

SOME RECENT AND CURRENT GOVERNMENT INITIATIVES RELATED TO GEOTHERMAL ENERGY

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SUMMARY – The geothermal energy sector will benefit from Government initiatives now being directed at the promotion of renewable energy and sustainable development. These areas and a broad range of other initiatives are progressively being brought under the Government's "Growth and Innovation Framework" and "Sustainable Development Initiatives".

The sustainable development initiatives in the energy sector have the desired outcomes of a) seeing energy use in New Zealand becoming progressively more efficient and less wasteful; b) ensuring renewable sources of energy are developed and maximised; and c) ensuring that consumers have a secure supply of electricity. To this end there is currently a range of energy-related Government initiatives that may have a positive effect on the geothermal and wider renewable energy communities.

Under these changes, Government departments are becoming more pro-active and are placing greater emphasis on linkages, innovation, and targeted regulation. The New Zealand energy industry has been the subject of a stream of reforms over the last 15 years and more, with further reforms currently in the wings.

1. GROWTH AND INNOVATION FRAMEWORK

In February 2002, following extensive consultation, the Government issued a report entitled "Growing an Innovative New Zealand". This report contained what is now **known as** the Growth and Innovation Framework (GIF), this being an umbrella policy document for government action. The Government's aim for the GIF is to return New Zealand's per capita income to the top half of the OECD, and then to maintain that standing.

The two key aspects for building an economy capable of sustaining the higher growth rates needed are:

- Strengthening the foundations (including such elements **as** sustaining a stable macroeconomic framework and an open and competitive microeconomy, and a solid research development and innovation framework), and
- Building more effective innovation (including elements such as enhancing the existing innovation framework, enhancing the talents and skills of New Zealanders, increasing global connectedness (including encouraging foreign direct investment), and focussing initial government efforts on three sectors (biotechnology, information and communications technology and creative industries) deemed to have both high growth potential combined with the ability to enhance productivity across the whole economy).

There are four broad means by which the framework will be given effect:

- Ministerial leadership across all related portfolios, including alignment of policies that impinge on economic transformation with the growth and innovation objectives. This will particularly impact on agencies such as MED, ME, EECA, MoRST, FRST, MFAT and NZ Trade & Enterprise,
- Policy and programme development in each of the key areas of enhancing innovation, talent and skills, and global connectedness,
- A specific budget allocation, and
- A GIF Cabinet advisory board.

To return New Zealand's per capita income to the top half of the OECD would require New Zealand to outperform the OECD average growth rate for a sustained period, and do substantially better than we have in the last 40 years or so.

For this growth goal it is thought that New Zealand will need to derive value from our natural advantages in terms of resources and infrastructure, while valuing our natural environment. Volatility in the economy will have to decrease to provide a better environment for business decision-making. The target involves a measure of radical change.

The Government will be proactive in supporting growth, it will work co-operatively with other sectors to achieve it, and it will emphasise the importance of sustainable growth and development. As part of the proactive policy the Government has strategic development initiatives aimed at improving infrastructure and resources by, for example ensuring efficient electricity and other infrastructure markets, or by amendment to the Resource Management Act.

A key aspect to achieving GDP growth will be **through** strengthening foundations through a solid research development and innovation framework. This could have both positive and negative effects on industry players. The Government is concerned:

- about the low level of private investment in this area,
- with aspects of commercialisation **of** ideas, and
- with linkages between research institutions to other researchers (including internationally) and with industry.

To address these concerns, the Government has commenced a range of initiatives directed at R&D, some of which have already impacted on geothermal projects.

2. SUSTAINABLE DEVELOPMENT PROGRAMME OF ACTION FOR ENERGY

The Sustainable Development Programme of Action (also known as the Sustainable Development Initiative or SDI) is another of the government's major over-arching documents designed to guide and underpin policy development. It was released in January 2003. It is tied in to the Growth and Innovation Framework, draws together a number of key issues, and signals that the government intends to apply a sustainable development approach to its policy and decision-making processes.

Energy has been identified **as** one of the target areas for sustainable development because **of** its correlation to economic growth, potential environmental impact, and because both consumers and industry are heavily reliant on its **supply**.

The major objective of the programme of action for energy is to ensure continued delivery of energy services to all classes of consumer in an efficient, fair, reliable and sustainable manner. It acknowledges that renewable energy sources, such **as** geothermal, will become increasingly important in providing security of supply. Three desired outcomes are identified:

- Energy use in New Zealand becomes progressively more efficient and less wasteful,
- Renewable sources of energy are developed and maximised, and
- New Zealand consumers have a secure energy **supply**.

Other **than** a programme of action for energy, the SDI also contains a programme for sustainable cities which includes actions around key infrastructure. Under MED co-ordination, there is now a broad overview being taken of infrastructure, including energy (both gas and

electricity) to ensure similar approaches where appropriate to regulation and efficient development.

3. ENERGY POLICY FRAMEWORK

The SDI **for** Energy now includes what was previously known as the Energy Policy Framework, issued by the Government in October 2000.

The major objective of the Framework has already been outlined above. However, the overall outcomes the Government seeks are:

- Environmental sustainability, including continuing improvement in energy efficiency and a progressive transition to renewable sources of energy,
- Costs and prices to consumers which are **as** low as possible, while still ensuring that prices reflect the full costs of supply including environmental costs,
- Reliable and secure supply of essential energy services,
- Fairness of pricing, so that the least advantaged in the community have access to energy services at reasonable prices, and
- Continued public ownership of publicly owned assets.

Some of the policies and programmes relating to energy are discussed later, but include:

- Energy efficiency and renewables policies (including establishing the Energy Efficiency and Conservation Authority (EECA) as a stand-alone Crown entity with expanded funding, and developing the National Energy Efficiency and Conservation Strategy),
- Climate change policies (including ratification of the Kyoto Protocol, and development of a comprehensive range of policy measures to assist in meeting commitments under the Protocol),
- Electricity reforms (including provision of a governance structure now known as the Electricity Commission for efficient market operation, market rules that promote demand-side participation and facilitate renewables while being consistent with policies on energy efficiency and climate change, facilitating distributed generation either by lines companies or other parties, ensuring security of supply, etc), and
- Gas and transport sector reforms.

4. THE NATIONAL ENERGY EFFICIENCY AND CONSERVATION STRATEGY

The National Energy Efficiency and Conservation Strategy (NEECS) was announced in September 2001. It is a foundational document for the climate change initiatives. It aims to improve energy efficiency by 20% and increase the use of

renewables by 2012. In October 2002, the renewables target was clarified to be an increase in consumer energy from renewable sources of 30PJ by 2012 over levels recorded for the year 2000.

The NEECS will not be discussed in detail. However, its six goals are:

- Reduce CO₂ emissions,
- Reduce local environmental impacts (though recognising local impacts of expanded renewable energy supply),
- Improve economic productivity,
- Promote industry development,
- Improve economic resilience, and
- Improve health and welfare.

The renewables target within the NEECS includes all additional energy above the 2000 datum irrespective of government incentives e.g. the Manapouri Tailrace. The data will be normalised to account for the influence of weather. Geothermal energy is one of the priority sectors for the renewable energy programme.

Climate Change policies are discussed later, but are key in achieving the renewables target. The renewable energy programme has cross-sectoral actions, and actions specific to electricity, process heat, transport and low temperature heat. EECA has worked with renewable energy associations, including the New Zealand Geothermal Association to develop industry Action Plans as a mechanism to help focus programme activities.

The programme maximises the use of industry linkages, and works to minimise barriers that might inhibit full realisation of renewables potential. The barriers include lack of knowledge/information among key parties and decision makers, lack of economies of scale for some technologies, and institutional regulatory/planning approaches that might discriminate against some renewable energy opportunities.

Some of the envisaged actions include: review of RMA processes, work to remove barriers to grid or network access for renewable energy generation, heat demand investigations, renewable energy resource studies, a Government leadership programme, trials and demonstrations of some technologies and a strong communications emphasis.

The indicative funding to be sought for the NEECS renewable energy programme could eventually rise to between \$4-7m by 2005/06. Given that some of this work could be directed **through** the industry associations, it could be that a significant share of these funds is used to support activities promoted by the NZGA in its

Action Plan. The NZGA may have to gear itself up for this change.

5. CLIMATE CHANGE OFFICE INITIATIVES

The Climate Change Office is now hosted by the Ministry for the Environment (MfE), but retains a separate identity. The office has responsibility to the Convenor of the Ministerial Group on Climate Change (Hon Pete Hodgson). It draws on staff from MfE, MED, EECA, MAF and Treasury and has commenced a range of initiatives.

This office was responsible for efforts related to the ratification of the Kyoto Protocol, which was achieved in December 2002 following the enactment of the Climate Change Response Bill.

Key elements of the climate change response include a Carbon Emission Charge, Negotiated Greenhouse Agreements (NGAs) for at-risk industries and a bid-in Projects mechanism.

The Government's carbon emission charge for the first commitment period (2008-2012) will approximate the international price of emissions, with a price cap of \$25 per tonne of CO₂ equivalent, and with an option for private sector emissions trading if the international trading market is functional and the price is right. This charge will raise the price of fossil fuels relative to the price of most renewable resources.

A design principle for the emissions charge is that it should among other things include fugitive energy emissions. A review of "New Zealand Energy Greenhouse Gas Emissions 1990-2002" shows that about 50% of CO₂ emissions and <10% of CH₄ emissions in this category are sourced from geothermal power station operations. This provision means that geothermal developments (unless subject to an NGA – see below) would be subject to an emission charge. However, there will be further consultation on the emissions charge design in 2004.

Under Climate Change initiatives there is the opportunity for industries judged to be at-risk (particularly **based** on the impact of a carbon charge on international competitiveness) to enter into NGAs. This could impact, say, on renewables projects hosted by the forestry or pulp and paper industries. The primary issue for negotiation with each emitter seeking an NGA will be the pathway and timeline to achieve international best practice in emissions management. This could lead to a partial or full exemption from the emissions charge.

Projects will be another key cross economy measure both before and during the first commitment period. They utilise a contestable approach to accessing Project support where

applicable, and include an additionality criteria to avoid funding projects that would occur anyway. The Projects mechanism will support a number of CO₂ mitigation projects, including renewable energy. While the process will be open to all forms of renewable energy supply, it is thought that process heat and electricity projects will be the most favourably positioned.

Note that trials of the Projects mechanism have been undertaken with wind-power projects having already secured benefit (Dunstall, 2003), in some cases with carbon credits having already been on sold offshore. The Climate Change office is now commencing its bidding round.

A further initiative, discussed next, relates to amendments to the Resource Management Act.

6. RESOURCE MANAGEMENT (ENERGY AND CLIMATE CHANGE) AMENDMENT BILL

The Resource Management (Energy and Climate Change) Amendment Bill was recently introduced into Parliament. Submissions have been received and the select committee will report back to Parliament on 25 November 2003. The Bill seeks greater alignment between local government plans and national energy objectives and aims to ensure that councils consider the contribution their regions can make to meeting New Zealand's commitments under the Kyoto Protocol.

Of particular relevance are the proposed amendments to section 7 of the RMA to require decision-makers to have particular regard to the efficient use of energy, the effects of climate change, and the benefits of renewable energy.

The RMA has been amended, rather than introduce a National Policy Statement (NPS). This is because a NPS works primarily through requiring changes to plans, and so is not as immediate or strong a legal direction as the inclusion of these matters in section 7.

The definition of renewable energy in the Bill is "energy from a source that occurs naturally and the use of which will not permanently deplete New Zealand's energy sources of that kind, because the source is generally expected to be replenished by natural processes". The definition then goes on to specifically include geothermal in a list of renewable sources of energy.

The bill forms part of a broad effort to promote renewable energy opportunities and sets out clear direction for local government and other parties. With Government officers taking a more proactive role in assisting the development of renewable projects through advocacy, it is legislative support such as this that has been and will be referred to e.g. in submissions on Environment Waikato's

proposed plan and policy statement changes with respect to geothermal energy.

7. IMPROVING THE RMA ASSESSMENT PROCESS FOR MAJOR PROJECTS

The business community and groups within local and central government have concerns about the RMA assessment process for major projects. Key problems include:

- time delays (and the costs associated with those delays), and
- variation in the quality of decision-making, particularly in relation to identification and weighing of matters of national interest.

Process costs and the quality of public participation are also of concern.

Options to improve decision-making on applications for major projects include: non-statutory guidance and/or direct assistance for those parties involved; removing a decision-making stage (e.g. direct referral to the Environment Court); changing the decision-makers (e.g. Government decision-making through ministerial 'call-in' or compulsory use of commissioners); and decision-making outside of the RMA.

The Ministry for the Environment is currently investigating options to address these issues.

8. GOVERNMENT POLICY STATEMENT ON ELECTRICITY GOVERNANCE

A Government Policy Statement (GPS) concerning electricity was issued in December 2000 (and slightly amended in February 2002). However in September 2003 a new draft GPS was released for public discussion with a view to this supplanting existing statements.

This GPS sets the objectives and outcomes that the Government wants the Electricity Commission to pursue in relation to governance of the electricity industry and against which the Commission must report and be examined. It ensures that the policies behind the Electricity Commission are aligned with the various initiatives outlined in previous sections of this paper. There is emphasis on sustainability and use of renewable energy in a number of places.

Broad areas addressed include: the nature of the Electricity Commission, consumer protection, security of supply (for which geothermal energy can play a role), energy efficiency, the reserve energy market (for which renewable energy will generally not have a role), hedge market issues, retail competition, transmission issues (that should see rational removal of further system constraints) and distributed generation issues (including the ability for line companies to now own up to 25MW of generation not necessarily connected to

their network, and regulation powers around the onsale of generation to retailers).

The establishment of the Electricity Commission is part of an effort to ensure sound governance within the industry. Careful market monitoring, market rules, and a reserve energy market should make for a more stable investment environment, both for electricity market players, and for those who will have to purchase electricity.

9. DISTRIBUTED GENERATION REGULATIONS

This is an initiative centred on the Ministry of Economic Development. Officials have worked with a range of organisations and parallel studies including the Centre for Advanced Engineering study on this topic. A discussion paper on the proposed regulations was issued for limited public consultation in September, with submissions due by 31 October 2003.

Behind the proposed regulations is a recognition that distributed generation will be of increasing importance in future and already plays a significant role in the national electricity mix.

The regulations aim to reduce potential barriers to investment in distributed generation. In particular the proposed regulations have the objective of providing:

- Certainty to investors, by means of
 - Clear information requirements and limitation on application processing times,
 - Standard contracts,
 - Defined interconnection costs with recognition of avoided transmission cost,
 - Ongoing connection terms, except where safety requirements are breached.
- Assurances to lines companies, by means of:
 - Requiring network connection and safety requirements to be met, and
 - Requiring payment of reasonable additional costs imposed by distributed generation.
- Dispute resolution procedures, by means of recourse to an arbitrator.

Distributed generation is broken up into a number of classes. However section 3(i) of the Electricity Industry Reform Act 1998 defines distributed generation as “a generator or generators that are connected to a local distribution network, or to end user load that is connected to a local distribution network, and not directly connected to the national grid”. As such, these regulations could have an impact on some of the new geothermal investments currently envisaged e.g. Mighty River’s Kawerau options and Top Energy’s Ngawha extensions. Detailed consideration of the benefits of the regulation

coupled with local considerations may also help make some smaller projects financially attractive.

10. PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT REVIEW OF THE ELECTRICITY SECTOR

The Parliamentary Commissioner for the Environment (PCE) is required (under the Electricity Amendment Act 2001) to assess the environmental performance of New Zealand’s electricity sector. Particular attention is to be given to the performance of the Electricity Commission against the requirements of the associated Government Policy Statement. 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”. Annual reports addressing the sustainability of sector operation will be produced.

In July 2003 the PCE issued a comprehensive discussion document for public consultation. The document was split into two sections.

Part A entitled “Electricity, Energy and the Environment: Making the Connections” outlines the basis for the work by the PCE, describes the current electricity environment (with equal emphasis on demand and delivery), then looks at sustainability issues.

Part B entitled “Proposed Assessment Framework” explains how the Commissioner proposes to assess the environmental performance of New Zealand’s electricity sector. It sets out quantitative and qualitative measures and procedures.

NZGA has made a submission on the document noting that geothermal projects do not receive adequate credit for their renewability or sustainability. The importance of this issue can be seen in the following quotation from the report. “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.”

11. RESEARCH AND DEVELOPMENT INITIATIVES

The Government has commenced a range of R&D funding initiatives, some pre-existing while others were prompted by the Growth and Innovation Framework.

The Government has established the New Zealand Venture Investment Fund which will invest \$100m of public money and \$200m of private money over 3 years in seed, start-up and early-stage

investment **through** private sector fund managers. It is improving ~~tax~~ treatment of R&D expenditure, has introduced the Grants for Private Sector R&D (GPSRD) initiative, has increased funding of basic research through the Marsden Fund and New Economy Research Fund (NERF), and is improving our intellectual property framework to ensure New Zealand receives full value for innovations. The Government has also recently introduced the Pre-seed Accelerator Fund and Targeted Equity Investment initiative to assist with the commercialisation of ideas generated in Crown Research Institutes and universities.

Research providers who were recently involved in the New and Emerging Energy Technologies (NEET) round of funding with FRST will be aware of the Growth and Innovation Framework elements required to be included in proposals. These included outlines of linkages with other researchers and commercial groups, human capital development, an emphasis on capturing commercial benefits, and an indication of likely economic benefit flowing from the research.

No specific strategic policy initiatives for research have been identified for enhancing geothermal energy. FRST makes its investments in response to signals from Government — **through** strategies such as GIF or Sustainable Development — and through letters of expectations and high-level instructions from the Minister of RS&T. FRST translates these signals in to its portfolio framework for investment. For example, FRST currently promotes research on geothermal energy where the outcome will lead to developments that give due regard to sustainability concepts and management of geothermal energy as a renewable resource. However, without integration into a robust research framework some priorities may lack the credibility needed to achieve the gains indicated. MoRST, through its i³ Challenge work, is addressing this by looking at how New Zealand can best focus its RS&T efforts on meeting national needs such **as** those signalled in government strategies.

FRST is currently consulting on development of a revised portfolio framework. Under the draft portfolio framework research relating to geothermal energy would fall into the *Optimising Use of Resources* portfolio. However, rather than being a sector-aligned portfolio (i.e. the current energy portfolios), the new portfolio structure is outcome based. The overarching factor for future investment in research will still be dependent on demonstrating alignment to government priorities such **as** GIF and sustainable development.

Agency co-ordination is essential to the successful implementation of GIF and other government strategies. But operational co-ordination, while necessary, is not sufficient in itself. For the Government's GIF goals to be achieved, it is

critical that the strategy work and consequent policy alignment are led by the central policy ministries. High-level discussions with FRST, MoRST, **MED**, Treasury and others have been held to develop a structure and performance measures.

12. CURRENT INTERNATIONAL INITIATIVES

The World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002, gave considerable impetus to the global dialogue on energy sector reform. Energy was near the top of the WSSD's reform agenda, and the Summit resulted in a number of important political decisions: (i) to provide access to energy services to 2 billion people currently without it; (ii) to clean up existing energy technologies; (iii) to enhance efficiencies; (iv) to expand the share of renewable energy; and (v) to phase out certain subsidies. These decisions established a new basis for future international cooperation on energy, underscoring public/private partnerships.

The European Union, and the United Kingdom in particular, took the lead in organising coalitions of countries committed to the link between energy and sustainable development. New Zealand was among more than sixty countries to sign up to the EU's declaration on Energy for Poverty Eradication and Sustainable Development, launched at the WSSD - the so-called "Johannesburg Renewable Energy Coalition" - and New Zealand has also committed to the UK-led "Renewable Energy and Energy Efficiency Partnership" (REEEP). The Government has liaised with industry regarding these initiatives, and there has been official and private sector participation from New Zealand in the tranche of meetings since WSSD.

The New Zealand Agency for International Development (NZAID) has launched renewable energy projects in the Pacific involving New Zealand suppliers of small scale wind and photovoltaic applications and energy system planning and design. The Pacific Islands Renewable Energy Project (PIREP), currently underway, will identify capacity and development needs required to overcome barriers to successful renewable energy initiatives in the region.

Key international meetings on the horizon include the **4th** session of the Global Forum on Sustainable Energy to be held in Vienna in February 2004; and the first World Conference on Renewable Energy to be held in **Bonn** in June **2004**. MFAT and MED are currently looking into possible financial assistance towards private sector participation in these international energy meetings, with a decision likely by early 2004. Indications of interest in the interim would be welcome.

13. CONTINUED CROWN OWNERSHIP OF GEOTHERMAL ASSETS

The Crown owns 102 geothermal wells and associated Intellectual Property (IP) throughout the Central North Island. Crown assets also include the steamfield development and steam supply contract with Norske Skog Tasman at Kawerau. Treasury administers the Crown's interests in geothermal assets.

The Crown has signaled its interest in the development of its geothermal assets. It has identified the State Owned Enterprise (SOE) Mighty River Power (MRP) as its preferred developer. Any transfer of the Crown's assets to an SOE would need to ensure that the Crown's Treaty obligations are fully met.

The majority of the 102 Crown wells are located on private land with most significant land owners including Norske Skog Tasman, Carter Holt Harvey, Fletcher Forests and Contact Energy.

Treasury has provided IP relating to the Crown's geothermal assets to regulatory bodies such as the Taupo District Council and Environment Waikato on a confidential basis to assist in RMA-related deliberations.

14. TREATY CLAIMS

The principles of the Treaty of Waitangi sit behind several pieces of legislation.

The Treaty is of particular interest to the geothermal community as there are several claims with the Waitangi Tribunal related to geothermal resources.

Claimants have the option of either proceeding with a Waitangi Tribunal hearing, or omitting this step and proceeding straight to negotiation with the Crown. In some cases, the Waitangi Tribunal is only at a very early stage of research, the Tribunal process being long and resource-intensive.

On 6 June 2003 a Deed of Settlement was signed between the Crown and Ngati Tuwharetoa (Bay of Plenty), which, amongst other things, provided the iwi a right to purchase the Crown's Kawerau geothermal assets, in the event that the Crown decides to sell these assets.

At the end of last year, the Crown and Central North Island iwi began a dialogue to explore ways to progress Treaty claims in the Central North Island. The iwi include Te Arawa, Tuhoe, Ngati Tuwharetoa (Taupo), Ngati Manawa and Ngati Whare. A driver for this hui was the desire to get resolution over all their claims (particularly forestry claims), more quickly than proceeding

with the Waitangi Tribunal. The associated geothermal claims would be settled as part of those settlements. Their resolution is now on an ambitious path to secure settlement agreements within two years.

The iwi are working through a process to mandate negotiators for direct negotiation with the Crown for the settlement of all their historical claims. Negotiations with at least some of these iwi should start this year.

The Crown and claimants will need to agree an historical account, an apology for Crown breaches of the Treaty, and cultural and commercial redress (possibly including geothermal-related redress).

15. A GOVERNMENT VIEW OF THE FUTURE ROLE OF GEOTHERMAL ENERGY

A significant effort has been directed by MED in developing views on New Zealand's future energy mix and associated costs. This has involved the preparation of input reports for both renewable resource development (covering costs and availabilities) and fossil fuel generation (East Harbour 2002 a and b). The final version of the MED Energy Outlook was in preparation at the time this paper was being finalised.

The scenarios presented in the Energy Outlook are the results of modeling the complex interactions of the New Zealand energy market using MED's SADEM energy model. This model is a partial equilibrium model (confined to the energy sector) which identifies a market clearing price consistent with supply and demand being in balance.

The Energy Outlook concludes that there is considerable potential for geothermal energy to play a large and vital role in our future energy mix. A reference scenario projects that over 600MW of new geothermal generation could be installed by 2025, with geothermal energy also contributing to the supply of process heat needs. Other scenarios show similar contributions. When this projection is compared with the assessment of available resources, it is essentially saying that over time most of the geothermal resource that can feasibly be developed will be developed.

16. CONCLUSIONS

The Crown has embarked on a number of initiatives aimed at both stimulating growth and innovation while addressing the issue of sustainability. A more pro-active government is working with the energy industry to ensure that renewable and sustainable energy sources play a greater role in the national energy mix. Geothermal energy should benefit from these initiatives, and has been assessed as making a significant contribution in future.

The Government is open to discussion with the sector on further measures that would assist geothermal energy's potential to be realised.

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18. LIST OF ABBREVIATIONS

CH₄ – methane
CO₂ – carbon dioxide
EECA – Energy Efficiency and Conservation Authority
FRST – Foundation for Research Science and Technology
GDP – Gross Domestic Product
GIF – Growth and Innovation Framework
GPS – Government Policy Statement
GPSRD – Grants for Private Sector Research and Development
IP – Intellectual Property
MAF – Ministry of Agriculture and Forestry
MED – Ministry of Economic Development
MFAT – Ministry of Foreign Affairs and Trade
MfE – Ministry for the Environment
MoRST – Ministry of Research Science and Technology
MRP – Mighty River Power
NEECS – National Energy Efficiency and Conservation Strategy
NEET – New and Emerging Energy Technology
NERF – New Economy Research Fund
NGA – Negotiated Greenhouse Agreement
NPS – National Policy Statement
NZAIID – New Zealand Agency for International Development
NZGA – New Zealand Geothermal Association
OTS – Office of Treaty Settlements
PCE – Parliamentary Commissioner for the Environment
PIREP – Pacific Islands Renewable Energy Projects
PJ – petajoule
R&D – Research and Development
REEEP – Renewable Energy and Energy Efficiency Partnership
RMA – Resource Management Act
RS&T – Research Science and Technology
SDI – Sustainable Development Initiative
SOE – State Owned Enterprise

WSSD – World Summit on Sustainable Development

19. REFERENCES

____ (2001). *National Energy Efficiency and Conservation Strategy Towards a Sustainable Energy Future*. Report prepared by Energy Efficiency and Conservation Authority and the Ministry for the Environment, Wellington.

____ (2002). *Growing an Innovative New Zealand*. Report for The Office of the Prime Minister, Wellington.

____ (2002). *New Zealand's Renewable Energy Target – A Component of the National Energy Efficiency and Conservation Strategy Towards a Sustainable Energy Future*. Report prepared by Energy Efficiency and Conservation Authority and the Ministry for the Environment, Wellington.

East Harbour Management Services Limited (2002). *Availabilities and Costs of Renewable Sources of Energy for Generating Electricity and Heat*. Report prepared for the Ministry of Economic Development.

East Harbour Management Services Limited (2002). *Costs of Fossil Fuel Generating Plant*. Report prepared for the Ministry of Economic Development.

____ (2003). *Sustainable Development for New Zealand Action Plan*. Report for Department of Prime Minister and Cabinet, Wellington.

____ (2003). *Electricity, Energy and the Environment Part A: Making the Connections and Part B: Proposed Assessment Framework*. Report prepared by the Parliamentary Commissioner for the Environment, Wellington.

Ministry of Economic Development (2003). *New Zealand Energy Greenhouse Gas Emissions 1990-2002*. Report by Energy Modelling and Statistics Unit, Energy Markets Information and Services Group, Resources and Networks Branch, Ministry of Economic Development, Wellington.

Dunstall, M. (2003). *Recent TrustPower Experience with Carbon Credits Tararua Wind Farm Expansion*. Paper in New Zealand Geothermal Association 2003 Seminar, Taupo, 12-13 June 2003.

Ministry of Economic Development (in preparation). *New Zealand Energy Outlook to 2025*. Report by Energy Modelling and Statistics Unit, Energy Markets Information and Services Group, Resources and Networks Branch, Ministry of Economic Development, Wellington.