Has the Marlborough District Council (MDC) developed a State of the Environment Report (SER)?

Yes

If you answered yes, is this the first SER for your region?

No

Does the SER specifically address energy as a significant issue?

No

Does the MDC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Marlborough Regional Policy Statement? Please respond to the following with respect to industry only:

None

What specific measures the MDC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

Generic Policies and Objectives in the RPS

Has the MDC developed a Regional Energy Plan?

No

If you answered no, is the MDC intending to develop a REP, and if so when?

No

Interactions with Central Government

Has the MDC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>(not answered)</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>(not answered)</i>
Climate Change	<i>(not answered)</i>	Waste	<i>(not answered)</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>	Urban Amenity	<i>Yes</i>

Is the MDC a member of the EECA's Energywise Councils Campaign?

Yes

What methods have the MDC used to advocate to central government the need for a National Energy Strategy/Statement?

Filenote: Sent email to MDC on 14.12.99 regarding a response to Q15 as it was not answered. MDC on 15.12.99: *Comments below from our Regulatory Department Manager hopefully will assist: "Through*

reforms such as the review of the RMA Council has advocated for the introduction of national standards in those areas where things should be driven nationally rather than locally. This is important from a regional development perspective".

State of the Environment Reporting

Has the Tasman District Council (TDC) developed a State of the Environment Report (SER)?

Yes

If you answered yes to question 1, is this the first SER for your region?

Yes

Does the SER specifically address energy as a significant issue?

No

Does the TDC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Tasman Regional Policy Statement? Please respond to the following with respect to industry only:

Data kept on:

- *Energy developments requiring resource consent, including effects on natural resources*
- *Building consents for new or altered buildings and any energy efficiency features*

What specific measures the TDC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

- *Advice as relevant in building consent and resource consent processes*
- *Advocacy with water utility service of council, and with irrigation sector on efficient water use*

Has the TDC developed a Regional Energy Plan?

No

If you answered no, is the TDC intending to develop a REP, and if so when?

No intention to produce.

Please provide examples of how the TDC has "led by example" in energy efficiency practices.

Filenote: Sent email 21.12.99 seeking for a response to Q9 (not answered). Stated in email that from his responses and comments could I take it that the TDC has not implemented any specific measures to lead by example in energy efficiency? TDC replied 22.12.99: *Correct - There is a barrier to initiating action, from management perceptions of the relative benefits of self-auditing of environmental including energy effects of Council's operations. Staff have attempted to raise this option and have not succeeded in any commitment. However, we are to readdress the opportunities with our developing environmental education programme in the near future.*

Within the RPS (in the energy section) the TDC identifies a number of key indicators. Please provide comment as to what Councils monitoring of the following key indicators has revealed"

- (a) Significant changes of water bodies or other sites affected by energy generation, transmission or use.

No systematic assessment of data so no response possible.

- (b) The extent to which energy demand can be reduced and the production outputs achieved with less energy consumption.
No systematic assessment of data so no response possible.

Interactions with Central Government

Has the TDC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>No</i>
Climate Change	<i>No</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>No</i>		

Is the TDC a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

Reluctance at manager level to commit to energy audit, waste audit, and specific unawareness by managers of this campaign.

State of the Environment Reporting

Does the West Coast Regional Council (WCRC) have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the West Coast Regional Policy Statement? Please respond to the following with respect to industry only:

When carrying out state of the environment monitoring we might pick up non compliance in terms of emissions or discharges. Some of these might be as a result of inefficient use of energy. However we don't come down on them because they are inefficient users, we only do it if they breach resource consent conditions. Thus the answer is no.

What specific measures have the WCRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

Promotion and advocacy through policies and objectives in the Regional Policy Statement, also through Regional Land Transport Strategy

Filenote: Follow up email on 23.11.99 to seek clarification: Response (WCRC) 24.11.99: *Very little work has been done by the Council in implementing the provisions in the Regional Policy Statement relating to energy conservation.*

Has the WCRC developed a Regional Energy Plan?

No

If you answered no, is the WCRC intending to develop a REP, and if so when?

No

What methods has the WCRC used to "promote a consistent approach to the use of energy" with it's neighbouring regions?

When making submissions to district plans of both constituent and neighbouring district councils and other regional councils.

Interactions with Central Government

Has the WCRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	Yes	Fresh Water	Yes
Land	No	Ozone	No
Climate Change	No	Waste	Yes
Biodiversity	Yes	Marine Environment	Yes
Transport	No		

Is the WCRC a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

It's a good idea but... we have too many other fish to fry to worry about matters which although in a national context may be important, to us are trivia in this backwater. We are a council with very limited resources with 80% of our region controlled by DOC, only 15% of our land is rateable, we have <1% of NZ's population yet 10% of its land area, so don't have the ability to do things that are low in Maslov's hierarchy of needs here but very relevant in an urban area like Christchurch or Auckland.

State of the Environment Reporting

Does the Canterbury Regional Council (CRC) have established energy-environment indicators that are relevant to industry?

Yes

If you answered yes please list them:

We have been collecting energy use data in the region every 2 years, broken down by "domestic", "transport" and "industry/commerce", and split into oil, gas, coal, electricity etc. While there are no established industrial indicators as such, we have ongoing data on annual energy use by industry in the region, and have also split CO2 emissions into transport/industry etc.

If you answered yes, please list the organisations who provided input to the development of your organisations energy-environment indicators:

Oil industry, electricity suppliers, gas suppliers, etc.

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Canterbury Regional Policy Statement?

Please respond to the following with respect to industry only:

Only as outlined above

What specific measures have the CRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

Indirectly - through the resource consent process; papers/talks etc

Has the CRC developed a Regional Energy Plan?

No (A Regional Energy Strategy has been scheduled for some time, but little progress because of other demands (such as the Air Plan)).

If you answered no, is the CRC intending to develop a REP, and if so when?

A draft energy strategy is scheduled for June 2000 - but this might be hopeful.

Has the CRC developed a Regional Energy Strategy?

No

Interactions with Central Government

Has the CRC provided feedback to the MfE on their Environmental Indicators Programme?

I was a member of the Transport Indicators Working Group. I don't know about feedback on other programmes.

If you answered yes, on which issues?

Air	(not answered)	Fresh Water	(not answered)
Land	(not answered)	Ozone	(not answered)
Climate Change	(not answered)	Waste	(not answered)
Biodiversity	(not answered)	Marine Environment	(not answered)
Transport	(not answered)		

Filenote: Correspondence with MfE dated 17.12.99 indicates that CRC did not put in a submission on the Transport Indicators probably because they were represented on the focus group that

developed the indicators. As part of that same focus group the MfE gave a presentation on the rest of the EPI programme strands.

Please provide a brief outline of the achievements the CRC has made as a result of being a member of the EECA's Energywise Councils Campaign?

It is difficult to know whether we have made achievements in energy as a result of being a member of the EW Councils Partnership, or whether our membership of the partnership is as much a reflection of our interest in energy.

Energy achievements in the last 12 months have been:

- Major sponsorship of Solar 98*
- Bringing over US energy consultant Anita Fenichel to assist with identifying domestic energy efficiency initiatives*
- Development of a Home Energy Rating Scheme proposal.*

State of the Environment Reporting

Has the Otago Regional Council (ORC) developed a State of the Environment Report (SER)?

No

Does the ORC have established energy-environment indicators that are relevant to industry?

No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Otago Regional Policy Statement? Please respond to the following with respect to industry only:

None

What specific measures the ORC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only:

None

Has the ORC developed a Regional Energy Plan?

No

If you answered no, is the ORC intending to develop a REP, and if so when?

No

Interactions with Central Government

Has the ORC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	<i>Yes</i>	Fresh Water	<i>Yes</i>
Land	<i>Yes</i>	Ozone	<i>Yes</i>
Climate Change	<i>Yes</i>	Waste	<i>Yes</i>
Biodiversity	<i>Yes</i>	Marine Environment	<i>Yes</i>
Transport	<i>Yes</i>		

Is the ORC a member of the EECA's Energywise Councils Campaign?

Yes

What methods have the ORC used to advocate to central government the need for a National Energy Strategy/Statement?

None

State of the Environment Reporting

Has the Southland Regional Council (SRC) developed a State of the Environment Report (SER)?
No

Does the SRC have established energy-environment indicators that are relevant to industry?
No

Regional Policy Statement and Regional Plans

What types of monitoring are currently being conducted with respect to the specific energy issues, policies objectives, and methods outlined in the Southland Regional Policy Statement? Please respond to the following with respect to industry only:

Monitoring of consent conditions primarily. Air Plan has been made operative.

What specific measures the SRC used to promote or advocate energy efficiency and/or conservation? Please respond to the following with respect to industry only.

Consent conditions and information, education and public awareness through our environmental education programme. The programme has been recognised nationally and has recd a MfE Green Ribbon Award.

Has the SRC developed a Regional Energy Plan?
No

If you answered no, is the SRC intending to develop a REP, and if so when?
No

Please provide examples of the types of consultation that SRC has undertaken in support of its energy issues, policies and objectives as outlined in the RPS.

The consultation leading up to the development of the issues, policies and objectives was extensive and covered a five year period. Ongoing consultation is also important and the areas in question 4 lead that.

Within the RPS (in the energy section) the SRC identifies a number of key indicators. Please provide comment as to what Councils monitoring of the following key indicators has revealed with respect to:

- Total regional energy use and the proportions of this which is based on renewable resources; *Not started as not considered a high priority*
- Trends in regional sectoral demand for energy relative to population and economic activity using energy sectoral modeling; *Watching brief only at this point. Population is dropping and there are significant changes occurring in land use (conversions to dairying).*
- Crisis events related to energy shortages and price shifts; *N/A*
- Air quality measurements, including trends in CO₂ and other emissions; *Information being gathered through monitoring results supplied as a requirement of consent conditions.*
- Quality, level and flow in water bodies; *Should read water quantity – Constant monitoring through hydrology section of Council. Low flow trends monitored. Currently developing a Regional Water Plan which in part will provide a framework for dealing with water quantity.*
- Trends in consent conditions and compliance; *Council has a Compliance section. Very few problems in terms of compliance issues with industry – they tend to be the best performers in terms of consent condition compliance*
- Extent of consultation with the public, consumer groups and statutory bodies. *Extensive and ongoing. The RPS was commenced in 1992 with a series of major consultation programmes. The SRC approach is to incorporate as much consultation as possible in the development of policy*

Interactions with Central Government

Has the SRC provided feedback to the MfE on their Environmental Indicators Programme?

Yes

If you answered yes, on which issues?

Air	Yes	Fresh Water	Yes
Land	Yes	Ozone	Yes
Climate Change	Yes	Waste	Yes
Biodiversity	Yes	Marine Environment	Yes
Transport	Yes		

Is the SRC a member of the EECA's Energywise Councils Campaign?

No

If you answered no, what are the main reasons for your organisation not participating in the Energywise Councils Campaign?

More cost than benefit to the region. Already undertook energy wise education through the environmental education programme.

What methods have the SRC used to advocate to central government the need for a National Energy Strategy/Statement?

Input through the MfE EPI project.

Approximated Industrial Energy Consumption in New Zealand by Region and the 1998 Energy Balance

The following Appendix contains:

- a calculation of the approximated industrial energy consumption by region.
- Statistics New Zealand "1998 Energy Balance" as presented in the "New Zealand Official Yearbook, 1999".

Approximated Industrial Energy Consumption by Region

Energy Consumption includes petrochemical uses and refining energy use and cogeneration use, but excludes electricity generation. All figures are approximate.

	N/land	Akld	Waik	BOP	Gisb	Tara	Mnwtu / Wang	H Bay	Wgtn	Nelson	Marlb	Tasman	W Coast	Canty	Otago	S/land	Other	Total
Coal	1.8	15.0	2.4					0.4		0.4			2.2	1.9	1.0		1.0	26.1
Gas	13.3	3.6	4.5	3.5		99.6			1.5									126
Oil	2.1	2.0	1.0	0.8	0.3	1.1		0.3	1.0			0.5		1.0		0.9	0.5	11.5
Electricity	2.1	6.1	3.5	7.0		2.8	1.0	1.5	2.5	0.5	0.5		0.2	2.5	1.0	17.7	0.5	49.3
Geothermal			6.0	5.0														11.0
Wood	1.9		2.9	10.9				1.9	1.9	1.9		1.9		1.9				25.4
TOTAL	21.2	26.7	20.3	27.1	0.3	103.5	1.0	4.1	6.9	2.8	0.5	2.4	2.4	7.3	2.0	18.6	2.0	249.3
Proportion	9%	11%	8%	11%	0%	42%	0%	2%	3%	1%	0%	1%	1%	3%	1%	7%	1%	100%

- References:
- Canterbury Regional Council, 1997: Regional Environmental Report 1995/96: Report 97(10).
 - Fletcher Challenge Paper, 1997: Tasman Environmental Report.
 - Statistics New Zealand, 1999: 1998 Energy Balance in New Zealand Official Yearbook 1999.
 - Ministry of Commerce, 1997: New Zealand Energy Outlook, February 1997.
 - Century Drilling and Energy Services, 1999: In: New Zealand Geothermal Fields Map, CDES.
 - Tasman District Council, 1998: Tasman Regional Policy Statement.
 - Delta Utility Services, 1999: Power Links

1998 Energy Balance

<i>Gross Calorific Values in Petajoules</i>	Coal	Oil	Gas	Hydro	Geothermal	Other	Electricity	TOTAL
Indigenous production	84.5	105.4	193.1	86.8	103.8	35	0	608.6
Imports less exports	-34	168.4	0.1	0	0	0	0	134.5
International transport	0	40.3	0	0	0	0	0	40.3
TOTAL PRIMARY ENERGY	50.5	233.5	193.2	86.8	103.8	35	0	702.8
Electricity transformation	-15.4	0	-76.4	-86.8	-84.2	-5.9	129.1	-139.6
Losses/ Own Use	-2.0	-12.4	-5.0	0.0	-6.0	0.0	-6.0	-31.4
Non-energy use	0	-8	-76	0	0	0	0	-84
CONSUMER ENERGY (calculated)	33.1	213.1	35.8	0	13.6	29.1	123.1	447.8
Agriculture	0.7	15.1	0	0	0	0	4.2	20
Industrial	26.1	11.6	25.4	0	11	22.7	44.7	141.5
Commercial	3.5	4.2	4.9	0	0	0.1	25	37.7
Residential	1.3	2.2	4.8	0	2.6	6.3	39.2	56.4
Domestic transport	0.1	170.9	0.5	0	0	0	0.2	171.7
CONSUMER ENERGY (observed)	31.7	204	35.6	0	13.6	29.1	113.3	427.3

Reference: Statistics New Zealand, 1998 Energy Balance in New Zealand Official Yearbook, 1999.

Industry Survey Responses

The following Appendix contains the survey responses of the energy sector companies that agreed to participate in the survey. These companies are:

- two electricity generation companies*
- Alliance Group
- BHP New Zealand Steel
- Carter Holt Harvey
- ECNZ
- Fletcher Challenge Energy
- Fletcher Challenge Paper (Tasman Pulp and Paper)
- Golden Bay Cement
- Kiwi Dairies
- Methanex
- Milburn Cement
- Natural Gas Corporation
- New Zealand Aluminium Smelter (Comalco)
- New Zealand Dairy Group
- New Zealand Refining Company
- New Zealand Sugar Company
- Solid Energy
- Shell Todd Oil Services
- TransAlta

* These companies have requested confidentiality.

The responses were received as either electronic or handwritten form. As such, the responses were translated into a common format for incorporation into this report for presentation purposes only. **All recipients' responses are shown in italics.** In certain instances some recipients either did not provide responses to certain questions or provided information that was contradictory to information provided by alternate sources. In these instances a filenote is shown under the applicable question.

Conditional to participation in this survey, this company has requested total anonymity.

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives
Energy conservation initiatives
Energy audit
Energy bench-marking study

Our organisation has only been operating since 1 April 1999 following the split of ECNZ. We have not completed any of the activities listed above since 1 April 1999. Its possible that ECNZ (our predecessor organisation) may have but we are unaware of whether this has occurred or not at this stage.

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?

Unsure in the case of ECNZ

3. Does your organisation have targets for any of the following?

Energy use
Energy efficiency
Energy conservation

Our organisation is currently in the process of developing its environmental strategy and management systems. As part of this process we will be developing targets and performance indicators, but this is not complete at this stage.

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?

Unsure in the case of ECNZ

5. If you answered yes to question 4, to who were these initiatives reported?

Unsure in the case of ECNZ

6. Does your organisation have an environmental policy statement?

Our organisation has completed a draft policy, which is currently with the senior management team and Board of Directors for comment prior to getting signed off and finalised.

7. Does your organisation publish an environmental report?

Our organisation is planning on publishing its first environmental report in June 2000.

8. Does your organisation have environmental performance indicators?

Our organisation is currently in the process of developing its environmental strategy and management systems. As a part of this process we will be developing targets and performance indicators, but this is not complete at this stage.

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council				X	
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council			X	X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment			X		
Ministry of Commerce		X			
Energy Efficiency and Conservation Authority	X				
Regional Council	X				
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Our organisation hasn't since its inception, but ECNZ has for parts of the work programme that are relevant to their operations.

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximate values are satisfactory.

Energy Consumption figures were not provided by this company.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Our organisation supplies its own electricity.

If there are any further comments you wish to make in support of your answers please provide them here:

Our organisation has only been operating as a business entity since 1 April 1999. We are currently working to develop an environmental management strategy, EMS and environmental reporting framework for our organisation but are at an early stage in this process, so are therefore unable to answer many of questions more fully.

Conditional to participation in this survey, this company has requested total anonymity.

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	<i>Yes</i>
Energy conservation initiatives	<i>No</i>
Energy audit	<i>No</i>
Energy bench-marking study	<i>No</i>

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?

3. Does your organisation have targets for any of the following?

Energy use	<i>No</i>
Energy efficiency	<i>No</i>
Energy conservation	<i>No</i>

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes

5. If you answered yes to question 4, to who were these initiatives reported?
Ministry of Commerce and Energy Efficiency and Conservation Authority

6. Does your organisation have an environmental policy statement?
Yes

7. Does your organisation publish an environmental report?
No

8. Does your organisation have environmental performance indicators?
No

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority			X		
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council			X		X
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Energy Consumption figures were not provided by this company.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

If there are any further comments you wish to make in support of your answers please provide them here:

The company is an electricity generator and fuel costs are a large component of the company's costs hence fuel usage is taken seriously. The savings that can be made in this area far out way the savings that could be made in energy usage in the company's facilities hence the focus is on efficiency in the plant.

Location of main industrial plant in NZ: Glenbrook, South Auckland
 Location(s) of other industrial plants in NZ: Taharoa, Maioro (Waikato River Mouth)
 Contact: Claire Jewell
 Jewell.Claire.ca@bhp.com.au

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	Yes

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
Have been doing equivalent of audits for many years under business improvement or waste minimisation banners, would estimate 30-40% of ideas were implemented

3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes

5. If you answered yes to question 4, to who were these initiatives reported?
New Zealand Government as part of the Annual Report for Voluntary Agreement to Reduce Carbon Dioxide Emissions and EECA Energy Wise Companies Campaign Annual reports

6. Does your organisation have an environmental policy statement?
Yes

7. Does your organisation publish an environmental report?
Yes

8. Does your organisation have environmental performance indicators?
Yes

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Refer attachment

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					X
Ministry of Commerce					X
Energy Efficiency and Conservation Authority					X
Regional Council				X	
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment	X				
Ministry of Commerce	X				
Energy Efficiency and Conservation Authority				X	
Regional Council	X				
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment	X				
Ministry of Commerce			X	X	
Energy Efficiency and Conservation Authority			X		
Regional Council	X				
Other (please specify)					

Filenote: On 17.11.99 email sent to Claire: In Q10 of the survey you indicated that MfE, MoC and EECA provides info to BHP at own initiative (i.e. proactive) but then in Q11 you rate the advice provided as "none provided". Please can you clarify what you mean. I was also impressed with BHP's environmental strategic plan, particularly in respect of the defined goals and objectives for energy efficiency, waste and greenhouse gas reductions. These have the potential to tie in very well with the potential for indicators at national level in NZ and so were wondering if you would object to me specifically referencing these in my thesis? Claire responded (17.11.99): *Jo, I interpreted Q10 in terms of "information" provided and for these groups that does not necessarily mean advice. They may provide us updates on legislation changes, industry developments, international or national policy, etc. Whereas Q10 specified*

"advice". We took this to mean advice on how to do things better, more efficiently, etc. I am glad you were impressed with our strategic plan. Although it is not a public document in that we do not publish it for circulation outside the company we would be happy for you to reference it in your thesis.

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

BHP New Zealand Steel requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

No

Location of main industrial plant in NZ: Kinleath
 Location(s) of other industrial plants in NZ:
 Contact: Ross Davison
 Ross.Davison@chh.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	Yes

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
Less than 30%

3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes

5. If you answered yes to question 4, to who were these initiatives reported?
 - *International Paper (parent company)*
 - *Government Minister (newsletter)*
 - *Other industry groups*
 - *External shareholders (EHS Report)*

6. Does your organisation have an environmental policy statement?
Yes

7. Does your organisation publish an environmental report?
Yes

8. Does your organisation have environmental performance indicators?
Yes

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.

<i>Completion of site environmental risk assessments</i>	<i>CO₂ emissions (total, business group)</i>
<i>CO₂ Voluntary Agreement</i>	<i>Waste to landfill (volume, business group)</i>
<i>Kinleith Mill – TRS emissions</i>	<i>Kinleith Mill (BOD, TSS)</i>
<i>Energy consumption (total, type, business group)</i>	<i>Recycled fibre use</i>
<i>Water usage (amount, source, business group)</i>	<i>Percent chemical free timber framing produced</i>
<i>Forest area classification (productive, reserves, other non-planted)</i>	

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council				X	
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment			X		
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority					X
Regional Council			X		
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council				X	
Other (please specify)					

12. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Yes

13. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

14. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Carter Holt Harvey requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

15. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

This questionnaire has been completed after the split and breakup of ECNZ. Therefore, while all responses have been answered to the best of ECNZ Residual's ability, they cannot be considered to represent a full and final view of the entity ECNZ as it existed prior to April 1999.

Location of main industrial plant in NZ: Widely dispersed (including the Huntly thermal power station)
 Location(s) of other industrial plants in NZ: Widely dispersed
 Contact: Chris Garr
 chris.garr@ecnz.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	No

Please note that much of what is referred to above was done by our Energy Services group who worked closely with industrial customers especially, i.e. not all are related to the operation of our own facilities since we were an energy transformation company.

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?

Some modest level audits were carried out e.g. Twizel offices I think, quite detailed analysis of hydro stations regularly occurred leading to the upgrade projects that formed the basis for the CO2 VA. Sale of some of the smaller stand alone stations resulted in the new owners promptly undertaking upgrades (e.g. Arnold, Coleridge).

3. Does your organisation have targets for any of the following?

Energy use	No (depends on demand, hydrology, etc)
Energy efficiency	Yes (general objective in environmental principles)
Energy conservation	No

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?

Yes

5. If you answered yes to question 4, to who were these initiatives reported?

Energy Wise companies reports to MoC, CO2 VA report to MoC, environmental and annual reports.

6. Does your organisation have an environmental policy statement?

Yes

7. Does your organisation publish an environmental report?

Yes

8. Does your organisation have environmental performance indicators?

Yes

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.

See the 8 or 9 EPI's in the environmental report.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce					X
Energy Efficiency and Conservation Authority				X	
Regional Council				X	
Other (Please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment				X	
Ministry of Commerce					X
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Yes

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes (considerable effort required here)

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximate values are satisfactory.

No data was provided by ECNZ.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Not really relevant

Location of main industrial plant in NZ:
Location(s) of other industrial plants in NZ:
Contact:

Taranaki Region (4 main plants)
Craig Evans
craig.evans@fce.co.nz

Energy Efficiency and Conservation

- Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	<i>Yes</i>
Energy conservation initiatives	<i>Yes</i>
Energy audit	<i>Yes</i>
Energy bench-marking study	<i>No</i>
- If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
90 percent
- Does your organisation have targets for any of the following?

Energy use	<i>Yes</i>
Energy efficiency	<i>Yes</i>
Energy conservation	<i>No</i>

Monitoring and Reporting

- If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
- If you answered yes to question 4, to who were these initiatives reported?
Energy Efficiency and Conservation Authority
- Does your organisation have an environmental policy statement?
Yes
- Does your organisation publish an environmental report?
No – are planning to start
- Does your organisation have environmental performance indicators?
No – in development
- If you answered yes to question 8, please list all of your organisation's environmental indicators.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council			X		
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment	X				
Ministry of Commerce					X
Energy Efficiency and Conservation Authority		X			
Regional Council				X	
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Yes

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Fletcher Challenge Energy requires that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?
Yes

Location of main industrial plant in NZ: Kawerau
Location(s) of other industrial plants in NZ: Nil
Contact: Rob Hunter
rob.hunter@fcpa.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	No
Energy bench-marking study	No
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
3. Does your organisation have targets for any of the following?

Energy use	No
Energy efficiency	No
Energy conservation	No

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
No
5. If you answered yes to question 4, to who were these initiatives reported?
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Water use; colour discharge; air emission non-compliance's; fibre losses.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					X
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council					X
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment			X		
Ministry of Commerce	X				
Energy Efficiency and Conservation Authority			X		
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment				X	
Ministry of Commerce		X			
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Yes

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Fletcher Challenge Paper – Tasman Mill require that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ: Portland, Whangarei
Location(s) of other industrial plants in NZ: Cement storage facilities throughout NZ
Contact: Paul Bonetti
paulb@goldenbay.co.nz

Energy Efficiency and Conservation

- Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	<i>Yes</i>
Energy conservation initiatives	<i>Yes</i>
Energy audit	<i>No</i>
Energy bench-marking study	<i>Yes</i>
- If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
- Does your organisation have targets for any of the following?

Energy use	<i>Yes</i>
Energy efficiency	<i>Yes</i>
Energy conservation	<i>No</i>

Monitoring and Reporting

- If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
- If you answered yes to question 4, to who were these initiatives reported?
Energy Efficiency and Conservation Authority and Ministry of Commerce as part of voluntary agreement.
- Does your organisation have an environmental policy statement?
Yes
- Does your organisation publish an environmental report?
Yes
- Does your organisation have environmental performance indicators?
No
- If you answered yes to question 8, please list all of your organisation's environmental indicators.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X	X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council			X	X	
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment		X			
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify) Cement and Concrete Association (C&CA)					X

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment					
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council					X
Other (please specify) C&CA				X	

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Not sure – but feature in 1997 State of the Environment Report

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximate values are satisfactory.

Golden Bay Cement requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?
Yes

Location of main industrial plant in NZ: Hawera
Location(s) of other industrial plants in NZ: Manawatu, Otago, Hawke's Bay, Christchurch,
Timaru
Contact: Karen Leov
kleov@kiwidairies.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	No
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
About 50 percent.
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
New Zealand Dairy Research, EECA.
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes – forms part of a wider report – Company Annual Report.
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Legal compliance, environmental effects, water use, wastewater volume and consumption, noise, carbon dioxide emissions, consultation and relationships with territorial authorities.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					X
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify) District Council					X

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council					X
Other (please specify) District Council					X

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council					X
Other (please specify) District Council					X

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Kiwi Co-operative Dairies Limited require that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

No

If there are any further comments you wish to make in support of your answers please provide them here:

Note gas consumption includes cogeneration plant which is a net exporter of electricity.

Location of main industrial plant in NZ: Motunui, Taranaki
Location(s) of other industrial plants in NZ: Waitara Valley, Taranaki
Contact: Dave Haden
D.Haden@methanex.com

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	Yes
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
15%. Most of the minor items.
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
Methanex Corporation Annual Report, Methanex Corporation Responsible Care Report, Energy Efficiency and Conservation Authority and Taranaki Regional Council.
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Number of: permit exceedences, complaints, spills, notifiable incidents, air emissions.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					X
Ministry of Commerce					X
Energy Efficiency and Conservation Authority					X
Regional Council					X
Other (please specify) Stds NZ			X		

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment					X
Ministry of Commerce					X
Energy Efficiency and Conservation Authority					X
Regional Council				X	
Other (please specify) Stds NZ				X	

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment				X	
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority				X	
Regional Council			X		
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximate values are satisfactory.

Methanex New Zealand Limited requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

No

If there are any further comments you wish to make in support of your answers please provide them here:

Methanex NZ is Responsible Care Company and as such has a commitment to high environmental performance and to a programme of continuous improvement.

Location of main industrial plant in NZ: Westport
Location(s) of other industrial plants in NZ: nil
Contact: Sheralyn Hume
shume@milburn.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	No
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
60 percent
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	No

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
West Coast Regional Council, CIEMA
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
No
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Thermal energy usage per tonne of product
Electrical energy usage per tonne of product
CO₂, SO_x and NO_x emissions
Number of environmental incidents (e.g. spills, consent non-conformances)
Number of outstanding environmental audit actions

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an “x”) in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council	X			X	
Other (please specify) CIEMA				X	

13. Has your organisation participated in the Ministry for the Environment’s national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Milburn New Zealand Limited requires that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

No

Location of main industrial plant in NZ: Kapuni
Location(s) of other industrial plants in NZ:
Contact: Tony van Gameren
Tony.vanGameren@natgas.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	No
Energy bench-marking study	No
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
N/A
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
Taranaki Regional Council and the Energy Efficiency and Conservation Authority
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
No
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
*Number of environmental events – company wide – not related to efficiency
Number of environmental breaches – company wide – not related to efficiency
The plant has various efficiency key performance indicators covering steam and fuel consumption, e.g. steam used per tonne of LPG produced, fuel gas per tonne of CO₂ produced.
CO₂ emissions (VA, nett), water usage, effluent discharge volumes, temps, air emissions (NO_x, VOC, CO).*

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council					X
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce		X			
Energy Efficiency and Conservation Authority				X	
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council					X
Other (please specify) District Council				X	

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

**The Natural Gas Corporation of New Zealand Limited
requires that the energy consumption data they have provided
for this survey be kept confidential.**

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ: Tiwai Point
Location(s) of other industrial plants in NZ:
Contact: Maria Robertson
Maria.Robertson@comalco.riotinto.com.au

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	Yes
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
Unsure
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	Yes

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
Energy Efficiency and Conservation Authority; Ministry of Commerce; Ministry for the Environment
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
There are too many to list separately. They cover resource use, emissions, waste management, compliance, incidents and a range of other performance drivers.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an “x”) in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council				X	
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment	X				
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority	X				
Regional Council			X		
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council			X		
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment’s national Environmental Performance Indicators Programme?

Yes

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximate values are satisfactory.

Comalco requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ:
Location(s) of other industrial plants in NZ:
Contact:

Waikato
Mason Jackson
mason.jackson@smtgate.ho.nzdairy.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	<i>Yes</i>
Energy conservation initiatives	<i>Yes</i>
Energy audit	<i>Unsure</i>
Energy bench-marking study	<i>Unsure</i>
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
3. Does your organisation have targets for any of the following?

Energy use	<i>Yes</i>
Energy efficiency	<i>Yes</i>
Energy conservation	<i>Yes</i>

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Unsure
5. If you answered yes to question 4, to who were these initiatives reported?
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes – the NZDG's Annual Report contains a small section dedicated to Environmental Performance
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Tonnes Product Made: CO₂ Emissions
Tonnes Product Made: Tonnes Waste Produced
Tonnes Product Made: Environmental Non-conformance's (consent breaches)
Tonnes Product Made: Environmental Complaints

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an “x”) in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X		
Ministry of Commerce					
Energy Efficiency and Conservation Authority					
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce					
Energy Efficiency and Conservation Authority					
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce					
Energy Efficiency and Conservation Authority					
Regional Council	X				
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment’s national Environmental Performance Indicators Programme?

Unsure

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Comalco requires that the responses their organisation has provided to this questionnaire for energy consumption be kept confidential as the data is of a commercially sensitive nature.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ: Marsden Point, Whangarei
Location(s) of other industrial plants in NZ: None
Contact: Rex Clark
iclark@nzrc.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	No
Energy audit	No
Energy bench-marking study	Yes
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
3. Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	No

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
Yes
5. If you answered yes to question 4, to who were these initiatives reported?
Shell International Oil Products (SIOP)
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
Yes
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Current RM Consent Requirements:
 - *SO₂ emissions t/d average*
 - *Environmental Consent breaches*
Environmental Performance:
 - *Oil discharge (gm/tonne intake)*
 - *VOC's (% mass on intake)*

- NO_x (% mass on intake)
- CO₂ (% mass on intake)
- HCFC's (tonnes)
- Hazardous waste (% mass on intake)

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority			X		
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment			X		
Ministry of Commerce	X				
Energy Efficiency and Conservation Authority	X				
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment	X				
Ministry of Commerce	X				
Energy Efficiency and Conservation Authority	X				
Regional Council	X				
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

The New Zealand Refining Company requires that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

If there are any further comments you wish to make in support of your answers please provide them here:

SIOP are the technical advisors to The New Zealand Refining Company. We take part in a Shell benchmarking programme to compare ourselves with other Shell refineries. In this programme fuel and electricity are converted to what is called a Standard Refinery Fuel. This is then related to the amount of feedstock processed. So all measurements are in terms of tonnes SRF/tonne feedstock. As the hydrocarbon fuels (gas and oil) are derived from the feedstock we have another index called a corrected energy and loss (CEL) index. This index is based on the amount of hydrocarbon received minus the amount of hydrocarbons shipped out. The difference is due to the hydrocarbon burnt as fuel, burnt at the flare, or is lost. Main losses come from evaporative losses. We set an annual target for this index and measure it monthly. I have answered the questions on the basis that the oil companies supply us with product and therefore fuel and can therefore be considered energy suppliers.

Location of main industrial plant in NZ: Auckland
Location(s) of other industrial plants in NZ: N/A
Contact: Peter Simpson
Psimpson@nzsugar.co.nz

Energy Efficiency and Conservation

- Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	No
Energy bench-marking study	Yes
- If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
- Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	No

Monitoring and Reporting

- If you answered yes to any of the initiatives in question 1, were these reported externally?
No
- If you answered yes to question 4, to who were these initiatives reported?
- Does your organisation have an environmental policy statement?
Yes
- Does your organisation publish an environmental report?
No
- Does your organisation have environmental performance indicators?
Yes
- If you answered yes to question 8, please list all of your organisation's environmental indicators.
CO₂ emissions and progress to CO₂ reduction voluntary agreement
Trade waste discharge volumes
Cooling water discharge volumes, temperatures

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					
Ministry of Commerce					
Energy Efficiency and Conservation Authority					X
Regional Council					X
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment	X				
Ministry of Commerce	X				
Energy Efficiency and Conservation Authority			X		
Regional Council		X			
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce		X			
Energy Efficiency and Conservation Authority			X		
Regional Council		X			
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

No

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

The New Zealand Sugar Company Limited requires that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?
No

Location of main industrial plant in NZ:

Location(s) of other industrial plants in NZ:

Contact:

Rueben Mills

rueben.mills@solidenergy.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	<i>Yes</i>
Energy conservation initiatives	<i>Yes</i>
Energy audit	<i>No</i>
Energy bench-marking study	<i>No</i>

2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?

3. Does your organisation have targets for any of the following?

Energy use	<i>No</i>
Energy efficiency	<i>No</i>
Energy conservation	<i>No</i>

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?

No

5. If you answered yes to question 4, to who were these initiatives reported?

6. Does your organisation have an environmental policy statement?

Yes

7. Does your organisation publish an environmental report?

Yes – report is not separate, forms part of the overall report

8. Does your organisation have environmental performance indicators?

No

9. If you answered yes to question 8, please list all of your organisation's environmental indicators.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment				X	
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority				X	
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment				X	
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority				X	
Regional Council				X	
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

Yes

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

No data was provided by Solid Energy.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ: Taranaki (Kapuni, Oaonui, and offshore – Maui A, Maui B and FPSO)
Location(s) of other industrial plants in NZ: Taranaki
Contact: Con Brouwers
con.brouwers@stos.co.nz

Energy Efficiency and Conservation

1. Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	Yes
Energy conservation initiatives	Yes
Energy audit	Yes
Energy bench-marking study	No
2. If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
50 percent.
3. Does your organisation have targets for any of the following?

Energy use	No
Energy efficiency	No
Energy conservation	No

Monitoring and Reporting

4. If you answered yes to any of the initiatives in question 1, were these reported externally?
No
5. If you answered yes to question 4, to who were these initiatives reported?
6. Does your organisation have an environmental policy statement?
Yes
7. Does your organisation publish an environmental report?
No
8. Does your organisation have environmental performance indicators?
Yes
9. If you answered yes to question 8, please list all of your organisation's environmental indicators.
Gas flaring (Mm³), hydrocarbons to air, average oil in produced water to surface environment (mg/l), oil spills > 100 l, energy efficiency (GJ/tonne hydrocarbon equivalents produced), non hazardous "process" waste to controlled disposal (% of non-hazardous waste generated (tonnes)), hazardous waste to disposal (% of hazardous waste generated), CO₂ (tonnes), SO₂ (tonnes), NO₂ (tonnes).

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment					X
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority					X
Regional Council					X
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment				X	
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment		X			
Ministry of Commerce		X			
Energy Efficiency and Conservation Authority				X	
Regional Council					X
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

Shell Todd Oil Services Limited require that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?

Yes

Location of main industrial plant in NZ:
 Location(s) of other industrial plants in NZ:
 Contact:

Stratford, Auckland, Taupo and Takaka
 Michael Wright
 michael.wright@transalta.co.nz

Energy Efficiency and Conservation

- Please indicate if your organisation has conducted any of the following within the last two years:

Energy efficiency initiatives	No
Energy conservation initiatives	No
Energy audit	No
Energy bench-marking study	No
- If you answered yes to conducting an energy audit in question 1, what percentage of the identified items from the audit have been implemented?
- Does your organisation have targets for any of the following?

Energy use	Yes
Energy efficiency	Yes
Energy conservation	No

Monitoring and Reporting

- If you answered yes to any of the initiatives in question 1, were these reported externally?
- If you answered yes to question 4, to who were these initiatives reported?
- Does your organisation have an environmental policy statement?
No
- Does your organisation publish an environmental report?
No – Note we are a new organisation formed in the restructuring of the NZ Industry. We have joined as a founding member the New Zealand Business Council for Sustainable Development, which is intending to produce environmental reporting guidelines. Our parent company in Calgary has environmental reporting and this is likely to be extended to NZ in the near future.
- Does your organisation have environmental performance indicators?
Yes
- If you answered yes to question 8, please list all of your organisation's environmental indicators.
Monthly reporting includes conformance to environmental requirements. Quarterly station managers are required to sign off compliance with requirements.

Interaction with Governmental and Non-Governmental Agencies

Rate the following (using an "x") in the appropriate boxes below:

10. The flow of information from the following organisations to your company. (Response below is for all types of information, not specifically energy related).

Organisation	1	2	3	4	5
	No information requested and none provided	Information requested, but none provided	Provides information, but only when requested	Provides more information than requested	Provides information at own initiative
Ministry for the Environment			X		
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority	X				
Regional Council			X		
Other (please specify)					

11. The advice provided by the following organisations:

Response below is for all types of information, not specifically energy related.

Organisation	1	2	3	4	5
	No advice provided	Seldom useful	Sometimes useful	Usually useful	Consistently useful
Ministry for the Environment			X		
Ministry of Commerce				X	
Energy Efficiency and Conservation Authority		X			
Regional Council				X	
Other (please specify)					

12. Rate the frequency that energy information is provided from your organisation to:

Organisation	1	2	3	4	5
	Never	Less frequently than every two years	Annually	Quarterly or twice yearly	Monthly or more frequently
Ministry for the Environment	X				
Ministry of Commerce			X		
Energy Efficiency and Conservation Authority	X				
Regional Council			X		
Other (please specify)					

13. Has your organisation participated in the Ministry for the Environment's national Environmental Performance Indicators Programme?

No

14. Has your organisation participated in the development of your region's Regional Policy Statements and/or Regional Plans?

Yes

Energy Consumption

15. In the table below, please quantify below the energy consumption (per annum) for your organisation. Preferably state all units in terrajoules (or 10^{12} joules) per annum. If you do not use TJ/annum, please specify the units used. Approximately values are satisfactory.

TransAlta require that the energy consumption data they have provided for this survey be kept confidential.

16. Does your energy supplier(s) provide your organisation with information that assists in achieving energy savings?
No

If there are any further comments you wish to make in support of your answers please provide them here:

This response is from the electricity generation business. I have not covered administration buildings, call centers, meter reading, computing, etc.

BHP Environmental Strategic Plan 1999 - 2004



New Zealand Steel

Environmental Strategic Plan 1999 - 2004

Vision

To achieve a high standard of environmental care

Mission Statement

To ensure continuous improvement in environmental performance and progressive minimisation of environmental risk.

Targets

- Comply with legal requirements 100% of the time.
- Reduction in purchased energy consumption
from 32 GJ/t-semi (1998/99) to <30 GJ/t-semi by 2004
- Deliver on greenhouse gas reduction commitments.
- Reduce waste tonnes to landfill ~
reduction of 5% by 2004 (1999 base year)
- Eliminate adverse effects on the environment from emissions to air and water by progressive reductions.
- Open and honest communications with employees, the community and government on environmental planning and performance.

Key Strategies

- Performance Management and Reporting
 - Operational Discipline & Process Improvement
 - Maintenance of Critical Plant
 - Resource Utilisation
 - Communication and Consultation
 - Education and Training

Appendix 7

Natural Resources Canada (Office of Energy Efficiency) Initiatives 1998-1999

	Energy Use Sector		
	Personal	Commercial/ Institutional	Industrial
Buildings			
Model National Energy Code for Buildings and Houses	*	*	*
R-2000 Home Programme	*		
EnerGuide for Houses	*		
RenoSense	*		
Energy Innovators/Energy Innovators Plus		*	*
Federal Building Initiatives (government)		*	
Commercial Building Incentive Programme		*	
Equipment			
EnerGuide for Equipment	*	*	*
Energy Performance Regulations	*	*	*
HVAC Energy Efficiency Rating System	*		
Industry			
Industrial Energy Efficiency			*
Transportation			
Vehicle Fuel Efficiency	*	*	*
EnerGuide for Vehicles	*	*	*
Auto\$mart	*		
FleetWise (government)		*	
FleetSmart (private sector)		*	*
Alternative Transportation Fuels	*	*	*
General			
Public Information	*	*	*
National Energy Use Database	*	*	*

Source: Office of Energy Efficiency, 1998: The State Of Energy Efficiency in Canada.

Appendix 8

Canada's Champion Reporting Checklist from VCR Inc., Registration Guide, 1999.

Components		Required Elements			
		Points Earned	Bronze	Silver	Gold
1.0	Senior Management Support				
1.1	Signed statement of endorsement	N/A	✓	✓	✓
1.2	Commitment to regular reporting	N/A	✓	✓	✓
1.3	Internal practices on climate change	2			
1.4	Management system description	3			
2.0	Base Year Quantification				
2.1	Any quantification that can be used in target setting	N/A	✓	✓	✓
2.2	Provide methodology for the calculation of the base year quantification	2			
2.3	Include GHG emissions inventory by gas type	6			
2.4	Provide methodology for the calculation of the base year quantification by gas type	4			
3.0	Projection				
3.1	Projection calculated in any way	2			
3.2	Projection expressed in tonnes of GHG emissions	2			
3.3	Identify major sources of GHG emissions	1			
3.4	Include indirect emissions	1			
3.5	Specified by GHG type	1			
4.0	Target Setting				
4.1	Commit to target setting	2	✓	✓	✓
4.2	Quantify a target	2			
4.3	Include a timeframe	2			
4.4	Target to the year 2005 and beyond	2			
4.5	Process for target review and update	2			
5.0	Measures to Achieve Target				
5.1	List key activities/projects	2	✓	✓	✓
5.2	Quantify the potential aggregate impact using any reporting format	3			
5.3	Quantify the impact of individual activities using any reporting format	3			
5.4	Quantify the potential aggregate impact in absolute quantity of GHG emissions	4			
5.5	Quantify the impact of individual activities in absolute quantity of GHG emissions	4			
5.6	Categorise the measures	4			

Canada's Champion Reporting Checklist from VCR Inc., Registration Guide, 1999, continued.....

Components		Required Elements			
		Points Earned	Bronze	Silver	Gold
6.0	Results Achieved				
6.1	In the reporting year	2			
6.2	In all years since 1990	2			
6.3	Tonnage inventory of emissions	2			✓
6.4	Tonnage inventory of emissions since 1990	2			
6.5	As an aggregate of identified key activities	2			
6.6	For individual key activities/projects	2			
6.7	Aggregated impact of key activities/projects in tonnes of GHG emissions	2			
6.8	Individual impact of key activities/projects in tonnes of GHG emissions	2			
6.9	In comparison with targets	5			✓
6.10	Which are below 1990 levels of CO ₂ e or energy intensity per unit of output	5			✓
6.11	Which are verifiable	2			✓
6.12	Which have been externally verified	3			
6.13	Offsetting projects	N/A			
7.0	Education, Training and Awareness				
7.1	Climate change issue explained to employees	3			✓
7.2	Communicate company response to climate change	3			✓
7.3	Identify opportunities for individual action	3			✓
7.4	Influence external contacts	3			
7.5	Undertake public education	3			
	Maximum Total	100			
<p>“✓” marks the level of reporting elements that must be included in order to reach Bronze, Silver or Gold Champion-level reporting status. You must attain 50 points to reach Bronze level, 70 points to reach Silver level and 90 points to reach Gold level</p>					

Source: Voluntary Challenge and Reporting Inc, 1999: Champion Reporting Checklist Registration Guide.

Appendix 9

Statistics Canada Quarterly Report on Energy Supply and Demand

	1990	1991	1992	1993	1994	1995	1996
Total Industrial							
Total Energy (PJ):	2617.58	2600.66	2572.53	2658.17	2760.02	2911.56	2926.13
Total Input Energy Use (PJ):							
Mining	261.65	260.36	250.64	306.82	329.00	351	391.33
Construction	44.37	41.73	39.27	32.94	35.10	40.77	47.69
Forestry	15.82	12.36	10.34	12.61	10.90	7.91	9.62
Manufacturing	2295.74	2286.21	2272.28	2305.80	2385.02	2511.21	2477.50
residual check	0.00	0.01	0.00	0.00	-0.01	0.01	0.00
Total Energy Use by Fuel Type (PJ)							
Coal & coke, coke oven gas	174.89	183.06	185.14	177.93	164.30	169.26	175.06
Electricity	654.68	667.36	673.39	693.11	712.77	738.36	743.04
Natural gas	823.45	798.50	778.30	817.85	853.28	910.17	928.72
DFO, LFO and kerosene	118.95	110.36	99.55	105.13	117.78	124.75	149.30
HFO	202.50	185.61	166.31	182.18	167.76	152.98	159.25
Petroleum coke and distilled gas	227.22	216.09	229.55	226.24	234.17	249.07	254.71
LPGs and gas plant LPGs	27.16	32.26	29.18	53.91	59.30	72.28	40.99
Other fuels	388.73	407.43	411.12	401.83	450.66	494.69	475.06
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	148193	139260	139128	143929	153092	156447	157888
Energy Intensity (GJ/\$86):	0.01766	0.01867	0.01849	0.01847	0.01803	0.01861	0.01853
Total Change in Energy (PJ):	0.00	-16.92	-45.05	40.59	142.44	293.98	308.55
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-157.79	-160.12	-75.32	86.53	145.79	171.25
Structure	0.00	28.42	88.33	123.02	79.49	87.86	99.78
Intensity	0.00	138.50	42.78	4.67	-19.00	58.43	35.45
Interaction	0.00	-26.06	-16.04	-11.78	-4.58	1.90	2.07
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining							
Total Energy (PJ):	261.65	260.36	250.64	306.82	329.00	351.68	391.33
Total Energy Use by Fuel Type (PJ)							
Coal & coke, coke oven gas	3.61	4.73	4.58	4.39	5.89	5.81	6.54
Electricity	107.22	104.79	104.28	102.92	107.05	116.75	118.85
Natural gas	65.42	62.07	56.57	104.10	109.37	107.04	120.55
DFO, LFO and kerosene	42.71	45.32	40.67	45.77	49.82	54.26	74.16
HFO	15.23	17.57	15.19	15.97	17.01	16.49	15.85
Petroleum coke and distilled gas	22.38	22.20	23.16	23.74	27.43	39.35	40.95

LPGs and gas plant LPGs	5.08	3.68	6.20	9.94	12.43	11.98	14.43
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	19664	20000	20410	21426	22720	23678	24462
Energy Intensity (GJ/\$86):	0.01331	0.01302	0.01228	0.01432	0.01448	0.01485	0.01600
Total Change in Energy (PJ):	0.00	-1.29	-11.01	45.17	67.35	90.03	129.68
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	4.47	9.93	23.45	40.66	53.41	63.84
Structure	0.00	-0.08	-3.82	-1.12	0.39	0.41	6.36
Intensity	0.00	-5.58	-16.00	21.99	23.13	30.42	45.14
Interaction	0.00	-0.11	-1.12	0.85	3.17	5.79	14.34
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction							
Total Energy (PJ):	44.37	41.73	39.27	32.94	35.10	40.77	47.69
Total Energy Use (PJ)							
Coal & coke, coke oven gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural gas	0.00	0.00	0.00	0.00	0.00	7.11	11.68
DFO, LFO and kerosene	39.11	32.88	29.32	29.17	32.67	32.06	31.89
HFO	2.24	0.58	0.85	0.53	0.68	0.63	0.58
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	3.02	8.27	9.10	3.25	1.75	0.98	3.54
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	32397	30087	28422	27866	28661	27221	26681
Energy Intensity (GJ/\$86):	0.00137	0.00139	0.00138	0.00118	0.00122	0.00150	0.00179
Total Change in Energy (PJ):	0.00	-2.64	-5.10	-11.43	-9.27	-3.60	3.32
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-3.16	-5.44	-6.21	-5.12	-7.09	-7.83
Structure	0.00	-4.95	-6.93	0.19	3.02	-11.98	-18.28
Intensity	0.00	6.34	9.05	-6.24	-7.25	10.43	29.97
Interaction	0.00	-0.86	-1.78	0.83	0.08	5.29	-2.61
residual check	0.00	0.00	0.00	0.00	0.00	0.25	-2.06
Forestry							
Total Energy (PJ):	15.82	12.36	10.34	12.61	10.90	7.91	9.62
Total Change in Energy (PJ):	0.00	-3.46	-5.48	-3.21	-4.93	-7.92	-6.21
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-1.92	-1.89	-1.00	-0.67	-0.25	-0.80
Structure	0.00	0.42	4.15	2.41	3.89	15.59	15.27
Intensity	0.00	-2.13	-6.63	-4.13	-6.73	-11.84	-10.60

Interaction	0.00	0.17	-1.10	-0.49	-1.42	-11.42	-10.08
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	3212	2822	2828	3008	3077	3162	3050
Energy Intensity (GJ/\$86):	0.00493	0.00438	0.00366	0.00419	0.00354	0.00250	0.00315
Total Energy Use (PJ)							
Coal & coke, coke oven gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural gas	0.08	0.31	0.07	0.09	0.00	0.00	0.00
DFO, LFO and kerosene	7.43	6.27	7.23	7.66	7.36	7.81	9.44
HFO	8.31	5.79	3.04	4.86	3.54	0.10	0.18
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing							
Total Energy (PJ):	2295.74	2286.21	2272.28	2305.80	2385.02	2511.21	2477.50
Total Energy Use (PJ)							
Pulp, Paper and Sawmills	743.76	769.19	766.19	769.66	830.79	883.23	850.08
Iron and Steel	220.29	236.84	246.55	245.13	235.12	237.97	249.16
Smelting and Refining	181.86	190.56	203.40	217.42	215.74	215.12	231.29
Cement	59.08	54.94	49.90	45.25	49.14	56.42	54.31
Chemicals	206.13	209.89	198.09	214.80	244.48	246.34	228.87
Petroleum Refining	322.98	313.21	312.38	316.54	311.06	303.51	317.80
Other Manufacturing	561.65	511.58	495.78	497.00	498.71	568.62	545.99
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Use by Fuel Type (PJ)							
Coal & coke, coke oven gas	171.28	178.33	180.56	173.53	158.41	163.45	168.51
Electricity	547.47	562.57	569.12	590.19	605.72	621.61	624.19
Natural gas	757.96	736.12	721.65	713.66	743.91	796.02	796.49
DFO, LFO and kerosene	29.70	25.90	22.33	22.54	27.94	30.62	33.82
HFO	176.71	161.67	147.24	160.83	146.53	135.77	142.65
Petroleum coke and distilled gas	204.84	193.89	206.39	202.50	206.74	209.72	213.76
LPGs and gas plant LPGs	19.06	20.31	13.88	40.72	45.11	59.32	23.03
Other fuels	388.73	407.43	411.12	401.83	450.66	494.69	475.06
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	92920	86351	87468	91629	98634	102386	103695
Energy Intensity (GJ/\$86):	0.02471	0.02648	0.02598	0.02516	0.02418	0.02453	0.02389
Total Change in Energy (PJ):	0.00	-9.53	-23.46	10.06	89.28	215.47	181.76
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-162.30	-134.70	-31.90	141.17	233.87	266.21
Structure	0.00	34.25	58.33	60.66	-6.94	-37.56	-39.30
Intensity	0.00	145.36	66.64	-6.83	-32.94	31.67	-25.28
Interaction	0.00	-26.85	-13.72	-11.88	-12.01	-12.52	-19.87
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pulp, Paper and Sawmills							
Total Energy (PJ):	743.76	769.19	766.19	769.66	830.79	883.23	850.08
Total Energy Use (PJ)							
Coal & coke, coke oven gas	4.13	3.56	1.87	2.10	2.46	1.48	2.11
Electricity	175.70	181.11	178.21	184.59	191.31	201.50	197.43
Natural gas	101.66	112.04	113.92	116.79	130.55	131.25	123.40
DFO, LFO and kerosene	10.52	9.43	6.14	5.49	5.16	6.53	7.51
HFO	82.37	78.64	70.41	68.32	62.12	55.42	60.35
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other fuels	369.37	384.41	395.65	392.36	439.18	487.05	459.28
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	8710	8286	8574	8958	9318	9356	9170
Energy Intensity (GJ/\$86):	0.08539	0.09283	0.08936	0.08592	0.08916	0.09440	0.09270
Total Change in Energy (PJ):	0.00	25.43	22.44	25.90	87.04	139.47	106.32
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-36.21	-11.61	21.18	51.92	55.16	39.28
Structure	0.00	-0.03	1.63	-0.87	4.93	13.55	11.56
Intensity	0.00	64.82	33.25	5.74	27.68	63.39	51.56
Interaction	0.00	-3.16	-0.82	-0.14	2.50	7.37	3.92
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron and Steel							
Total Energy (PJ):	220.29	236.84	246.55	245.13	235.12	237.97	249.16
Total Energy Use (PJ)							
Coal & coke, coke oven gas	120.92	135.49	137.24	131.92	117.06	119.59	123.43
Electricity	28.47	28.58	29.86	30.40	31.27	31.16	32.00
Natural gas	54.61	61.73	68.91	71.84	76.34	77.27	83.70
DFO, LFO and kerosene	1.36	1.08	1.12	1.02	1.13	1.26	1.22
HFO	14.93	9.97	9.42	9.95	9.32	8.70	8.81
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	2461	2180	2351	2603	2654	2745	2818
Energy Intensity (GJ/\$86):	0.08951	0.10864	0.10487	0.09417	0.08859	0.08669	0.08842
Total Change in Energy (PJ):	0.00	16.55	26.26	24.84	14.83	17.68	28.87
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-25.15	-9.85	12.71	17.28	25.42	31.96
Structure	0.00	-0.36	-0.23	-0.29	-0.35	-0.21	-0.08
Intensity	0.00	47.54	37.57	11.32	-2.34	-6.77	-2.69
Interaction	0.00	-5.48	-1.24	1.10	0.24	-0.76	-0.31

residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smelting and Refining							
Total Energy (PJ):	181.86	190.56	203.40	217.42	215.74	215.12	231.29
Total Energy Use (PJ)							
Coal & coke, coke oven gas	13.84	10.35	13.43	11.15	11.80	13.14	14.44
Electricity	130.48	145.25	152.74	168.74	168.25	168.83	176.76
Natural gas	24.41	26.29	28.45	27.20	25.96	25.72	27.39
DFO, LFO and kerosene	0.51	0.44	0.67	0.74	0.75	1.91	2.57
HFO	12.61	8.21	8.11	9.58	8.98	5.52	10.13
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	2213	2587	2674	2911	2835	2920	3070
Energy Intensity (GJ/\$86):	0.08218	0.07366	0.07607	0.07469	0.07610	0.07367	0.07534
Total Change in Energy (PJ):	0.00	8.70	21.54	35.56	33.88	33.26	49.44
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	30.73	37.88	57.36	51.11	58.10	70.43
Structure	0.00	-0.61	-0.43	-0.75	-0.88	1.29	2.51
Intensity	0.00	-18.45	-12.84	-15.42	-12.15	-17.80	-14.71
Interaction	0.00	-2.97	-3.07	-5.62	-4.21	-8.32	-8.79
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cement							
Total Energy (PJ):	59.08	54.94	49.90	45.25	49.14	56.42	54.31
Total Energy Use (PJ)							
Coal & coke, coke oven gas	25.22	22.09	21.84	20.89	23.80	23.80	23.31
Electricity	6.39	5.66	5.22	5.84	5.90	6.11	6.11
Natural gas	17.07	17.11	16.57	13.34	12.89	15.70	13.30
DFO, LFO and kerosene	0.34	0.35	0.36	0.26	0.21	0.23	0.37
HFO	2.22	2.24	2.26	1.68	1.61	1.62	1.83
Petroleum coke and distilled gas	7.84	7.49	3.65	3.24	4.73	8.96	9.39
LPGs and gas plant LPGs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	453	325	308	333	376	382	395
Energy Intensity (GJ/\$86):	0.13042	0.16904	0.16201	0.13589	0.13069	0.14769	0.13749
Total Change in Energy (PJ):	0.00	-4.14	-9.18	-13.83	-9.94	-2.66	-4.77
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-16.69	-18.91	-15.65	-10.04	-9.26	-7.56
Structure	0.00	0.06	0.01	-0.16	-0.34	-0.18	-0.21
Intensity	0.00	17.45	14.81	2.68	0.50	8.09	3.63

Interaction	0.00	-4.95	-5.10	-0.70	-0.06	-1.31	-0.63
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemicals							
Total Energy (PJ):	206.13	209.89	198.09	214.80	244.48	246.34	228.87
Total Energy Use (PJ)							
Coal & coke, coke oven gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	65.32	62.38	61.15	58.94	61.57	69.64	67.70
Natural gas	112.80	114.83	112.02	114.94	137.29	135.08	132.62
DFO, LFO and kerosene	0.34	0.26	0.24	0.17	0.27	0.86	0.91
HFO	8.87	7.12	6.75	10.42	12.24	4.18	4.09
Petroleum coke and distilled gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LPGs and gas plant LPGs	0.00	2.60	2.60	21.00	26.07	33.42	12.33
Other fuels	18.79	22.71	15.31	9.33	7.03	3.15	11.22
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	2878	2372	2514	2438	2671	2824	2805
Energy Intensity (GJ/\$86):	0.07162	0.08849	0.07879	0.08810	0.09153	0.08723	0.08159
Total Change in Energy (PJ):	0.00	3.77	-8.04	8.67	38.35	40.21	22.74
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-36.24	-26.07	-31.51	-14.83	-3.87	-5.23
Structure	0.00	-1.70	-2.56	-19.47	-20.69	-26.71	-10.03
Intensity	0.00	47.49	20.49	46.52	55.72	44.29	28.32
Interaction	0.00	-5.78	0.10	13.13	18.14	26.50	9.68
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Petroleum Refining							
Total Energy (PJ):	322.98	313.21	312.38	316.54	311.06	303.51	317.80
Total Energy Use (PJ)							
Coal & coke, coke oven gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity	19.79	20.28	21.22	21.44	21.02	17.58	17.55
Natural gas	65.76	63.78	52.10	51.18	55.20	46.79	54.81
DFO, LFO and kerosene	1.22	1.05	0.82	1.35	0.42	0.75	0.90
HFO	40.00	42.51	38.38	41.74	35.94	38.47	40.64
Petroleum coke and distilled gas	192.89	184.08	196.80	196.99	193.98	196.04	198.17
LPGs and gas plant LPGs	3.32	1.51	3.06	3.85	4.50	3.89	5.73
Other fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	2075	2045	1993	2059	2100	2120	2234
Energy Intensity (GJ/\$86):	0.15565	0.15316	0.15674	0.15373	0.14812	0.14317	0.14226
Total Change in Energy (PJ):	0.00	-9.77	-10.60	-6.44	-11.92	-19.47	-5.18
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-4.67	-12.76	-2.49	3.89	7.00	24.75
Structure	0.00	-0.28	-0.42	0.02	-0.69	0.08	0.39

Intensity	0.00	-4.06	1.92	-3.44	-14.84	-24.78	-27.46
Interaction	0.00	-0.76	0.66	-0.53	-0.29	-1.77	-2.85
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Manufacturing							
Total Energy (PJ):	561.65	511.58	495.78	497.00	498.71	568.62	545.99
Total Energy Use (PJ)							
Coal & coke, coke oven gas	7.17	6.84	6.17	7.47	3.30	5.45	5.23
Electricity	121.32	119.31	120.70	120.24	126.40	126.79	126.64
Natural gas	381.64	340.33	329.69	318.36	305.67	364.21	361.28
DFO, LFO and kerosene	15.40	13.28	12.98	13.52	19.99	19.08	20.33
HFO	15.70	12.98	11.91	19.13	16.32	21.86	16.79
Petroleum coke and distilled gas	4.11	2.32	5.94	2.27	8.03	4.73	6.20
LPGs and gas plant LPGs	15.75	16.20	8.22	15.87	14.54	22.01	4.97
Other fuels	0.57	0.31	0.16	0.15	4.45	4.49	4.55
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Activity variable:							
GDP (mn \$86)	74130	68556	69054	72327	78680	82039	83203
Energy Intensity (GJ/\$86):	0.00758	0.00746	0.00718	0.00687	0.00634	0.00693	0.00656
Total Change in Energy (PJ):	0.00	-50.08	-65.88	-64.65	-62.95	6.97	-15.66
Energy Indicator Analysis:							
Change in energy due to (PJ):							
Activity	0.00	-42.23	-38.46	-13.66	34.47	59.92	68.74
Structure	0.00	-2.33	-3.40	-1.99	6.49	3.60	3.39
Intensity	0.00	-6.16	-26.06	-50.44	-93.02	-49.85	-76.91
Interaction	0.00	0.64	2.04	1.44	-10.89	-6.70	-10.88
residual check	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 10

Statistics Canada Standard Industrial Classification (SIC) System

SIC	Tier 1	SIC	Tier 2
061	Metal Mining	10	Food
0611	Gold	101	Meat and Poultry
0612	Copper & Copper-Zinc	103	Fruit & Vegetables
0613	Nickel-Copper	104	Dairy Products
0614	Silver-Lead-Zinc	107	Bakery
0616	Uranium	11	Beverages
0617	Iron	1111	Soft Drinks
0619	Other Metals	1131	Brewery
062	Non-Metal Mining	12	Tobacco
0621	Asbestos	15	Rubber
0622	Peat	151	Tube and Tyre
0623	Gypsum	16	Plastics
0624	Potash	17	Leather and Allied
0625	Salt	18	Primary Textile
0629	Other	19	Textile Products
0712	Oil Sands and Upgraders	24	Clothing
27	Pulp, Paper and Allied	25	Wood
2711	Pulp	2512	Sawmill and Planing
2712	Newsprint	252	Veneer & Plywood
2713	Paperboard	26	Furniture and Fixtures
2714	Building Board	28	Printing & Publishing
2719	Other Paper Products	29	Metal Smelting
29	Metal Smelting	2911	Ferro-alloys
2919	Iron and Steel	292	Steel pipe and Tubes
2951	Aluminium	294	Iron Foundaries
2959	Other Metals	296	Aluminium Roll & Cast
35	Industrial Minerals	297	Copper Roll & Cast
3521	Cement	299	Other Roll & Cast
3561	Glass	30	Fabricated Metal
3581	Lime	31	Machinery Industry

Statistics Canada Standard Industrial Classification (SIC) System, continued.....

SIC	Tier 1	SIC	Tier 2
36	Petroleum and Coke	32	Transport Equipment
3611	Petroleum Refining	3231	Motor Vehicle Industry
37	Chemical Products	3251	Engine and Parts
3711	Organic Chemical	3252	Wiring Assemblies
3712	Inorganic Chemical	3253	Stamping
3721	Agricultural Fertilisers	3254	Steering and Suspension
3731	Plastics and Resins	3255	Wheel and Brake
		3256	Plastic Parts
		3257	Textiles
		3259	Other Accessories/Parts
		33	Electrical and Electronic Parts
		39	Other Manufacturing

* Tier 1 & Tier 2 Industries as defined for use in the CIEEDAC report *Energy Intensity Indicators for Canadian Industry, 1990-97*.

Source: Canadian Industry Energy End-use Database and Analysis Centre, 1998

New Zealand's Energy Data Sources

The Ministry of Commerce compiles their Energy Data File using the following main external sources of data.

Coal

Mine operators provided six-monthly coal production returns until December 1997.

Statistics New Zealand provides:

- Quarterly Coal Sales Survey for coal from which quarterly production data are estimated. This survey is sponsored by the Ministry of Commerce.
- Coal imports and exports through its INFOS database.

BHP New Zealand Steel Limited provides quarterly data on production, natural gas and coal used.

Oil and Gas

NZOG Services Limited provides monthly returns for crude oil production, own use, closing stock and sale, as well as gas production, and for production of gas fields and the volume of gas flared.

New Zealand Refining Company Limited provides monthly returns of receipts for all crude oils and condensates by origin, refinery stocks, and crude and semi-refined input, and on oil products production and stocks.

Oil and gas field operators (Fletcher Challenge Energy Taranaki Limited, NZOG Services Limited and Shell Todd Oil Services Limited) each provide information on their expected oil and gas reserves.

Oil companies (BP New Zealand Limited, Caltex New Zealand Limited, Challenge Petroleum Limited (from March 1998), Gull Petroleum Limited (from December 1998), Mobil Oil New Zealand Limited and Shell New Zealand Limited) each provide a monthly return containing

product stocks, imports and exports, refinery receipts, intercompany sales, rebrands and blends, deliveries, and losses.

Fletcher Challenge Energy Taranaki Limited provides monthly returns for crude oil production and the production of gas fields, gas flared and own use.

Shell Todd Oil Services Limited provides monthly returns for condensate crude oil separated, stock changes of condensate and crude oil, for amounts of condensate and crude oil sent to the refining company and exported, and for production of raw gas, gas flared, own use, LPG and natural gasoline extracted, gas to NGC/ECNZ and the amount of gas reinjected.

Statistics New Zealand provides through its:

Deliveries of Petroleum Fuels by Industry Survey, quarterly data on petroleum product demand to 14 final use sectors, based on oil company returns. This survey is sponsored by the Ministry of Commerce.

Survey of Manufactured Gas, until September 1990 when manufactured gas production ceased, monthly data on production of gas and by-products, feedstocks used in production, and stocks at the end of the month.

Survey of Natural Gas, monthly data on the production and distribution of gas in New Zealand. The figures used in the Data File are deliveries to undertakings, deliveries to ECNZ, gas to other customers, losses in production, own use, and natural gasoline and LPG extracted from the raw gas.

Trade statistics, data on nominal CIF cost of oil imports and all imports.

Renewables

Renewables use for electricity generation is sourced as shown under **Electricity** below.

Statistics New Zealand provides direct use data for geothermal through its INFOS database.

Electricity

Electricity Corporation of New Zealand Limited (ECNZ) and **Contact Energy Limited** (from March 1996) provide monthly generation data.

Electricity companies (generators, wholesalers, transmitters, distributors and retailers, including ECNZ and Contact Energy Limited) provide annual electricity statistics (operational) for years ending March including end use information.

The Cogeneration Association of New Zealand's survey of its members is used to supplement the annual electricity statistics to provide more information on cogenerators.

Electricity Prices

Price data are derived from the Ministry of Commerce's annual (year ending 31 March) electricity statistics. These data are national average prices for residential, commercial and industrial consumers, and hence for all consumers, measured as total income received by electricity wholesalers and retailers, divided by total electricity sold.

Transport Fuels Prices

Retail prices for premium petrol are based on data from Statistics New Zealand.

Retail prices for regular petrol are based on data from the Motor Trade Association (until fourth quarter 1983) and Statistics New Zealand (from first quarter 1984).

Retail diesel prices are based on data from the Motor Trade Association (until 1982), the former Ministry of Energy (from 1983 to 1987) and Statistics New Zealand (from 1994). Limited price data are available from 1988 to 1993. The *Transport Fuels Retail Price Survey* (produced by the former Ministry of Energy) has been used to estimate prices for 1988 and 1989.

Retail prices for CNG and LPG are from Statistics New Zealand.

Wholesale prices (from 1990) are a weighted average price calculated quarterly by the Ministry of Commerce, based on information provided by the oil companies. Diesel wholesale prices for the period 1984 to 1987 are those set under price regulation.

Non-transport Fuels Prices

Heavy and light fuel oil prices are a weighted average price calculated quarterly by the Ministry of Commerce, based on information provided by the oil companies.

Natural gas prices are calculated quarterly by the Ministry of Commerce, using a sample of gas companies' standard tariffs for industry and residential consumers, based on annual consumption of 100,000 GJ and 60 GJ respectively.

Energy Price Indices

The energy price indices for selected OECD countries are calculated by the IEA from data supplied by individual countries. Their approach is to use a current weight scheme (Paasche formula) in tons of oil equivalent, derived from data in the OECD yearbook *Basic Energy Statistics*, to weight the energy prices supplied by each country for the industrial and residential sectors. The industrial sector includes the price for automotive diesel, while the residential sector includes the price for premium leaded petrol or premium unleaded petrol depending on the country.

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