Electricity, Energy and the Environment

Part B: Proposed Assessment Framework

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

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Overview—Proposed Assessment Framework

This discussion document is part of a framework the Parliamentary Commissioner for the Environment (PCE) is developing to assess the environmental performance of New Zealand's electricity sector. The purpose of the framework is:

> *to certify that energy services from electricity are provided in an environmentally sustainable manner through ongoing environmental performance assessments of New Zealand's electricity sector.*

There are two parts to this discussion document (*Electricity, Energy and the Environment):*

Part A: *Making the Connections* (a companion document)

Part A should be used as a reference point for the *Proposed Assessment Framework*. It provides background information on the assessments of New Zealand's electricity sector and explains key concepts and terms. It also provides an overview of the existing electricity sector and its impacts on environmental sustainability. Importantly, it explains key features that New Zealand's electricity sector needs to have for it to develop in a sustainable direction.

Part B: *Proposed Assessment Framework* (this document)

This part explains how the Commissioner proposes to assess the environmental performance of New Zealand's electricity sector. It sets out the proposed framework for the assessments and identifies quantitative and qualitative indicators and a variety of complementary approaches.

The Commissioner would like to hear your thoughts and ideas about the proposed framework. Public submissions are invited until 30 September 2003. Guidelines for providing feedback are given at the end of this document.

Key points from Part B: *Proposed Assessment Framework*

Although the proposed framework will have a prime focus on the Electricity Governance Organisation (EGO), it will also examine the environmental performance of the wider electricity sector.

The Commissioner is proposing to base the assessments on a set of priorities. These are (in descending order of priority):

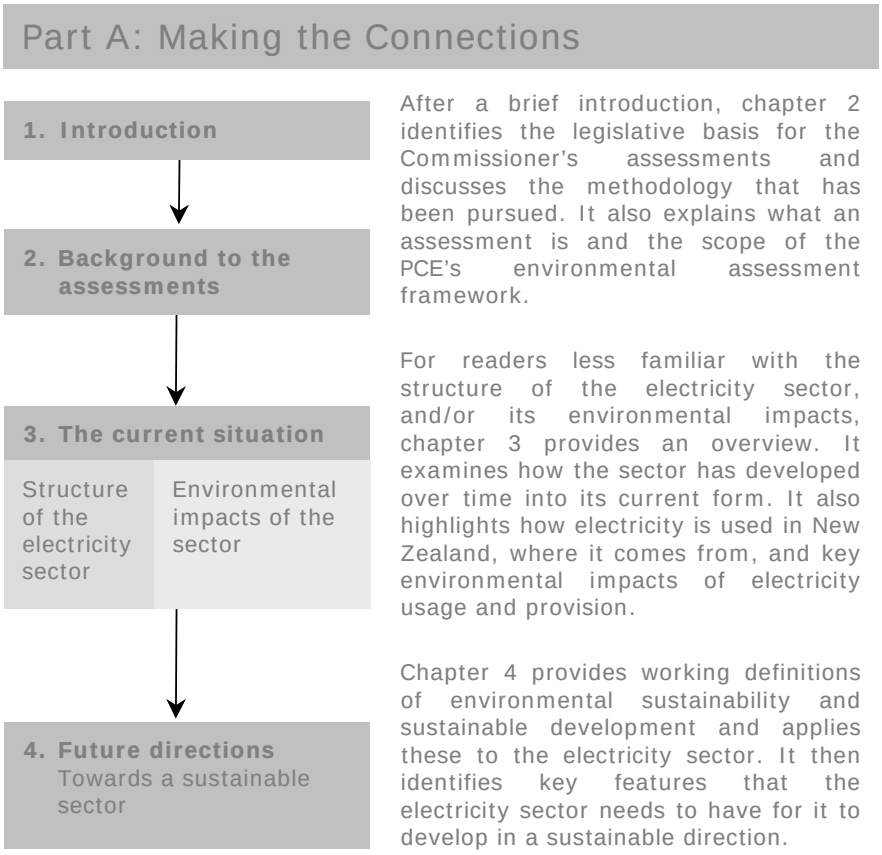
1. Manage growth in electricity demand.
2. Promote the development and role of renewable technologies, in particular new and emerging technologies.
3. Promote the efficiency and security of the electricity system.
4. Ensure consistency with government policies on climate change and energy efficiency.
5. Minimise greenhouse gas emissions.
6. Avoid, remedy or mitigate new or existing impacts on the environment.

The proposed framework consists of three key components:

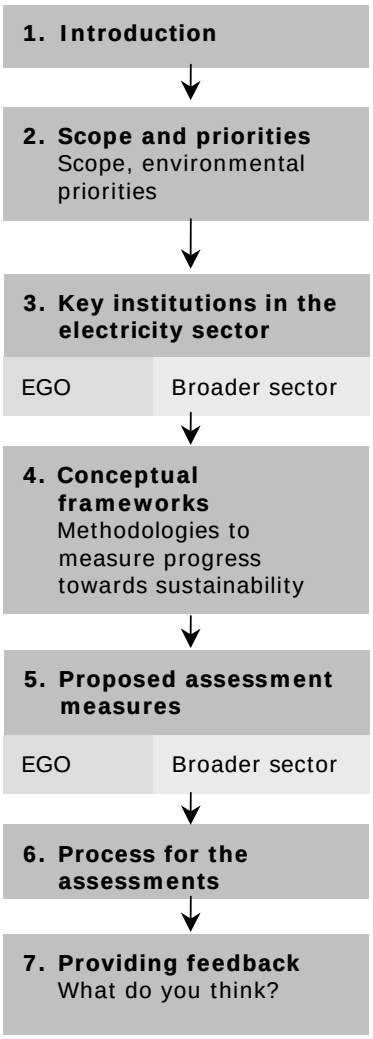
1. Assessments of the EGO.
2. Assessments of electricity retailers and key policy initiatives for climate change, energy efficiency and renewables.
3. Complementary investigations of market participants and specific electricity related issues.

Structure of *Electricity, Energy and the Environment*

There are two parts to this discussion document. This document is **Part B: *Proposed Assessed Framework.***



Part B: Proposed Assessment Framework



Following an introduction, chapter 2 establishes the rationale for the proposed framework. It discusses the scope of the framework and proposes a set of environmental priorities.

Chapter 3 discusses key institutions that affect the environmental performance of the electricity sector. It then examines how these institutions are related to the proposed environmental priorities.

Chapter 4 identifies the conceptual basis and methodologies for the proposed framework. It introduces a set of environmental performance measures and discusses the suitability of targets in the assessment process.

Chapter 5 outlines the measures and procedures that the PCE is proposing to use for the assessments.

Chapter 6 discusses how the assessments can be applied. It includes a proposed timeline and discusses how the PCE can manage both data and relationships with other agencies.

Chapter 7 identifies how you can have your say about the proposed framework.

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1 Introduction

This document is the second part of the Parliamentary Commissioner for the Environment (PCE)'s proposed assessment framework to examine the environmental performance of New Zealand's electricity sector. The Parliamentary Commissioner (the Commissioner) is developing this framework to determine the shape of subsequent assessments of this sector. The proposed framework is open for feedback until 30 September 2003. If you would like to comment on any part of this document, please refer to our instructions in chapter 7.

1.1 Link with Part A: *Making the Connections*

Part A is a separate document and comprises the first part of the proposed assessment framework. It sets out why the Commissioner is undertaking this assessment, including discussing the legislative justification for doing so. Part A also provides an overview of the existing electricity sector and its impacts on environmental sustainability. Importantly, it explains key characteristics that New Zealand's electricity sector needs to have for it to develop in a sustainable direction.

1.2 The structure of Part B: *Proposed Assessment Framework*

This part sets out the proposed approach for undertaking environmental assessments of the electricity sector, based on the criteria discussed in Part A.

Chapter 2 sets out the rationale for the proposed assessment framework including the scope of the assessments and a set of desired environmental priorities or outcomes for the electricity sector.

Chapter 3 identifies and discusses the key institutions that affect the environmental performance of the electricity sector.

Chapter 4 summarises the conceptual frameworks and methodologies used to prepare a proposed set of key environmental performance measures. This chapter also discusses the suitability and role of targets for the assessment process.

Chapter 5 outlines the initial set of measures and complementary investigations proposed for the assessments.

Chapter 6 sets out the work stream for the assessments including a proposed timeline. It also discusses the management of data and relationships with other agencies.

Chapter 7 provides information for those wishing to comment on the proposed assessment framework including the initial set of measures.

2 Scope and priorities

This chapter explores the potential scope of the assessment framework and proposes a set of environmental priorities against which the performance of the electricity sector can be assessed.

2.1 Scope of the assessments

There are a number of considerations that need to be taken into account to determine the appropriate scope for the Parliamentary Commissioner for the Environment (PCE)'s assessment. These include:

- the Government's policy intention for electricity
- the PCE's legislative mandate or authority
- the influence of key institutions (including the legislative and regulatory framework) that impact on the environmental sustainability of the electricity sector (discussed in chapter 3).

2.1.1 The Government's policy intention for electricity

Government reforms in the electricity sector have primarily targeted the electricity industry. This is reflected in the thrust of the Government Policy Statement (GPS). However, while the GPS is focused on developing an efficient electricity market, the policy statement is clearly titled '*Government's Policy Objective for **Electricity**'*. The first paragraph of this statement sets out that:

> *the Government's overall objective is to ensure that electricity is delivered in an efficient, fair, reliable and environmentally sustainable manner to all classes of consumer.*

These same words are then repeated in a modified form in the guiding principles of the GPS, but this time only focusing on the electricity industry. This revised version of the objective demonstrates that the Government's policy focus has been on the electricity industry. It is clear, however, from the scope of the overall objective that the requirement to be environmentally sustainable applies to more than just the electricity industry and that the GPS does encompass the entire electricity sector (including electricity users, regulatory authorities, market and other service providers, such as energy efficiency services providers).

2.1.2 Legislative scope for the assessments

As discussed in Part A, section 2.1.2, while the requirement of the assessment process was instigated by the amendments to the Electricity Act 1992, the PCE will implement the assessment using the powers provided by the Environment Act 1986.

However, the scope is determined by the combination of the two pieces of legislation, with:

- the Electricity Governance Organisation (EGO) being the focus of the Electricity Act 1992
- the wider electricity sector, including the role of government agencies, public authorities and other bodies or persons encompassed by the scope of the Environment Act 1986.

2.1.3 Scope of the environment

As discussed in Part A, section 2.1.2, the term 'environment' under the Environment Act 1986 can be defined very broadly.

Table 2.1 summarises key elements that can be included in the definition of the environment.

Table 2.1: Environmental dimensions of electricity delivery and usage

Category	Dimensions
Physical environment	Atmosphere (Global), Air, Water, Land, Biodiversity
Economic	Economic efficiency (dynamic, allocative, productive) [See glossary], resource efficiency (for renewable and non-renewable resources), energy efficiency (e.g. least cost energy services, demand management, integrated resource planning).
Social	Social and cultural conditions, including health, recreation, safety and aesthetics.

2.2 Setting the assessment priority

The PCE's assessment process will need to be incremental and encompass both the EGO and other significant institutions that impact on the environmental sustainability of the electricity sector. This will allow the Commissioner to focus on those actions that will have the most benefit to the environment.

The next sections develop the rationale for determining environmental priorities for the electricity sector.

2.2.1 Priority 1: Assessment of the electricity sector against the GPS

The main environmental objective contained in the GPS is set out in the Government's overall objective statement, which is *"…to ensure that electricity is delivered in an efficient, fair, reliable and environmentally sustainable manner to all classes of consumer"*.

The concept of environmental sustainability will, therefore, be central to the achievement of both the Government's and the Commissioner's environmental outcomes. This concept has been discussed in Part A.

Table 4.2 from Part A, which is based on the OECD (2001b) criteria for environmental sustainability, is repeated here as table 2.2.

Table 2.2: Core sustainability criteria applied to the electricity sector

Criteria	Example
Regeneration	• Using electricity generated from renewable resources (from the hydrological cycle, biomass, wind, sun, waves, and tidal action) efficiently.* This includes ensuring that there are no avoidable hydro spills.* Promoting and facilitating active demand side participation can significantly assist the achievement of this criterion. • Ensuring that the use of renewable resources (e.g. from biomass) does not exceed their long-term rates of natural regeneration.
Substitutability	• Using non-renewable resources (such as gas and coal) efficiently. Promoting and facilitating active demand side participation in the market can assist in the achievement of this criterion.* • Facilitating the use of new, more efficient electricity technologies and renewables, and distributed generation.*
Assimilation	• Minimising emissions of: - greenhouse gases* - other contaminants to air (e.g. oxides of nitrogen and oxides of sulphur) - contaminants to water (including heat).
Avoiding irreversibility	• Avoiding irreversible impacts on: - ecosystems and the loss of biodiversity - significant cultural and historic landscapes or areas with wild and scenic attributes.

Within its overall environmental objective of delivering electricity in an environmentally sustainable manner, the Government set out a number of specific environmental goals. These specific environmental goals are indicated in table 2.2 by an asterisk (*****).

The GPS also requires that the delivery of electricity be *"consistent with sustainable development"*. It is proposed that the Commissioner should focus on the sustainability considerations associated with the 'natural' environment—one of the components of sustainable development.

There are two reasons for this approach. First, it is consistent with the priorities contained in the Commissioner's own strategic plan (PCE, 2003: 6). Consultation during the development of this plan provided a clear signal that the focus of the Commissioner's work should be on the environmental dimensions of sustainable development, and not sustainable development *per se*.

Second, the definition of environmental sustainability that underpins this assessment process, with its focus on increasing reliance on sustainable energy sources and improving the overall energy efficiency of the electricity system, is a core component of sustainable development.

2.2.2 Priority 2: Assessment of the EGO

The PCE has a statutory responsibility (under the Electricity Act 1992) to assess the EGO with respect to the environmental considerations contained within the GPS. The core for any assessment of the electricity sector by the PCE must be the consideration of the role and impact of the EGO on the environmental outcomes that are clearly identified in the GPS.

When assessing the EGO, however, it will be necessary to ensure that the EGO is not being assessed out of context. This is because some of the environmental priorities identified below may not be under the influence of the EGO.

The Commissioner is intending to assess, in addition to the EGO, those institutions that also have an impact on the environmental performance of the electricity sector.

2.2.3 Environmental priorities

By combining the environmental considerations of the GPS, the definition of environmental sustainability discussed in Part A, and the Commissioner's priorities contained in the Commissioner's strategic plan, it is possible to develop a set of proposed prioritised environmental outcomes for the electricity sector.

The Commissioner's primary focus is on the long-term evolution of the electricity sector. A truly sustainable sector would be one in which all forms of energy were derived from sustainably managed renewable energy sources. This goal could potentially be achieved through the combination of two approaches:

(1) Manage growth in electricity demand and promote renewables

All forms of renewable energy are limited by their natural *flows* of water, wind, solar radiation etc. This physical constraint places an ultimate limit on the amount of energy that they can provide at any one time. In practice, access to these energy flows is subject to limitations of technology and capital constraints. Current energy systems and economic structures are founded on the prolific use of cheap and plentiful fuel sources and have been sustained through the *mining* of the earth's energy stock of non-renewable fossil fuels.

Renewable energy sources and technologies on their own, at least for the foreseeable future, cannot sustain current consumption patterns. For New Zealand to truly have an environmentally sustainable electricity system, it is necessary to realise that the way electricity is used will have to change. By implication, the production and use of energy will have to be decoupled, permanently, from economic development and deliver more to society from each unit of energy.

This will necessitate significant changes in the way economies operate and presents a huge challenge for all modern societies. However, at least initially New Zealand may be in a better position than most to start moving in this direction. Preliminary analysis indicates that because of the low priority given to energy efficiency and conservation in the past, there is significant potential in New Zealand for investment in these areas that is cost-effective (EECA, 2002; Bishop, 2001).

Managing demand is one side of the environmentally sustainable electricity coin. The other is developing a path to a fully-renewable electricity supply. New and emerging renewable generation technologies present an exciting opportunity to decrease New Zealand's reliance on non-renewable and (relatively) environmentally harmful fossil fuels. However, such a transition may be derailed by short-term considerations that do not take full account of the long-term costs and benefits of the different energy forms, particularly with regard to the as yet unknown costs associated with climate change. Yet there are still pressures for significant investments in non-renewable energy sources. Such investments will delay the point at which new renewable technologies become mainstream, rather than marginal generation technologies.

(2) Promote the efficiency and security of the electricity system and minimise environmental impacts

The daily operation of the electricity sector, particularly arising from the mix of thermal and hydro generation, directly impacts on the type and amount of adverse environmental effects that occur in the short-term.

Even more importantly, how it is operated will influence decisions that will impact on its future development. An inefficiently operated system can lead to premature decisions to invest in new generation capacity. In the longer-term such decisions may not be compatible with moving toward an environmentally sustainable electricity sector.

There are a number of approaches that can maximise the efficiency of the electricity system. These include:

- ensuring that all markets are fully competitive and that prices reflect all costs, including environmental costs
- ensuring fuel sources are used efficiently
- ensuring users have a choice in their energy solutions and are encouraged to manage their demand

- promoting technologies that improve system efficiency and are easily integrated into existing systems (e.g. distributed generation, advanced meters)
- ensuring decision-making processes do not preclude options that promote sustainability.

Table 2.3 summarises a set of proposed priorities against which the environmental performance of the electricity sector could be assessed.

Table 2.3: Environmental priorities for the performance assessment

Priority	Environmental considerations and responses
1	Manage growth in electricity demand: • by promoting energy efficiency in all segments of the electricity sector • facilitating and promoting active demand side participation in the wholesale market.
2	Promote the development and role of renewable technologies, in particular new and emerging technologies.
3	Promote the efficiency and security of the electricity system by: • ensuring that the use of distributed generation is facilitated • facilitating and promoting active demand side participation in the wholesale market • ensuring that energy resources are used efficiently • ensuring renewable sources are managed within their natural rates of replenishment • facilitating and promoting the complementary use of energy sources so as to overcome supply limitations, in particular for renewable sources of energy.
4	Ensure consistency with government policies on climate change and energy efficiency.
5	Minimise greenhouse gas emissions through: • using energy and other resources efficiently • minimising avoidable hydro spill • efficiently managing transmission losses and constraints.
6	Avoid, remedy, or mitigate new or existing impacts on the environment, including impacts on: • biodiversity • air, water and land.

The environmental considerations and responses listed in table 2.3 are not mutually exclusive, with many of the short-term considerations also contributing to the longer-term priorities. For example priority 3: *Promote the efficiency and security of the electricity system* is directly linked to both priority 1: *Manage growth in electricity demand* and priority 2: *Promote the development and role of renewable technologies*. This is because promoting efficiency and system security can be achieved through improved demand side measures and the uptake of more efficient new and emerging renewable technologies.

Another example of linkages between priorities is that the achievement of priority 5: *Minimise greenhouse gas emissions* from the sector is supportive of priority 4: *Ensure consistency with government policies on climate change.*

In addition, many of the institutions discussed in chapter 3 can impact on multiple priorities. For example, the Resource Management Act 1991 clearly impacts on priority 6: *avoid, remedy, or mitigate new or existing impacts on the environment*, but also on priorities 2 and 3, through its influence on the pattern of future investments in both generation and energy efficiency measures (e.g. through building approvals).

Questions:
Do our environmental priorities provide a sound basis for assessing the performance of the electricity sector?

Have we correctly defined and ranked these priorities?

2.2.4 Should the performance of the broader energy policy framework be assessed?

Potentially the Commissioner could step outside the scope set by the Government's current electricity policy framework, and undertake a 'clean sheet' type assessment. Such an assessment could examine the performance of both the Government and the electricity industry against the environmental principles contained in the Environment Act 1986, and concepts such as environmental sustainability.

It is the view of the Commissioner, however, that such an assessment would not be reasonable or fair until the current reforms have been given time to perform and the various institutions assessed have had an opportunity to respond to any findings made by the Commissioner.

However, an assessment could be warranted:

- should an EGO not be established, or be slow in being established
- following an assessment by the Commissioner, where it becomes apparent that there may be a systemic policy failure.

If a 'clean sheet' assessment were undertaken, it would follow the Commissioner's usual investigative procedures. Scoping of such an investigation would involve extensive consultation with all affected parties, including the EGO. For more information on how these types of examinations are undertaken, please refer to the PCE's Strategic Plan (PCE, 2003: 10).

3 Key institutions in the electricity sector

3.1 Identifying key institutions

As indicated in chapter 2, there are a number of institutions in addition to the Electricity Governance Organisation (EGO) that have an impact, to a greater or lesser extent, on the environmental performance of the electricity sector. Table 3.1 provides a list of these institutions.

Table 3.1: Institutions that influence the environmental performance of the electricity sector

Institution	Primary influence on the environmental performance of the electricity sector
Legislation: International	
United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol to the UNFCCC	Places an obligation on the New Zealand Government to achieve specific CO_2 reductions.
Legislation: Central government	
Environment Act 1986	Sets out PCE's functions and powers. Defines scope of the environment.
Electricity Act 1992 Electricity Regulatory Framework Government Policy Statement (GPS) on the electricity industry	PCE's environmental assessment role. Industry-specific regulation including the establishment and functions of an Electricity Governance Organisation (EGO). Environmental concepts of the Government Policy Statement (GPS).
Energy Efficiency and Conservation Act 2000	Provides for the development of the National Energy Efficiency and Conservation Strategy (NEECS). Provides powers to set Minimum Energy Performance Standards (MEPS) and Minimum Energy Performance Labelling (MEPL).
Health and safety legislation: Electricity Act 1992 Health and Safety in Employment Act 1992	 Industry-specific occupational and safety regulation. General occupational safety regulation.
Resource Management Act 1991	Establishes framework setting policies and standards for regulating activities and controlling environmental impacts.

Institution	Primary influence on the environmental performance of the electricity sector
Legislation: Central government (cont.)	
Building Act 1991	Sets standards that will impact on the energy efficiency performance of new buildings.
Local Government Act 2002	This Act has a purpose (see section 3 of the Act), amongst others, that: *"… provides for local authorities to play a broad role in promoting the social, economic, environmental, and cultural well-being of their communities, taking a sustainable development approach"*
Industry participants	
Electricity market-based arrangements (includes the New Zealand Electricity Market (NZEM), the Metering and Reconciliation Information Agreement (MARIA)), and the draft industry rules)	See section 3.2.
Other industry initiatives	For example, company-based sustainability initiatives including environmental reporting (e.g. triple bottom line).
Arrangements with the broader energy sector	For example, contracts for access to gas, coal, landfill gas, and wood.
Other key institutions	
Climate Change Office	
Implementation of Climate Change Policy	Implements the Government's Kyoto Protocol. Will impact on: • emissions of CO_2 from the sector • uptake of renewables and energy efficiency.
Energy Efficiency and Conservation Authority (EECA)	
Implementation of the NEECS Implementation of MEPS and MEPL	NEECS sets national targets for: • renewables (with a considerable contribution from the electricity sector) • energy efficiency improvements (electricity industry's contribution unspecified, but users must provide a significant contribution). NEECS also requires that EECA develop an energy efficiency system measure for the electricity sector.

Institution	Primary influence on the environmental performance of the electricity sector
Local government	
The Resource Management Act 1991 (RMA; implementation level)	Sets regional and local controls, using the legislative framework: • that will influence the type, scale and location of future electricity developments • on the environmental impacts arising from the operation of generation and transmission facilities
Local Government Act 2002 and non-RMA initiatives (e.g. for social or local economic development reasons)	Local authorities will be able to undertake a range of initiatives that promote energy and resource efficiency.
Community	
User initiatives (includes iwi and hapu based initiatives)	For example community-based energy efficiency and conservation programmes, consumer groups e.g. Major Energy Users Group, Consumers' Institute.
Non-user community initiatives	For example the Guardians of Lake Manapouri, Monowai and Te Anau.
Associations (including Non-Government Organisations)	For example: • Sustainable Energy Forum • New Zealand Energy Federation • Energy Management Association • New Zealand Wind Energy Association • Electricity Network Association • Electricity Engineers Association
Treaty of Waitangi	
Waitangi Tribunal— Te Ropu Whakamana i te Tiriti o Waitangi	Treaty claims on electricity-related resources (access to specific sites, water, and petroleum).

Not all of these institutions, however, will have the same impact on environment performance or the Commissioner's priorities. The next section discusses those institutions that are considered to be 'key' to achieving the environment outcomes required by this assessment process.

3.2 The Electricity Governance Organisation (EGO)

On 16 May 2003, the Minister of Energy announced that the Government would establish an EGO called the 'Electricity Commission', following the failure of the industry participants to establish an industry EGO. The Government EGO will be central to the achievement of the Government's environmental objectives that are contained in the Government Policy Statement (GPS). Because of the scope of the proposed EGO functions, it will have more influence than an industry organisation would have had.

The full scope of the proposed EGO has yet to be determined, but on 20 May 2003 the Minister announced that it will have a key function of ensuring dry year capacity to a 1 in 60 dry year standard. In addition it was announced that the new Electricity Commission will:

- encourage the development of small generation projects connected to local lines, rather than the national grid, by regulating lines charges to ensure such generators pay no more than is reasonable for connection.
- be empowered to require generators to offer long-term electricity hedge contracts into the market, for a nominated proportion of their reliable capacity, if it decides this is necessary to safeguard against underinvestment in ordinary generation. Related powers to require electricity retailers and major electricity users to hedge a set proportion of their consumption will also be provided for.
- be responsible for improved modelling and forecasting of future electricity supply and demand. It will also have new powers to require disclosure of information from the industry that will improve the function of the wholesale market, including information on fossil fuel supplies and hedge contracts.
- establish, as a high priority, a decision-making process and transmission pricing methodology that will enable necessary investment in the national grid to proceed.
- be responsible for making demand side energy exchanges, which enable consumers to on-sell electricity they have contracted for but do not need, available nationwide. It will also be charged with improving the industry's ability to manage ripple control for water heating.

The Electricity Commission is likely to develop regulations comparable to those in the industry's draft rulebook. The areas covered include:

- market governance arrangements (general rules, the rule-making process, compliance and information disclosure)
- consumer issues
- quality and security technical standards
- metering arrangements
- registry information for customers switching between retailers
- electricity transport—including the development of transmission services and pricing methodologies
- trading arrangements—including how to make bids and offers, the scheduling and dispatch of electricity, and price reconciliation
- clearing and settlement—including the terms of the deed of guarantee, and indemnity and surety bond required by market participants.

In addition to the functions outlined above, the legislation currently empowering the EGO should also enable it to set regulations for:

- a low fixed tariff option or options to assist low-use consumers and encourage energy conservation
- promoting accountability of community and customer trusts
- establishing a complaints resolution system
- setting codes of conduct and benchmark best practice for distributors and retailers
- requiring retailers to offer prepayment meters to domestic customers
- setting rules to enable customers to choose between competing retailers and distributors (Note: this area may be covered in the industry EGO's uncompleted customer issues section of the rules).

3.3 The EGO's key environmental performance areas

The EGO's key areas of environmental concern are discussed in this section.

3.3.1 Incorporating the principles of environmental sustainability and sustainable development in the regulations

Environmental priorities relevant to this action	
1: Manage demand	2: Promote renewables
3: Promote efficiency and security	4: Consistency with CCPP and NEECS
5: Minimise greenhouse gases	6: Manage impacts

The legislation requires the EGO to be able to demonstrate that its rules or regulations are consistent with the GPS. In the context of this assessment process, the criteria of environmental sustainability and sustainable development are of central concern.

The EGO must be able to clearly demonstrate to the Commissioner that the concepts of 'environmental sustainability' and 'sustainable development' have been fully considered, understood and incorporated into its rules or regulations.

3.3.2 Taking an unbiased approach to making rules or regulations and development of energy models (including participation in the process)

Environmental priorities relevant to this action	
1: Manage demand	**2:** Promote renewables
3: Promote efficiency and security	

A major concern of the Commissioner will be to ensure that the EGO is not biased in its composition, structure or operation towards any particular groups, approach or technology.

This is particularly important where such a bias would result in an ongoing reliance on unsustainable technologies or approaches.

It will therefore be important to ensure that:

- the members of the EGO (the Electricity Commission) represent the full range of options and views within the sector and not only those of the current incumbents
- the development of rules, or regulations, and the energy forecast models take account of all energy service options, both demand and supply side
- those advocating (or intending to enter the sector with) cost-effective technologies such as new renewables, distributed generation, and demand management services have fair access to the decision-making processes
- consumers, particularly those groups representing the 'smaller' customer, have an effective voice in the rule-making process.

3.3.3 Promoting the role of the demand side and energy efficiency within the sector

The EGO's rules or regulations for the wholesale electricity market, transmission / distribution pricing, and retail sector will impact on the:

- contribution the demand side has in the setting of prices in the wholesale market
- contribution the demand side has in ensuring the security of the electricity system
- ability of consumers to respond to changing prices by adjusting their demand both over the short and longer term.

The EGO's function in promoting demand side and energy efficiency can be broken down into a number of actions.

Promoting participation of the demand side in the wholesale market

Environmental priorities relevant to this action	
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	

The New Zealand market is typical of most, if not all, wholesale markets around the world in that the demand side is not active in determining wholesale prices. Although demand side bids are allowed in the pre-dispatch indicative market, the market does not currently permit demand side participation in real-time dispatch.[1]

A market where demand side bidding fully contributed to setting the order of dispatch and final wholesale price would allow those customers on fixed price contracts to easily offer, and then sell back into the market, quantities of their electricity demand when the price of generation reached certain levels. A market with active demand side participation can be expected to: reduce price volatility in the wholesale market; contribute to electricity system security through the provision of a demand side reserve capacity (EECA 2002); and reduce the need to use thermally-based reserve generation capacity (with a corresponding reduction in CO_2 emissions).

For the market to permit both supply and demand bidding, the EGO will need to:

- resolve outstanding monitoring and metering technology issues
- determine the role of and develop an active day-ahead market (other than just for reserve capacity) where the demand side is able to fully participate
- develop the means of moving to *ex-ante*[2] pricing where the price of electricity for any period is determined prior to the period of actual dispatch.

[1] The pre-dispatch schedule is the order in which generation plant is called on, or 'dispatched'. The order is arrived at through a system of market bids and offers with the lowest bids going first. However, this schedule and the prices set are only indicative, with the final order (and prices) being set by the actual (real time) schedule.

[2] Ex-ante pricing lets the consumer know in advance what they will be paid for their demand offer. This type of pricing is considered to be a key element in providing certainty and overcoming reluctance by those considering making demand side bids.

Passing through wholesale price signals to consumers

Environmental priorities relevant to this action	
1: Manage demand	
3: Promote efficiency and security	

A key means of effectively introducing demand side into the wholesale market and encouraging the uptake of energy efficiency measures by consumers is to have the wholesale price passed through to the final consumer. Users of electricity, when more clearly faced by the actual cost of use, should be able make decisions about whether their consumption of electricity is worth the cost of using it. At present, very few consumers are exposed to wholesale market prices or are given the choice to purchase at these prices.

Many large consumers buy their electricity directly from the generator with the price either determined by the spot market price, or a contract price. It is these large consumers that will have the most incentive and ability to enter the wholesale market with their demand side bids.

Most consumers, however, buy their electricity through energy retailers who in turn purchase in bulk from generators.

For consumers (including both direct and indirect purchasers) to make informed decisions about electricity use based on price, they will require access to timely and appropriate information and the right incentives. For this to happen there will need to be:

- advanced metering technology that provides useful price signals to customers
- a range of tariff options that reflect variations in electricity price in the wholesale market
- the ability to switch between price competitive energy services.

By promoting these measures, energy retailers will not only be assisting their customers to manage their demand and electricity costs, but will also be reducing their own exposure to high spot market prices.

As highlighted in chapter 2, in order to manage the demand for electricity, the relationship between retailers and users will need to be a key part of the Commissioner's assessment. However, the degree of influence that the EGO will have over energy retailers and their relationships with their customers has yet to be determined.

The retail segment of the electricity sector is discussed further in section 3.4.

3.3.4 Promoting a more efficient supply of electricity

The traditional focus when addressing concerns about the electricity system has been to improve the supply side of the system. The supply side comprises generation, transmission/distribution, and sale of electricity.

This focus is reflected in the GPS, which has mostly supply side-related environmental considerations.

These supply side environmental issues fall into two broad and interrelated categories:

- Improving efficiency in the supply of electricity by using existing technology more efficiently and through the introduction of new (more efficient) technologies.
- Increasing the role of renewable fuel sources in the generation of electricity.

The EGO's function in promoting supply side efficiency can also be broken down into a number of actions.

Improving efficiency in fuel use

Environmental priorities relevant to this action	
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

In some cases, the wholesale market rules may provide incentives that do not promote the efficient use of primary energy resources. Inefficiency in fuel use may arise from a range of operating decisions. The four following issues surrounding fuel efficiency have been identified: fuel choice; avoidable hydro spill; the characteristics of particular generation technologies; and direct use of fuels.

Fuel choice

If operating correctly, the market should send price signals to consumers that incorporate information about the relative efficiencies (physical, economic, and environmental) of different fuel sources and the associated generation technologies. This issue applies in terms of day-to-day operation and the types of investment that should occur in new generation technologies in the future. A key consideration for the electricity sector will be how it anticipates, in its planning, the introduction of the carbon charge in 2007.

Hydro spill

The GPS sets out the expectation that hydro spillage be minimised in the electricity sector. In a hydroelectric system, water is sometimes 'spilled' (i.e. passed through the system without being used for electricity generation). This results in an adverse environmental impact when other non-renewable sources of electricity have to make up any shortfall in production.

To make the most productive use of water, and to reduce the need for generating electricity from other sources, spillage should be prevented wherever possible. However, there will be some circumstances when hydro spill is necessary, and potentially desirable from an environmental perspective. For example, if turbines are out of action because of maintenance, it may be necessary to spill water to meet minimum flow requirements (i.e. to ensure that adequate water is flowing to maintain the ecological integrity of the river system). Another common example is when lake storage levels are already at maximum permitted levels even with the turbines running at full capacity. In such cases water will need to be spilled to prevent flooding and environmental damage.

Nonetheless, concerns have been raised that electricity generators may sometimes have an incentive to spill water to maximise their profits. This may occur if a generator can reduce the available supply of water for electricity generation (through spilling) to drive up the price of electricity on the wholesale market. In addition, water may be spilled because of poor management and planning.

While the GPS requires the minimisation of hydro spill, the Commissioner proposes that the requirement should be *"that there be no avoidable hydro spill"*.

While the wording differs slightly from the requirement in the GPS, it is considered by the PCE that this choice of words reflects the same sentiment.

The industry has a working party developing hydro disclosure procedures. A key part of the disclosure procedures is the development of 'reason codes'—in effect, a categorisation of reasons for spill. The draft codes are listed in appendix 1.

The stated intention of this initiative is to disclose the spill amounts as a percentage of total possible generation and it will be possible to determine absolute quantities as well. This information will provide a useful starting point for any analysis of specific hydro spill events undertaken by the Commissioner. However, this information in itself will be insufficient to distinguish environmentally undesirable spill events from those that are unavoidable. The Commissioner will also need to assess other information such as market prices, the generator's bidding behaviour before and after the event, storage lake capacity, and plant utilisation and maintenance.

The assessment of hydro spill will require detailed analysis and modelling. As such, it is anticipated that (at least some) episodes of hydro spill will be a focus of attention for both the EGO and the Commissioner.

Characteristics of generation technologies

Different generation technologies have different characteristics and roles within the generation mix. These roles have changed over the years in New Zealand. Some plant, such as wind, solar and run-of-river hydro and co-

generation, is mostly used as baseload generation. Combined Cycle Gas Turbine (CCGT) plant tends to run as baseload because of its higher efficiency than conventional thermal plant. The more expensive thermal plant usually runs as baseload when hydro resource is scarce, and as peaking plant when hydro is plentiful. Hydro plant operates in the reverse fashion.

With the introduction of new technologies such as wind, the issue of how these can be integrated efficiently into the generation mix will be of increasing concern. For example, it has been proposed that for wind power to be most effective in New Zealand, it is best operated as a complement to hydro power, and in this way enhances the country's limited water storage capability.

Direct use of fuel sources

In some cases (for example gas and geothermal sources), it may be more efficient to use the resources directly for particular end uses (such as water and space heating) instead of converting them to electricity as an intermediate step. In other cases, the direct use of these energy sources may not be economically or technically feasible. It will be necessary to ensure that there are no inherent biases within the EGO's rules and regulations that prevent fuels being used directly, where it is more environmentally beneficial and economically efficient to do so.

Improving efficiency in transmission (and distribution)

Environmental priorities relevant to this action	
3: Promote efficiency and security	
	6: Manage impacts

The market is designed to dispatch plant in a way that minimises the cost of supply of energy and reserve, including the impact of transmission losses and congestion on the transmission and distribution infrastructure. Losses are not in themselves minimised—instead the aim is to reduce them to some predetermined 'optimal' level.

Transmission losses are a function of the extent to which the grid is utilised to transport electricity, and at times of high demand, losses become much greater.[3] The issue of transmission losses is closely connected with grid pricing and in particular the institutional arrangements governing new investment in the grid.[4] Both of these matters will have a direct bearing on the extent to which the transmission network is used, and thus transmission losses.

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[3] The formula for line losses is given by $P_{loss} = P^2R/V^2$. Where P is power (Watts) being transported, R is the resistance (Ohms) of the conductor and V is the Voltage. P is itself a function of the current (I) multiplied by the voltage. Given that R is very low for transmission lines and voltage is held constant, it can be seen that any increase in the current will have an exponential impact on transmission losses.

[4] New investment is important, because losses from two partly utilised lines will be less than those from one highly utilised line transporting the same amount of electricity.

For example, a reduction in transmission losses for a given level of electricity supply and demand could be achieved if:

1. The supply and demand are more closely matched in terms of geographic location (i.e. they are nearer each other).
2. The transmission grid is upgraded (i.e. 220kV to 330kV lines).[5]

The market rules for both grid pricing and new investment in the grid will be a key focus when assessing the impact of the rules on supply side efficiency and distributed generation, which is often renewable.

3.3.5 Promoting new and emerging generation technologies

All electricity generation technologies have potentially adverse environmental impacts (see Part A, chapter 2). However, new generation technologies provide the opportunity to both increase supply side efficiency and reduce the number of environmental impacts through:

- improved conversion rates in the use of traditional sources of electricity (such as in gas-fired generation), or
- through the displacement of traditional sources of supply with significantly adverse environment impacts by new forms of relatively low impact generation (such as wind, solar, micro-hydro and wave).

Two categories of supply side technologies have been specifically identified in the GPS, 'distributed generation' and 'new renewables'.

Distributed generation

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

Distributed generation is sometimes also known as embedded generation. Distributed generation is generation capacity that is located close to the end user. This can either be located within a large industrial site, or within a local distribution network.

Distributed generation may or may not assist in moving toward an environmentally sustainable electricity sector. It does assist when it:

- Increases the flexibility of the existing electricity system. Distributed generation can assist in circumventing constraints in transmission and distribution systems, delaying the need for further investment in these assets (and thus avoiding the associated environmental impacts). Distributed generation can also delay investment in large-scale dispersed

[5] This makes V in the $P_{loss} = P^2R/V^2$ formula larger and thus P_{loss} smaller.

generation[6] by more closely matching demand with supply (e.g. distributed generation for specific industrial projects or to meet peak demands).[7]

- Increases energy efficiency. Distributed generation may improve energy efficiency if it can replace less efficient dispersed generated electricity. This is often the case with respect to distributed co-generation plants where efficiency is improved through finding applications for both the heat and the power produced in small scale thermal power plants.
- Reduces environmental impacts. The introduction of distributed generation can reduce the overall environmental burden of the electricity sector, when it results in thermal plant with higher conversion efficiencies replacing thermal plant with lower conversion efficiencies, or when renewable distributed generation replaces non-renewable generation.

New renewable energy

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

The supply side of the electricity market is well represented by participants that understand established renewable technologies such as large-scale hydro. It is unlikely that the market rules will have any difficulty accommodating new investment in these types of technologies. However, the same may not be true of renewable generation technologies that have different characteristics and requirements because they are of a smaller scale, distributed, or based on other sources of renewable energy such as wind, solar or bioenergy.

Of particular importance both to those currently in the market and those wishing to enter the market will be the rules regarding compliance with technical standards, dispatch (who goes first) and ancillary service costs.

The current market rules have made some attempt to accommodate new renewable technologies, especially small and inflexible plant. There are a number of specific rules that are intended to reduce the barriers and costs these technologies face in the wholesale market. For example, these rules allow for:

- small plant, of less than 5MW, to be exempt from having to offer supply into the wholesale market

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[6] Generation remotely located from the user and delivered via transmission and distribution networks.

[7] Dispersed generation is generally characterised by large-scale projects that provide 'lumps' of additional generation capacity into the market. During the period until demand catches up with supply, other projects will be uneconomic. From an environmental perspective, if these large projects are non-renewable (which is likely), investment in new renewables (and demand side measures) will be delayed.

- plant that varies its generation by less than 5MW to avoid the cost of making revised bids into the wholesale market
- run-of-river-hydro that has its production vary by less than 10MW, to offer its electricity in at zero or negative prices, making it a 'must run' station and ensuring that it will be dispatched
- generation plant of less than 30 MW of capacity to be exempt from some technical standards.

The EGO will need to ensure that its rules or regulations continue to evolve to accommodate new and emerging technologies.

Promoting access of new generation technologies to transmission and distribution infrastructure

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

Some distributed power sources and renewables such as wind and solar can often have the potential to impact adversely on the quality of supply or grid security.[8] This is because production from these types of renewable energy can fluctuate unexpectedly depending on the vagaries of sun and wind. The grid operator must therefore be able to accommodate sudden changes in voltage.

The institution responsible for grid security will have an important role to play in developing methods to accommodate these new technologies into the grid.

Currently Transpower has the function of ensuring the security of the grid. Under the market rules proposed for the industry EGO, it was intended that the market participants (including Transpower) would agree on 'common quality standards'. It would have then been up to Transpower to deliver with respect to those standards, as the initial grid security service provider. At this time it is unknown who will have final responsibility for grid security, but it is likely that the EGO will have at least an overseeing role.

Another concern for owners of transmission and distribution lines is that increased investment in distributed generation may 'strand'[9] their assets. This may act as an incentive to transmission and distribution companies to resist the introduction of these types of technologies.

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[8] distributed generation usually requires some degree of connection to the grid and the wholesale market. In some cases this connection will be required for when the distributed generation operator requires backup power to cover equipment outages. In other cases, the operator may wish to sell any surplus electricity that may be produced in the wholesale market.

[9] Stranding is when conditions change (i.e. new technologies are introduced) and result in the under-utilisation, or even circumvention, of existing transmission assets, thereby adversely impacting on revenue and capital value.

Transpower, distribution companies, or the EGO (depending on the final form of the rules) have two approaches to dealing with these new technologies:

- Make the new technologies conform to existing standards before they are permitted to connect to the grid. However, applying one standard will be complicated by the cumulative impact of an increasing number of connections. The first participants will have a limited impact on system security and reliability, but as more new technologies are introduced there will be an increasing adverse impact on the system.
- Pursue innovative ways to incorporate new technologies by accommodating the rules for the circumstances (e.g. complement variable wind generation with the flexibility of hydro generation).

It will be important to ensure that the 'guardian' of the grid and distribution companies is not too conservative thereby impeding the introduction of new technologies (even if more innovative options may, at least initially, be more challenging to implement).

In the case of distribution lines, the EGO is required by the GPS to develop model 'Use of System' agreements for distribution and also model approaches to distribution pricing.

The Commissioner will need to assess the progress, content and environmental impact of:

- Transpower's Statement of Corporate Intent (SCI)
- the EGO model pricing contracts.

In addition, it will be useful to undertake an annual survey of charges to distributed generation by distribution companies (and Transpower). When undertaking this analysis, it will be useful to assess whether the various pricing methodologies take account of the economic benefit to the line company of deferring transmission and distribution infrastructure construction through the use of distributed generation.[10]

[10] For example Orion's use of 1.3 cents per kWh incentive to place generation within certain parts of their grid to delay the need for investment in new line capacity.

3.4 Institutions beyond the EGO

3.4.1 The electricity retail market

Environmental priorities relevant to this action	
1: Manage demand	
	4: Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

Sustained reduction in the growth of electricity, which will benefit the environment, must be achieved through ongoing energy conservation and increasing energy efficiency.

The current market model relies on consumers being aware of the cost of using electricity and making decisions both in the short term (primarily energy conservation measures) and over the longer term (generally by investing in measures that promote energy efficiency).

This model appears to make more sense for large consumers who have the resources to undertake this type of activity. For most consumers, however (in particular household consumers), the small amount of savings (both in electricity and in cost) available to them from constantly monitoring the market price may be an insufficient incentive.

The ability for households to conserve electricity over the short term is often limited, because many forms of household demand are inelastic (e.g. lighting at night time or heating when it is cold). Over the longer-term limitations of building design or configuration mean the savings may be small.

However, a larger demand response from households may be expected if retailers were to aggregate these individual demand responses. This could be done by the retailer offering contracts to consumers that have the effect of aggregating a large number of small energy conservation responses from their customer base. An example of this type of contract is where an energy retailer offers a discounted electricity tariff to those consumers who accept having their hot water heating turned off at times of high wholesale prices.

If the market is operating efficiently, it can be expected that retailers (either on their own or in conjunction with the relevant distribution company) will compete for customers and new areas of profit not just through the provision of electricity, but also through the provision of associated energy services that add value to the retailers' product range. These services would include the improved tariff structures and advanced metering services discussed in section 3.3.

It would also include other energy services such as selling energy efficiency improvements and other demand response measures. For example, retailers

could provide energy efficiency retrofit measures and energy switching options such as solar water heating. These are functions of retailers that are not currently part of the oversight of the EGO.

Promotion of energy efficiency amongst all groups of consumers is critical to the achievement of the GPS and the PCE's performance assessment. It will therefore be necessary (despite this area not being part of the EGO's oversight function) for the PCE to assess how the retail and distribution companies are promoting demand side/energy efficiency solutions amongst their customer base.

3.4.2 The environmental performance of participants in the electricity sector

Environmental priorities relevant to this action	
1: Manage demand	**2:** Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

The Electricity Commission will oversee many of the functions in the electricity sector; more than those functions that were envisaged under the industry EGO. However, the electricity sector comprises a number of participants whose operations directly impact on the environmental objectives contained in the GPS. There is a real danger that these participants will now not take ownership of the environmental objectives in the GPS because the Electricity Commission, rather than an industry body, has prime responsibility.

It will be critical, however, that these participants still undertake their own functions in a way that is supportive of the environmental objectives contained in the GPS. It would be a concern if these organisations, in particular those that currently dominate the sector, were operating at cross purposes with, or even just indifferently to, the GPS.

It is generally considered that the main players in the sector are:

- the incumbent generators
- Transpower
- distribution companies (some involved in distributed generation)
- energy retailers/traders (mostly owned by the major generators)
- major energy users (direct purchasers, some also involved with distributed generation).

There is also a group of secondary or emerging players whose influence is likely to increase over time:

- energy management service providers
- small or entrant generators (using new technologies)
- small consumer organisations.

One possible way of assessing these players' performance would be to review their performance through their sustainability or triple-bottom-line (TBL) reporting. TBL reporting is based on the premise that business organisations should not just report their financial performance but also their environmental and social performance. Some background information on the benchmarking of TBL and environmental reporting is provided in appendix 2.

3.4.3 The Government's climate change policy response and the National Efficiency and Conservation Strategy

There are two key non-electricity-specific Government policy initiatives that directly link to and impact on the environmental objectives in the GPS. These are the Government's Climate Change Policy Package (CCPP) and the National Energy Efficiency and Conservation Strategy (NEECS).

The Government's Climate Change Policy Package

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	

The GPS makes it clear that the Government has an expectation that the EGO will operate in a way that will minimise greenhouse gas emissions. In addition, the GPS states that the EGO's rules or regulations will *"be consistent with government policies on climate change and energy efficiency"*.

However, focusing only on the EGO's response to the climate change policies could result in drawing incomplete conclusions. It is clear that other segments of the electricity sector will have an impact on the achievement of the Government's goals (i.e. the behaviour of users, energy management providers, and non EGO-related functions of electricity retailers). It will therefore be important to assess the effectiveness of the Government's climate change policies as they apply to the electricity sector as a whole.

In the CCPP the electricity sector falls within the category of 'General Energy Users'. The emissions from this category will be constrained through use of an emissions charge, initially capped at $25 per tonne of carbon dioxide equivalent. It is estimated that the full emissions charge would

increase the price of residential electricity by 9% and industrial prices by 16% (New Zealand Government, 2002).

Certain industries that are major users of electricity and whose competitiveness will be at risk from the introduction of an emissions charge will receive full or partial exemption from this charge. These firms will be required to address their emissions through Negotiated Greenhouse Agreements (NGAs).

NGAs are voluntary contractual agreements between the Government and the competitiveness-at-risk firm that achieve demonstrable reductions based on moving to international best practice in emissions management. If negotiations do not result in an agreement that reaches best practice within an acceptable timeframe, a partial charge may be negotiated. In addition, any competitiveness-at-risk firms that fail to negotiate a NGA would be treated as part of the general energy users category.

The policy package also provides for the option of reducing emissions by undertaking 'projects'. These encompass new technologies, practices, or enhancements of sinks. For a project to count in the pre-commitment period (until 2007) it must be something that would not have been considered without a price incentive (emission charge) and would not have occurred anyway (in the absence of climate change commitments). Projects can be economically enhanced via funds or emissions units, such as the two recently announced wind farm projects. This mechanism would also accommodate demand side projects.

The effectiveness of the CCPP can be assessed through four questions:

- Is the Government on track for implementation of the policy package (specifically the implementation of the carbon charge)?
- What are the verifiable reductions in carbon dioxide emissions directly related to electricity production and use that have occurred through the implementation of the NGA and 'project' mechanisms?
- Is the EGO anticipating or responding to the forthcoming changes in terms of changing rules to accommodate measures that reduce carbon emissions?
- Are the participants in the electricity industry anticipating or responding to the forthcoming changes in terms of proposing future investments that will reduce reliance on fossil fuels?

National Energy Efficiency and Conservation Strategy

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	

The NEECS is focused on improving overall energy efficiency and increasing the renewable energy supply. The electricity sector will play a significant role for both of these objectives.

The NEECS has two primary targets:

- At least a 20% improvement in economy-wide energy efficiency by 2012.
- An increase in the renewable energy supply to provide a further 25–55PJ of consumer energy by 2012 (the proposed target is 30PJ).

The NEECS also contains a specific action plan for the electricity sector. This plan aims to improve institutional arrangements and information streams within the electricity industry, so that whole system efficiency of electricity supply is improved.

The NEECS identifies a range of actions for the electricity sector, most of which are relevant to this assessment. These include the investigation of:

- greater demand side involvement in the market
- pricing aligned to more sustainable outcomes
- optimisation of network losses
- better metering agreements to facilitate optimal use of distributed generation
- providing lower cost energy services by optimising the grid to allow for dispersed and distributed generation, and demand side management
- using or developing tools to better measure whole system efficiency.

Conclusion

Both the CCPP and NEECS are directly relevant to the achievement of the environmental outcomes in the GPS. Any assessment of the sector must therefore take account of how the sector is responding to these programmes. The PCE could evaluate the sector's performance in terms of:

- Ensuring that the Government's climate change policies (including the carbon charge) are effective for the electricity sector by asking:
  - Are the Government policies on track for implementation?
  - What reductions have NGAs and 'projects' made in the sector?
  - Are electricity industry participants changing their behaviour in anticipation of the carbon charge?
- Assessing the contribution of the electricity sector to the achievement of the renewable energy target within the electricity sector.
- Monitoring progress on NEECS objectives, especially the development of an overall system efficiency measure.

3.4.4 The impact of the wider energy system on the environmental performance of the electricity sector

Environmental priorities relevant to this action	
1: Manage demand	**2:** Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

The electricity sector is part of the wider energy system and it is often difficult to clearly distinguish the boundary between the two. This is particularly true in the case of electricity sector efficiency improvements that incorporate approaches including the direct use of non-electricity energy options.

The environmental performance of the electricity sector can be affected by changes in other parts of the energy system in three general ways:

- Through the availability of non-electricity-based energy services for users. For example, the cost and availability of other energy sources for direct use and the influence of different technologies.
- Through the use, cost, and availability of different types of energy sources as fuels for electricity generation (e.g. gas and coal). These energy sources will have associated environmental characteristics and will have different conversion efficiencies.
- Through the use of electricity in those parts of the energy system that traditionally have used other sources of energy (e.g. transport).

Some key links between the electricity sector and the wider energy system include:

Residential: Uptake of solar water heating systems.
Development of energy efficient building designs.
Direct use of primary energy sources (e.g. gas, coal, wood, solar).

Commercial: Development of energy efficient building designs.
Direct use of non-electricity energy (e.g. gas boilers).

Industrial: Direct use of non electricity energy (e.g. gas boilers, co-generation, biomass).

Transport: Potential use of off-peak electricity to power hydrogen fuel cells.
Use of electricity in public transport systems.

Availability of gas

Gas has been a key fuel source for New Zealand's electricity system over the last 20 years. Its ability to contribute in the future will have major implications for the environmental performance of the electricity sector.

Depletion of the Maui gas field

A key issue for the electricity sector, and the wider energy system in New Zealand, is the decline of the Maui field. About 20% of New Zealand's electricity is currently produced from Maui gas. If nothing else changes, the winding-back of Maui gas supply in 2003 will leave a gap between electricity supply and demand. As electricity prices begin to rise, a number of possible scenarios may come into effect to fill the gap in gas supply:

- **New gas fields may come online** to provide fuel for (existing and/or future) gas-fired electricity generators.
- **Other thermal (coal/oil) generation may increase** to meet (existing and/or future) demand, with Huntly switching more to coal as the main effect.
- **Renewable generation may increase**.
- **Demand may reduce**. Increasing wholesale electricity prices may decrease demand through increased energy efficiency and energy conservation.

The most likely outcome will be a mix of all these scenarios, with different weightings having different environmental impacts.

Future gas contracts

The Maui gas contract has had a huge influence on the wholesale price of electricity. Industry practice for gas contracts between gas producers and their customers is to use long-term 'take-or-pay' agreements. These contracts have the customer pay for a fixed quantity of gas each year and agree to use the contracted quantity of gas in the current year or some defined future time. There is an incentive for the purchaser to use the gas now, or on-sell it rather than have the gas used at some future time.

The flexibility of take-or-pay contracts for gas available in the future will have a significant impact on its use and future role in electricity generation.

3.4.5 Government's energy policy framework

Environmental priorities relevant to this action	
1: Manage demand	**2:** Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

The ability of the EGO (and the broader electricity sector) to achieve the environmental goals set out in the GPS will be affected by the Government's broader energy policy and legislative framework.

In addition to the EGO, the CCPP, and the NEECS, New Zealand has other regulatory features that affect the environmental performance of the electricity sector.

New Zealand's electricity regulatory framework is based on a 'light-handed regulation' approach. This approach focuses on controlling those parts of the sector that have natural monopoly characteristics. These are the wire components of transmission and local distribution, and these parts have the greatest potential to abuse their dominant position.

The primary legislation controlling the electricity sector is the:

- Electricity Act 1992
- Commerce Act 1986
- State Owned Enterprises Act 1986 (as most of the generators and Transpower are State Owned Enterprises).

In addition to the legislation, the Government has also issued a number of energy and electricity related 'policy statements', including the Energy Policy Framework in October 2000. The GPS is the latest of these and was released in December 2000, with a revision being released in February 2001.

This legislative framework has a direct impact on the environmental performance of the sector. If the Commissioner decides it is necessary to undertake a 'clean sheet' assessment of the type discussed in section 2.2.4, then assessment of the effect of these pieces of legislation will also need to be undertaken.

3.4.6 Resource Management Act 1991

Environmental priorities relevant to this action	
	2: Promote renewables
3: Promote efficiency and security	
5: Minimise greenhouse gases	**6:** Manage impacts

The Resource Management Act 1991 (RMA) is the principal piece of legislation used to manage the local and regional environmental impacts arising from the electricity sector in New Zealand. Regional and local government administer the Act.

The RMA will, both in terms of its design and its implementation, have a direct impact on the electricity sector's ability to be more environmentally sustainable. With regards to generation, two significant aspects need to be considered:

- *The impact of the RMA on future investment in generation.* Is there an inherent bias in the system favouring non-renewables because it is easier to take account of 'local' environmental impacts over national (or even global) environmental concerns, such as climate change, when granting consents associated with generation capacity?[11]

[11] The Minister of Energy announced on 10 February 2003 that the Government would be amending the Resource Management Act 1991 to give greater weight to the national benefits of renewable energy and to give a clearer mandate to consider the effects of climate change.

- *The need of those administering the RMA to consider resource efficiency.* Does the RMA adequately address resource efficiency and its impact on the sustainability of the electricity sector, and if not, is the RMA the appropriate instrument or should other mechanisms be used?

The RMA also impacts indirectly on electricity demand through the rules used to approve buildings and the design of other facilities (e.g. swimming pools, street lighting).

3.4.7 Treaty of Waitangi

Environmental priorities relevant to this action	
1: Manage demand	**2:** Promote renewables
3: Promote efficiency and security	**4:** Consistency with CCPP and NEECS
5: Minimise greenhouse gases	**6:** Manage impacts

The long title of the Environment Act 1986 states (amongst other things) that it is an Act to:

> *ensure that, in the management of natural and physical resources, full and balanced account is taken of… the principles of the Treaty of Waitangi.*

Section 17 of the Act outlines the matters to which the Commissioner must, in the performance of his functions, give regard where he considers it appropriate. The matters that he is to give regard to include:

> *any land, water, sites, fishing grounds, or physical or cultural resources, or interests associated with such areas, which are part of the heritage of the tangata whenua and which contribute to their well-being.*

This indicates that any assessment by the Commissioner of the environmental performance of the electricity sector must take into account the concerns of the tangata whenua.

The most obvious concerns for Maori are related to the operation and development of electricity generation and transmission projects and how these impact on:

- rights of ownership and access, to energy-related natural resources (for example see Waitangi Tribunal, 1998: 41-80).
- the values associated with taonga, wahi tapu, and kaimoana.

However, there are other concerns of Maori that may also have an impact on the environmental sustainability of the electricity sector. These concerns relate to:

- access to electricity or alternative energy services (especially distributed generation for remote rural areas)

- access to energy efficiency and conservation measures (for low income households and health-related benefits).

4 Conceptual frameworks and methodologies

This chapter briefly discusses the conceptual framework that has been used to identify and develop the proposed qualitative and quantitative indicators that make up the core part of the first assessments.

In addition to discussion of the conceptual framework, this chapter also outlines the complementary investigations that are intended to supplement the core assessment process. These complementary investigations will be used to provide additional insights into the environmental performance of the sector.

Finally, this chapter discusses some issues surrounding the setting of targets and the obtaining of data for the core part of the assessments.

4.1 Conceptual frameworks for identifying and developing measures

4.1.1 Dimension–Measure–Target framework

Many electricity markets are regulated using a Performance Based Regulation (PBR) approach. PBR seeks to encourage economic efficiency and business conduct that furthers competition, addresses environmental impacts, and improves customer services (Biewald and Woolf, 1997). There is a range of PBR approaches. However, it is typical to employ a three-tier framework for describing (and assessing against) performance standards. Such a framework is as follows:

A **performance dimension** describes attributes or qualities that are regarded as important. In this case, they could be environmental dimensions against which performance could be assessed.

Performance measures seek to describe the performance dimensions in terms of quantifiable measures. In this context, they could be specific environmental outcomes that can be measured directly. A number of measures may be associated with each individual dimension. However, it may be extremely difficult to develop measures for some of the dimensions of interest.

Performance criteria and targets set standards (described in terms of the performance measures) that a regulated entity is expected to meet.

The advantages of the framework are that:

- it is well known to the electricity industry
- it has a track record in the regulation of the electricity sector internationally
- there is already a considerable body of empirical information that can assist implementation in New Zealand.

In addition, the inherent logic of the framework lends itself to an environmental performance context. It can be used to specify:

- environmental dimensions of interest
- the means for measuring the environmental performance of an entity, with respect to the dimensions of interest
- specific performance standards that are consistent with implementing the regulatory test contained in the legislation, or as a means of benchmarking against international best practice.

To adopt this framework for the Commissioner's assessment, it is necessary to:

- decide on the environmental dimensions to focus on
- develop performance measures (these need to be directly related to the selected dimensions)
- determine a set of targets for each measure that the EGO (or any other relevant institution) would be expected to achieve.

4.1.2 The Pressure–State–Response model

As indicated in section 2.2 of Part A, environmental sustainability is difficult to measure in an objective manner. Methodologies have been developed to understand the state of the environment, and how this environment is changing in a quantitative way over time.

The most common methodology for developing environmental performance indicators is the Pressure-State-Response (PSR) model pioneered by the Organisation for Economic Co-operation and Development (OECD, 1993). Like many other countries, New Zealand's environmental indicators programme administered by the Ministry for the Environment relies on this model.

In summary, the PSR model classifies the indicators into one of three types: pressure, state or response. The model assumes human activities exert pressure on both the quality and the quantity of natural resources. These pressures alter the state, or condition, of the environment, which in turn gives rise to human responses (behaviour aimed at reducing, preventing or mitigating undesirable environmental impacts). The responses in turn alter the pressures on the environment. For further discussion of the PSR model see appendix 3.

4.1.3 Combining the two models

Combining both models provides the Commissioner with a framework or matrix that assists in defining a comprehensive range of measures for the assessment. Table 4.1 summarises the scope of the proposed assessment matrix.

The performance dimensions are based on the three elements of sustainability that are contained within the definition of 'environment' in the Environment Act 1986. The sub-dimensions provided are indicative of the areas of potential interest. More can and will be added over time.

Table 4.1: Dimensions and sub-dimensions relevant to the measurements of the environmental performance of the electricity sector

Performance dimension		Performance measure			Performance target		
Dimension	**Sub-dimension**	***P***	***S***	***R***	***P***	***S***	***R***
Physical environment	Atmosphere						
	Air						
	Land						
	Waters						
	Biodiversity						
Economic	Materials utilisation: • non-renewable resources • renewable resources.						
	Energy efficiency: • use • transport/transmission • production.						
	Economic efficiency: • dynamic • allocative • productive.						
Social	Indirect economic impacts	*It is proposed that these indicators will not be directly included in the framework during the initial stages of the assessment. It will also be more appropriate to address some of these impacts in complementary investigations to explore contextual issues.*					
	Social conditions						
	Cultural conditions						
	Equity						
	Health and safety						
	Aesthetics						

P = Environmental Pressure Indicator S = Environmental State Indicator
R = Environmental Response Indicator

4.1.4 Comprehensiveness of the core indicators

In chapter 2 a series of environmental priorities were proposed. As a consequence of this prioritisation, certain cells in the matrix will initially receive greater focus than others. In particular, the environmental and economic/efficiency indicators are going to be of key importance in the initial assessment rounds. Examination of the 'pressures' on the environment will highlight the need for new or refined responses (including those of the EGO) to improve the environmental sustainability of the sector.

The 'response' indicators are of considerable importance. Response indicators will show the actions taken by the EGO and other institutions, to actively manage the electricity sector's environmental outcomes. It is these indicators that will allow judgements to be made on the performance of the various institutions.

Another reason why the proposed set of core indicators is not comprehensive across all the PSR categories is that there are currently no proposed 'state' indicators. State indicators are measures of the quality of the environment and the quantity of natural resources, and include the health effects on human populations and ecosystems caused by the deterioration of the environment.

For a 'state' indicator to be included in the assessment framework, it must meet two criteria:

- It must be able to be clearly linked to some activity or activities in the electricity sector.
- It must inform about [changes in] the environmental sustainability of the electricity sector.

It has been difficult to identify any state indicators that meet these two criteria. It should also be noted that the Ministry for the Environment has only identified pressure indicators for the energy sector. However, as the assessment framework evolves, if any indicators are identified that meet the criteria it is intended that these will be included in future assessments.

4.1.5 Non-quantitative assessments

Not all measures within the combined model are amenable to quantitative measurement. This is especially true for many of the response indicators, which are often related to the performance of institutions (primarily the EGO) assessed against stated policies (e.g. the environmental priorities). It will therefore be necessary to set qualitative expectations against which to assess the progress or the outcome of a response indicator.

4.2 Complementary investigations

The types of measures identified by the combined framework are not always suitable for the Commissioner to use to assess all aspects of concern in the electricity sector. There are two areas where alternative methodologies are proposed:

- Assessing the environmental performance of participants in the electricity sector by reviewing sustainability or environmental reports (see section 3.4.2).
- Contextual studies by focused investigations.

Focused investigations are assessments that use qualitative approaches to assess the contextual issues affecting the environmental performance of the electricity sector. Possible topics might include the impact of the Resource Management Act, concerns of the tangata whenua, and features relating to the broader energy sector.

The Commissioner has extensive experience of assessing environmental concerns using these types of focused studies. These focused investigations will use information from a range of sources, including discussions with affected individuals, groups or organisations. The approach to be used is discussed in chapter 5.[12]

4.3 Targets, trends and data

4.3.1 Defining targets for the electricity sector

The combined model implies that targets will be set, against which the performance of the various institutions will be assessed.

Targets are particularly important where the assessment is part of a regulatory process that requires a pass/fail decision on the performance of an institution. However, with the announcement by the Minister of Energy that the EGO will be established, the pass/fail decision is no longer required.

Targets have been defined for key response indicators. These indicators are focused on the processes or work undertaken by institutions to promote sustainability. Expectations for these institutions can clearly be defined in terms of objectives, desired outcomes, and timescales for achieving any changes.

Defining targets for the pressure indicators for the electricity sector (and more specifically for the EGO) is more problematic. This is for two reasons:

- For many of the proposed pressure indicators, it is difficult to establish a clear link between an institution (i.e. the EGO) and the contribution it makes to environmental pressures. There are many factors that could influence these outcomes, particularly those that deal with pressures on the physical environment.

[12] For more information on the Commissioner's procedures, see PCE (2003:10).

- There may be circumstances where it is more appropriate to use a (pan-sectoral) policy instrument, than to hold one institution (such as the EGO) solely accountable. For example, it may not be appropriate to hold just the EGO accountable for addressing greenhouse gas emissions, when these emissions should also be addressed as part of the Government's broader climate change policy or energy efficiency programmes.

This is not to say that specific targets for pressure (or state) indicators will not be defined in the future. It is envisaged that, over time, targets will be developed as the assessment framework continues to evolve.

Questions

Are there any suitable state indicators for assessment of the electricity sector, and how would these be applied?

Are there potential targets for the pressure indicators that are both meaningful and measurable?

4.3.2 Assessing trends

Instead of specifying a target in terms of an acceptable level of performance, it may be more useful to assess outcomes in terms of desired trends with particular reference to the Commissioner's environmental priorities. This approach would not, however, address the difficulties in determining which institution or institutions should be held responsible for responding to any undesired trends.

Assessing the performance of the electricity sector will require analysis of the long-term trends contained within the data rather than any single annual period. There are two reasons for using this longer-term approach:

- Moving towards environmental sustainability is a process of continuous improvement (see box in section 4.2.2 in Part A).
- There is considerable variability in the short-term performance of the electricity sector because of:
  - changes in the physical environment (e.g. dry years)
  - planned and unplanned technology outages.

Note: Decisions in response to short-term variations in the electricity sector can result in adverse outcomes with respect to its longer-term sustainability. This assessment process will therefore need to take account of the longer-term implications of such decisions.

4.3.3 Obtaining data

The current development and future evolution of the framework will be dependent on the availability of specific data sets. In chapter 5 an attempt has been made to identify key data sets in terms of their availability and likely source.

Not all the data required for the assessments is currently available. Some data is not collected because, even though an institution may have the responsibility or powers to do so, it is not being done because of other priorities and limited resources. In other cases, the raw data may already be collected, but for other reasons and is not in a form suitable for these assessments.

The Electricity Act 1992 does not provide the Commissioner with any specific powers to undertake any examination. The Act does state, in section 172ZQ, that the Commissioner may use, for this purpose, all the powers contained in the Environment Act 1986. The Environment Act 1986 (section 19) provides the Commissioner with specific powers to obtain information, including the power to examine under oath.

The Commissioner's standard policy has been not to invoke these powers, but to negotiate with the relevant parties involved in an investigation. This will be the preferred policy for this assessment process as well. Therefore, there will be ongoing discussions with the appropriate agencies (including the EGO when it is established) for the collection and provision of the key annual data sets.

5 Proposed assessment measures

This section summarises the proposed indicators for the core part of the assessment.

This section also outlines the proposed methodologies for undertaking complementary investigations.

5.1 Core indicators

The presentation of each of the following tables is based on the Dimension–Measure–Target framework discussed in chapter 4. Each table also links the proposed indicator to the most relevant key environmental priorities identified in chapter 3. The table then identifies which organisation is considered to be the primary source of information for that indicator.

Following on from the discussion in chapter 4, expectations have been set at two levels:

- **An aim/trend** identifies a desired outcome, or the direction of a movement towards this outcome. The Commissioner recognises that the transition towards a sustainable sector will take time as institutions adjust and therefore is concerned with trends over the longer term.
- **Targets** will be established (consistent with these aims and trends) when it is possible to ascertain a clear link with an institution. However, many of these are yet to be confirmed. Targets will be set in consultation with the sector, to ensure that they are both realistic and achievable.

Note: In the following tables, information/data for indicators that is not currently collected is highlighted with an asterisk (*).

Information that is collected, but not currently available in a form suitable for use as indicators in the annual assessment process, is highlighted with a (⊘).

Table 5.1: Dimensions: physical environment, efficiency and social

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Data source
Environmental sustainability Sustainable development 1, 2, 3, 4, 5, 6 (see table 2.3)	The Electricity Governance Organisation (EGO) will demonstrate that the concepts of environmental sustainability and sustainable development have been included in the regulations and modelling protocols	The EGO will have developed and implemented a detailed programme, with deadlines	To be achieved by the end of the first assessment period	EGO

Table 5.2: Dimension: Physical environment

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Data source
Climate change 2, 4, 5, 6	CO_2 [13] emissions from the electricity sector	Carbon neutral	To be defined	Available in the New Zealand Greenhouse Gas Inventory Report
	N_2O [14] emissions from the electricity sector	Long-term reduction in absolute terms	To be defined	Available in the New Zealand Greenhouse Gas Inventory Report
	CH_4 [15] emissions from the electricity sector	Long-term reduction in absolute terms	To be defined	Available in the New Zealand Greenhouse Gas Inventory Report

[13] Carbon dioxide: the main greenhouse gas produced by the energy sector
[14] N_2O: Nitrous oxide
[15] Methane: after CO_2 the next most important greenhouse gas emitted by the energy sector

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Data source
Climate change 2, 4, 5, 6	NMVOC[16] emissions from the electricity sector	Long-term reduction in absolute terms	To be defined	Available in the New Zealand Greenhouse Gas Inventory Report
	Assess the behaviour of market participants against climate change policies and objectives, specifically: • changes in the regulations • proposed new investment • changes in operating procedures of market participants	Ongoing robust assessment of regulations, investment decisions and market practice, with the objective of reducing climate change emissions	Each assessment period	EGO Note: The effect of the Government's climate change policies, including the proposed carbon charge, will be assessed against the behaviour of electricity sector participants.
	Proportion of electricity generated from renewable energy sources	Increasing as a percentage of total	To be confirmed	Ministry of Economic Development (MED) Energy Data File
	Percentage of proposed investment in renewable generation	Increasing	Continuing	EGO or MED
	Negotiated Greenhouse Agreements (NGA) and 'projects under the Kyoto Protocol Projects Mechanism' Verifiable reductions in CO_2 emissions directly related to electricity production and use (tonnes CO_2)	Increasing	Continuing	Climate Change Group *

[16] Non-methane volatile organic-compounds.

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Data source
Air 6	Resource Management Act 1991 (RMA) consent violations for all species of emissions to air by electricity sector companies. Primarily NOx[17] and SOx[18]	Zero	Zero	Local authorities ⊘
Water 6	All water-related RMA consent violations by electricity sector companies	Zero	Zero	Local authorities ⊘
Land 6	All land-related RMA consent violations by electricity sector companies	Zero	Zero	Local authorities ⊘
Bio-diversity 6	All biodiversity RMA consent violations by electricity sector companies	Zero	Zero	Local authorities ⊘

[17] NOx: usually refers to two species of oxides of nitrogen: nitric oxide (NO) and nitrogen dioxide (NO_2)
[18] SOx: Sulphur dioxide (SO_2) and Sulphur trioxide (SO_3)

Table 5.3: Dimension: Economic/Efficiency

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Resource efficiency 1, 3, 5	Avoidable spillage in the hydroelectricity system (GWh per year)	Zero	Zero	EGO and the Ministry for the Environment's (MFE) Environmental Performance Indicators (EPI) programme *
	Hydro spill—the EGO will be required to demonstrate that proposed regulations for hydro spill reporting are comprehensive / effective, effectively implemented, and enforceable	Ongoing review of regulations to ensure that hydro spill reporting is effective	To be confirmed each assessment period	EGO
	Hydro spill—the EGO will work with the Commissioner to investigate in depth the environmental and resource efficiency implications of specific spill events	As needed	To be confirmed each assessment period	EGO Note: The PCE will require access to additional information when investigating specifically identified spill events
Energy efficiency 1, 3, 4, 5	Electricity consumption per capita	Decreasing	Each assessment period	EECA
	Electricity consumption per GDP	Decreasing	Each assessment period	EECA

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy efficiency 1, 3, 4, 5	Average electricity consumption for the residential sector	Decreasing	Each assessment period	EECA
	Peak electricity demand per capita, by all sectors, and by: • residential • commercial • industrial • primary sectors	Decreasing	Each assessment period	EECA
	Overall energy efficiency improvement (all forms of energy) • residential • commercial • industrial • primary sectors	Increasing	Each assessment period	EECA Note: These measures are not specific to just electricity, but provide the necessary context in which to assess the demand measures identified above

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy efficiency 1, 3, 4, 5	Proportion of operating reserve supplied by the demand side	Increasing	Each assessment period	EGO *
	Ratio of primary energy to consumer energy by fuel type Sub-measures of losses by: • generation • transmission • distribution	Increasing	Each assessment period	MED Energy Data File
	National average efficiency of thermal electricity generation, including co-generation (MWh/PJ)	Increasing	Each assessment period	MfE indicators programme This has been identified as a 'stage 2' indicator by MfE Alternative source EGO ⊘
	Demand side in wholesale market—EGO will have completed an investigation of, and reported on, the practicalities of introducing a more active demand side into the wholesale market, including a timetable for implementation	To complete an investigation, which will result in the implementation of an active demand side in the market	To be achieved by the end of the first assessment period	EGO Note: EGO will need to demonstrate real progress in identifying the features necessary for the wholesale market to have a functioning demand side, and that progress to its implementation is occurring

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy efficiency 1, 2, 3, 4	Distributed generation— EGO will undertake an analysis of its regulations and procedures to identify any technical and operational barriers to the participation of new technologies (particularly dispersed and renewable technologies), and where these are identified, develop a programme to have them removed	The analysis will result in the removal of all barriers that prevent the introduction of these technologies	To be achieved by the end of the first assessment period	EGO
1, 2, 3, 4, 5	Access to process— EGO will have demonstrated that the process for making or changing regulations (which will affect the degree of competition) ensures that new and innovative supply and demand side options are being fairly treated[19]	Completed	To be achieved by the end of the first assessment period	EGO

[19] This requirement is similar to some of the key requirements of the Commerce Commission decision.

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy efficiency 2, 3, 4, 5	Access to infrastructure—the development of model use of system agreements for distribution and model approaches to distribution pricing as required by the GPS These models are to be assessed in terms of their impact on investment in distributed generation and new renewables	Completed	To be achieved by the end of the first assessment period	EGO Note: Technical standards and cost allocation methodologies (especially for transmission and distribution pricing regimes) should facilitate the uptake of distributed generation and new renewables

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy Efficiency 1, 3, 4, 5	Provide data to assess trends in availability and uptake of retail tariffs that reflect the wholesale price, based upon the time of use Proposed tariff measure—annual data on generic types of tariff. Types are: • flat rate • day/night • winter/summer • interruptible (by number of consumers and by total kWh sold)	Increased uptake of day/night, winter/summer, and interruptible rates	Each assessment period	EGO *
	The introduction of advanced metering technology (see glossary)	Increasing uptake		*
	The involvement of the retail sector in energy efficiency and conservation programmes i.e. investment in energy efficiency programmes by electricity retailers and distribution companies	Increasing expenditure	Each assessment period	Distribution and/or energy retailers *

Sub-dimension and priorities addressed	Indicator	Aim / trend	Target	Source for data
Energy Efficiency 1, 3, 4, 5	EECA will be assessed with respect to its progress in: • developing a whole system efficiency measure for the electricity sector • developing programmes that are targeted at promoting renewable electricity generation	Completed Demonstrated that programmes are effective against stated objectives	End of first assessment period Each assessment period	EECA

5.2 Complementary investigations

5.2.1 The environmental performance of participants in the electricity sector

Process

As discussed in section 3.4.2, it is proposed that each year there will be an assessment on a small sample of market participants' triple-bottom-line (TBL) or environmental reports. The Commissioner's purpose in assessing the electricity market participants' TBL or environmental reports is as a means of determining compliance or support for the sustainability and environmental considerations contained within the Government Policy Statement (GPS). This assessment process would also assess whether the participants have prepared these types of reports.

The process and key considerations to implement this proposal are discussed in appendix 2.

Undertaking these assessments will require the development of specific benchmarking criteria that are linked to the objectives contained in the Commissioner's environmental assessment framework.

It is proposed that these specific criteria will be developed during the second half of 2003, before the commencement of the first assessment round. This development process will include a round of stakeholder consultation.

Considerations during the development of a reporting assessment framework

Work undertaken so far has identified a number of key considerations or questions that will need to be addressed by the Commissioner during the development of the 'reporting assessment framework'. These considerations are summarised here to provide an opportunity for early feedback.

Development options: These options include (in order of increasing resource requirements):

- adopting and applying, without modification, one of several existing frameworks, for example the UNEP model
- modifying a framework already in existence
- developing a new framework based on disclosure examples from international best practice
- developing a framework with input from experts in the fields of electricity systems, energy management, ecological science, resource management and sustainable development.

Lack of independent verification: Relying on voluntary and unverified sources of environmental and energy performance information provided by organisations is of limited value as they may not be valid or reliable. The resources required to verify the claims made in the reports may be beyond the capability of the Commissioner.

Use of other sources of information: State of the environment monitoring, resource consents compliance monitoring by local authorities, and electricity regulatory disclosure undertaken by the Ministry of Economic Development (MED).

Motivating improved environmental reporting: One of the Commissioner's objectives for assessing or 'benchmarking' the reports is to motivate participants in the electricity sector to improve their performance. This can occur in three ways:

- By showing organisations that their environmental and energy reporting is improving or declining over time.
- By providing a basis for organisations to show their reporting is as good as their peers, both in New Zealand and in similar overseas organisations.
- By motivating organisations to stretch and improve their reporting to achieve higher levels against a normative target by setting the benchmark at a sufficiently high and exacting level (but not so high as to be unachievable).

Scope of the reporting assessment: The type of reporting/disclosure index to be constructed could be one that is confined to a narrow set of performance measures (such as those in the MED electricity disclosures). On the other hand, it could incorporate some type of broader framework.

Weighting of objectives: There are a number of key objectives contained in the Commissioner's overall assessment framework (e.g. improved efficiency, reduced environmental impacts, improved demand side participation, increased role for renewables); some of these may be of more importance than others.

Type of scoring criteria: What scoring criteria should be used to assess the reporting performance of each index item (i.e. absence/presence approaches versus qualitative 'graded' approaches)? See appendix 2 for more information on the UNEP/SustainAbility report scoring criteria.

Management of the assessment costs: There will be costs for both the Commissioner, in assessing the reports, and the participants in the electricity market in generating and publicly disclosing the information specified. An index that requires 'too much' in the way of resources from respondents may fail to motivate improvements in reporting and subsequent environmental performance.

Encompassing the different segments of the market: Generators, transmission and lines companies, and retailers have different profiles in terms of their environmental and energy impacts, and performance.

Peer review: How should the Commissioner proceed with peer reviewing the disclosure index and pilot testing it?

Questions

Would an annual assessment of selected market participants' sustainability or environmental reports be a useful exercise in the context of the broader assessment framework?

If such an assessment process is of use, how might the PCE proceed in developing a robust methodology to assess these reports?

5.2.2 Focused investigations

There is no pre-determined form for these focused investigations. Indeed their form and focus have been kept deliberately open so as to be able to specify them on a case-by-case basis. In this way, investigations are most likely to reveal additional insights into the relationships between environmental and sustainability outcomes in the electricity sector, its governing institutions, and the behaviour of its participants. Focused investigations could be based on:

- a specific component of the industry (e.g. generation, transmission/distribution, retail, demand/energy efficiency, or consumer)
- geographical location (e.g. catchment-based)
- an emerging technology or technologies
- future alternative energy paths
- a specific issue, conflict, or environmental effect.

The implementation of the focused investigation will be based on the Commissioner's investigation procedures. This process involves extensive interviews with all (or selected) parties both within and outside the electricity sector.

The outcome of the focused investigation will be a report that:

- describes the issues
- identifies key institutions and barriers
- analyses the barriers and their impact on and relationship to the achievement of an environmentally sustainable electricity sector.

The report may also:

- include recommendations to central or local government, the EGO, industry participants and any other relevant party that can address these barriers
- highlight any positive developments and promote positive models.

The PCE has already identified (through ongoing monitoring and discussions with participants in the sector) some key issues that could be examined using this framework. Potential topics and key issues for a focused investigation are listed in table 5.4.

Table 5.4: Potential topics for focused investigations

Topic	Possible key issues
Whole sector	
National strategic issues	Data availability, collection, accuracy, and management Modelling (demand, supply, climate change emissions and economic effects) Energy security
Demand side	
Electricity sector role in promoting energy efficiency	Focused study on the relationship between electricity industry and energy efficiency
Assessment of trends in demand side improvements	What has happened? What is happening? Any sign of take-off?
Sustainability of electricity use in the residential sector	Barriers and opportunities for encouraging the adoption of solar water heaters Housing trends in building and retrofitting for energy efficiency
Sustainability of electricity use in the primary production sector	Impacts of irrigation schemes for intensive land-use patterns on electricity demand
Supply side	
Waikato River system	Complex water systems, including adding water from other catchments, Lake Taupo related issues Competition for control of water resource between generators RMA—management of flooding and recreational values Tangata whenua (multiple iwi) issues

Topic	Possible key issues
Supply side cont.	
Project Aqua	First major hydro under the RMA: including use of requiring authority powers by a generator Taking water from the riverbed and irrigation in-stream values The impact on iwi values
Hydro project on the West Coast	Hydro in a conservation area. An indication of a number of potential future projects
Impact of generation scale on environmental effects	Comparison of the effects of single large generation technologies with the impacts of multiple small scale generation technologies
The future role of hydrogen in the electricity sector	Is it desirable, and, from an environmentally sustainable point of view, is it feasible? Possibly using SWOT analysis [20] The question of where the energy will come from (renewable or non-renewable)?
The future of natural gas as an input into the electricity sector	Is it there? Transition to other sources Impact of take or pay contracts
Assessment of the recent amendments to the RMA for renewables	Future assessment of the recently proposed changes to promote renewables
Planning for wind farms	Dealing with noise and visual amenity impacts
Whanganui River	Iwi issues
Sustainable use of geothermal resources	Wairakei/Oaahu/Broadlands/Tauhara system
The future of remote area supply	Environmental, social and economic impacts on users in remote areas. Reference to rural Maori

Questions

Are there any other environmentally significant topics you would like to add to this list?

Which topics do you think are most important (in terms of promoting environmental sustainability) for the PCE to investigate over the next few years?

[20] Method of analysis based on assessing the strengths, weaknesses, opportunities and threats of an issue.

6 Process for the assessments

This chapter explains the proposed process for applying the Commissioner's environmental assessment framework.

6.1 Assessment process

As discussed in Part A, there are a number of steps that need to be followed when an assessment is undertaken. The major steps for the Commissioner's assessments are illustrated in figure 6.1 (although there will be some overlap in the timing between these steps).

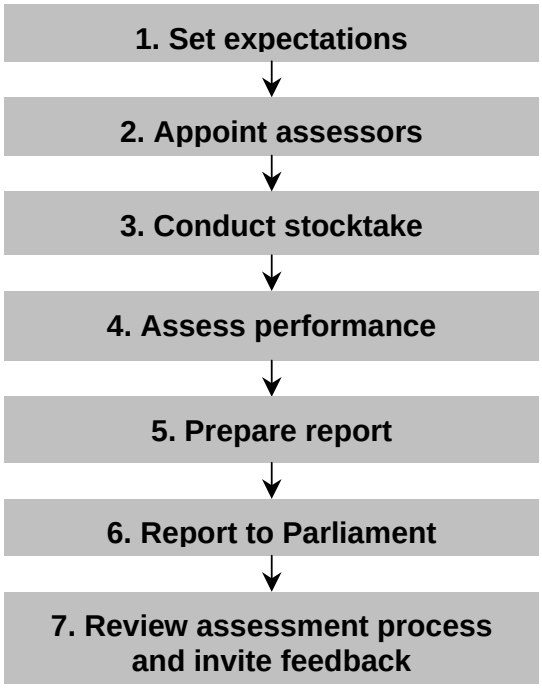


Figure 6.1: Key steps in the assessment process

Step 1: Set expectations

1A: Propose expectations

Prior to each assessment period, the Commissioner will propose a set of expectations for the upcoming assessment round. These expectations will be based on the priorities and criteria established in the assessment framework. All participants in the electricity sector will be entitled to comment on what expectations should be set (see step 7).

The proposed expectations will identify:

- specific role(s) that each agency in the sector is expected to play
- data provisions, or access to data, to assist in the assessment process
- measures that will be used to assess the performance of each agency
- targets (where applicable) that agencies are expected to meet.

The proposed expectations will also identify:

- the topic for a focused investigation (where applicable)
- which market participants will have their environmental/sustainability reporting assessed.

1B: Discuss expectations

The Commissioner will discuss the proposed expectations with the agencies that have been identified. These agencies will have the opportunity to provide feedback on the proposed measures and targets.

The Commissioner will then prepare a written response to any submissions. This will outline any amendments to the proposed expectations, and/or the rationale for not making any suggested changes.

1C: Finalise expectations

Before the beginning of the assessment period, the Commissioner will publish a finalised set of expectations. These will include:

- measures and targets for the Electricity Governance Organisation (EGO)
- measures and targets for other relevant agencies in the electricity sector
- the names of electricity companies that will have their environmental or sustainability reporting assessed
- the data or information that will be required from various government agencies (e.g. Ministry of Economic Development (MED), Ministry for the Environment (MfE), Energy Efficiency and Conservation Authority (EECA), and the Climate Change Group (CC Group)).

Each year's expectations may also include:

- the terms of reference for any focused investigation that the Commissioner decides to undertake during the upcoming year.

Step 2: Appoint assessors

The Commissioner will undertake a formal process for appointing assessors to assist in the assessment. This process will be timed in such a way that the assessors can contribute to the progress stocktake (see step 3).

The appointment process will involve the following steps:

1. define and agree on selection criteria (including draft contract terms)
2. advertise, or contact target groups
3. assess responses against criteria
4. choose shortlist
5. interview potential candidates
6. follow up references and select candidate
7. agree on contract terms.

Step 3: Conduct stocktake

A progress stocktake will need to be undertaken each year (primarily focused on the EGO's performance), based on the expectations for the current assessment period.

The main objective of the progress stocktake is to provide a timely input into the development of expectations for the following year. It would be too late to wait for the full assessment to be completed to provide an input into the following year.

In addition, the stocktake will provide the EGO and other agencies with timely feedback on their progress. This should help avoid any end of year surprises.

Step 4: Assess performance

The final performance assessment will consist of:

- focused investigations—throughout the year
- sustainability reporting—as reports become available
- EGO, retail sector, NEECS and Climate Change—as soon as possible after completion of the EGO's reporting period.

The assessment will determine the performance of the EGO and other identified agencies in terms of that year's expectations.

Step 5: Prepare report

The findings of the assessments will be incorporated into a report. Before it is finalised for presentation to Parliament those agencies directly affected by the assessment will have an opportunity to preview and comment on the draft of the report.

Step 6: Report to Parliament

Upon completion, the report will be tabled in Parliament and distributed to any interested parties.

Step 7: Review assessment process and invite feedback

The Commissioner invites ongoing feedback on the assessments from participants in the electricity sector. In particular, interested parties may wish to comment on proposed expectations (for the next available assessment round) after a report is tabled in Parliament.[21] In addition, the assessment framework will be formally reviewed on a 3–5 year cycle. All participants will be given the opportunity to comment on any potential changes during this process.

[21] Because of scheduling (see section 6.2), these expectations will be related to an assessment *two* rounds in advance, i.e. the next assessment will already be in progress with established expectations.

6.2 Timetable for assessments

The timetable for the Commissioner's assessment will be linked to the EGO's reporting timeframe. At this stage it is assumed that the EGO will report at the default time set by the legislation (i.e. 30 June). Based on the timetable released by the Minister of Energy on 20 May 2003, the 'Electricity Commission', as the EGO, will not come into operation until February 2004. This means that it is highly likely that the first full reporting period will not be until June 2005. However, the EGO may decide to provide a part year report in June 2004. The indicative timetable below is based on a reporting period for a year ending 30 June.

		First round	Second round
Year 1	April	1A: Propose expectations	
	May	1B: Discuss expectations	
	June	1C: Finalise expectations 2: Begin appointing assessors 4: Begin processes for assessing environmental reporting	
	July	2: Appoint assessors	
	August		
	September		
	October		
	November		
	December		
	January		
	February		
	March		3: Conduct stocktake
Year 2	April		1A: Propose expectations
	May		1B: Discuss expectations
	June		1C: Finalise expectations
	July		*Continue processes of first assessment round…*
	August		
	September	4: Complete collection of data from EGO, retail sector, EECA CC Group etc. 5: Begin preparing report	
	October	5: Produce draft report	
	November	4-5: Hear submissions from targeted agencies on draft	
	December	4: Finalise assessment	
	January	5: Finalise report	
	February	6: Report to Parliament	
	March	7: Receive feedback on expectations for round 3.	

Figure 6.2: Proposed timetable for the core assessment process

As this timeline illustrates, the core assessment timetable is complicated by the fact that one complete assessment round will take 23 months. This means that (except for the beginning of the first assessment) there will always be work underway on two consecutive assessment rounds.

Running in parallel to the core assessment will be the focused investigations. It is intended that these will operate on an annual cycle. However, in practice it is expected that the actual timing will be subject to the requirements of the core assessment process.

6.3 Data issues

6.3.1 Data requirements

Data for the assessment will be required from a number of sources using the provisions of the Environment Act 1986. These source were first identified in chapter 5, and are summarised below.

Data requirements/sources

Ministry for the Environment
Energy environmental performance indicators (EPI) measures
Primary energy supply
Consumer energy use
Consumer use versus primary supply
Commercial sector energy use
Household energy use
Industrial sector energy use
Non-renewable primary energy
Thermal generation efficiency
Avoidable hydro spillage

Ministry of Economic Development
Electricity retail tariff structures (rates and conditions)
Energy delivery efficiency performance measures
System statistics

Energy Efficiency and Conservation Authority
Electricity consumption per capita Electricity consumption per GDP Average electricity consumption of all sectors and by: • residential • commercial • industrial • primary sectors Peak electricity demand per capita, by all sectors and by: • residential • commercial • industrial • primary sectors Overall energy efficiency improvement (all forms of energy) • residential • commercial • industrial • primary sectors Whole system efficiency measure for the electricity sector

Electricity Governance Organisation
Promotion of meters
Energy efficiency and demand side management activity by retail and distribution companies
Rules, processes and status related to promotion of: • demand side participation • distributed generation participation • new renewables participation • hydro spill minimisation • improving resource efficiency
Resource utilisation data
Specific hydro spill data, including information on any related activities such as: • maintenance • bidding • price
Demand side activity wholesale market data

Regional councils
Consents violations (air and water)
Emissions from generators
Resource utilisation (e.g. geothermal)

6.3.2 Data protocols

In some cases, the data required by the Commissioner and the assessors working on the Commissioner's behalf may be considered to be commercially sensitive. This could be particularly true of the additional data required to analyse the financial circumstances that relate to a specific hydro spill event.

During the expectation setting process, the Commissioner will discuss with the EGO and other relevant agencies the:

- type and form of data provided
- use of the data (the purpose for which it is provided)
- storage of data (including the keeping of data after the assessment period).

Prior to this stage, the Commissioner will develop template confidentiality agreements between the Commissioner and the:

- appointed assessors
- EGO and other relevant agencies.

It is proposed that these confidentiality agreements will be based on principles that are similar to those used by Statistics New Zealand. These principles are that:

- information collected is only to be used for the purposes of the assessment of the environmental performance of the electricity sector
- information collected is to be kept secure to prevent unauthorised access
- identifiable information is not to be published or otherwise disclosed.

There may be some exceptions to these principles but these would be limited to where:

- the agency or organisation concerned approves, in writing, the disclosure of the information
- the information is publicly available elsewhere.

6.4 Relationships with other agencies

6.4.1 Relationship with the Office of the Auditor General

As noted in Part A, chapter 1, the Electricity Act 1992 requires the Office of the Auditor General (OAG) to undertake an assurance audit of the EGO's annual report. The focus of this audit will be to determine:

- the appropriateness, adequacy, and accuracy of the information
- whether the report contains the information necessary to enable an informed assessment of the performance of the EGO against the objectives and outcomes contained in the Government Policy Statement (GPS).

There is the potential for areas of overlap between the OAG's assurance audit and the Commissioner's environmental performance assessment. To maximise the effectiveness of both work streams, the Commissioner will seek to work with OAG to:

- ensure that, subject to confidentiality agreements, information common to the Commissioner's assessment and the OAG's audit is shared
- minimise disruption to the operation of the EGO and other agencies in the sector
- coordinate reporting to Parliament.

6.4.2 Other agencies

The Commissioner will need to maintain contact with a number of agencies in the sector, including those that will provide information and those that will have their performance assessed.

When dealing with these agencies, the Commissioner will pursue a 'no surprises' policy. This will be facilitated by:

- applying a transparent assessment framework with clear expectations
- making use of annual stocktakes to provide timely information on progress
- engaging in ongoing dialogue with all agencies in the sector to ensure that they are clearly aware of their roles and responsibilities to promote environmental sustainability.

7 How you can provide feedback

We need your feedback

What is your role?

This framework is a work in progress. The Commissioner welcomes your feedback, which will help ensure that the framework for the assessments is as robust as possible. This feedback will assist us in our objective of certifying that energy services from electricity in New Zealand are provided in an environmentally sustainable manner.

Key questions we would appreciate your feedback on

While developing the assessment framework, the following key questions have been identified:

1. Do our environmental priorities provide a sound basis for assessing the performance of the electricity sector, and have we correctly defined and ranked these priorities?
2. Are the proposed assessment methodologies appropriate for both the core assessment and the complementary investigations?
3. Are there any other readily available indicators that would be useful?
4. Are there any suitable state indicators for assessment of the electricity sector and how would these be applied?
5. Are there any other targets that we could or should define at this time?
6. Would an annual assessment of a selection of market participants' sustainability or environmental reports be a useful exercise in the context of the broader assessment framework?
7. If such an assessment process is of use, how might the Parliamentary Commissioner for the Environment (PCE) proceed in developing a robust methodology to assess these reports?
8. Would you like to suggest any other potential topics for focused investigations?
9. Which topics suggested for the focused investigation do you think are most important (in terms of promoting environmental sustainability) for the PCE to investigate over the next few years?
10. Are there any further changes required in the framework to account for the newly proposed 'Electricity Commission'?
11. Are there any other sources of data that could assist the PCE in developing the indicators we have identified?

Although we would like to receive feedback on these questions, you are also very welcome to make any additional comments on the proposed framework and any other aspects of this document.

How to make a submission

Your comments can be e-mailed and/or posted to us and should be marked 'Electricity Energy and the Environment'. To ensure we can consider your comments for the final framework, we need to receive all responses no later than **30 September 2003**.

E-mail electricity@pce.govt.nz

Post Electricity Energy and the Environment
Parliamentary Commissioner for the Environment
PO Box 10-241
Wellington

We usually identify the names of respondents in a summary of submissions. If you do not wish to have your identity revealed (or if you want some specific comments to remain confidential) please let us know.

After all submissions have been considered, a final framework will be developed and released before the end of 2003. It will also be available on the Commissioner's website: www.pce.govt.nz.

Appendix 1: Reason Codes for Hydro spill

The electricity industry has developed the following codes to categorise reasons for hydro spill.

Code	Description
Plant	Hydro spill was due to a plant malfunction including plant owned by a third party, or from plant testing, or from planned or unplanned outages.
Obstructions	Hydro spill was due to physical obstructions preventing normal operation of generating plant (such obstructions include weed, logs, silt, public obstruction, etc).
High inflow	Hydro spill was due to high inflow events. This code applies when the flows exceed the ability of the generation scheme to generate at that level. This code only applies when the operator has no discretion over avoiding the release.
Regulatory	Hydro spill was due to regulatory obligations. It includes statutes, resource consents, use permits, bylaws, etc. This code only applies when the operator has no discretion over avoiding the release.
Contractual	Hydro spill was due to contractual obligations. This code only applies when the operator has no discretion over avoiding the release.
Recreational	Hydro spill was for recreational use. That is where recreational, social or cultural interests have negotiated hydraulic profiles, and hydro release has occurred as a result.
Cost	Hydro spill was due to the cost of generation exceeding the spot price.
Economic	Hydro spill was for other commercial reasons such as price support in the market.
Transmission constraint	Hydro spill was due to transmission or distribution constraints.
Hydraulic constraint	Hydro spill was due to capacity differences within some hydraulically coupled schemes, requiring additional water bypass to maintain output.
Other	Hydro spill was due to any other reason. When this code is used, an appropriate description and explanation must also be included.

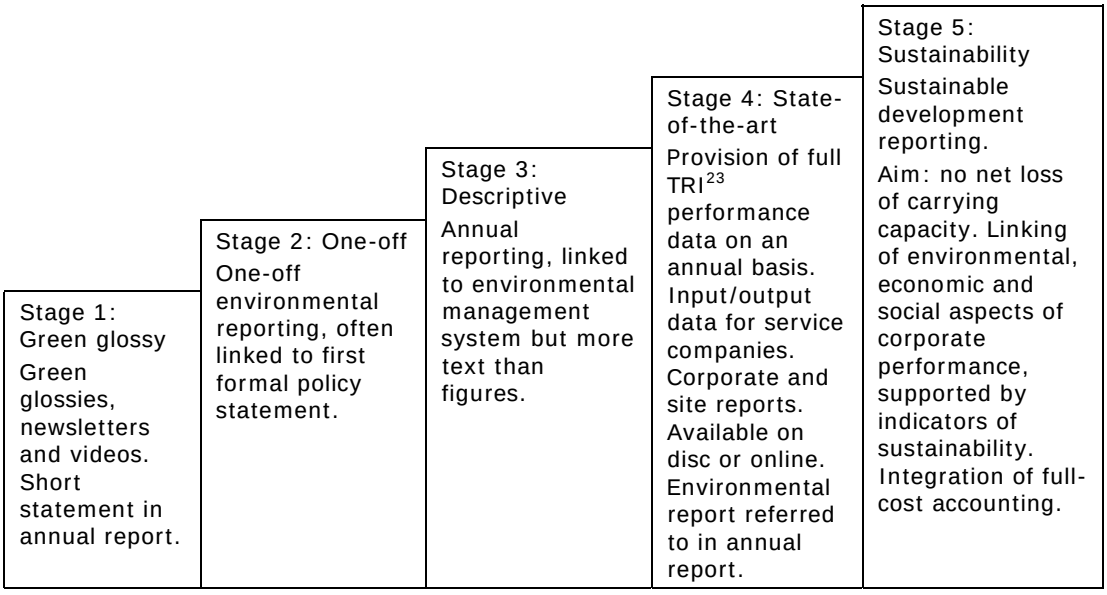
Source: Coad (2002)

Appendix 2: Benchmarking sustainability and environmental reporting

There are number of initiatives that are designed to provide assistance to organisations wishing to undertake more comprehensive environmental or sustainability reporting by providing guidance, technical protocols or standards.[22] In New Zealand the New Zealand Business Council for Sustainable Development (NZBCSD) has sponsored work that promotes sustainability reporting.

As can be expected, there is considerable variability in the quality of sustainability reporting undertaken by different organisations. The United Nations Environment Programme (UNEP) in conjunction with SustainAbility has devised a scheme for categorising the quality of these reports into five self-descriptive categories:

Table 1: Five-stage model of environmental reporting



Source: Bebbington & Gray (2000)

Work undertaken in New Zealand by Milne *et al.* (2003) already indicates that there is considerable variation in the quality of the sustainable reporting amongst eight early corporate reporters, including two electricity generators.

[22] For example: see the Global Reporting Initiative www.globalreporting.org; UNEP/SustainAbility Engaging Stakeholders series www.sustainability.com/home.asp; and AccountAbility: Institute of Social and Ethical Accountability www.accountability.org.uk/default.asp

[23] Toxic release inventory.

The benchmark criteria used by UNEP/SustainAbility are designed to apply to all types of companies and across social, economic and environmental dimensions (UNEP/SustainAbility 1996). Table 2 presents the version of the criteria used by Milne *et al*. (2003).

Table 2: UNEP/SustainAbility 'Engaging Stakeholders' Survey Instrument 1996 revised version

1 Management policies and systems
1. Top Management Statement
2. Environmental Policy
3. Environmental Management System
4. Responsibility and Accountability
5. Environmental Auditing
6. Goals and Targets
7. Legal Compliance
8. Research and Development
9. Awards*
10. Verification
11. Reporting Policy
12. Corporate Context
2 Input/Output inventory
Inputs
13. Material Use
14. Energy Consumption
15. Water Consumption
16. Clean Technology
17. Health and Safety
18. Accidents and Emergency Response
19. Risk Management and Environmental Impact Assessments
20. Land Contamination and Remediation
21. Stewardship of Ecosystems
Outputs
22. Waste Minimisation
23. Air Emissions
24. Water Effluents
25. Noise and Odours
26. Transportation
Products
27. Life-Cycle Design and Assessment
28. Environmental Impacts
29. Product Stewardship
30. Packaging

3	**Finance**
31. Environmental Spending	
32. Environmental Liabilities	
33. Market Solutions and Instruments	
34. Environmental Cost Accounting	
35. Charitable Contributions*	
4	**Stakeholder relations and partnerships**
36. Employees	
37. Legislators and Regulators	
38. Local Communities	
39. Investors	
40. Suppliers and Contractors	
41. Customers and Consumers	
42. Industry Associations	
43. Environment Groups	
44. Science and Education	
45. Media	
46. Mana Whenua†	
5	**Sustainable development**
47. Technology Cooperation	
48. Global Environment	
49. Global Operating Standards	
50. Visions, Scenarios, Future Trends	
All items are scored from 0–4, except those marked with *, which are scored 0 or 1. † To acknowledge Maori culture within New Zealand's context, we added an extra item, labelled 'Mana Whenua', to the section 'Stakeholder Relations and Partnerships'. This item carried a maximum score of 4, equivalent to the other stakeholder groups. To balance this addition and keep the total possible score at 194, the item 'Global Development Issues' was omitted from the fifth section 'Sustainable Development' as this was considered covered by the item 'Global Operating Standards'.	

Source: Milne *et al.* (2003)

The UNEP/SustainAbility report scoring criteria are presented in table 3.

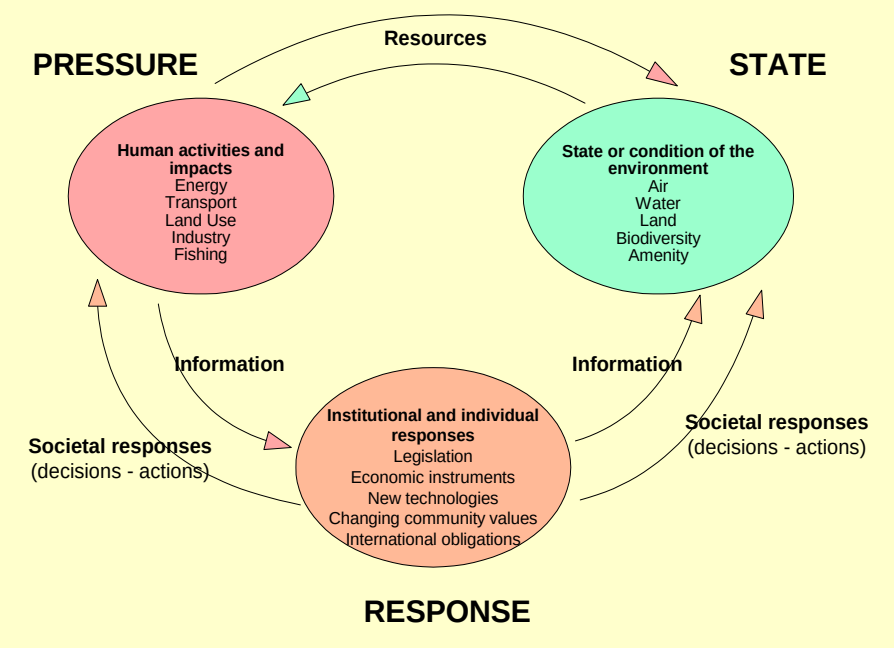
Table 3: UNEP/SustainAbility Report Scoring Criteria

0	1	2	3	4
No coverage	Minimum coverage, little detail	Detailed and honest, including company short-comings and commitments	Commitment to and progress towards sustainable development in core business	Commitment to and progress towards 'triple bottom line' of sustainable development in core business plus benchmarking against competition and/or best practice in other sectors

Source: UNEP/SustainAbility (1996)

Appendix 3: Pressure–State–Response environmental indicator framework

The model comprises three indicator types that are related to one another in a causal framework identified in figure 1 below.[24]



Source: Adapted from Ministry for the Environment (1996)

Figure 1: The Pressure–State–Response characterisation of environmental indicators

The Ministry for the Environment has developed environmental performance indicators in the areas of air, marine, climate change, ozone, land, waste, freshwater, amenity, transport, pests, weeds, diseases, energy, biodiversity, Maori, and contaminated sites.[25]

The Pressure–State–Response (PSR) framework is attractive for a number of reasons.

[24] From www.environment.govt.nz

[25] The indicators for the energy sector relevant to this assessment are: primary energy supply, consumer energy use, consumer use versus primary supply, commercial sector energy use, household energy use, industrial sector energy use, non-renewable primary energy, thermal generation efficiency, avoidable hydro spillage.

First, it is already being implemented in New Zealand in an energy and environment context. As such, there is an opportunity to use both the prior thinking that has been done in this area (with respect to the selection of the indicators) and the data sets that have already been generated and will continue to be generated in the future.

Second, it facilitates the drawing of causal linkages between the state of the environment and the performance of the various institutions in the electricity sector that can influence environmental outcomes (see chapter 3). This becomes particularly important for setting appropriate environmental performance standards or targets for those institutions that have an impact on environmental sustainability of the electricity sector, i.e. the Electricity Governance Organisation.

Definition of the PSR categories

Pressures

This category relates to the pressures that human activities exert on the environment, including natural resources. These indicators also cover the underlying or indirect pressures, which are the driving forces for environmental issues (i.e. the activity itself and trends of environmental significance), as well as proximate or direct pressures (i.e. the use of resources and the discharge of pollutants and waste materials).

Pressure indicators are closely related to production and consumption patterns. They are important in that they can be used to show progress in decoupling economic activities from linked environmental pressures. They can also be used to show progress in meeting national objectives and international commitments (e.g. emission reduction targets).

State

These indicators measure environmental conditions or the quality of the environment. They also include related effects or impacts, including the quality and quantity of natural resources. They cover ecosystems and natural environment conditions as well as quality of life and human health aspects.

Examples of state indicators are: concentration of pollutants in environmental media, any exceeding of critical loads (limits), population exposure to certain levels of pollution or degraded environmental quality, the status of wildlife and of natural resource stocks. In practice, measuring environmental conditions can be difficult or very costly. Therefore, environmental pressures are instead often measured as a substitute.

Response

These indicators demonstrate the extent to which society responds to environmental concerns through environmental, economic and sectoral policies and through changes in awareness and behaviour. They refer to individual and collective actions and reactions that are intended to:

- mitigate, adapt to, or prevent human-induced negative effects on the environment
- halt or reverse environmental damage that has already happened
- preserve and conserve nature and natural resources.

Examples of these indicators are expenditure on environmental measures such as:

- environment-related taxes and subsidies
- price structures
- market shares of environmentally-friendly goods and services
- pollution abatement rates
- waste recycling rates.

In practice, these indicators mostly relate to abatement and control measures. Those showing preventive and integrative measures and actions are more difficult to obtain (OECD, 2001).

Criteria for selecting environmental indicators

The general criteria used by the Organisation for Economic Co-operation and Development (OECD) for selecting relevant indicators are: policy relevance and utility for users, analytical soundness, and measurability.

Policy relevance

An environmental indicator should:

- provide a representative picture of environmental conditions, pressures on the environment, or society's responses
- be simple, easy to interpret and able to show trends over time
- be responsive to changes in the environment and related human activities
- provide a basis for international comparisons
- be either national in scope or applicable to regional environmental issues of national significance
- have a threshold or reference value against which to compare it, so that users can assess the significance of the values associated with it.

Analytical soundness

An environmental indicator should:

- be theoretically well-founded in technical and scientific terms
- be based on international standards and international consensus about its validity
- lend itself to being linked to economic models, forecasting and information systems.

Measurability

The data required to support the indicator should be:

- readily available or made available at a reasonable cost/benefit ratio
- adequately documented and of known quality
- updated at regular intervals in accordance with reliable procedures.

Note: These criteria describe the 'ideal' indicator; not all of them will be met in practice (OECD, 2001).

Glossary and acronyms

Advanced metering technology: Devices for recording or communicating the costs and use of electricity during specific time frames (such as minutes, hours, days or weeks). They can promote better load management by enabling users to alter their demand for electricity in response to changing prices. These prices may vary according to the time of day, during on-peak and off-peak periods of demand, and whether or not the supply of electricity is interruptible. They also provide opportunities for additional customer services, innovative rate structures, and automated meter readings, as well as for recording key indicators of availability and quality of electricity supply.

Bioenergy: Energy derived from the use of biomass. Bioenergy technologies can generate electricity by burning biomass in its solid form or by converting it to gas (biogas) and burning the gas.

Biological diversity (biodiversity): The variety of all life forms. It includes the different plants, animals and micro-organisms, the genes they contain and the ecosystems of which they are a part.

Biomass: Any organic matter that is available on a renewable or recurring basis (excluding old-growth timber), including: dedicated energy crops and trees; agricultural food and feed crop residues; wood and wood wastes and residues; aquatic plants; grasses; residues; fibres; and animal wastes, municipal wastes, and other 'waste' materials.

CCPP: Government's Climate Change Policy Package

Cogeneration: The simultaneous generation of electricity and usable heat for industrial processes, or the use of 'waste' heat from electricity generation in an industrial process.

Demand side management: Methods used to manage electricity demand including energy efficiency, load management, and fuel substitution.

Demand management service providers: Individuals or organisations that assist electricity retailers and customers to reduce their electricity demand both in the short (interruptible load) and long term. Potential services include: the introduction of new energy efficient technologies, the development and management of financial management tools, and changing individual or institutional behaviours.

Demand side participation: The process whereby electricity retailers or users operating in the market can alter their demand for electricity according to varying prices.

Demand side: Of the electricity sector, refers to those who buy electricity and/or offer to alter their demand for electricity (according to price) in the wholesale market.

Distribution: The transport of electricity through a local network via low voltage power lines. Distribution networks connect users with the national grid. There are approximately 30 different distribution companies currently operating in New Zealand.

Economic efficiency: Economics defines three types of efficiency:

- *Allocative efficiency:* An economy is said to be allocatively efficient when it is not possible to improve total welfare further by re-allocating productive resources, i.e. any further reallocation will make someone worse off.
- *Dynamic efficiency:* Results from the socially optimal introduction of new goods and services over time.
- *Productive or technical efficiency:* A firm is productively efficient if it produces a level of output at the lowest possible average total cost.

EECA: Energy Efficiency and Conservation Authority.

EGO: Electricity Governance Organisation.

Electricity industry: The part of the electricity sector that undertakes to generate electricity, transport it through the national grid and local distribution networks, and sell it to users.

Electricity sector: Consists of people or organisations who use the energy services provided from electricity, providers of electrical equipment and infrastructure (such as buildings) that use electricity, demand management service providers, the electricity industry and the wholesale electricity market (including any secondary financial markets).

Embedded generation: Electricity generated by a plant that is connected to a distribution network instead of to the transmission grid.

Energy: The capacity to do work.

Energy efficiency: Any change in energy use that results in an increase in net benefits per unit of energy.

Energy management service providers: Individuals or organisations who assist users to use energy (including electricity) efficiently.

Energy services: Services such as heating and cooling, motive power and lighting that individuals and organisations can obtain through the provision of energy.

Environment: As defined in the Environment Act 1986, it includes:

1. Ecosystems and their constituent parts (including people and communities); and
2. All natural and physical resources; and
3. Those physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes; and
4. The social, economic, aesthetic, and cultural conditions that affect, or are affected by, the matters stated in points (1) to (3) of this definition.

Environmental performance: Progress made by an organisation (or a group of organisations) in meeting the criteria of environmental sustainability that can be objectively verified through indicators and measures.

Environmental sustainability: In the context of this framework, there are four specific criteria for environmental sustainability (OECD, 2001):

- *Regeneration:* Using renewable resources efficiently and not permitting their use to exceed their long-term rates of natural regeneration.
- *Substitutability:* Using non-renewable resources efficiently and limiting their use to levels that can be offset by substitution of renewable resources or other forms of capital.
- *Assimilation:* Ensuring that releases of hazardous or polluting substances to the environment do not exceed the environment's assimilative capacity.
- *Avoiding irreversibility:* Avoiding irreversible impacts of human activities on ecosystems.

Fuel substitution: Using different energy sources or fuels to achieve the same energy services.

Generators: Organisations or individuals that generate electricity. They include remote generators (who generate electricity in one area for use in another area); distributed generators (who generate electricity for use within a local network); and on-site generators (who generate electricity on a user's premises).

GPS: Government Policy Statement. It describes the Government's guiding principles and objectives for the electricity industry.

Hapu: Family or district groups, communities.

HVDC: High Voltage Direct Current (transmission between the North and South Islands of New Zealand is via an HVDC line).

Hydro spill: The spillage of water that could potentially have been used for the purposes of electricity production but was released for other reasons.

Institution: Any set of rules and practices (either formal or informal) embodied in an organisation, regulation, policy, programme or convention constructed by society.

Interruptible load: Systems that, in accordance with contractual arrangements, can permit a supplier to interrupt a consumer's supply of electricity at times of peak load.

Iwi: Tribal groups

Kaimoana: Food from the sea, shellfish.

Kaitiaki: Iwi, hapu or whanau group with the responsibilities of kaitiakitanga.

Kaitiakitanga: the responsibilities passed down from the ancestors, for tangata whenua to take care of the places, natural resources and other taonga in their rohe (geographical territory of an iwi or hapu), and the mauri of those places, resources and taonga.

kV: kilovolts

Lines businesses: Organisations involved in the distribution of electricity.

Load: The amount of electric power delivered or required at any specific point or points on an electric system.

Load management: Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times. This may be with reference to peak hours, peak days or peak seasons.

Load shifting: A demand response that involves users changing their behaviour to shift part or all of their demand from a peak period of a system (or a period of constrained supply) to some other period. This provides a key source of flexibility in an electricity system.

MACQS: (Multilateral Agreement on Common Quality Standards)—the agreement that deals with the security and quality of the electricity transported across the national grid.

MARIA: (Metering and Reconciliation Information Agreement)—outlines the rules that allow a retail buyer and seller to form a bilateral contract for the supply of electricity. This is achieved through a system that reconciles different quantities of electricity at different points of supply. It also enables consumers to switch suppliers regardless of their location.

Mauri: Essential life force, the spiritual power and distinctiveness that enable each thing to exist as itself.

M-Co: The Marketplace Company, which currently operates the New Zealand Electricity Market for trading wholesale electricity. It also administers both NZEM and MARIA.

MED: Ministry of Economic Development.

MfE: Ministry for the Environment.

MW: Mega Watt

National grid: The high voltage power cables that transport electricity from generators to distribution networks or direct users of electricity.

NEECS: National Energy Efficiency and Conservation Strategy.

NZEM: (New Zealand Electricity Market)—the current trading arrangement where most wholesale electricity is bought and sold on a half-hourly basis. It is a voluntary market that operates within a code of conduct (the rules of NZEM).

OECD: Organisation for Economic Co-operation and Development.

PCE: Parliamentary Commissioner for the Environment.

Peak load: High electricity demands experienced for short periods of time. During a normal day, demand peaks at around 8am and 6pm.

Renewable energy: Includes energy that comes from sources such as the sun, wind, waves, tides, ocean currents, the hydrological cycle, and biomass.

Retailers: Organisations that monitor the electricity usage of households and businesses and bill them accordingly. There are competing retailers in local distribution areas. Many retailers of electricity are also generators.

SCI: Statement of Corporate Intent

Supply capacity: The sustained maximum power output from an individual power station, or the sustained maximum throughput of an electricity supply system.

Supply side: Of the electricity sector, refers to those organisations that offer quantities of electricity into the wholesale electricity market.

Sustainable development: Commonly referred to as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). It recognises:

- the finite reserves of non-renewable resources and the importance of using them wisely and, where possible, substituting them with renewable resources
- the limits of natural life-supporting systems (ecosystems) to absorb the effects of human activities that produce pollution and waste
- the linkages and interactions between environmental, social and economic factors when making decisions, emphasising that all three factors must be taken into consideration if we are to achieve sustainable outcomes, particularly in the long-term
- the well-being of current and future generations as a key consideration (PCE, 2002:6).

Tangata whenua: People of the land, Maori people.

Taonga: Valued resources, assets, prized possessions (both material and non-material) of tangata whenua.

Transmission: The transport of electricity via the national grid through high voltage power cables. This function is the responsibility of Transpower.

Transmission losses: Electrical energy losses, incurred largely because of conductive resistance within the national grid (including the HVDC link between the North and South Islands).

Users: Individuals or organisations that demand energy services provided by electricity. They range from residential households to large industrial users. They may receive their electricity directly from the national grid (direct users); via distribution networks (indirect users); or they may generate electricity on their own site (off-grid users).

Wahi tapu: Special and sacred places.

Wholesale market: Where purchasers buy electricity off the generators. It includes the half-hourly spot market, longer-term contract markets, and the security and reserve markets.

References

Bebbington, J. and Gray, R. 2000. *Accounts of Sustainable Development: The Construction of Meaning Within Environmental Reporting*. Working Paper 00—18, Aberdeen Papers In Accountancy, Finance & Management, ISSN 0962-4627. University of Aberdeen. www.abdn.ac.uk/accountancy/web_pgs/public/dept/Wps/00jb3.doc [Accessed April 2003]

Biewald, B. and Woolf, T. 1997. *Performance-Based Regulation in a Restructured Electric Industry*. Prepared for the National Association of Regulatory Utility Commissioners. Synapse Energy Economics, Inc. http://resourceinsight.com/work/naruc_pbr_97.pdf [Accessed May 2003]

Bishop, Rob. 2001. New Zealand's energy efficiency potential—a top-down analysis. In: *Moving New Zealand Toward Sustainable Energy Use*. Proceedings of the 8th Conference of the Sustainable Energy Forum. Wellington 17–18 May 2001: 50–62.

Coad, Victoria. 2002. *Paper For Electricity Governance Establishment Committee: Hydro Spill Disclosure*, 26 February 2002. Wellington. EGEC-260202-HSD-VC-v3.0. www.egb.co.nz/media/RWG/020211/hydrospilldisclosure.doc [Accessed March 2003]

Energy Efficiency and Conservation Authority (EECA). 2002. *Exploring our Untapped Electricity Resource: Demand-side Participation in the New Zealand Electricity Market*. Wellington: EECA.

Milne, M.J., Tregida, H. and Walton, S. 2003. *The Triple-Bottom-Line: Benchmarking New Zealand's Early Reporters*. University of Otago: Unpublished.

Ministry for the Environment (MfE). 1996. *National Environmental Indicators: Building a Framework for a Core Set*. Wellington: MfE.

Ministry of Economic Development (MED). 2002. *New Zealand Greenhouse Gas Emissions 1990–2001*. Wellington: MED.

New Zealand Government. 2002. *Climate Change: The Government's Preferred Policy Package: A Discussion Document*. Wellington: New Zealand Government.

Organisation for Economic Co-operation and Development (OECD). 1993. *OECD Core Set of Indicators for Environmental Performance Reviews*. Environment Monographs No. 83. Paris: OECD.

Organisation for Economic Co-operation and Development (OECD). 2001. *Using the Pressure-State-Response Model to Develop Indicators of Sustainability: OECD Framework for Environmental Indicators*. http://destinet.ewindows.eu.org/aEconomic/5/OECD_P-S-R_indicator_model.pdf, [Accessed January 2003].

Organisation for Economic Co-operation and Development (OECD). 2001b. *OECD Environmental Strategy for the First Decade of the 21st Century: Adopted by OECD Environment Ministers 16 May 2001*. Paris: OECD.

Parliamentary Commissioner for the Environment (PCE). 2003. *Future Focus: Strategic Plan of the Parliamentary Commissioner for the Environment 2003–07*. Wellington: PCE.

United National Environment Programme (UNEP) and SustainAbility. 1996. *Engaging Stakeholders: The Benchmark Survey*. London: SustainAbility.

Waitangi Tribunal. 1998. *Te Ika Whenua Rivers Report: Wai 212*. Waitangi Tribunal, Wellington. http://www.waitangi-tribunal.govt.nz/reports/nicentr/wai212_1/default.asp [Accessed May 2003]